Environmental Assessment of the Alaskan Continental Shelf

Program Work Statements

FY 1978

Volume II

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Environmental Research Laboratories

U.S. DEPARTMENT OF INTERIOR
Bureau of Land Management

1978 Work Statements

Vol. II

June
1978

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WORK STATEMENTS

FOR FISCAL YEAR 1978

(October 1, 1977 - September 30, 1978)

VOLUME II

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ENVIRONMENTAL RESEARCH LABORATORIES

BOULDER, COLORADO 80303

June 1978

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CONTENTS

VOLUME II

Scholl, D. W.
Lahr, J. C.

For information purposes the contents of Volumes I and III are also given.

CONTENTS

VOLUME I

CONTENTS

VOLUME III

Table I

Classification of Research Units as to Tasks

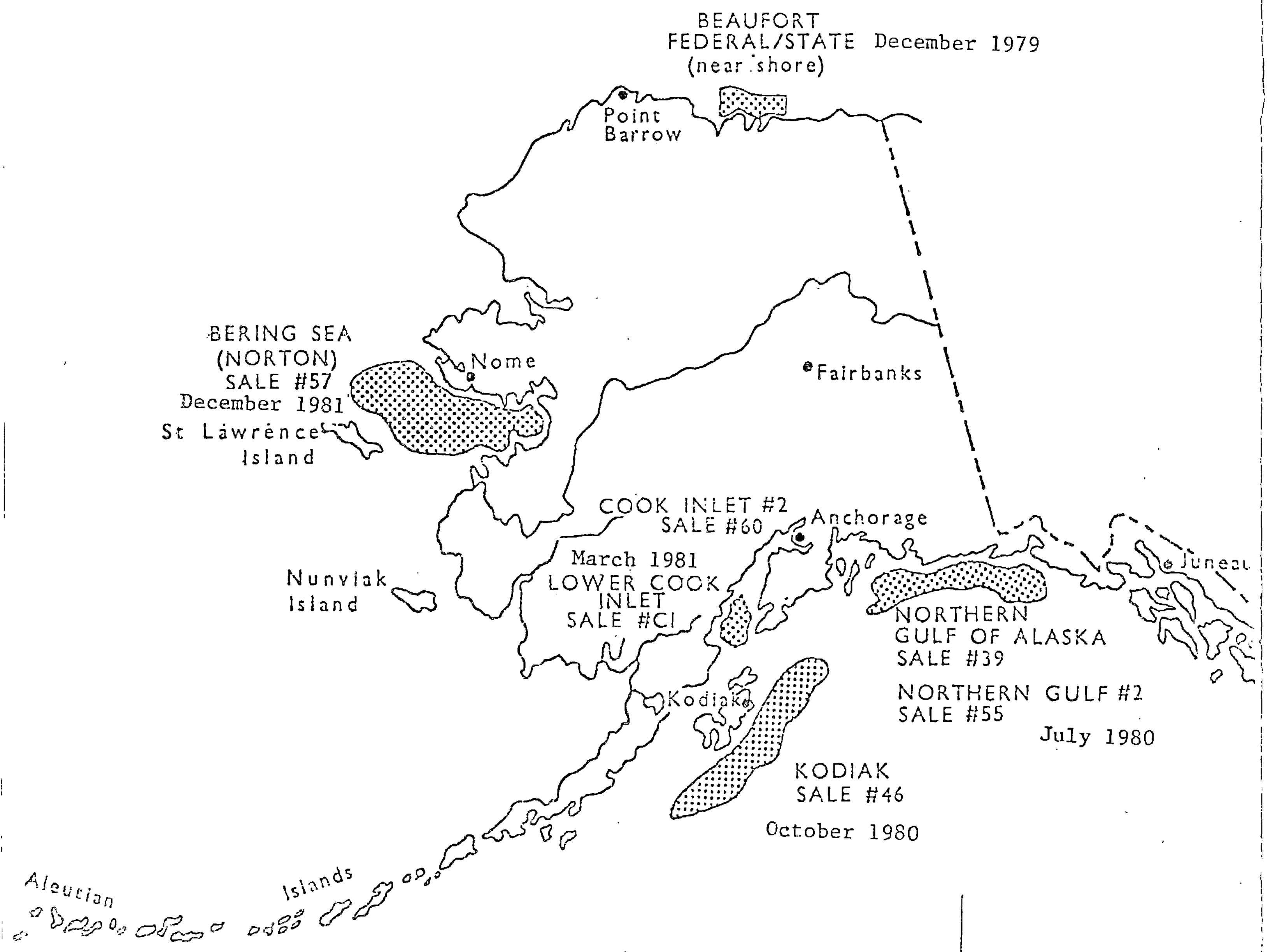
A	C	D	E		F	Data Management
43	16	48	3	232	71	350
152	59	91	5	237	72	351
153	87	138	6	243	73	362
162	88	140	19	248	77	370
275	98	141	29	332	96	468
480	105	208	67	337	389	497
500	204	217	68	341	423	527
506	205	250	69	356	454	545
556	206	257	78	359	460	563
	210	265	83	417	467	
	212	267	108	424		
	251	289	172	425		
	253	367	190	427		
	271	435	194	428		
	290	499	196	481		
	327	519	229	512		
	429	526	230	537		
	430	529				
	431	530				
	473	531				
	483	536				
	516	541				
		549				
		557				

Work Statements are arranged in numerical order according to research unit number, beginning on page 1.

Table II

Distribution of Research Units in Lease Areas

Aleutians	Beaufort	Bristol Bay	Chukchi Sea	Kodiak	Lower Cook Inlet	NEGOA	Norton	St. George	Non-Site Specific
16	6	67	59	5	3	5	5	16	43
67	29	77	69	59	5	68	19	77	71
68	69	141	87	68	29	78	69	83	72
138	87	194	88	78	48	138	87	108	73
217	88	232	172	138	138	140	88	141	96
289	91	248	196	140	152	210	152	194	389
337	98	257	230	194	153	212	153	196	423
	105	267	232	217	162	217	162	206	454
	162	289	248	229	190	229	194	230	499
	172	337	253	243	194	243	196	232	500
	190	435	257	251	229	289	208	248	537
	196	556	267	289	243	337	230	257	549
	204		271	290	251	341	232	289	557
	205		289	327	267	367	237	337	
	230		337	332	275	417	248	427	
	232		356	337	289	481	257	435	
	248		359	341	290		267	556	
	250		427	367	327		275		
	253		460	480	341		289		
	257		473	506	367		290		
	265		483		417		337		
	267		516		424		427		
	271		536		425		429		
	275		541		430		430		
	289				480		431		
	290				512		435		
	337						480		
	341						483		
	356						541		
	359								
	467								
	473								
	516								
	519								
	526								
	529								
	530								
	531								
	536								



ALASKA OUTER CONTINENTAL SHELF

AREAS PRESENTLY SCHEDULED FOR LEASING

1978 Proposal
R.U. 204

TITLE: Offshore permafrost studies, Beaufort Sea

PRINCIPAL INVESTIGATOR: David M. Hopkins

INSTITUTION AND DEPARTMENT: U.S. Geological Survey, Branch of Alaskan Geology

DATE OF PROPOSAL: June 28, 1977

REQUIRED SIGNATURES:

Principal Investigator David M. Hopkins

Name David M. Hopkins   Date June 28, 1977

Address 345 Middlefield Road, Menlo Park, CA 94025

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Required Organization Approval

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Reston, VA 22092

Telephone: FTS 928-6572

TECHNICAL PROPOSAL

I. Title: Offshore permafrost studies, Beaufort Sea
Research Unit 204
Proposed dates: October 1, 1977-September 30, 1978

II. Principal Investigator: D. M. Hopkins

III. Cost of Proposal

Total	$46,740

IV. Background

Studies conducted during the early 1970's near Point Barrow by R. E. Lewellen (funded by the Office of Naval Research) and on the Canadian segment of the Beaufort Sea shelf by the Canadian Department of the Environment showed that, contrary to expectations, permafrost is widely distributed offshore. The permafrost is evidently largely relict. Calculations by Lachenbruch (R.U. 204) and Osterkamp and Harrison (R.U. 253) indicate that the prolonged persistence of permafrost on the continental shelf must indicate a considerable ice content distributed through a thick vertical section. Osterkamp and Harrison showed that salt advection and salt diffusion may also play a considerable role in the rate at which ice-bonded permafrost is dissipated after submergence. Ice-rich permafrost in sub-sea sediments can pose a serious hazard to the integrity of structures associated with the exploration, recovery, and transportation of petroleum on the continental shelf, and so a joint effort by the U.S. Army Cold Regions Research and Engineering Laboratory (R.U. 105) and the U.S. Geological Survey (R.U. 204) was undertaken to determine the temperature, ice- or water-content, pore-water chemistry, lithology, and engineering characteristics of sub-bottom sediments on the Beaufort Sea shelf in and near Prudhoe Bay.

During spring, 1976, four boreholes ranging in depth from 15 to 50 m were completed, and experiments were conducted by some of the CRREL participants in order to develop a probe technique that would let us quickly and cheaply extend the results obtained by drilling. In spring, 1975, five additional boreholes were completed, and many probe holes were punched down, giving us a detailed three-dimensional picture of the distribution of thawed ground and underlying permafrost in and near Prudhoe Bay. Our efforts were focused in the Prudhoe Bay area mainly for logistic reasons, but the information obtained can be generalized to other parts of the Beaufort Sea shelf. We felt some pressure to distribute our study over a larger area. However, the intense local variability of permafrost only became

IV. Background (cont.)

apparent as a result of concentration of our effort in this one critical area. If we had spread our nine holes over a larger region, it would have been impossible to determine whether we were looking at a pattern variable on a small scale or whether the variation resulted from regional differences in climatic and geologic history.

Preliminary analysis of our results indicates that permafrost is widely but irregularly distributed, that it extends at least 18 km from the present shore beneath water nearly 15 m deep, and that at least 10 m of thermokarst subsidence must be anticipated after an area has become submerged by shoreline erosion or rising sea level.

Our boreholes are supplemented by a series of boreholes drilled earlier by Osterkamp and Harrison (R.U. 253). A study of coastal permafrost and shoreline retreat (R.U. 473) provides a basis for understanding and extrapolating our results. Barnes and Reimnitz have attempted to trace the top of permafrost laterally from our borehole sites using high-resolution seismic reflection profiles (R.U. 205). Seismic refraction lines by J. C. Rogers (R.U. 271) confirm the borehole-based profiles of the top of permafrost within several kilometers of the present shore but indicate that, further seaward, the top of permafrost is extremely irregular and less sharply defined than we had anticipated. Our data is used in M. Vigdorchik's effort to develop a predictive model for the distribution of offshore permafrost (R.U. 516).

V. Objectives

1. Determine the temperature, lithology, degree of ice bonding, and ice content of permafrost in cores from a series of offshore boreholes in the Prudhoe Bay area.

2. On the basis of geochronological analyses of material from these boreholes, determine the history of sea level and of lateral migration of the shoreline on the Beaufort Sea shelf during the last 30,000 years.

3. Determine as nearly as possible the quantity and timing of thermokarst subsidence at the borehole sites.

4. Combining data from this study and R.U. 473, establish a quantitative climatic-thermal history for the Beaufort Sea area during the last 30,000 years.

   Relevance: These data are needed as inputs for development of predictive models of the distribution of permafrost on the continental shelf of the Beaufort Sea and as inputs for estimates

V. Objectives (cont.)

of the amounts of potential thermokarst subsidence at particular sites near Prudhoe Bay. Knowledge of the distribution and ice content of permafrost is needed in order to anticipate areas where subsea permafrost and potential thermokarst subsidence poses a threat to the integrity of structures and tunnels used for exploration and recovery of petroleum and gas on the continental shelf, and to recognize potential blow-out situations involving clathrates or oil, gas, or ground water trapped beneath permafrost.

VI. General Strategy and Approach

The field program, involving collection and field description of cores and cuttings, the penetration of the bottom with probes, and the geothermal logging of the boreholes and probe holes has now been completed. Analytical work on samples and geothermal data collected in 1976 is completed but analysis of the 1977 boreholes has barely begun and cannot progress very far until autumn, 1977, because several of the participants are involved in other summer field programs, notably R.U. 473.

Segments of 1977 cores allotted to the U.S.G.S. have now been radiographed. Sample splits are being washed to concentrate foraminifera, ostracodes, pollen, wood, and other plant remains. Marine fossils and microfossils, pollen, and seeds will be identified in autumn and will then be used to reconstruct climatic and depositional history. (Study of the frozen cores is being conducted at CRREL.) Then suitable samples will be sacrificed for radiocarbon dating and amino-acid-racemization studies in order to provide age estimates for various levels in the cores. Pebble lithology and pebble roundness will be measured in order to develop supplemental information on former sources of sediment, direction and mode of transport, and environment of deposition.

These analytical studies will provide information on sedimentation rates and rates of sea level changes, data needed in order to reconstruct the thermal history at individual borehole sites. Experience with our study of the 1976 samples indicates that these studies will provide insight into the vertical distribution of excess ice in unthawed ground and will provide a basis for estimate of the timing and amount of thermokarst subsidence following submergence of individual sites.

Equilibrium temperature profiles will be calculated for each borehole and probehole site. The results will be compared with geothermal results obtained from the 1976 drilling, and the attempt will then be made to draw general conclusions about the horizontal and vertical distribution of bonded and unbonded permafrost on the continental shelf of the Beaufort Sea.

TECHNICAL PROPOSAL (cont.)

VII. Sampling Methods

All core samples were subdivided into subsamples suitable for study of stratigraphy, engineering parameters, and water chemistry. Engineering and water-chemistry samples were given to CRREL, and stratigraphic samples were retained by U.S.G.S. During 1976, cuttings washed up between coring intervals were collected as completely as possible; because these samples are less useful, in 1977 we limited collection of wash samples to about 500 grams for each one-meter interval of advancing holes. These samples are useful only for studies of pebble lithology and, at some horizons, geochronology.

VIII. Analytical Methods

Identification and counts of foraminiferal and ostracode species in 100-gram samples; identification of pollen in selected samples; identification of any other recognizable organic remains (seeds, insects, bones, crustaceans); roundness and pebble-lithology counts; radiocarbon and amino-acid-racemization studies for geochronological dating. Calculation of equilibrium temperature profiles at each borehole and probe site.

IX. Anticipated Problems

We need more than 4 months to complete annual report. I estimate that at least one year will be required to complete descriptive and analytical work. Principal Investigator must fund 50% of his salary in order to maintain his participation in this study.

X. Deliverable Products

A. No digital data.

B and C. Narrative reports and visual data (this will all be submitted with or as part of Quarterly, Annual, and Final Reports).

1. Graphic logs for nine offshore boreholes at Prudhoe Bay.
2. Graphic log and identification chart listing and interpreting microfauna in marine section of offshore boreholes.
3. Fence diagram and probably a map showing distribution and thickness of bonded and unbonded permafrost and of various types and ages of subsea sediments in the Prudhoe Bay area.
4. Graphic thermal logs and explanatory report for the Prudhoe Bay boreholes.
5. Diagram and interpretive report on sea-level history in Beaufort Sea.
6. Interpretive diagram of thermal history at ground-air or bottom-water interface during last 30,000 years at each of the Prudhoe Bay boreholes.
7. Interpretive report on amount and timing of thermokarst subsidence in submerged areas on the Beaufort Sea shelf.

8. These will be combined into an interpretive report on factors affecting distribution and character of permafrost in the Prudhoe Bay area and on the Beaufort Shelf.

D. No other non-digital data.

E. Data Submission Schedule: not applicable.

XI. Information Required from Other Investigators

Need all available data on bottom temperatures, shoreline geology and permafrost conditions, and thermal data from other boreholes. R.U. 204 and R.U. 105 share operational tasks and they work from the same data base; our present informal and steady information exchange must continue. R.U. 473 is conducted in support of R.U. 204 and generates shoreline permafrost and geological data needed by R.U. 204. We also must stay in touch with data and interpretations arising from R.U.'s 253, 271, and 516. I recommend that a meeting of all offshore permafrost researchers be organized during winter of 1977/78, perhaps in conjunction with the Annual Meeting of National Research Council's Permafrost Committee.

XII. Not applicable.

XIII. Special Sample and Voucher Specimen Archival Plans

Samples archived in Principal Investigator's office until no longer needed and then to be discarded.

Important paleontological specimens will be retained in collections of Paleontology and Stratigraphy Branch of U.S. Geological Survey as long as needed. Types, illustrated specimens, and other significant material will ultimately be deposited in the U.S. National Museum.

XIV. Logistics Requirements - none

XV. Management Plan

Management of the project is the responsibility of the Principal Investigator and the administrators of the Geological Survey. The Principal Investigator will lead and supervise the proposed work.

See page 8.

XVI. Outlook

This project will be essentially completed near the end of FY 1978, and no funds will be sought during the following fiscal year. Reports prepared in connection with the project may still be in

XVI. Outlook (cont.)

editing and drafting stage at the end of the year, but no funds will be sought during the following fiscal year.

The final product will be one or more interpretive reports with maps discussing the distribution of bonded and unbonded permafrost, the thermal regimen, the vertical distribution of excess ice, and the potential for thermokarst subsidence, and the recent climatic and geologic history of the Prudhoe Bay area and then outlining factors governing the distribution of bonded permafrost on the continental shelf of the Beaufort Sea.

XVII.

1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labeled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when these are used, and sexes where these are morphologically distinguishable.

4. At the option of the Project Office the P.I. is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

XVII. 8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following standard acknowledgement is acceptable.

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

MILESTONE CHART

RU #: 204 PI: D. M. Hopkins

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	FY 1977			FY 1978											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Identify foraminifera	---	---	---												
Prepare and identify mollusks	---	---	---												
Concentrate and date radiocarbon samples	---	---	---	---	---	---	---	---	---						
Amino-acid racemization analyses	---	---	---	---	---	---	---								
Pebble roundness and lithology		---	---	---	---	---	---								
Prepare final report	---	---	---	---	---	---	---	---	---	---	---	---			△
Quarterly Reports			△						△			△			
Annual Report						△									

Title: Geologic processes and hazards of the Beaufort Sea shelf and coastal regions (RU205)

Principal Investigators: Peter Barnes
Erk Reimnitz
David Drake

Institution: Pacific-Arctic Branch of Marine Geology
U.S. Geological Survey
Menlo Park, California 94025

Date of Proposal: June 10, 1977

Required Signatures, Principal Investigators: Name__________

Name__________ Name__________

Address 345 Middlefield Road, Menlo Park, CA 94025

Telephone 415 323-8111 (Extension 2114, 2695, 2013)

Required Organization Approval

Name__________ Date__________

Address 345 Middlefield Road

Menlo Park, CA 94025

Organizational Financial Officer

Name Lois P. Williams Date June 15, 1977

Address U.S. Geological Survey, National Center, Mail Stop 916
12201 Sunrise Valley Drive, Reston, Va 22092

Telephone: FTS (8) 928-6434 (202) 860-6434

TECHNICAL PROPOSAL

I. Title: Geologic processes and hazards of the Beaufort Sea shelf and coastal regions

Research Unit Number: 205 - P 5

Contract Number:

Proposal Date of Contract: October 1977 - September 1978

II. Principal Investigators: Peter Barnes, Erk Reimnitz, David Drake

III. Cost of Proposal:

C. Total $93,500

D. Distribution of Effort in Lease Area:
- 90% Beaufort Sea
- 10% Chukchi Sea

IV. Background:

This project has studied geologic processes which are unique to the arctic shelf environment, where ice plays a dominant role. Using sediment profiling, core sampling, diving, underwater TV and photography, thermoprobes, oceanographic sensors and remote sensing, the effect of ice on sediments, bathymetry, heat transfer and river discharge and sediment transport were investigated.

Because offshore development is likely to be limited to the ice zone inshore of the stamukhi, our studies have and will continue to emphasize this region (0-30 m) although interest in the outer shelf for utilization necessitates some consideration of this area. To date we have learned a great deal about the dominating influence of ice on the geologic environment. Rates of gouging inside the stamukhi are beginning to be understood, however, the seasonal distribution of events is unknown. Our understanding of sediment thickness and distribution is reasonably complete, although our seismic records have shown at least two features which may be hazards; unexplained hyperbolas and acoustic blank spots which may be related to ice or gas in near surface sediments. Delta front processes are being initiated this fiscal year addressing the interaction of rivers and the coastal zone. Results from summer suspended sediment studies along with near bottom current measurements has helped define transport vectors along the coast in summer, although rates, composition and seasonality are poorly understood. Morphologic features in addition to the ice gouging are apparently very dynamic on the inner part of the shelf; shoals, coastlines and islands are changing, although the rates, volumes and timing of change are poorly understood. In most aspects of our studies we have found it to our advantage to relate to other projects including: Hopkins (473), Osterkamp and Harrison (253) Sellmann (105), Rogers (271) Lewellen (407) Aagaard (91), Naidu (529), Shapiro (250), Weeks (88), Stringer (257), Carey (6), Broad (356), and Hufford (48).

In our work to date each new data gathering and analysis effort has brought to light areas where further research is needed to define a hazard or to understand a process. We anticipate that this year's field effort will be no different and new problems will be delineated which need to be assessed.

V. Objectives

1) To gain an understanding of year-round processes within the extensive bottom-fast-ice zones of arctic deltas. Harrison Bay has been chosen as an example because extensive background data exists for the Colville River system, and because the high oil potential and ongoing oil drilling is now taking place in the bay.

2) To establish a longer time-data base for knowledge of the repetitive rate of ice gouging, and attempt to extend our knowledge offshore through the stamukhi zone. The presently held belief that ice gouging on the deeper part of the shelf does not take place today could become very costly for industry and the environment.

3) Attempt to evaluate the causes of striking anomalies seen in our seismic records of certain areas. Among possible causes are: a) gas within the sediment, b) clathrates, c) high relief of the upper surface of ice-bonded sediment, d) ground ice within the upper shelf sediment, and other factors. Until these are understood, they present a real hazard to offshore development.

4) Contribute additional data on the physical properties of shelf sediments, such as shear strength, penetration rate of objects, pore water salinities, temperature, and freezing points. Such data will lead to a better understanding of bottom processes and the forces involved in the formation of ice gouges, and an evaluation of potential hazards in offshore construction.

5) Continue our study and evaluation of coastline stability as related to marine and thermal processes, sediment sources and transport, and man's construction of causeways, artificial islands, and ice pads as drill bases.

6) To study the configuration of the undersurface of undeformed first-year ice and of multi-year ice. A knowledge of this surface is not only important for evaluating how and how much spilled oil can be trapped, and how it would spread, but as a substrate for an inverted benthic community and a surface of high primary productivity.

7) Continuation of data reduction and preparation of reports. We anticipate that our emphasis and priorities, as in our Beaufort Sea studies over the past 7 years, will shift during the next year.

VI. General Strategy and Approach

The 1st objective would be accomplished by continuation of on-ice and skiff operations to measure the relationship of under-ice profiles to bottom profiles in the 10-km wide zone from the delta shore to the 2-m isobath, to measure vertical fluctuations of the ice with meteorologic and astronomic tides, to measure current flow velocities in the narrow sapce between ice and 2-m bench surface, and to monitor seasonal changes of this surface.

In order to accomplish the 2nd objective inside the stamukhi zone (approx. 20-m isobath) we will continue monitoring the sea floor along precisely navigated tracks with side-scan sonar and fathometer. We will also attempt to plow an artificial furrow from the beach to the 20-m isobath, along which we would monitor the number and location of future ice intercepts and the rate of infilling by sediments in different depth zones.

The possibility of having gas-charged sediments, suggested by certain seismic phenomena, will be investigated by collection and analysis of sediments across boundaries where such phenomena occur. The cause of hyperbolas seen in the seismic records will be studied together with Jim Rogers (RU 271). Initially, we will attempt to determine the horizontal extend and the depth to the top of a particular point-source reflector within Prudhoe Bay proper, by attempting to core into such a beast with our vibratory tool, and by other methods and approaches which we will devise.

Sediment physical properties will be studied as in the past using a combination of in situ vane shear measurements, measurements of pore water salinities in long cores and surface samples, measurements of sea floor temperatures, and calculations of sediment freezing temperatures in different shelf environments.

Stability of coastal features will be investigated through study of long cores and seismic reflection profiles and through continued monitoring of certain island and nearshore bottom areas. We have begun, and will continue to monitor, sea floor areas near the new causeway and below the Union Oil ice platform for changes, and attempt to relate these to our knowledge of marine geologic and ice processes in the area, and to our understanding of sediment sources. The under-ice morphology of first-year ice will be monitored by dragging a side-looking sonar in an inversed attitude through cuts of several hundred meter lengths made with a "ditch witch," and along newly formed leads. Coupled to the side-looking sonar would be a narrow-beam upward-looking sonar. Bottom-mounted sonars would be installed for periods of up to a year for the purpose of studying the submerged relief of multi-year ice and recording these data. Knowledge of ice drift rates would be used to correct the horizontal scale of such records. These data will be related to our data on ice gouges in the test areas.

VII. Sampling Methods:

Temporal and spatial sampling schemes will be dictated by field conditions of ice and logistics capabilities. Sampling locations will often be determined on the basis of real time profiling, side-scan sonar, SCUBA, TV or other on-site observation tools. In general, our sampling transects have run perpendicular to the coast. The broad scope of this project requires a varied sampling effort. This includes:

Towed temperature, salinity, transmissivity sensors
High-resolution seismic equipment
Side-scan sonar
Precision fathometer
Precision navigation system
SCUBA techniques
Upward-looking sonar recorders (under-ice profiles)
Vibracoring device
Hand corers
Grab samplers
Bottom-plow and strength measuring tools

Tide and ice level recorders
Ice displacement monitors

VIII. Analytical Methods:

Sample analysis and data reduction will follow standard techniques previously used in the study area, which are summarized in:

Barnes, P., Reimnitz, E., 1974, "Sedimentary processes on Arctic shelves of northern coast of Alaska"; In Proceedings of the Arctic Institute of North America Symposium on Beaufort Sea Coast and Shelf Research, Arlington, VA., Arctic Inst. No. Am. p. 301-353.

Reimnitz, E., and Barnes, P., 1974, "Sea ice as a geologic agent on the Beaufort Sea shelf of Alaska," ibid, p. 439-467.

Drake, D.E., 1976, "Suspended sediment transport and mud deposition on Continental Shelves"; In Stanley, D.J. and Swift, D.J.P. (eds.), Marine Sediment Transport and Environmental Management, Wiley-Interscience, p. 127-158.

Core material will be x-radiographed and sediment peel casts constructed for the study of internal structures that provide information on depositional disturbance. Where appropriate, surface sediment samples will be sampled and analyzed for total carbon and gas content.

IX. Anticipated problems:

The effort to study under-ice morphology with side-scan and upward-looking sonar is a new venture which may cause initial organizational and logistics hassles. Of course the uncertainty of ice conditions cannot be anticipated although statistics would have both 1977 and 1978 as good years for small boat operations.

X. Deliverable Products:

A. Digital Data:

None.

B. Narrative Reports:

Reports describing survey and sampling techniques, analytical and interpretive methods and summarizing the nature and comprehension of Beaufort shelf geologic environment as it might interact with proposed offshore development. These would be in the form of U.S. Geological Survey Open-file reports and journal articles. These reports will include: a) discussions of ice gouge distribution and evaluation of ice hazards, b) delineation of offshore near surface gravel deposits, and c) discussions of the sedimentary processes on an ice-covered shelf, including the fate of river effluents.

C. Visual Data:

Maps and graphs displaying tracklines, ice gouging, under-ice morphology, water and sediment properties, and other items warranting visual display.

D. Other Non-digital Data:

Microfilm of seismic and side-scan data to NGSDC.

E. Data submission schedule:

Field sampling reports will be submitted within four weeks after the termination of the sampling efforts, outlining the data gathered, field party, station and trackline location and description of accomplishments.

Additional data from analysis and reduction of records and samples will be presented in the quarterly and annual reports.

XI. Information Required from Other Investigators:

Results from studies of permafrost, hydrographic and current meter measurements, barrier island and ice dynamics studies will greatly improve the usefulness of the proposed work.

XII. Quality Assurance Plans:

Calibration and intercomparison of instruments, techniques and analytical results as they will be used in this project are not anticipated to be a problem.

XIII. Special Sample and Voucher Specimen Archival Plans:

Samples and data collected that should be kept for future reference will be archived and microfilmed and split cores/samples/filters, will be stored in Menlo Park by the U.S. Geological Survey.

XIV. Logistics requirements:

Logistics and operation of the R/V KARLUK will be provided by the U.S. Geological Survey. Other required logistics support is detailed on the attached forms and in the Cost Proposal form. (See ship budget)

XV. Management Plan:

The principal investigators will actively lead and supervise the proposed work. Using the assistance of 3 full-time and several part-time technicians, they will make use of the field and laboratory facilities available at the U.S. Geological Survey. Field efforts will take place in October, 1977, and in April and during the summer of 1978. During this period samples and records from the FY 77 program will be thoroughly worked up to further define the areas and processes to be studied during the FY 78 field efforts.

A summary of our proposed activities during the 1978 fiscal year is shown on the accompanying chart.

XVI. Outlook

We at present know some of the critical questions that will remain to be answered after the period covered by this proposal. To obtain answers for certain questions, new approaches and techniques will have to be tried, and specialized equipment needs to be developed. This involves uncertainties. We are sure, furthermore, that after the work through FY 78, we will raise additional questions of urgency for the state of affairs on the Beaufort Sea shelf at that time.

Some of the problems pointed out by our seismic records, and which we want to address during the next two field seasons (i.e. gas-charged sediments), will certainly remain only partly solved. The questions of geologic-oceanographic interaction with fast ice growth and vertical fluctuations in extensive shallows of Arctic deltas certainly will remain with only partial solutions. New lease sales or offshore developments may require additional studies east and west of the area presently under investigation. There are some rather unique settings in these shelf regions, (for example, Dease Inlet, Icy Reef, etc.) where general knowledge gained so far may not be applicable. Certainly the problem of ice gouging on the outer shelf will require much work under almost impossible conditions. We have good reason to believe that modern ice gouging does not stop at 48 m water depth, as postulated by a number of workers. K. Aagaard recently reported 1 knot currents at 100 m depth along the shelf edge. Such currents are strong enough to transport sand size material. Thus the gouges we see in those depths zones cannot be several thousand years old. The proposed use of submarine tankers and bottom-mounted discharge and loading facilities at the shelf edge, are still considered viable alternatives to the oil and gas transport problem. Development surely will extend beyond the stamukhi zone, and our understanding of geologic hazards in those areas is minimal. For example, seismic and fathometer records suggest the presence of large slump blocks along the shelf edge, which may require specific studies in the future.

Ongoing developments on the inner shelf, as the construction of a long causeway and of a large ice pad for support of offshore drilling, and of future artificial drilling islands, have their effects on the environment. We are interested in monitoring some of the anticipated changes, for what they teach about the environment, and for what one may learn about the prevention of adverse effects.

Our studies of the interaction of offshore shoals with pack ice drift, and the formation of the stamukhi zone, suggest concepts that may be used to make the inner shelf ice regime less hazardous. Much additional work will be required along these lines of thought, and we plan to be involved.

We therefore anticipate a need for future funding at about the same level as proposed here.

XVII. Standard Statement:

1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following standard acknowledgment is acceptable.

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

4. All other matters relative to data management deliverables and reporting procedures are covered by the NOAA/USGS Memorandum of Understanding of 5/12/77.

AIRCRAFT SUPPORT - HELICOPTER

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: if flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed)

Ice reconnaissance and logistic support for KARLUK/submersible operations. See attached transect chart for location of stations along transects 1, 2, and 3. Transport of personnel and equipment will also be required for planned operations on Colville Delta. Origin of these flights will be Prudhoe Bay with destinations either at Oliktok Pt. or at stations along the delta front.

2. Describe types of observations to be made.

Ice reconnaissance across outer shelf within area of KARLUK/submersible operations (see chart).

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

For work on Colville Delta; April 15-May 30, 1978, Ice reconnaissance Aug.-Sept. 1978

4. How many days of helicopter operations are required and how many flight hours per day? Transect 1,2,3--10 days at 6 hrs/day, and 10 days at 2 hr/day for sub-ice morphology survey.
Colville Delta--2-3 days 15 hrs. total, Ice reconnaissance and support 4-6 days 5 hrs/day. Total flight hours: 125 hours

5. How many people are required for each flight (exclusive of the pilot)? Two

6. What are the weights and dimensions of equipment or supplies to be transported?

Delta support--2,000 lbs. largest dimension about the size of a snow machine 2' x 6' x 3'
Submersible support - up to 1,000 lbs.
Sub-ice morphology - approx. 1,200 lbs., w/one item the size of a piano at 1,000 lbs.

7. What type of helicopter do you recommend for your operations and why?
Need versatility, long range, and good payload. Also must be able to sling about 800 lb. load. Recommend UH1H or equivalent.

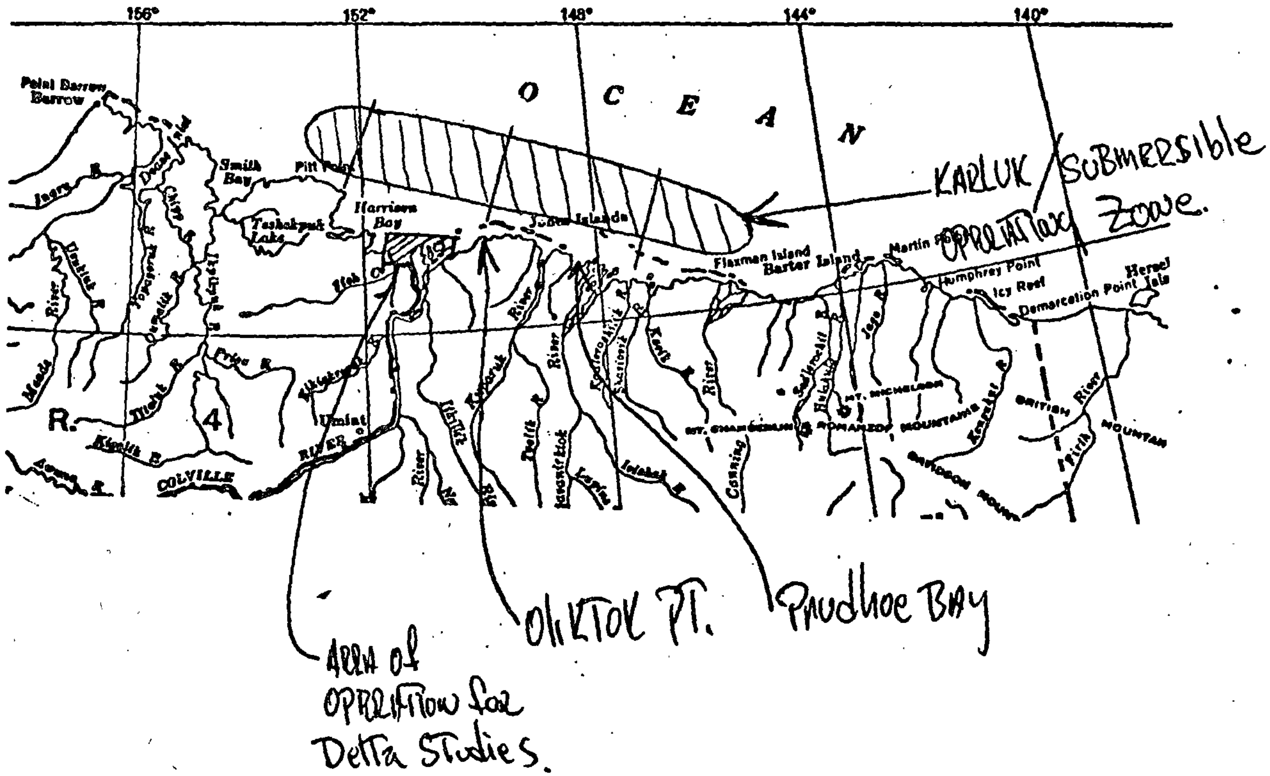
8. Do you recommend a particular source for the helicopter?---?-----

9. What is the per hour charter cost of the helicopter? ----?---

10. Where do you recommend that flights be staged from? Prudhoe Bay (Surf-co camp)

11. Will special navigation and communications be required?

Stations and transects must be located within 1 km of desired location.


156°
152°
148°
144°
140°
OCEAN
Point Barrow
Barrow
Smith Bay
Pitt Point
Harrison Bay
Teshekpuk Lake
Jones Islands
Flaxman Island
Barter Island
Martin Point
Humphrey Point
Icy Reef
Demarcation Point
Umiat
COLVILLE
RIVER
Canning
R.
4
KARLUK / SUBMERSIBLE OPERATION ZONE.
OLIKTOK PT.
Prudhoe Bay
Area of operation for Delta Studies.

SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

Under-ice profiles obtained using modified side-scan sonar system will require an ice-trenching machine such as a Ditch-Witch and transport of the machine plus necessary equipment to camps located offshore of the Colville Delta. This operation can be carried out together with operations already outlined for delta studies. However, the lead requirements will necessitate the use of a larger helicopter during this phase of the operations.

Helicopter transport of Ditch-Witch type trencher 2/way from Prudhoe. $2,500

QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

Location: Prudhoe - Delta studies support
4 people- 6days-May, 1978, 24man days
Oliktok DEWline site-4 people 8 days, May, 1978, 32 man days

Location: Prudhoe-KARLUK operations
8 people-5 days-Aug.-Sept. 1978, 40 man days.

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

V. &. E. Const. located at Surf-Co camp at Prudhoe Bay. Have shop able to handle most equipment problems and also becuase much of our equipment and supplies are already located at this site.

3. What is your estimated per man day cost for this support at each location?

Prudhoe Bay (B.&E. Const.) $105/day
Oliktok DEWline site $17.50/day

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

Estimate is based on established costs as of summer, 1976.

RU#205 + P5   PI: Barnes, Reimnitz, Drake

Major Milestones: Reporting, data management and other significant contractural requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Field effort								x			x	x	x		
Data reduction and analysis 1977 data	x	x	x	x	x	x	x	x							
Data reduction and analysis 1978 data			x	x	x	x	x	x	x	x	x	x	x	x	x
Data input								x					x		
Report to OCSEAP	x			x			x			x			x		

Research Unit #206

I. TITLE: Faulting and Slope Instability on the Outer Continental Shelf and Margin of the Southern Bering Sea

II. PRINCIPAL INVESTIGATOR(S):

T. L. Vallier
J. V. Gardner

U. S. Geological Survey
Pacific-Arctic Branch of Marine Geology

III. GEOGRAPHICAL AREA AND INCLUSIVE DATES:

October 1, 1977 - September 30, 1978

Southern Bering Sea

The statements of work had not been received in finally approved form in time for publication.

August 1977

YUKON DELTA COASTAL PROCESSES STUDY

OCSEAP Research Unit 208

Submitted by:

University of Houston
Department of Geology
Houston, Texas 77004

I.D. No. 74-6001399

William R. Dupré
Principal Investigator
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TECHNICAL PROPOSAL

I. Title: Yukon Delta Coastal Processes Study
Research Unit Number 208
Contract Number
Proposed Dates of Contract: 10/1/77-9/30/78

II. Principal Investigator: William R. Dupré

III. Cost of Proposal

Total: $13,000.00
Distribution of Effort by Lease Area: Norton Sound

IV. Background

The combined Yukon-Kuskokwim delta complex is an area of unique natural resources covering over 31,000 square miles. It has a large native population living in large part on a subsistence economy. It provides access to most of the spawning areas for salmon in the region. It is, in addition, one of the most significant breeding grounds for migratory birds in North America. Probably no other area of similar size is as critical to so many species of water fowl as is the delta region.

The Yukon River is the 17th largest river in the world (Lisitzin, 1972), providing over 90% of the sediment introduced into the Bering Sea. Its freshwater discharge is sufficient to noticeably dilute the salinity of the Alaska current. Yet for all its importance, relatively little is known of the Quaternary history of the region.

The ancestral Yukon River emptied into the Pacific in the vicinity of Cook Inlet during the early Cenozoic. Late Miocene uplift of the Alaska Range resulted in the diversion of the drainage system into the Bering Sea, where it has remained to the present (Nelson et al., 1974). Gradual submergence during the late Miocene and Pliocene was followed during the Pleistocene by repeated glacioeustatic fluctuations of sea-level. Glacial intervals were characterized by emergence of the shallow Bering Sea. During this time the major rivers, including the Yukon and the Kuskokwim, emptied near the heads of major submarine canyons at the shelf edge (e.g., Scholl, Buffington et al., 1970; Hopkins, 1972).

River valleys cut into the exposed continental shelf were filled during the most recent rise in sea level with estuarine and marine sediments (e.g., Moore, 1964; Creager & McManus, 1967; Knebel and Creager, 1973). This was apparently accompanied by a general northward shift of the Yukon River to the north (Knebel & Creager, 1973; Shepard and Wanless, 1971). Information from one offshore core taken in the Norton Sound suggests that the Yukon may have reached its present position approximately 6,000 years ago (Nelson, C. Hans, and Creager, 1977).

Geologic mapping in the delta region (e.g., Hoare, 1961; Hoare and Coonrad, 1959a, 1959b; Hoare and Condon, 1966, 1968, 1971a, 1971b) has been largely concerned with defining the pre-Quaternary history of the region. Much work has been done on studying the Cenozoic sedimentary and tectonic history of the Bering Sea (see summary by Nelson et al., 1974), including studies of the Holocene sediments of the Yukon River at its mouth (Matthews, 1973) and on the Bering Sea shelf (McManus et al., 1974), yet this study is the first to deal in detail with the processes and events by which the present day Yukon-Kuskokwim delta was formed.

V. Objectives

The overall objective of this project is to provide data on geologic processes in the Yukon-Kuskokwim delta region in order to better evaluate the potential environmental impacts of oil and gas exploration and production. In particular, we plan to do the following:

1) Study the processes along the delta shoreline (e.g., tides, waves, sea-ice, river input) in order to develop a coastal classification including geomorphology, coastal stability, and dominant direction of sediment transfer.

2) Study the processes active on the delta plain, including river breakup, river bank erosion and sedimentation, and the hydrology of the interconnected lakes and abandoned river channels.

3) Make a tectonic map of the delta area, delineating areas of Quaternary volcanism, faulting, and potential faultings.

4) Make a geologic map of the delta area, emphasizing the delineation of depositional systems, in order to:

   a) establish a chronology of delta sublobes to serve as a datum by which the relative age of Quaternary faulting and volcanism can be measured.

   b) establish a chronology of storm-induced erosional events recorded in chenier-like sequences along the coast to estimate the recurrence interval of major storms in the region.

   c) determine the physical properties of the different geologic units, including the depth and stability of permafrost.

VI. General Strategy and Approach

The basic tenet of this project is that by studying the processes by which the present-day delta formed, we may gain insights as to how those processes might affect and be affected by proposed offshore drilling and related activities in the future. This study emphasizes not only the processes (e.g., flooding, erosion, sedimentation), but also the products (e.g., permafrost stratigraphy, textural parameters) as they are fundamental in determining the potential environmental impact of increased development in the area.

VII. Sampling Methods

The coastline has been divided into units which are characterized by similar processes and properties. Ground truth in support of this classification has been in the establishment of 40 benchmarks (at approximately 10 km intervals) where detailed vegetation and sediment samples have been collected, as well as beach profile. These coastal stations will be re-occupied next year, in order to measure short-term rates of change.

Historical rates of change are being determined by comparison of old bathemetric maps and aerial photos taken in 1950-54, 1975, and 1976. In addition, geomorphic criteria are used to evaluate long-term trends as well as dominant direction of longshore drift.

Inland sites are selected to be characteristic of major depositional units within the delta region (e.g., natural levees, abandoned channels, point bars). Sampling at these sites will include short cores, description of vegetation, depth to frozen ground, and samples for radiocarbon dating where significant.

Sampling and beach profiling will be done in late June and early July during spring tides, in order to allow maximum exposure of the near-shore zone. In addition, offshore samples will be taken at 1 mile intervals up to 5 miles offshore using a helicopter and bottom sampler, where feasible.

Breakup of the delta region will be observed during late May mainly using a light plane working out of St. Marys, as ground conditions during this time make landings in the delta region difficult.

VIII. Analytical Methods

Short cores are being collected at different sites and will be x-rayed for sedimentation structures, split, and then analyses for grain-size analysis. Surface samples will also be analyzed for grain size distribution. Both grain size analyses and beach profiles will be formatted using NOAA formats. Selected samples will be analyzed for radiocarbon dating. Similarly, some samples have been collected for pollen analysis to aid in the interpretation of a 5-1/2 meter core taken from a volcanic lake last field season.

IX. Anticipated Problems

They are likely to be those encountered in the past (e.g., difficulty in predicting breakup, technical problems with aircraft). I have made arrangements to be kept in contact regarding breakup conditions by phone. I have tried to allow some time for mechanical problems, but this remains an unknown.

X. Deliverable Products

A. Digital data:

Grain size distributions and beach profiles will be provided by the Principal Investigator (see Data Products Schedule).

B. Narrative Reports

A report assessing the geologic hazards associated with the delta system, including both fluvial and coastal processes and the influence of permafrost in the area is being prepared. Much of it will be synthesized in the annual report, but that portion dealing with the fluvial part of the delta may be submitted separately.

A separate report and map is being prepared dealing with coastal classification, complete with detailed descriptions of the vegetation and sediment in the area, and will be submitted in preliminary form this fiscal year. A separate data report will be provided for sediment analyses, as the data are voluminous. These reports will include required documentation of methodology, data processing and quality control.

C. Visual Data

All visual data will be submitted in or as appendices to reports. The exception will be the 35mm slides of the region. A map will be provided showing location of important slides, copies of which may be requested from the Principal Investigator.

D. Other Non-Digital Data - N/A.

Data Products Schedule

Data Type (ie. Intertidal, Benthic Organisms, etc.)	Media (Cards, coding sheets, tapes, disks)	Estimated Volume (Volume of processed data)	OCSEAP Format (If known)	Processing and Formating done by PI (Yes or No)	Collection Period (Month/Year to Month/Year)	Submission* (Month/Year)
Grain Size Analysis	Tape	100-150	073	yes	7/75-8/75; 6/76-7/76; 7/77-8/77; 6/78-7/78	9/79
Beach Profiles	Tape	90-100	072	yes	7/75-8/75; 6/76-7/76 7/77-8/77; 5/78-7/78	12/78
Vegetation	Report	30	N/A	N/A	7/75-8/75; 6/76-7/76 7/77-8/77; 6/78-7/78	12/78
Radiocarbon Dates	Table	20	N/A	N/A	7/75-8/75; 6/76-7/76 7/77-8/77; 6/78-7/78	6/79
Geologic Map	Map	1	N/A	N/A	7/75-8/75; 6/76-7/76 7/77-8/77; 6/78-7/78	9/79
Coastal Stability Map	Map	1	N/A	N/A	7/75-8/75; 6/76-7/76 7/77-8/77; 6/78-7/78	12/78

*Preliminary results will be summarized in quarterly and annual reports as they become available.

E. Data Submission Schedule

See attached Data Products Schedule

XI. Information Required From Other Investigators

This project will be coordinated with those of the USGS (C. Hane Nelson, R.U. 429 and Abbey Sallenger, RU 431) and the USFWS in Anchorage (Cal Lensink and Bob Jones). Arrangements have been made for the sharing of information.

XII. Quality Assurance Plans

A. During field work/data collection:

Sample sites are carefully selected, usually after extensive aerial photo interpretation, in order to be as characteristic as possible of large areas of the delta. Special care is taken during sample collection to see that 1) the sample is characteristic of the site as a whole, and 2) that there has been no reworking. The latter is of crucial importance in collecting wood or peat samples for radiocarbon dating. Whenever possible, such samples are returned to the base camp as soon as possible and refrigerated, thereby reducing the possibility of mold collecting which might affect the dating.

B. During storage and sample analysis/formatting:

Samples collected for possible radiocarbon dating are dried in an oven and stored in a cool place at the University of Houston until being sent for dating. Whenever possible, replicate samples will remain with the Principal Investigator. Splits will be made of a sample collected for grain size analysis. Careful reweighing at each stage of sieve analysis will reduce the possibility of error. Grain size data will be formatted following NGSDC/NODC Sediment Characteristics Format 1.

Computer printouts will be verified against original lab sheets; location coordinates will be checked against original field maps. Beach profiles will be checked against field notes, as will sample locations and numbering.

C. Final Report

The final report will be reviewed for accuracy and scientific merit by a series of colleague reviews, both in the U.S. Geological Survey and the University of Houston. Final maps will be edited, verified against original field maps and photos, and will be on a project and at a scale which is acceptable to OCSEAP.

XIII. Special Sample and Voucher Sample Archival Plans

Approximately 100 core samples will be collected, most of which will be kept for at least three years for possible future reference. These will be stored at the University of Houston, the facilities being provided by the Geology Department. Similarly, 35mm slides will be stored in the Geology Department as well.

XIV. Logistical Requirements

See attached forms.

XV. Management Plan

A. Field Logistic Plan

Dupré will be in the field for two weeks during breakup and three weeks during summer, 1978. During that time, he and his assistant(s) will study the effect of river breakup on flooding, as well as obtain ground truth from mapping done from aerial photos during the previous summer. They will collect the following <u>kinds of data</u>:

1) Field observations of selected sites along the coast and inland.

2) Samples for textural analysis (approximately 50), radiocarbon dating (approximately 5), pollen analysis (approximately 10), and the determination of depositional environment (approximately 40).

3) Re-occupy semi-permanent coastal stations (40), where sediment samples, beach profiles, and coastal process measurements will be taken, thereby monitoring short-term shoreline changes.

4) Numerous 35mm slides will be taken in order to provide repetitive, up-to-date photo coverage of the coastal zone, as well as serving as base-line information.

B. Preservation and Archival of Data

Samples collected for textural analysis will be stored at the Geology Department of the University of Houston, as will samples collected for radiocarbon analysis. Samples collected for pollen analysis will be stored with Dr. Thomas Ager, U.S. Geological Survey, Reston, Virginia. Aerial photos and 35mm slides as well as field notes will be on file at the Geology Department of the University of Houston.

C. Sample Analysis

Grain size analysis will be done at the Geology Department, University of Houston, using standard sieve and settling tube techniques. Radiocarbon analysis will be done by Dr. Steve Robinson at the U.S. Geological Survey, Menlo Park, California; pollen analysis will be done by Dr. Thomas Ager at the U.S. Geological Survey, Reston, Virginia.

D. Dissemination of Data

The Project Data Manager will be informed of the kinds and quantity of data collected within 10 days of the completion of field work. This will be done by the submission of a ROSCOP data inventory form, NOAA 24-23.

All archivable data will be submitted within 90 days of the data. In the case of sample analyses (e.g., grain size, radiocarbon), submission will be based on the date of completion of the analyses.

Wherever possible, data will be submitted with quarterly, annual, or final reports. In addition, quarterly reports will include updated Activity/Milestone/Data Management charts with dates for data collection; sample analyses, key punching and/or verification, data submission, and final report submission. All reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, April, July, and October.

E. Format and Compatibility

All of the data will be submitted in report or map form except for grain size analyses, for which a format (File Type 073) is available. Grain size data will be processed and formatted at the University of Houston, and will be in the form of magnetic tape acceptable to OCSEAP. These data will be accompanied by a Data Documentation Form, NOAA 24-13.

All base maps will be in Universal Transverse Mercator Projection, they will be at a scale of 1:1,000,000 except where the detail of data necessitates a larger scale (e.g., 1:250,000).

XVI. Outlook

A. The final results of this project will include a final report and associated maps including discussion of the following:

1) geologic history of the Yukon delta
2) active processes in the delta region (with an emphasis on geologic hazards)
3) coastal classification scheme
4) implications for oil and gas development
5) geologic map of the region
6) coastal classification map, including sediment transport information

B. The report and maps will be ready no later than December, 1979, but parts of the reports will be submitted earlier as they are finished.

C. The cost of the remaining project beyond FY 78 is mainly for sample analysis and report preparation, and is approximated at $8,000.00 for FY 79.

D. No additional major equipment will be required beyond FY 78.

E. No future field work is necessary; however, continued reoccupation of coastal stations may prove valuable if the pressure for development in the region increases.

F. No unusual logistical requirements are expected beyond FY 78.

XVII. 1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labelled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when they are used, and sexes where these are morphologically distinguishable.

4. At the option of the Project Office the PI is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort a ROSCOP data collection inventory from (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release for information and for forwarding to BLM. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following acknowledgment is standard.

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

B. AIRCRAFT SUPPORT - FIXED WING

1. Delineate proposed flight lines on a chart of the area. Indicate desired flight altitude on each line. (Note: If flights are for transportation only, chart submission is not necessary but origin and destination points should be listed)
Not possible at this time, but will concentrate along the coast, the Yukon, the Black, and the Kashunick Rivers. During breakup overflights across the ice.

2. Describe types of observations to be made.

Aerial photography, collection of samples for grain size analyses, pollen analysis, and radiocarbon dating.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification)

N/A

4. How many days of flight operations are required and how many flight hours per day?
N/A
Total flight hours? N/A

5. Do you consider your investigation to the principal one for the flight thus precluding other activities or requiring other activities to piggyback or could you piggyback? Principal investigation - unlikely other could piggyback (except for USFWS work on delta).

6. What types of special equipment are required for the aircraft (non carry-on)?
Floats
What are the weights, dimensions, power requirements, and installation problems unique to the specific equipment.
Nothing unique.

7. What are the weights, dimensions and power requirements of carry-on equipment?

Approx. 300#, max. length 2 meters. Battery operated.

8. What type of aircraft is best suited for the purpose?
Cessna 180 will do.

9. Do you recommend a source for the aircraft?
If "yes" please name the source and the reason for your recommendation.

St. Mary's Charter Service. Have used them for 3 field seasons.

10. What is the per hour charter cost of the aircraft?

Approx. 105.00/hour

11. How many people are required on board for each flight (exclusive of flight crew)?

1-3

12. Where do you recommend that flights be staged from?

St. Mary's

C. AIRCRAFT SUPPORT - HELICOPTER

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed)

   See attached map.

2. Describe types of observations to be made.

   Beach profiling, sediment samples and vegetation photos.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? Spring tide in June, or July, preferable June 18-26, July 2-10, or July 17-24.

4. How many days of helicopter operations are required and how many flight hours per day? 8 days, 3 hours/day.

   Total flight hours? 24 hours

5. How many people are required on board for each flight (exclusive of the pilot)?

   2-3

6. What are the weights and dimensions of equipment or supplies to be transported?

   Approx. 350 lbs.; max. length = 2 meters.

7. What type of helicopter do you recommend for your operations and why?

   UHIH (because of size and weight requirements), with pontoons (for working offshore and on tidal flats).

8. Do you recommend a particular source for the helicopter? If "yes" please name the source and the reason for your recommendation.

   Best source is NOAA (used last summer)

9. What is the per hour charter cost of the helicopter?

   Unknown

10. Where do you recommend that flights be staged from?

    St. Mary's/Cape Romanzoff

11. Will special navigation and communications be required?

    Global Navigation System for offshore sampling (up to 5 miles offshore).

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

   a. Breakup (one person)
      Approx. 3 days in Anchorage at $50/day.
      Approx. 12 days out of Pitkas Pt. at $20/day (State School rate)

   b. Coastal Survey: (2 people)
      Anchorage (day 1-2)
      Pitkas Pt. (day 3-7)
      Emmonak (day 8)
      Cape Romanzof (day 9-11)
      Pitkas Pt. (day 12-14)
      Anchorage (day 15)

   Total: 30 man days

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

   P.I. will provide for all support except those of pilot and mechanic. It would also be better to have Juneau office make arrangements with Cape Romanzof DEW line station.

3. What is your estimated per man day cost for this support at each location?

   a. Breakup:
      Anchorage $50/day
      Pitkas Pt. $20/day

   b. Coastal Survey
      Anchorage $40/day
      Pitkas Point $20/day
      Emmonak $30/day
      Cape Romanzof $25/day

   How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

*Estimates based on previous year's field experiences.

E. SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

The main problem that might arise is mechanical problems with the NOAA helicopter, which must be handled by NOAA.

MILESTONE CHART

RU #: 208 PI: William R. Dupré

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978														
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D			
Quarterly Report	X			X						X			X			X		
Annual Report							X											
Report on Geologic Hazards												X						
Field Work								X	X									
Final Submission of Beach Profiles															X			
Final Submission of Coastal Vegetation															X			
Final Submission of Coastal Stability Map															X			

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FY 78 PROPOSAL REVISIONS AND ADDITIONS FY 78 PROPOSAL REVISIONS

TITLE: Earthquake activity and ground shaking in and along the eastern Gulf of Alaska

OCSEAP Research Unit: 210

PRINCIPAL INVESTIGATORS: John C. Lahr
Robert A. Page

AGENCY: Office of Earthquake Studies
U.S. Geological Survey

DATE OF PROPOSAL: 15 June 1977. Revised: 22 September 1977

PERIOD OF WORK: 1 Oct 1977 through 30 September 1978

TECHNICAL PROPOSAL

I. Title: Earthquake activity and ground shaking in and along the eastern Gulf of Alaska
Research Unit Number: 210
Proposed Dates of Contract: 1 October 1977 through 30 September 1978

II. Principal Investigators:
John C. Lahr
Robert A. Page

III. Cost of Proposal for FY 78

C. Total: $207,625
D. Area: NE Gulf of Alaska

IV. Background:

The USGS has operated a telemetered network of seismograph stations in south central Alaska since 1971. In 1974, 13 additional stations were installed in the region adjacent to the NE Gulf of Alaska (NEGOA) with funding from OCSEAP. At this time, of the 46 stations operated by the USGS in Alaska, 20 are in the region between Montague Island and Yakutat Bay and are used for monitoring the seismicity of the NEGOA. Data from these stations is again required in FY 78 to permit earthquake hazard assessment and to contribute to the study of earthquake prediction.

The USGS operates with OCSEAP support a network of 11 standard triggered strong-motion accelerographs between Chignik, on the Alaskan Penninsula, and Cross Sound in SE Alaska. These are operated for the purpose of obtaining records of strong ground motion for use in the engineering design of offshore and coastal structures.

Ocean-bottom seismographs (OBS) will be used to study, with much improved accuracy and a much lower detection limit, the seismicity and mode of deformation associated with the active Pamplona Ridge - Icy Bay region. Although we have not detected substantial activity in the Pamplona Ridge area, this ridge is fault bounded and was the site of three magnitude 6 shocks in 1970. Thus, this is an area of much interest and clear seismic hazard for which OBS recording is essential.

This research is closely coordinated with the offshore fault investigations of the U. S. Geological Survey. Information generated by either group will be made available to the other to assist in the interpretation of geologic hazards.The principal investigators are in close communication with investigators at the Geophysical Institute of the University of Alaska and at the Lamont-Doherty Geological Observatory of Columbia University who are studying the seismicity and seismic hazards in the Kodiak Island and Alaskan Peninsula - southern Bering Sea regions.

V. Objectives:

1) Tabulate the locations and magnitudes of all significant earthquakes in the NEGOA region.
2) Prepare focal mechanism solutions to aid in interpreting the tectonic processes active in the region.
3) Identify both offshore and onshore faults that are capable of generating earthquakes.
4) Assess the nature of the strong ground shaking associated with large earthquakes in the NEGOA.

VI. General Strategy:

The eastern Gulf of Alaska is a region of known seismic hazard along the zone of interaction between the Pacific and North American plates. Earthquakes of magnitude class 8 have occurred there in the past and are expected in the future. Indeed this region has been labeled a "seismic gap" by some investigators and therefore may be the most probable site for the next major earthquake in southern coastal Alaska (e.g., Kelleher, 1970; Sykes, 1971; Page, 1975). Given this situation it is important to improve our understanding of the regional tectonics, to identify both offshore and onshore faults that are capable of generating earthquakes, and to assess the nature of the resulting ground shaking.

An existing network of high-gain seismographs (Figure 1) along the Gulf of Alaska coast from Yakutat Bay through Prince William Sound will be used to monitor offshore seismicity for the purpose of delineating active coastal and offshore faults with epicenters of small earthquakes and determining the modes of deformation on the delineated faults. Thirteen of the coastal seismograph stations between Yakutat Bay and Montague Island were installed by the USGS in September, 1974 specifically for the purpose of monitoring offshore seismicity. This monitoring program will be continued through September 1978 under this proposal.

In the Icy Bay - Pamplona Ridge area we plan to conduct a seismicity survey from August 1 through September 1, 1978 using ocean-bottom seismographs. During the past two year period the Icy Bay region has been one of high seismic activity, as shown by the distribution of epicenters of earthquakes located using this network of stations (see, e.g., Figure 2). The epicenters of the better located earthquakes near Icy Bay are aligned with mapped onshore faults and suggest a possible offshore extension of these faults (Stephens and Lahr, 1977). In contrast, the area southwest of Icy Bay and including Pamplona Ridge appears to be relatively quiet seismically. However, the land based network of seismic stations is not ideal for detecting or locating earthquakes in the offshore area, and it is possible that earthquakes of small magnitude are occurring southwest of Icy Bay. Detection of these events is important in order to interpret the apparent continuity of the onshore and offshore structures in this area. The use of ocean bottom instruments is therefore strongly recommended. The USGS will be funding the development costs, the cost of playback

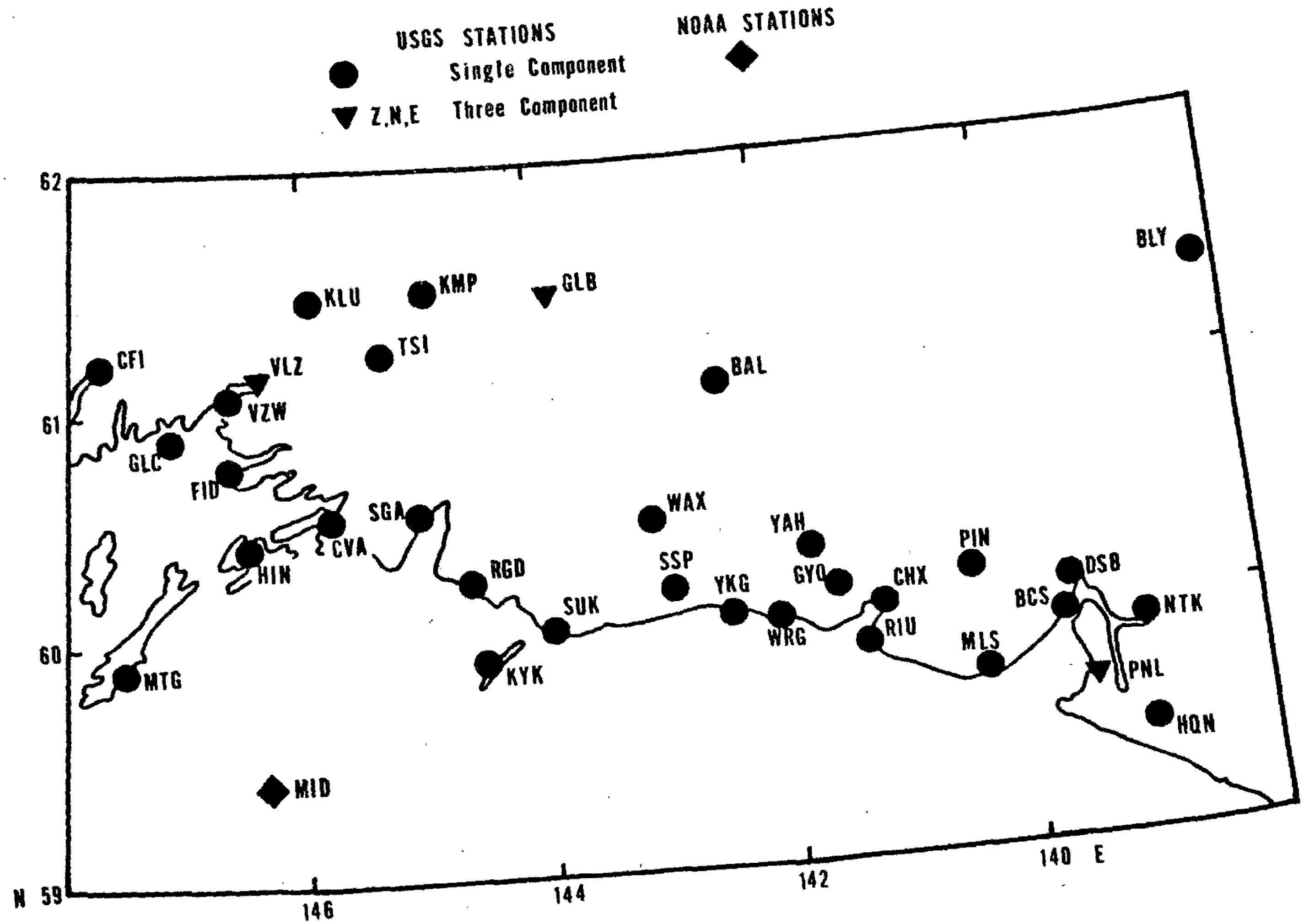


Figure 1. Seismic stations located in the eastern Gulf of Alaska region.

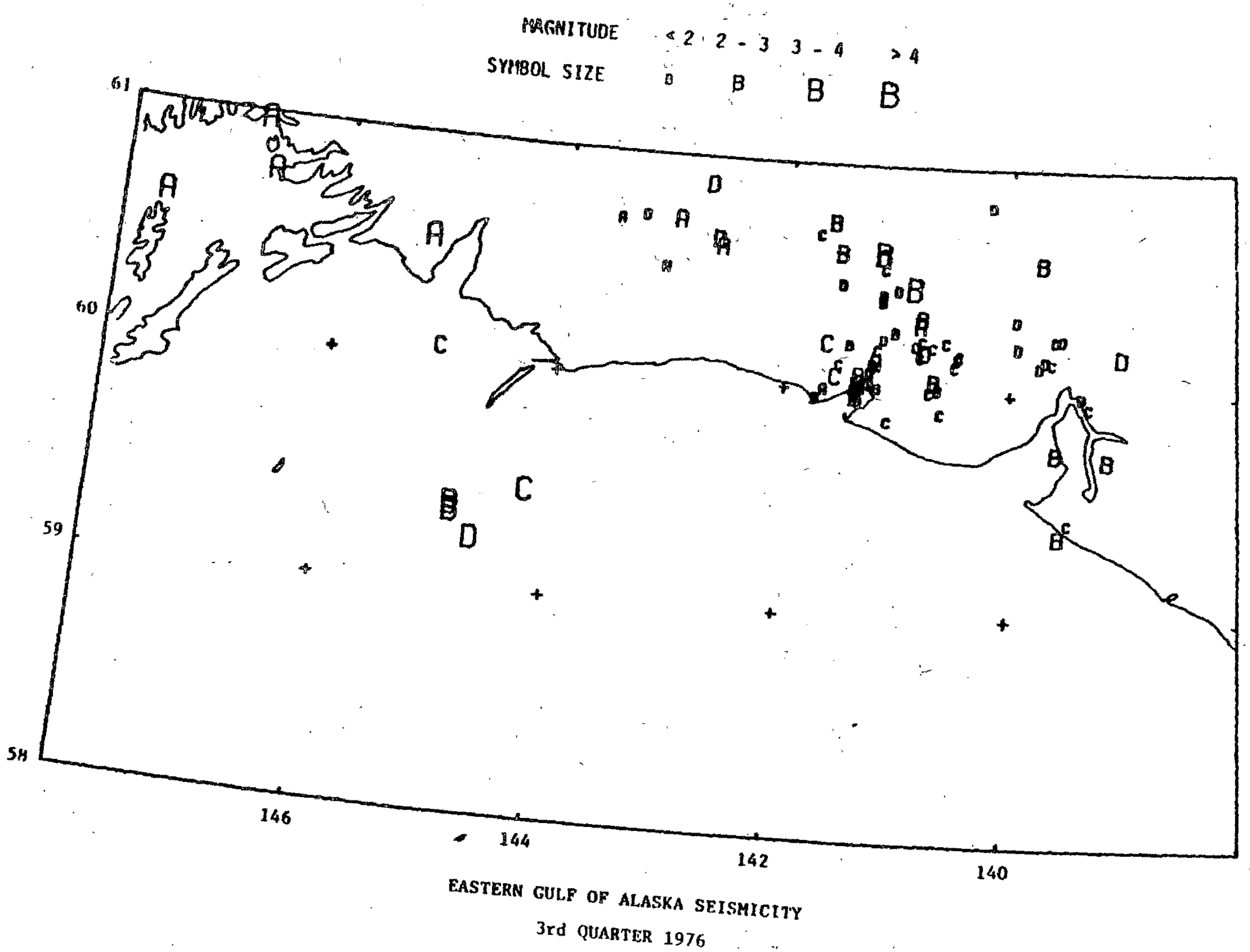


Figure 2. Map of earthquake epicenters from data from the USGS regional seismograph network, July–September, 1976.

equipment, deployment personnel costs, and the cost of building three OBS units. We are requesting from NOAA only the funds to build three additional OBS systems and logistics ship support. Six units recording for one month should provide important additional seismic data for this region.

The OBS system selected was designed by Bruce Ambuter of the U.S Geological Survey Branch of Atlantic and Gulf of Mexico Geology. Each has one vertical and one horizontal geophone and will utilize digital-tape event recording with a dynamic range of 72 db from the main conversion and 42 db from dynamic gain ranging. Approximately 900 events of one minute duration each can be recorded on each OBS unit.

A network of standard triggered strong-motion seismographs (Figure 3) is located at relatively accessible sites along the Gulf of Alaska coast from Chignik, on the Alaskan Peninsula, to Cross Sound in SE Alaska. They will be operated for the purpose of obtaining records of strong ground motion for use in the engineering design of offshore and coastal structures. Because this area includes a seismic gap that is a probable site for the next major earthquake in coastal Alaska, the chance to obtain critical new instrumental measurements of ground shaking close to the source of a magnitude 7 or 8 earthquake in this area within an interval of several years is judged to be equal to or greater than that for any other seismic zone within the United States. To date no strong-motion records have been obtained within 40 km of the causative fault in a magnitude 7 earthquake and within more than 100 km of the fault in a magnitude 8 shock.

VII. Sampling Methods:

Not applicable.

VIII. Analytical Methods:

Not applicable.

IX. Anticipated Problems: Discuss any anticipated major difficulties associated with the task and recommend solutions.

Operation of remote seismic field equipment throughout the winter will continue to be subject to failure under extremely hostile environmental conditions. Work will continue on improving the installation procedure and electronic design to minimize these problems. A prototype model of a new crystal-controlled voltage controlled oscillator has been built and operated successfully in California. It remains to have the circuit boards layed out, and a package designed. If possible one or two units will be installed in Alaska in the Fall of 1977. This unit should substantially improve seismograph station reliability and could become the standard for use in all of the Alaskan networks.

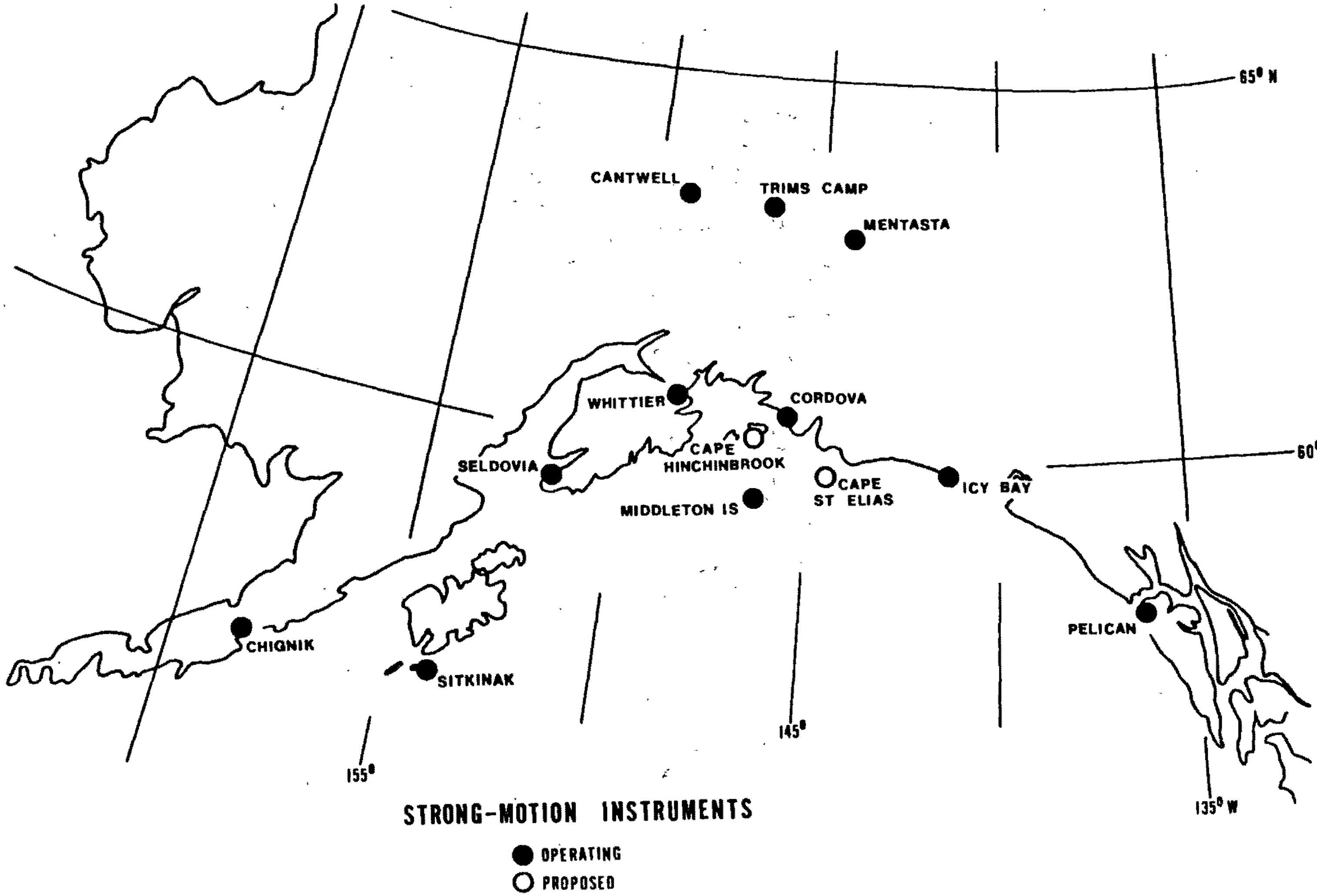


Figure 3. Map showing the locations of USGS operated strong-motion instruments in the eastern Gulf of Alaska and supported by OSCEAP

X. Deliverable Products:

A. Digital Data

1) Punched cards of earthquake parameters derived from the film records are supplied to EDS/NGSDC, including origin time (Universal Time), latitude, longitude, depth beneath surface (km), magnitude estimate, and an estimate of the precision of the location.

B. Narative Reports

1) Quarterly and Annual Reports including periodic reassessments of earthquake related hazards in the NEGOA region.

2) Special reports following earthquakes of magnitude 6 or greater describing the strong motion accelerations recorded.

C. Visual Data

1) Maps of epicenter locations keyed to magnitude and depth.
2) Maps of interpreted correlation (if any can be made) between earthquakes and possibly active sea floor faults identified by geoghysical techniques.

D. Analog Data

1) 568 feet of 16 mm photographic film produced each day and archived by the USGS

E. Data Submission Schedule:
Data will be submitted by quarter. The first data collected will be in October 1977, and collection will continue through September 1978. See Table I for time schedule.

XI. Information Required from Other Investigators

The location of offshore faults detected by ship board profiling will be required. We have been working with the USGS Office of Maring Geology on the possible correlation of offshore seismicity to surface faulting.

XII. Quality Assurance Plans

One of the problems in the location of offshore earthquakes is epicentral control. If earthquakes occur within an ocean-bottom seismograph network, and the same events are recorded onshore as well, then corrections to the assumed velocity model can be determined. These corrections "calibrate" the travel times so that future events can be more accurately located even without the ocean bottom stations.

XIII. Special Sample and Voucher Archival Plans.

Not applicable.

TABLE I

Data Products Schedule

Data Type	Media	Estimated Volume	Processing and Formating done by PI	Collection Period	Submission
Earthquake Parameters	Preliminary Maps and Listing	75	Yes	Oct./77 to Dec./77	Apr./78
				Jan./78 to Mar./78	July/78
				Apr./78 to June/78	Oct./78
				July/78 to Sept./78	Jan./79
Earthquake Parameters	Cards	75	Yes	Oct./77 to Dec./77	July/78
				Jan./78 to Mar./78	Oct./78
				Apr./78 to June/78	Jan./79
				July/78 to Sept./78	Apr./79

I. Description of ocean bottom seismometer (OBS) system.

A. Background

We plan to deploy six OBS units to study, with much improved accuracy and a much lower detection limit, the seismicity and mode of deformation associated with the active Pamplona Ridge - Icy Bay region. The OBS program will be undertaken in conjunction with Bruce Ambuter of the U.S.G.S. Branch of Atlantic and Gulf of Mexico Geology and Ray Davis of Woods Hole Oceanographic Institution. Ambuter and Davis have recently completed the system design and built one prototype unit which will be tested both on land and on the ocean bottom off Hawaii in the coming months.

B. Physical Package

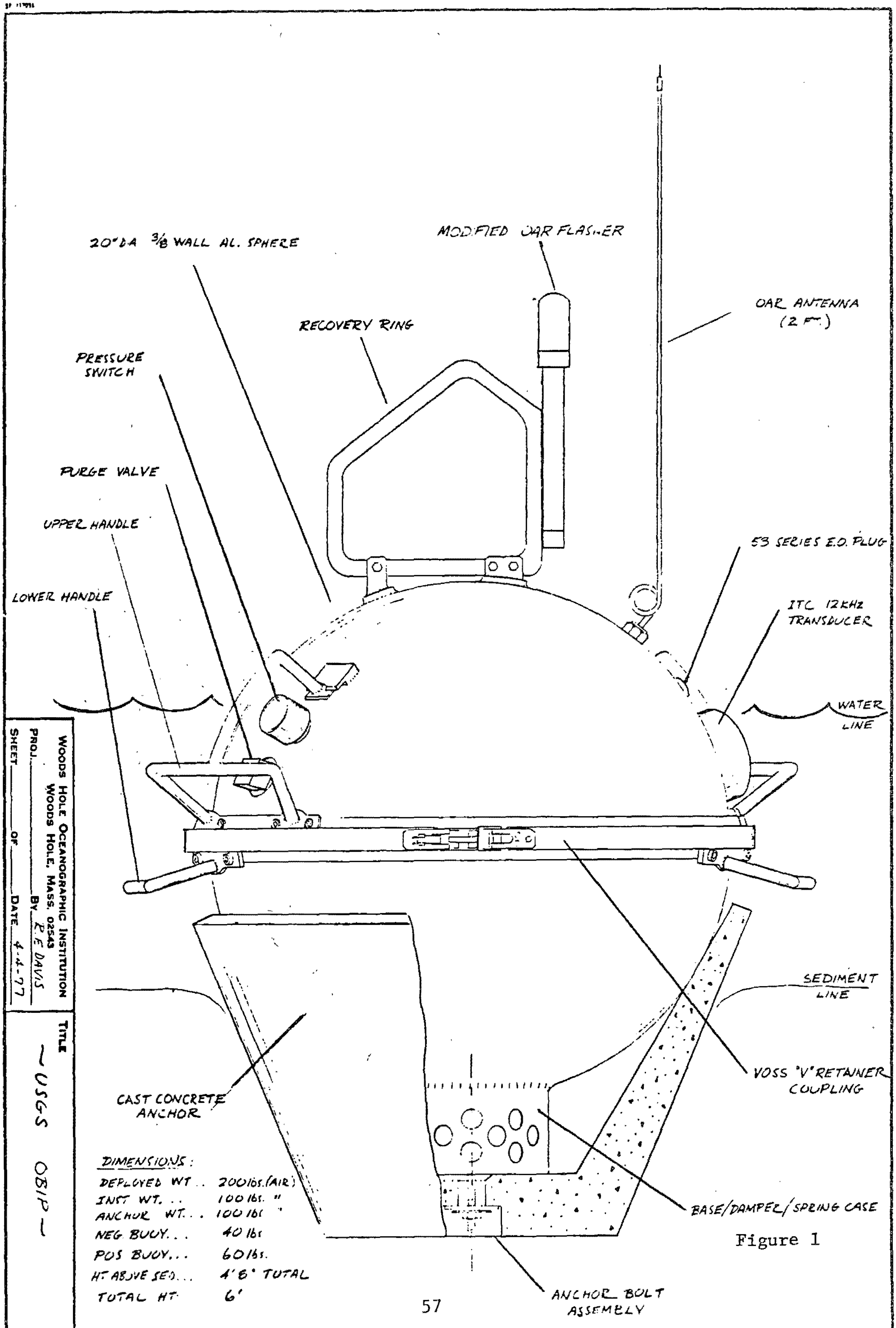
The physical package, as deployed on the ocean bottom (see Figures 1, 2 and 3), is inevitably a result of many trade-offs among imcompatible requirements. An OBS requires the best possible coupling of sensor to sea floor, and yet the greatest isolation from disturbances in the water environment.

Cylinders make a low bottom profile dificult to achieve for an instrument of this size (.75 ft^3 requires a 6 in I.D. x 48 inch long case) due to the relatively large amount of bouyancy required, thereby increasing current drag and eddy disturbances. A sphere, however, provides all necessary floatation (a 20 inch sphere displaces 150 lbs water) and has a smooth, symmetrical shape. The ballast, or anchor, can be readily cast to fit around the lower half and bury itself to facilitate sensor coupling without hindering release capability. Shipboard handling difficulties of the 200 lb., ballasted system should be minimized, and instrument access enhanced by splitting the sphere about the equator using a single-bolt "V" - clamp closure and "O" - ring seal.

The OBS aluminum sphere will be rated for 1 km water depth and should cost little more to fabricate than a comparably sized deep water cylinder with floatation. Other materials, such as glass, were rejected due to small sizes available and unresolved closure problems; or casting failures in the case of glass reinforced epoxy.

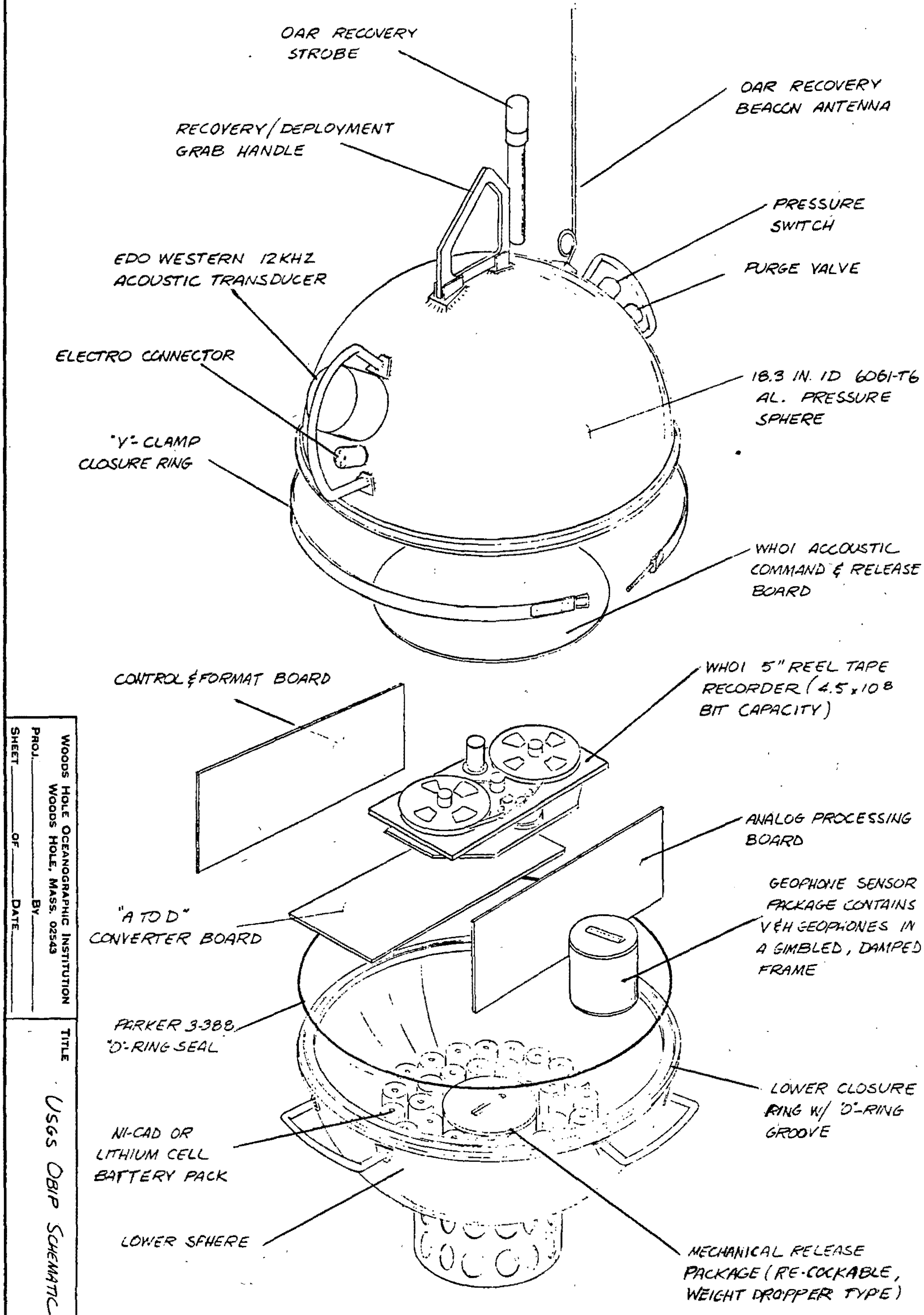
A 10 KHz acoustic transducer, a grab ring, and a short folded recovery-aid mast (strobe and beacon) will be mounted on the upper hemisphere. Deployed height will be approximately 28 inches with a negative buoyancy of 50 lbs. Upon bottom release, a net positive bouyancy of approximately 50 lbs. will lift the sphere clear of the anchor at the same time permi erection of the recovery mast.

Internal hardware will consist of a sensor package, release mechanism, tape recorder, Li-cell battery packs, and instrument and release electronics cards. For ease of maintenance, the tape recorder and cards will be an integral plug-in unit. The release is a lighter, modified version of the highly reliable AMF re-cockable weight dropper.



20"DA 3/8 WALL AL. SPHERE
MODIFIED OAR FLASHER
OAR ANTENNA (2 FT.)
RECOVERY RING
PRESSURE SWITCH
PURGE VALVE
UPPER HANDLE
LOWER HANDLE
53 SERIES E.O. PLUG
ITC 12KHz TRANSDUCER
WATER LINE
SEDIMENT LINE
VOSS 'V' RETAINER COUPLING
CAST CONCRETE ANCHOR
BASE/DAMPER/SPRING CASE
ANCHOR BOLT ASSEMBLY
DIMENSIONS:
DEPLOYED WT.. 200lbs.(AIR)
INST WT... 100 lbs. "
ANCHOR WT... 100 lbs "
NEG BUOY... 40 lbs
POS BUOY... 60lbs.
HT ABOVE SED... 4'6" TOTAL
TOTAL HT 6'
WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
PROJ. BY R.E DAVIS
SHEET OF DATE 4-4-77
TITLE ~USGS OBIP~

Figure 1


OAR RECOVERY STROBE
OAR RECOVERY BEACON ANTENNA
RECOVERY/DEPLOYMENT GRAB HANDLE
PRESSURE SWITCH
PURGE VALVE
EDO WESTERN 12KHZ ACOUSTIC TRANSDUCER
ELECTRO CONNECTOR
18.3 IN. ID 6061-T6 AL. PRESSURE SPHERE
"Y"-CLAMP CLOSURE RING
WHOI ACCOUSTIC COMMAND & RELEASE BOARD
CONTROL & FORMAT BOARD
WHOI 5" REEL TAPE RECORDER (4.5 x 10⁸ BIT CAPACITY)
ANALOG PROCESSING BOARD
GEOPHONE SENSOR PACKAGE CONTAINS V & H GEOPHONES IN A GIMBLED, DAMPED FRAME
"A TO D" CONVERTER BOARD
PARKER 3-388 "O"-RING SEAL
LOWER CLOSURE RING W/ "O"-RING GROOVE
NI-CAD OR LITHIUM CELL BATTERY PACK
LOWER SPHERE
MECHANICAL RELEASE PACKAGE (RE-COCKABLE, WEIGHT DROPPER TYPE)
WOODS HOLE OCEANOGRAPHIC INSTITUTION
WOODS HOLE, MASS. 02543
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USGS OBIP SCHEMATIC

Figure 2

Vertical restoration force of a floating instrument should exceed 8 ft-lbs., allowing a mast of up to 4 ft. above the water. Sphere penetrations will include the acoustic transducer, the release rotor, recovery aid power leads, and test points.

C. Electronic System

Each OBS system will be a self contained unit with geophone and hydrophone sensors and a digital magnetic tape recorder. The tape recorder will be triggered to record only "events" detected by an analog logic circuit. The total dynamic range of the system is 114db, 72db from the main conversion and 42db from dynamic gain ranging. The seismic data will be bandpass filtered from 2 to 25 Hz and digitized at 125 samples per second. At this rate, a total of 12 hours of recording can be placed on the tape, almost double the amount typically required for a one month duration seismicity study. In order to maintain timing accuracy, a low-power oven-controlled oscillator will be used to control the clock within each OBS unit. The design goal is an accuracy of a few hundredths of a second over 30 days.

II. Anchoring and Recovery System.

The vertical geophone sensor (Walker-Hall-Sears, 3.5 Hz) will be coupled to the sea floor through the pressure case and mounted in self-aligning gimbals, damped in high viscosity oil. The cast anchor, which fits around the lower half of the sphere, will bury itself to improve sensor coupling. The deployed weight will be 200 lbs. (50 lbs. negative buyoyancy) and although this is not very large, the deployed height will be only 28" and the current drag will be minimized by the spherical shape.

The sphere will be released from the unrecoverable anchor on acoustic command (AMF re-cockable weight dropper type). Recovery aids will include OAR Radio Beacon and OAR strobe. The released sphere will weigh 100 lbs. and have 50 lbs. positive buoyancy. A grab ring mounted on the sphere will facilitate recovery from the water.

III. Logistics Requirements, including location and time frame. This supersedes Section C-XIV of original proposal.

Institution: USGS
Investigators: John C. Lahr
Robert A. Page

A. Ship Support

1. The proposed sites for OBS deployment are shown in Figure 4, and numbered 1 through 6. The geographic coordinates are as follows:

Station	Latitude(N)	Longitude(W)
1	59.87	141.70
2	59.75	142.00
3	59.60	142.20
4	59.50	142.60
5	59.65	142.55
6	59.85	142.60

2. Proposed deployment operation:
a. Using either two-frequency satellite navigation, or other high quality navigation equipment, locate the ship above the OBS site.
b. Make a short (1 hour) site survey with shipboard fathometer to determine the bottom topography of the site.
c. Lower the OBS unit into the water (air weight is 200 lbs.) and then release it to free fall to bottom. (5 minutes to free fall).
d. Total time on each station will be about two hours.

Removal operations:
We hope to recover all six OBS systems after about one month of operation.
a. Locate the ship above each OBS site to within 2 km.
b. Use acoustic signal to "zero in" on OBS.
c. Signal release of OBS capsule with acoustic signal.
d. Locate OBS on surface either by visually siting its strobe light or via its radio beacon.
e. Pull OBS unit onto deck using its "recovery ring" and a boat hook.

3. Optimum time chronology. The order of deployment or removal of the OBS systems is of no importance, and the total duration of each leg could be as long as 3 or 4 days, if necessary.

4. Cruise dates:
Deployment leg.
a. One 24 hour day will be required to deploy the OBS system once the ship is in the vicinity of Icy Bay. The date planned is August 1, 1978. This date could slip back by 10 to 15 days if we are notified at least one month in advance.
b. Removal leg. 30 days following deployment at the earliest. Two 16-hour days (night-time preferred) will be required to remove the OBS systems. The planned dates are September 1

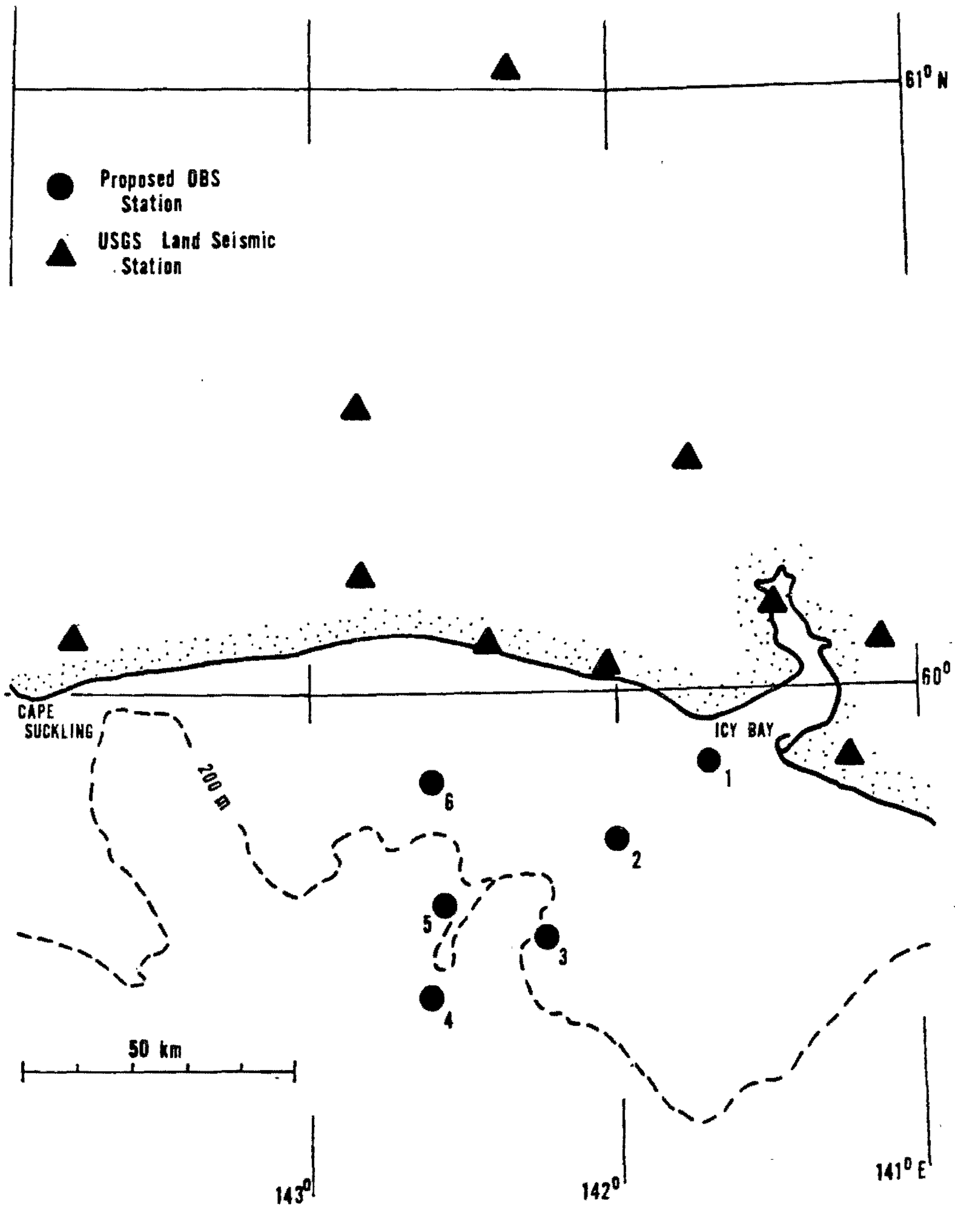

Figure 4. Proposed sites for OBS deployment.

and September 2 and these dates could slip back by as much as 20 days as long as we are notified before our arrival in Alaska.

5. In order to optimize use of ship time the OBS legs could be run in cooperation with other projects planning to work in the Icy Bay area. However sufficient time must be allowed at each of the 6 OBS stations for satisfactory completion of our tasks.

6. Equipment and personnel provided by ships:
a. Help from deck force in moving, lowering and recovering OBS systems.
b. Ship space required will consist of 8' of bench space to set up a radio receiver, strip-chart recorder, and other electronic test equipment.
c. Space for one 19" rack, approximately 5' high.
d. Refrigerator space of about 2 cu. ft. is desirable for battery storage.
e. High quality navigation, Loran C.
f. Winch with quick release.
g. Boat hook.
h. We need to mount a whip antenna on the mast during OBS recovery.

7. Weight and volume of equipment on the ship:

			Storage	
Item	Volume	Weight	Open	Closed
1 playback system	3'x3'x3'	100 lbs.		X
6 OBS units	each 2.5'x2.5'x2.5'	200 lbs.	X	

OBS units cannot be stacked.
Approximate total weight will be 1500 lbs.

8. Special handling of OBS equipment:
None

9. Gasses or chemicals required: Dry nitrogen

10. Ship preference:
Minimum of freeboard.

11. N/A

12. Participants,
deployment: 2, including Dr. Ambuter.
recovery: 2

B. Aircraft support.
Fixed wing. N/A

C. Aircraft support.
Helicopter. N/A

D. Quarters and subsistence support. N/A

E. Special logistics problems: None.

IV. A. Management project Plan:
Dr. Lahr will be responsible for the day-to-day operation of the project and for the timely completion of objectives. In deciding scientific and technical strategies and in interpreting results, he will be aided by Dr. Page. Dr. Lahr will assign various tasks to individuals working on this project and will monitor and review their work. Dr. Bruce Ambuter will be in charge of building and deploying the OBS systems.

B. Data Management:

The digital magnetic tapes from the OBS systems will be processed to produce IBM compatible digital tapes. A visible playback of each event recorded will be made. These records will be archived, along with the Develocorder films produced by the land stations. The OBS records will complement the land station records and will be used in a similar manner to derive the parameters of recorded earthquakes, including origin time, latitude, longitude, depth beneath surface (km), magnitude estimate, and an estimate of the precision of the location.

C. Data Products Schedule for OBS

Data Type	Media	Estimated Volume	Processing by PI	Collection Period	Submission
Earthquake Parameters	Preliminary Maps and Listings	60	Yes	Aug.1, 1978 to Aug. 30, 1978	Jan./79
Earthquake Parameters	Cards	60	Yes	Aug. 1, 1978 to Aug. 30, 1978	Apr./79

V. Coordination with other investigators.
This OBS research will be closely coordinated with the other offshore fault investigations of the U. S. Geological Survey. Information generated by either group will be made available to the other to assist in the interpretation of geologic hazards. The principal investigators are also in close communication with investigators at the Geophysical Institute of the University of Alaska and at the Lamont-Doherty Geological Observatory of Columbia University who are studying the seismicity and seismic hazards in the Kodiak Island and Alaskan Peninsula - southern Bering Sea regions.

VI. Outlook:

As seismic monitoring is continued over the next few years a more detailed understanding of the tectonic regime of the NEGOA will emerge. This will be essential to making more reliable estimates of the seismic hazard than can be made today. Significant milestones will include positive identification of additional active faults, earthquake recurrence estimates, and expected accelertion estimates for large earthquakes. The costs to do this work over the next few years should not vary greatly from FY 78 costs. However, depending upon the results obtained fr temporary OBS recording in FY 78, a greater emphasis may n placed on ocean bottom recording in order to speed up the which data is collected for the offshore areas.

VII A. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

B. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

C. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labeled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when these are used, and sexes where these are morphologically distinguishable.

D. At the option of the Project Office, the PI is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

E. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

F. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. B).

G. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

H. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

I. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release for information and for forwarding to BLM. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

J. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following acknowledgement is standard.

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

TABLE II

MILESTONE CHART

RU #: 210

PI: John C. Lahr
Robert A. Page

Major Milestones	1977			1978																
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
Reports: Quarterly				X															
Annual							X												
Quarterly										X									
Quarterly													X						
Seismic station maintenance										X	X								
OBS Experiment											X	X							
Data Submission to EDS/NGSDC Oct.to Dec. 1977										X									
Jan. to Mar. 1978													X						
Apr. to June 1978																X			
July to Sept. 1978																			X

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Research Unit #212

I. TITLE: Erosion, Deposition, Faulting and Instability of Shelf Sediments: Eastern Gulf of Alaska

II. PRINCIPAL INVESTIGATOR: Bruce F. Molnia
Paul R. Carlson

U. S. Geological Survey
Pacific-Arctic Branch of Marine Geology
Menlo Park, California 94025

III. GEOGRAPHICAL AREA AND INCLUSIVE DATES:

October 1, 1977 - September 30, 1978

Eastern Gulf of Alaska

The statements of work had not been received in finally approved form in time for publication.

PROPOSAL FOR

LAGRANGIAN SURFACE CURRENT OBSERVATIONS

(Continuation and extension of OCSEAP
Research Unit #217)

Submitted to

Outer Continental Shelf Environmental Assessment Program
Bering Sea - Gulf of Alaska Project Office
Juneau, Alaska

from

Atlantic Oceanographic and Meteorological Laboratories
Miami, Florida 33149

Principal Investigator
Donald V. Hansen

Total Cost of Proposal
$158,900

Period of Work: Oct. 1977 to October 1978

15 June 1977

I. Title: Langrangian Surface Current Measurements

R.U. 217
Contract Number ________
Proposal Dates - October 1, 1977 to September 30, 1978

II. Principal Investigator:

Donald V. Hansen

III. Cost
A. Science $143.4K
B. Logistics 15.5K
C. Total 158.9K
D. Distribution of effort by lease area (%)

Aleutians	16
Bristol Bay	19
Kodiac	16
NEGOA	30
St. George Basin	19

IV. Background: Collection of Lagrangian surface current data by means of satellite tracked free drift buoys was initiated in the NEGOA region at the end of 1975 primarily to provide data for development of a new concept in contaminant trajectory modelling. Because of important inhomogeneities in the circulation regime. This approach to modelling no longer appears attractive in the NEGOA region, these observations have however proven to be one of the most direct and easily interpretable methods of obtaining estimates of the probable movement of surface contaminants. They also provide a wealth of information on the spatial structure of the flow, and some of the most convincing data for verification of inferences drawn from other kinds of data as well as the results of modelling work. This year's work is an increase over last year's level of effort. Further analyses will be completed on data collected in the NEGOA, Bristol Bay, and St. George Basin during 1976-7, and additional deployments will be made, primarily in the Kodiac and Aleutian areas. Additional deployments may be made in the Bristol Bay/St. George Basin area if it appears necessary following work presently in progress there.

V. Objectives: The objectives of this research unit are to obtain Lagrangian surface current data, and to use these data singly and in combination with other data to describe the important features of the surface circulation in the various areas for the purpose of identifying critical impact areas. Attention will also be given to the feasibility of developing Lagrangian statistical models of oil spill dispersion for the new areas to be addressed. The concept is still viable for the Aleutians and Bering Sea areas.

VI. General Strategy and Approach: The general strategy is to deploy small groups (3 to 6) of drogued drift buoys either within an area of particular concern or at the presumed upstream side of larger regions. Because the general flow in the northern Gulf of Alaska is to the west, deployments are usually made at the eastern side of the sub regions. Buoys also are expected sometimes to escape their region of deployment and to provide data from adjacent regions as well. Because the greatest value has accrued from the buoy position data, and environmental sensors contribute heavily to buoy cost, the number of deployments to be made will be maximized by not including any sensors for environmental data other than a drogue-loss sensor.

VII. Sampling Methods: Six buoys are presently working in the Bering Sea region. Deployment of three additional buoys in the Kodiac region is scheduled for October. During the coming year it is planned to deploy 2 more sets of three buoys in the Kodiac area and three sets of three buoys in the Aleutian area. These buoys will be deployed on transects across the continental shelf in conjunction with STD cruises in the area scheduled for October 1977, and March, May, and September 1978. An additional five buoys will be available for additional deployments in the Bering Sea or other areas of special concern. The strategy for these deployments will be developed following results of work presently in progress.

VIII. Analytical Methods: A set of computerized objective analysis routines has been developed to process, display, and analyse buoy data. This system is described in Herman, Alan, and D.V. Hansen. Objective analysis of Lagrangian Trajectory Data. Proceedings of the American Congress on Surveying and Mapping, 37th Annual Meeting, Washington, D.C. February 26 March 5, 1977. pp 177-185. The entire package will be published as an ERL Technical Memorandum.

IX. Anticipated Problems: None.

X. Deliverable Products:

A. Digital Data

1. The new data to be collected and recorded consist of buoy position data as a function of time, adequate to define complete buoy trajectories and buoy velocity as a function of time.

2. Data will be processed and submitted in OCSEAP format by the investigator.

B. Narrative Reports: None other than quarterly and annual reports.

C. Visual Data: None planned. Trajectory plots can be provided to the project office on request, in either Polyconic or Mercator projection.

D. Other Non-digital data: None.

E. Data Submission Schedule: Data collection activities will be initiated according to cruise schedule referenced in Section VII or subsequent amendments. Buoys continue data collection following the cruise, but are not dependent upon a recovery cruise. Data will be submitted within 120 days of the time when the last of a deployment group has moved out of areas of interest to OCSEAP, or has ceased functioning.

XI. Information required from other investigations: None.

XII. Quality assurance plans: Not applicable. The operating system used requires only checks for internal consistency and noise reduction.

XIII. Special Sample and Voucher Specimen Archival Plans: None.

XIV. Logistic Requirements: Buoy deployments are best done by piggybacking on STD cruises. Simultaneous collection of data and complimentary experience of the scientific party in planning and operation are considerations. Investigator plans to take care of buoy shipment to ports of embarkation.

XV. Management Plan: Dr. Hansen will actively lead and supervise the conduct of the proposal work and the scientific interpretation thereof. Expendable buoy hardware will be acquired.

on procurement contract, buoys will be shipped to appropriate embarkation ports for deployment during STD cruises. Close coordination with personnel of PMEL and U. of Alaska is required for conduct of the deployment operations. Once launched, the buoys transmit autonomously. The transmission is received several times daily by the NIMBUS-6 satellite, processed by NASA/GSFC, and forwarded to AOML on magnetic tape approximately weekly. Editing, smoothing, and display, are then compiled at AOML. Dr. Hansen is an authorized user of the NIMBUS-6 system. The next generation of locating satellite systems is scheduled to go into operation about October 1978(see section XVI (3)). Present plans at NASA are to continue operation of the NIMBUS-6 system being used in this work unit to match or overlap establishment of the follow-on system.

XVI. Outlook:

1. The final results are expected to be improved site specific and statistical description of the surface circulation in the various OCSEAP regions to identify critical areas and generally help meet the needs of BLM lease activities.

2. Significant Milestones:

Complete Bering field effort	Dec. 78
Complete Kodiac field effort	Dec. 78
Complete Aleutian field effort	March 79
Finish joint analysis of Lagrangian and other data for NEGOA	Dec. 77
Finish preliminary analysis of Lagrangian data for Bristol Bay	Jan. 78
Finish joint analysis of Kodiac area	Dec. 78
Finish joint analysis of Bering Sea area	Jan. 79
Finish joint analysis of Aleutian area	June 79

3. Cost by fiscal year: After 1978, costs of acquiring this type of data will increase substantially because the data service now provided free of charge by NASA,

3. must be purchased from the French space agency with the next system. This data service cost is expected to be comparable to the buoy hardware cost. Further deployment plans should therefore be made only if critical questions about regional circulation patterns remain following the several deployments planned during FY 1978. It is expected that the major questions should be covered by deployments described in this proposal. At the end of FY 78, there will remain buoy equipment in the water collecting data, perhaps in more than one area. The data collection, editing and general processing, followed by synthesis with the other kinds of physical oceanographic data will continue into FY79 and FY80. Funding requirements are estimated at $50 K in each of these years.

4. Additional major equipment needed: None unless further new data needs are discovered.

5. Location of future field efforts: Not Applicable.

6. Logistics requirements: None.

XVII. 1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labelled, held, and shipped to an official OCSEAP - designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when these are used, and sexes where these are morphologically distinguishable.

4. At the option of the Project Office the PI is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release for information and for forwarding to BLM. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following acknowledgment is standard.

    " This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION NOAA/AOML PRINCIPAL INVESTIGATOR D Hansen

A. SHIP SUPPORT

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions.
NA

2. Describe types of observations to be made on tracks and/or at each grid station Include a description of shipboard sampling operations. Be as specific and comprehensive as possible.
NA

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.)
should be coincident with STD cruises

4. How many sea days are required for each leg? (Assume vessel cruising speed of 14 knots for NOAA vessels. Do not include running time from port to beginning point and from end point to port and do not include a weather factor.) NA

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Can piggyback

Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling-time on station and sample processing time between stations.
Negligible

6. What equipment and personnel would you expect the ship to provide?
Assistance on dock (2 men) for short periods

7. What is the approximate weight and volume of equipment you will bring?
Less than 1 Ton and less than 500 ft³ per cruise. Can be stored on deck.

8. Will your data or equipment require special handling? NO If yes, please describe:

9. Will you require any gasses and/or chemicals? NO If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If "yes" please name the vessel and give the reason for so specifying.
NO

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availability
NA

MILESTONE CHART

RU #: 217 PI: D.V. Hansen

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978													
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D		
Buoy deployments	Δ					Δ		Δ				Δ					
Data Submission (estimate)			Δ				Δ			Δ			Δ				Δ
Quarterly Report			Δ						Δ			Δ					
Annual Report						Δ											

ENVIRONMENTAL RESEARCH LABORATORIES
AOML/Physical Oceanography Laboratory
15 Rickenbacker Causeway
Miami, Florida 33149

Date: September 2, 1977 Refer to: RH1-173H-41.02

To : Dr. Herbert E. Bruce
Bering Sea-Gulf of Alaska Project Manager
OCSEAP, Juneau, Alaska

From: D. V. Hansen D Hansen
Director, Physical Oceanography Laboratory

Subj: Reduction of Budget and Level of Effort on Research Unit #217

Reference: Guidance Letters RFx41-217-500, RFx41-217-607, RFx41-217-655

Your most recent guidance letter advises that the budget for this work unit must be reduced from $158,900 to $89,800 by deletion of all work proposed for the Bering Sea area and curtailment of effort in the Aleutian area. I am agreeable to these changes. It is unfortunate that we cannot exploit the existence of the NIMBUS-6 more extensively during the probable last year of its operational life. The choice of areas where the effort will be reduced is sound in that the buoys presently deployed in the Bering Sea are giving excellent results for that area, thus reducing the need for future work there, and there is reasonable expectation that some of the buoys to be deployed in the Kodiak area will provide information for the Aleutian area.

cc: Program Office
Director, AOML

BIOLOGY OF THE HARBOR SEAL, *PHOCA VITULINA RICHARDI*, IN THE GULF OF ALASKA

OCSEAP RESEARCH UNIT #229

Principal Investigators

Kenneth W. Pitcher and Donald G. Calkins

Total Cost $80,045

Alaska Department of Fish and Game

Division of Game

1 October 1977 - 30 September 1978

Technical Proposal Form

I. Title: Biology of the harbor seal, *Phoca vitulina richardi* in the Gulf of Alaska

Research Unit: #229

Contract Number: #03-5-022-69

Proposed Dates of Contract: 1 October 1977 to 30 September 1978

II. Principal Investigators: Kenneth W. Pitcher
Donald G. Calkins

III. Cost of Proposal:

Total - $80,045

Distribution of effort by lease area

NEGOA	25%
Lower Cook Inlet	12%
Kodiak	63%

IV. Background: The proposed research is a continuation of work begun in 1975 to investigate the biology and life history of the harbor seal in the Gulf of Alaska. Much of the work involving prey selection and trophic relationships closely ties in with the biological oceanography studies and assessment of marine fish, bird and invertebrate populations which are being conducted in the Gulf of Alaska. The original objectives of RU-229 were quite general in nature and the study area spanned a large geographical area. Considerable progress has been made during the past two years. Many of the questions regarding food habits, reproduction, growth and body condition have been answered. Some data gaps do exist particularly regarding seasonal and geographic variations. We are now at a point where we feel the value of harbor seal research to the OCS program would be enhanced by a general shift in emphasis from a broad life history approach to a narrower more intense effort aimed at specific problems. We are proposing FY 78 as a transition year. Considerable effort will be expended filling data gaps which exist in our general biological studies while new intensive work will begin in other areas, mainly in the field of developing techniques for monitoring population status. While the importance of monitoring size of harbor seal populations is obvious, virtually no work has been done. Much of the harbor seals life is spent in and under water where direct counting is impossible. Recent work in Alaska showed that far greater numbers haul out during the molt (15 August - 15 September) than at other times of the year (Johnson 1976 and Pitcher and Calkins 1977). With this knowledge and with the recent development of radio-tracking equipment which has been used successfully on phocid seals (Siniff et al. 1975) it now appears feasible to develop techniques for obtaining data on population trends of harbor seals.

The most feasible method of monitoring population status over time appears to be by establishing trend count areas. These will be established at strategically located haul out areas and monitored annually during the peak hauling period of the molt.

Tugidak Island, one of the Trinity Island group, is located 24 km southwest of Kodiak Island within the southern portion of the proposed western Gulf of Alaska lease area (Fig. 1). Tugidak is used as a haul out ground for the largest known concentration of harbor seals in the world. Although the size of this population is unknown, several very general estimates are available (Table 1) which illustrate the general magnitude.

Table 1. Population estimates of harbor seals for Tugidak Island.

Estimate Source	Population Estimate
Mathisen and Loop (1963)	15,000*
Bishop (1967)	12-17,000**
1964 pup production with Bigg's (1969) population parameters	15,925
1964 pup production with Pitcher's (1977) population parameters	22,872

* Mathisen and Lopp give only Trinity Islands total of 16,776 - this has been adjusted to give Tugidak estimate.

** Bishop used 32% as gross annual productivity which later research has shown to be high. This would cause his estimate to be low.

Tugidak Island, by virtue of the large numbers of harbor seals using the island must be considered critical habitat. Tugidak has a number of characteristics typically attributed to good harbor seal hauling habitat. The location is remote and isolated and receives relatively little human disturbance. The sand and gravel beaches provide extensive areas for hauling. No large terrestrial predators are found on the island. Tremendous expanses of shallow, productive waters adjacent to the island provide excellent feeding habitat. Tugidak appears to be particularly important for pupping and molting activities. In 1964 an estimated 4,300 pups were produced on the island (Bishop 1967). During the height of the molt, 15 August to 15 September, there is a considerable increase in hauling activity which may very well be related to a physiological requirement for warming of the epidermis during the molt (Feltz and Fay 1966 and Ling et al. 1974).

Observations made during the summer of 1976 (Pitcher and Calkins 1977) indicated the OCS activities were already having a harmful effect on Tugidak Island harbor seals. Helicopters transporting geologists, involved in exploration, resulted in frequent disturbance and subsequent separation of females and young pups which apparently often resulted in the death of the pups. Other effects of disturbance are not so easily observed but may result in reduced long-term survival. Other possible effects of exploration for and development of oil reserves on the health and status of harbor seal populations are not known.

IV. Objectives: Continuing objectives are; (1). Investigation of food habits and identification of important prey species. (2). Examination of growth and body condition. (3). Determination of population productivity with emphasis on establishing age of sexual maturity and age specific pregnancy rates. Peripheral objectives include collection of data concerning distribution, use of critical habitats, effects of disturbance, population composition and collection of specimen materials for disease and environmental pollutant analyses.

New objectives of proposed research for FY 78 are: (1) to establish population trend count areas at strategically located haul out areas, (2) to develop techniques and explore the feasibility of conducting a census of harbor seals on Tugidak Island, (3) to examine activity patterns of harbor seals on Tugidak Island, to find out the proportion of time seals spend hauled out, (4) to determine if there are differential use patterns by different sex and age classes of harbor seals on Tugidak Island and (5) to collect information on movements and population discreteness of harbor seals on Tugidak Island.

Exploration, development and transportation of petroleum reserves in the Gulf of Alaska have a number of potential harmful effects on harbor seal populations. Some of the more obvious include the following: (1) direct injury to animals through contact or ingestion of oil (this may result directly in death of the individuals involved or could result in lowered physical condition which in turn might alter long term survival and biological processes such as growth and reproduction). (2) disturbance, particularly during vulnerable stage of their life cycle such as pupping and molting activities, (3) reduction of productivity of the marine system by contamination, (4) direct mortality of important prey species by contact with oil and (5) increased levels of environmental contaminants.

This project was designed to collect information to aid in the decision making process for gas and oil development in the Gulf of Alaska. Data gathered will enable guidelines to be placed on all stages of the O.C.S. development program that will reduce harmful effects on harbor seal populations. Predevelopment data are being collected so changes which might occur can be detected.

Tugidak Island has the largest single concentration of harbor seals in the world and is located near proposed OCS lease sites in the western Gulf of Alaska. Exploratory activities for oil reserves has already had a harmful effect on this population by increasing pup mortality. Continued exploration for and development and transport of oil reserves have the potential for other negative impacts on the population.

As previously stated the population size of Tugidak harbor seals is unknown. Various estimates have ranged from 12,000 to 23,000 animals. These are very general estimates and the degree of reliability cannot be quantified. In order to understand the true significance of this population and measure the effects of OCS development on it we must obtain a reliable baseline population estimate.

Studies conducted during 1976 indicated the possibility that certain sex and age classes may have different timing in their haul out requirements. It may be that in the future it will become desirable to restrict disturbance when certain segments of the population are ashore e.g. mature females. For this we need to understand the haul out patterns of harbor seals. Should some catastrophic event, such as an oil spill, occur and large scale mortality result it would be important to evaluate the severity in light of population segments involved.

There is evidence that a large breeding population such as occurs at Tugidak may be important for repopulating areas some distance away. Based on a tagging study from a population in the British Isles, Bonner and Witthames (1974) stated that harbor seals are capable of wide dispersal and speculated that the population that they studied could function as a reservoir from which other populations which had been depleted could be replenished. Based on recoveries of harbor seal pups, which were tagged on Tugidak, of up to 160 km away, it seems entirely possible that the Tugidak population could perform such a function. If this is the case, the Tugidak population assumes even greater importance with the prospect of oil development in a number of areas in the Gulf of Alaska.

The Tugidak harbor seal population is rather unique from a scientific research viewpoint. The particular situation lends itself to conducting a number of research activities which are not possible in most areas. This is one of the few populations for which a census may be possible with present technology. It appears promising that knowledge gained from intensive study of this population can be applied to other populations near prospective lease sites which cannot be so readily studied.

VI. General Strategy and Approach: Data gaps in the general life history study will be filled during the coming year by selective collecting of harbor seals by area and season.

Data on population productivity will be gathered through the analysis of reproductive tracts from collected animals. By combining these analyses with age determination techniques a number of reproductive parameters will be estimated including: age specific reproductive rates, age of sexual maturity, reproductive duration and frequency of breeding.

Food habits and trophic relations will be approached through the analysis of contents contained in stomachs and intestinal tracts of collected animals.

Growth rates for harbor seal populations in different areas of the Gulf will be examined by comparison of weights and measurements of the various sex and age classes. Body condition will be examined through comparison of blubber reserves by sex and age class, area and season.

Specimen materials for pathology and environmental contaminant loads will be taken from each collected animals. Data will be collected on an opportunistic basis on segregation, seasonal distribution and use of critical habitat.

Population trend count sites will be established at major haul out areas. Criteria for their selection will include: representative habitat, consistant use, ease and accuracy of counting and accessibility. These count areas will be monitored annually in order to detect long range trends in population abundance.

The work proposed for Tugidak Island is based on attachment of radios and subsequent tracking of individual harbor seals. From these individuals we expect to gain considerable insight into activity patterns, haul out behavior and seasonal use patterns. In addition information and techniques necessary for future census work will be obtained.

VII. Sampling Methods: Sampling for populations productivity data must take place during the period when it is possible to determine with certainty if the animal is either supporting a fetus or has recently given birth (i.e. from implantation of the blastocyst in October to cessation of lactation in early July). It is not possible to accurately determine reproductive status during the period of delayed implantation (July-September). Spatial sampling for productivity information should include animals from various "populations" in the Gulf as each may exhibit unique productivity characteristics related to population status and quality of habitat. Sampling areas include: Cape Fairweather to Cape St. Elias, Copper River Delta-Prince

William Sound, Kenai Coast, Southern Kodiak plus Trinity Islands and northern Kodiak, Afognak and Shuyak.

Food habit sampling will coincide with the population productivity work. However, because of seasonal variations which occur, additional sampling must take place during the period: July-September when the productivity work is not normally conducted.

VIII. Analytical Methods: Weights and standard measurements are taken from each collected animal including: total weight, blubber weight, standard length, curvilinear length, axillary girth, maximal girth, hind flipper length and blubber thickness (Scheffer 1967). These data are being collected to establish growth rates, seasonal condition patterns and assist in making calculations of biomass.

Age determinations are being made. This is done by decalcifying a canine tooth from each animal, using a microtome to produce thin sections, staining the sections with hematoxylin and counting the annual growth rings with the aid of a microscope (Johnson and Lucier 1975). Age determinations are necessary for development of growth rates and to determine population structure and productivity.

The ovaries and uterus are taken from each female seal and preserved in formalin. Presence or absence of a conceptus in the uterus is determined using standard laboratory techniques for reproductive analysis and a partial reproductive history is reconstructed by examination of ovarian structures. These data are necessary for determination of ages of sexual maturity and age specific reproductive rates, basic parameters required for population productivity calculations.

Testes and epididymides from each male seal are collected and preserved. A microscopic examination is made of epididymal fluid to determine whether sperm are present or not. These data are used for determination of age of sexual maturity and periods of seasonal potency in males.

Stomach contents from each seal are preserved in formalin. Weights and volumes are determined for all contents. Identifications of prey species are made by examination of recognizable individuals and skeletal materials of diagnostic value. Frequency of occurrence and numbers of individual prey species are then determined.

Intestinal contents from each seal are strained through mesh sieves to recover fish otoliths. Otoliths, which are diagnostic to species, are compared to a reference collection and identified. All otoliths to date have been sent to John Fitch for verification of the identifications (Fitch and Brownell 1968).

IX. Anticipated Problems: No major difficulties expected.

X. Deliverable Products:

A. Digital Data:

Collection Location	Ovary/Corpora lutea
Date/Time	Corpora albicantia
Habitat	Follicles
Behavior	Number of Uterine Scars
NODC Taxonomic Code	Sperm Determination
Sex	Baculum/Testes Measurements
Activity	Weight and Volume Food Contents
Measurements/Weights	Stomach Content Species
Age/Age Determination	NODC Taxonomic Code
Reproductive Status	Life History Code
Number of Fetuses	Misc. Stomach Contents
Number/Volume/Weight of Identified Items	Mean/Maximum/Minimum Length of Identified Items
Digestive Organ	

2. List of digital products: see data products schedule.

B. Narrative Reports - Nothing in addition to the required quarterly, annual and final reports.

C. Visual Data: None.

D. Other Non-Digital Data: None.

E. Data Submission Schedule: See data products schedule.

XI. Data Required From Other Investigators: No information will be required of other investigators. However, any data collected regarding abundance, distribution and biology of prey species will compliment the food habit studies.

XII. Quality Assurance Plans: Data sheets are designed so that data are key punched directly from them. The data printout is completely checked entry by entry from the raw data sheets. Limits for each data field are being submitted in order to screen the data for major errors. A copy of the raw data forms, printout and keypunched cards are stored in our office in event data are lost in transit.

XIII. Special Sample and Voucher Specimen Archival Plans: Not applicable.

XV. Management Plan: All sampling activities will be under direct supervision of the principal investigators. Laboratory analyses will be accomplished both by the principal investigators and by qualified laboratory personnel in the Department of Fish and Game Anchorage laboratory. Data analysis will be done by the principal investigators with assistance by a Department biometrician. Report writing will be done by the principal investigators.

XVI. Outlook: As previously mentioned we envision FY 78 as a year of transition. We propose to divide our effort between completing the general life history studies and initiating new work in the field of developing census techniques and monitoring population trends. Data concerning activity patterns, haul out needs and behavior and seasonal use patterns and requirements will be collected. The anticipated long term final results will be a statistically qualified population estimate for the large and very important harbor seal population located on Tugidak Island. In addition, we plan to establish trend count areas at key haul out sites in each of the lease areas. From these we anticipate collecting data which will be useful for monitoring population trends over time.

Significant milestones will include; the successful deployment of radio tracking equipment, understanding of activity patterns, understanding of individual movements and population discreteness and knowledge of haul out behavior. Major goals will be the establishment of trend count sites in each of the lease areas.

Cost by fiscal year is anticipated to be approximately the same as current levels i.e. $80,000.

The only major equipment purchase anticipated is radio tracking equipment.

Locations of future field efforts will be Tugidak Island and selected sites within the major lease areas.

Logistic requirements are anticipated to be reduced from current needs. Limited helicopter and possibly ship time may be requested for transportation of personnel and materials to field camps.

Consideration should be given to extending harbor seal life history studies to the proposed Aleutian Shelf lease area. As collecting activities in the Gulf of Alaska are to be completed during FY 78 we propose to begin work in the Aleutian Shelf in FY 79. Similar methods and techniques for collection and analysis of data will be employed. Due to the remoteness of the area we anticipate increased requests for logistics from NOAA. All field activities would be cooperative ventures with RU 243 (Steller sea lion).

A large and important land breeding harbor seal population in the southeastern Bering Sea should be studied. Present studies are examining the species associated with the ice to the north and land breeding harbor seals and Steller sea lions in the Gulf of Alaska. No biological data are now being collected from this population. It would be desirable to study this population after work in the Aleutian shelf area is completed.

Table 2. Types of data, limits and frequency of collection RU-229.

Data Field	Normal Limits	Frequency of Collection
Location of Collection	N/A	Always
Date of Collection	N/A	Always
Time of Collection	N/A	Most of the time
Habitat Code	00-41	Most of the time
Behavior Code	0-70	Most of the time
Taxonomic Code	9221030107	Always
Sub Species	01	Always
Sex Code	0-2	Always
Accomp. by Pup	Y-N	Occasionally
Lactating	Y-N	Occasionally
Mammal Sunk	Y-N	Most of the time
Group Size	0-15,000	Most of the time
Weight Hide and Blubber	1000-113000	Most of the time
Curvilinear Length	0.0-250.0	Most of the time
Axillary Girth	0.0-200.0	Most of the time
Maximum Girth	0.0-200.0	Most of the time
Hind Flipper Length	0.0-35.0	Most of the time
Blubber Thickness Sternum	0.0-7.5	Most of the time
Age	0-50	Most of the time
Age Unit Code	1 or 2	Most of the time
Age Determination Technique	1 thru 4	Most of the time
Baculum Length	10-200	Some of the time
Baculum Weight	0.1-30.0	Some of the time

Table 2 (cont.) Types of data, limits and frequency of collection RU-229.

Data Field	Normal Limits	Frequency of Collection
Testes Weight with Epididymis	1.0-125.0	Most of the time
Testes Weight without Epididymis	0.5-100.0	Most of the time
Testes Volume	0.5-100.0	Most of the time
Testes Length	1.0-12.0	Most of the time
Testes Weight	0.5-5.0	Most of the time
Presence of Sperm in Epididymis	0-3	Most of the time
Sperm Method of Determination	0-2	Most of the time
Reproductive Status Code	0-3	Most of the time
Reproductive Condition Code	0-8	Most of the time
Number of Fetuses	0-2	Most of the time
Ovary Weight	0-3	Most of the time
Number of Corpora Lutea	0-30.0	Most of the time
Diameter of Largest Corpora Lutea	0-300	Most of the time
Number of Corpora Albicantia	0-10	Most of the time
Diameter of Longest Corpora Lutea	0-300	Most of the time
Number of Corpora Albicantia	0-10	Most of the time
Diameter of Largest Corpora Albicantia	0-200	Most of the time
Number of Follicles Greater than 5mm in Diameter	0-10	Most of the time
Diameter of Largest Follicle	0-300	Most of the time
Number of Uterine Scars	0-3	Some of the time
Weight of Food Contents	0-7000.0	Some of the time
Total Volume of Food Contents	0-7000.0	Some of the time
Taxonomic Code	NODC Code	Most of the time

Table 2 (cont.) Types of data, limits and frequency of collection RU-229.

Data Field	Normal Limits	Frequency of Collection
Life History Code	0-9	Occasionally
Miscellaneous Stomach Contents	01-11	Occasionally
Number of Items Identified	0-10,000	Some of the time
Volume of Items Identified	0-7000.0	Some of the time
Weight of Items Identified	0-7000.0	Some of the time
Mean Length of Items Identified	0-1000	Occasionally
Maximum Length of Item Identified	0-1000	Occasionally
Minimum Length of Item Identified	0-1000	Occasionally

XVII.1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labeled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when these are used, and sexes where these are morphologically distinguishable.

4. At the option of the project office the PI is prepared to travel to the project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release for information and for forwarding to BLM. The release of such information within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following acknowledgement is standard.

11. In the past, some confusion has developed on the schedule for data submission in the specimen format of RU 229. The confusion has arisen because of the eight record types which are submitted at various intervals after the initial animal collection. Record types 1-3 all involve data which are related to environmental conditions at the time of collection and physical measurements of the animal i.e. measurements and weights. These data are available immediately after collection and are submitted within 120 days of collection. Record types 4 and 5 involve age and reproductive analyses both of which involve somewhat lengthy laboratory procedures. Record types 6 and 7, food habit analyses, also involve lenghty laboratory procedures. The time lag is even greater than for record types 4 and 5 because material must be submitted to outside authorities for verification of identifications. Again, data will be submitted within 120 days after analyses are completed.

As requested in the guidance letter, a series of tables and figures from the 1977 annual report followed as Appendix I, illustrating graphical presentation of data.

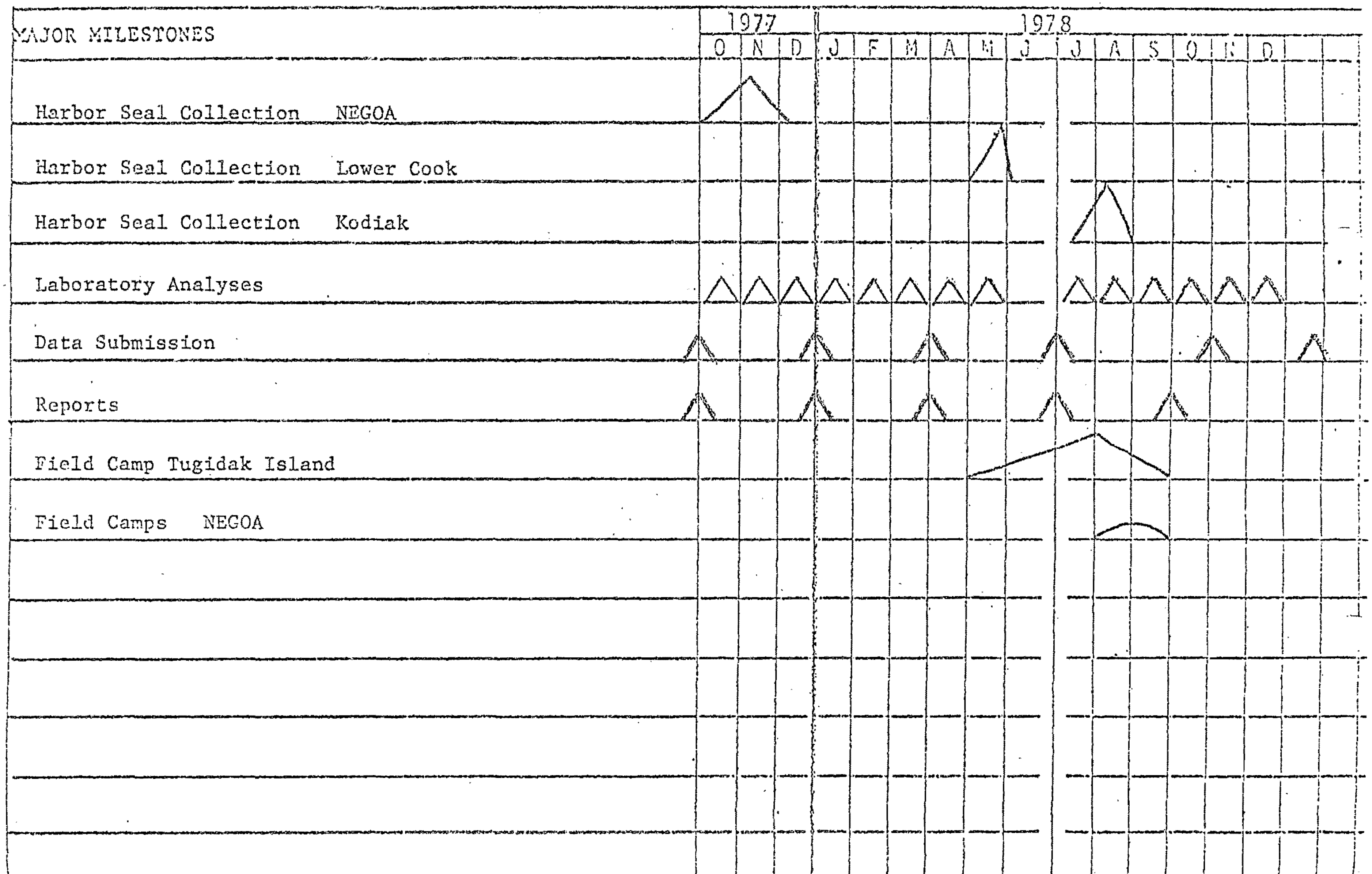
Data Products Schedule

a Type . Intertidal, thic Organisms, .)	Media (Cards, coding sheets, tapes, disks)	Estimated Volume (Volume of processed data)	OCSEAP Format (If known)	Processing and Formating done by PI (Yes or No)	Collection Period (Month/Year to Month/Year)	Submission (Month/Year)
rbor Seal imen data	Magnetic Tapes	100 animals at 12 cards per animal	File types 025, 026, 027	Yes	Oct. 1977 to Sept. 1978	31 Dec 78

MILESTONE CHART

RU #: 229 PI: K. Pitcher, D. Calkins

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.



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Title: The natural history and ecology of the bearded seal, _Erignathus barbatus_, and the ringed seal, _Phoca_ (_Pusa_) _hispida_

Research Unit Number: 230

Principal Investigators: John J. Burns, Thomas J. Eley and Kathryn J. Frost

Institution: Alaska Department of Fish and Game
1300 College Road
Fairbanks, Alaska 99701

Date of Proposal: July 1, 1977

Required Signatures:

Principal Investigators:

Names John J. Burns Date 1 July 1977
Thomas J. Eley
Kathryn J. Frost

Address Alaska Department of Fish and Game, 1300 College Road,
Fairbanks, Alaska 99701

Telephone Number 452-1531

Required Organization Approval:

Name [illegible signature] Date 1 July 1977

Address Alaska Department of Fish and Game, Subport Building,
Juneau, Alaska 99801

Telephone Number 465-4190

Organizaton Financial Officer:

Name [illegible signature] Date 1 July 1977

Address Alaska Department of Fish and Game, Subport Building,
Juneau, Alaska 99801

Telephone Number 465-4120

C. Technical Proposal:

I. Title: The natural history and ecology of the bearded seal, *Erignathus barbatus*, and the ringed seal, *Phoca (Pusa) hispida*.

Research Unit Number: 230

Contract Number: 03-5-022-53

Proposed Dates of Contract: 1 October 1977 to 30 September 1978

II. Principal Investigators: John J. Burns, Thomas J. Eley, Jr., Kathryn J. Frost

III. Cost of Proposal: $113,600

Distribution of effort by lease area:

1. Beaufort Sea, 40%
2. Chukchi Sea, 40%
3. Bering Sea (Norton Sound and St. George Basin), 20%

IV. Background: This multi-year study focuses on the biology and population dynamics of the two species of ice-inhabiting seals of greatest importance to coastal inhabitants of arctic Alaska. The two species differ widely in their biology as it is currently understood. The ringed seal is a relatively small pinniped with greatest densities observed nearshore, in drifting and landfast ice. It is dependent on zooplankton and small fishes. The bearded seal is a large animal and the most completely independent on land of the two. It occurs mainly offshore and feeds on benthos in those areas which are seasonally covered with drifting ice.

In order to understand the biology of these two northern seal species and to acquire information necessary to predict probable impacts of OCS development, several kinds of data are required. These data include: distribution patterns, migration routes and timing, natality, mortality, growth (fetal and neonatal), population structure, longevity, age specific reproduction, habitat requirements and other process studies. The extent of dependency on these two species by Native Alaskans must also be monitored. These studies are required to develop an assessment of the vulnerability to, and recovery from perturbations which are likely to result from OCS development.

Field work depends in part on securing specimens from key coastal sites where the investigators make use of their unique, privileged associations with Native hunters, who make available bearded and ringed seals they harvest. In important areas beyond the operating range of coastal based hunters, project personnel obtain required samples by collection efforts from a variety of OCS-supported logistic platforms or from strategically located facilities on the coast (particularly in the Beaufort Sea where Native hunting is very limited).

Almost all specimen material will be analyzed in the Fairbanks laboratory. Data from shipboard and aerial surveys will also be acquired. Initial analysis will be accomplished at the University of Alaska Computer Center. Specimen material, as requested, will be made available to a variety of other investigators.

The project is characterized by taking the maximal amount of information from collected specimens, and making these analyses available to other projects (RU 194, 232, 248). The large number of determining parameters require extensive computer support for analytic work, and a multi-year systematic effort at data gathering. The 1978 effort is designed to shift emphasis to the Beaufort Sea; a region which has not been featured in previous years' work, because of relatively high costs of operation and low densities of these seals. However, the much larger harvest-based collections now undergoing analysis will provide the context of variability in which necessarily small Beaufort Sea samples can be interpreted.

Some of the most significant tentative findings to emerge from the OCSEAP funded study conducted to date are: 1) compared with information from the 1960's there has been a general decline in productivity of ringed seals in all areas studied; 2) the density of ringed seals on landfast ice of the Beaufort Sea, during late spring, has been declining since 1970; 3) the density of ringed seals in the southern Chukchi Sea and Norton Sound, during spring, currently appears higher than in previous years; 4) during the past two years there has been a significant increase in polar bears (these bears feed mainly on ringed seals) south of Bering Strait during winter and early spring; 5) productivity of bearded seals has remained high and stable; 6) significant numbers of bearded seals winter as far south as the ice front including the proposed Bristol Bay and St. George Basin lease areas; and 7) more definitive information about all aspects of reproduction in ringed and bearded seals in the Bering and Chukchi Seas has been obtained. We have not had the opportunity to work effectively in the Beaufort Sea, except to conduct aerial surveys during late spring.

This study is designed specifically to provide information and specimen material for use in other projects (as indicated above) and to acquire the baseline information necessary for investigators involved in broader systems analyses.

Virtually no work has previously been done on seals in the western Beaufort Sea. In other areas, most notably the Bering Sea, a significant amount of research has been done by both Soviet and American investigators. We are attempting to expand upon these previous investigations. By doing so it is possible to increase the time dimension required for meaningful analyses of biological parameters as well as to address aspects of seal biology which have not been adequately investigated.

V. Objectives:

1. The summarization and evaluation of literature and current unpublished information on reproduction, distribution, abundance, food habits and human utilization and dependence on bearded and ringed seals in the Bering, Chukchi and Beaufort Seas.

2. Determination of the spatial and temporal distribution of these seals including assessment of regional differences in density and distribution in relation to proposed OCS lease areas and, to a lesser extent, in relation to major habitat conditions.

   The relevance of this objective relates to the importance of lease areas as seasonal seal habitat or as routes of movement.

3. Determination of population structure and dynamics of these two seal species as indicated by composition of the harvest taken by Eskimo subsistence hunters.

   Initial studies indicate significant segregation of age classes, especially of ringed seals within the various proposed lease areas. Demographic information is also required as pre-development baseline data.

4. Determination of the current parameters of productivity.

   Information about the biological productivity of bearded and ringed seals is basic to any determination of population health, vigor, trends and standing stock. It is also a major baseline parameter required for comparison with information which may be obtained during and after petroleum development.

5. Acquisition of natural history information including growth, behavior, conditions, annual biological events and habitat requirements.

   This information is a significant component of required baseline assessment of bearded and ringed seals.

6. Determination of the magnitude of annual harvest of these seals by coastal residents of Alaska.

   Bearded and ringed seals are the species taken in largest numbers by village residents of the north coast. Their dependence on these species is significant and must be determined.

7. Acquisition of specimen material required for the successful continuance of other studies, particularly RU#232 and 194.

   The proposed study of the natural history of bearded and ringed seals is an integral component of a group of investigations designed to investigate the ecological relationships among marine mammals and the processes operative within the marine systems proposed for OCS development. The information obtained in this and other studies will be required for the formulation of ecological models of the regions in question.

VI. General Strategy and Approach: The strategy which will be employed to meet these general objectives is as follows:

1. Primary sites for field work will be at those coastal settlements where subsistence hunting is an important activity. Offshore work will be conducted from vessels or aircraft, particularly in Norton Sound, St. George Basin, Chukchi Sea and Beaufort Sea.

2. A large series of animals, taken by both subsistence hunters (nearshore samples) and the principal investigators (offshore samples) will be weighed, measured and necropsied in the field.

3. The samples required for the various objectives will be processed in the laboratory in Fairbanks. These include but are not limited to: teeth for age determination (and subsequently correlation of age with every other aspect of the biology of these seals); reproductive tracts for determination of natality, natal mortality, fetal growth, seasonality of reproductive events, ages at sexual maturity and senility, etc.; blood and tissue samples for use in acquiring baseline data on regional and seasonal conditions, mortality, morbidity and contaminant burdens.

4. Based on the required large series of specimens from coastal and offshore sites, the population structures will be analyzed.

5. Observations at various locations during different times of the year will provide information on seal movements, distribution and density as well as magnitude and composition of harvests. Data will be obtained at coastal settlements as well as through use of ships and aircraft deployed for various scientific missions.

6. Specimens and data will be provided specifically for two other projects involved with different aspects of marine mammal ecology. These are RU#232, trophic studies and RU#248, relationships of marine mammals to sea ice.

VII. Sampling Methods: As during the previous contract year, we will obtain specimen material in two ways:

1. The bulk of our material will be obtained at coastal hunting villages located in the study areas. Subsistence harvests are in relation to availability which may or may not be biased.

2. In areas where specimen material cannot be obtained in the above manner (e.g. St. George Basin and offshore Chukchi Sea),

we will collect specimen material ourselves. Village residents will be employed to field process seals during critical periods. Provisions will be made to obtain records and observations of bearded and ringed seals from interested collaborators including commercial pilots.

Location	Sampling Schedule	
A. Village Collections		
Beaufort Sea (Barrow)	intermittent	November to August
Northern Chukchi Sea (Wainwright)	intermittent	January to March July to August
Central Chukchi Sea (Pt. Hope)	optional	winter 1978
Southern Chukchi Sea (Shishmaref)	November	June to July
Norton Sound (Nome area)	intermittent	November to June
St. Lawrence Island	intermittent	November to June
Central Bering Sea (Tanunak or Hooper Bay)	optional	winter 1978
B. Shipboard Collections, including ship based helicopters		
Beaufort Sea - USCGC Icebreaker		August - September
Norton Sound - ice strengthened vessel (SURVEYOR)		November
St. George Basin/Bristol Bay - USCGC Icebreaker		February
St. George Basin/Bristol Bay - ice strengthened vessel (SURVEYOR)		May-June
C. Aircraft Operations, land based		
Beaufort Sea (Deadhorse)	helicopter	November
Chukchi Sea (Cape Lisburne or Barrow)	helicopter	March
Beaufort Sea (Deadhorse)	helicopter	April
Northern Chukchi and Beaufort Seas (from Barrow)	fixed-wing	June

VIII. Analytical Methods:

A. Ringed and bearded seals are collected as systematically as possible from different geographic areas and habitat types throughout the year. The objective of our sampling program is to detect variations in sex and age distribution, growth rates, reproductive conditions and parasite loads in relation to season, geographic area and habitat type. Acquisition of the large amounts of specimen material required for an understanding of the natural history and ecology of these two species is continuing at major Eskimo hunting villages. In addition, selective collection by the principal investigators is utilized to collect animals under specific environmental, temporal or behavioral conditions. Selective collection provides additional data that cannot be obtained from the animals taken at the Eskimo hunting sites.

B. Weights and standard measurements are taken, when possible, from animals taken by Eskimo hunters, and from all animals selectively collected. The weights and measurements include: gross weight, hide and blubber weight, curvilinear length, standard length, axillary girth, maximum girth, front and hind flipper lengths and widths, navel to anus length, penis to anus length, tail length and blubber thickness at the sternum. These data are used to establish fetal, pup, subadult and adult growth rates, seasonal condition patterns and to assist in making biomass calculations. In addition to weights and standard measurements, we attempt to obtain: specific location, date and time of collection; group size and composition; tidal stage; and water depth.

C. The sex of a specimen is determined by examination of the external genitalia, or reproductive organs in those cases where the intact animal is not presented.

D. The ages of all seals for which claws are available are initially estimated by claw examination. The claw provides a rapid and accurate means of age determination for seals up to six years of age, as growth rings or ridges are formed annually on the claw. After six years the claws are worn such that the initial ring ("constriction of birth") and usually subsequent rings are worn off. For these specimens, a canine tooth is sectioned and stained with paragon stay. The tooth sections are examined with the aid of a light microscope and the age of the seal is determined by enumerating the dentine or cementum annuli. Age determinations are necessary for development of growth rates, to determine population structure and productivity, and age specific food habits.

E. Species productivity is determined through laboratory examination of reproductive tracts and correlation of these data with the age of each specimen.

Testes are weighed to the nearest 0.1g with and without epididymides. Length and width at the middle of the testes are measured to the nearest millimeter. Testes volume (nearest cc) is determined by water displacement. Bacula are cleaned by boiling, air dried and then measured (nearest mm) and weighed (nearest 0.1g).

The presence of sperm in the epididymides is used to ascertain breeding condition. The epididymides are sliced and a drop of fluid is squeezed onto a slide and examined under 78x or 300x mangification. Sperm presence or absence in the epididymal fluid is quantified as: none found, trace or abundant.

Ovaries are weighed to the nearest 0.1 g and then cut into 2mm longitudinal sections. The sections are left joined at the base to preserve their relative position. The sections are examined macroscopically for corpora lutea, corpora albicantia, follicles and ovarian masses or abnormalities. The largest diameter of corpora lutea, corpura albicantia and largest follicle are measured to the nearest mm. Drawings are made of each ovary for later reference. The presence or absence of a fetus is noted at necropsy.

F. Samples (about 125 cm^3) of heart, liver, kidney, skeletal muscle and skin and blubber are wrapped in aluminum foil, labeled and frozen. These tissue samples will be provided to other investigators for microbiological, hydrocarbon, pesticide and heavy metal analyses.

G. Aerial, ship and ground surveys are being used to determine the distribution and densities of ringed and bearded seals killed by polar bears and arctic foxes. These dead seals are being examined to determine physical condition, and amount of each consumed by the predator. Specimens are collected for laboratory analyses. In addition, the geographic location, specific habitat (breathing hole, lead, lair, etc.) and ice type are noted. Standard measurements are taken whenever possible.

Teeth and claws are collected to determine the age of the prey. Reproductive tracts are examined for sex and reproductive condition following standard techniques. Blubber, selected organs and tissues, stomach and digestive tract of prey species are examined for parasites, diseases or pathologic conditions and food habits, and will be provided to cooperators for analyses for pesticides, heavy metals and petro-chemicals.

Several ecological and behavioral parameters will be investigated to determine factors affecting prey availability and selection and hunting success of predators. For example, polar bears tend to take seals at breathing holes, hauled out on the ice, or in lairs, therefore, these factors influence hunting success of bears. The numbers and kinds of seals seen on the ice during surveys will be related to ice conditions, weather and seal biology data to obtain environmental and natural history correlates to hauling out behavior.

H. Population structure of ringed and bearded seals is assessed through sex and age determination of samples obtained at coastal hunting sites and during the course of selective collection. Eskimo collectors have been established in various villages, with hopes of obtaining jaws and claws and other specimen material from seals killed by the villagers. The collectors also maintain logs of dates, species and sexes of kills.

I. Seasonal migration patterns are determined through observations at coastal hunting sites, and from shipboard and aerial surveys.

J. Aerial, shipboard and ground surveys are used to determine the distribution and densities of pinnipeds in the ice-covered Bering, Chukchi and Beaufort Seas. These surveys are conducted chiefly in June during the post-reproductive and molting period of ringed and bearded seals but by the end of this research surveys will have been conducted during every season and will have covered all ice types.

Aerial surveys are flown in both fixed-wing airplane and helicopters. Aircraft used thus far for surveys have been a Cessna 180, Cessna 185, DeHavilland Twin-Otter, and Lockeed P2V, all fixed-wing aircraft) and a Bell 206B helicopter. Survey transects were 0.8 km (0.5 miles) on each side of the aircraft. Transect width was maintained with fixed reference points on the windows and wing struts or floats. Surveys were flown at altitudes of 91.5 meters (300 feet). All seals (by species) and polar bears observed on these flights were enumerated on a prepared survey form.

Locations and distances traveled along flight tracts were determined by standard aerial navigation techniques, by radar fixes from various DEW-Line stations, or with the aid of GNS-500 system (very low frequency, Omega navigation system).

Ground surveys were conducted on shorefast ice near villages or base camps either on foot on on snow machines. Shipboard surveys were conducted from U. S. Coast Guard and NOAA ships working near the ice edge.

K. Natural history and behavioral observations are obtained from several sources: (1) field observations by the principal investigators, (2) unpublished field observations of other reliable investigators, (3) reports from Eskimos, and (4) observation of captive animals.

The bulk of the natural history and behavioral observations are recorded by the principal or other investigators while they are on the sea ice, or aboard ships, skin boats or aircraft. These observations are usually made with the aid of field glasses or spotting scopes and are recorded as field notes with appropriate ecological and behavioral conditions.

Because of the amount of time they spend on the ice pursuing marine mammals, Eskimo hunters can provide a wealth of information concerning behavior and natural history. However, this information is accepted with caution. Interview of several hunters may be required to separate facts from legends, or information given just to please the investigators. Rarely has information been given which is intended to mislead the investigators.

IX. Anticipated Problems:

Research efforts during FY 78 will be directed more intensively toward work in the Beaufort Sea. Because of the wide distribution and small number of coastal settlements in this area, collections will have to be made by the principal investigators. Several factors of which we are well aware, will result in a somewhat reduced return per unit of effort in this area as compared to either the Bering or Chukchi Seas.

In all areas, we will be faced with the normal vagaries of weather, sea and ice conditions as well as problems associated with availability of suitable logistic support operating in the right places and at the right times.

We have continuously dealt with these problems and anticipate that FY 78 will be no different than previous years.

X. Deliverable Products:

A. Digital Data

1) Parameters recorded
   a) species of seal
   b) sex of seal
   c) age of seal
   d) date and time of location
   e) collection location
   f) reproductive status
   g) reproductive condition
   h) number of fetuses
   i) ovary weight
   j) number of corpora lutea and corpora albicantia
   k) diameter of corpora lutea and corpora albicantia
   l) number of follicles and uterine scars
   m) testes length, width, and weight
   n) testes volume
   o) sperm presence or absence
   p) ice condition
   q) number of seals observed
   r) general behavior

2) List of digital products

   See attached Data Products Schedule

B. Narrative Reports

It is not anticipated that any reports other than quarterly and annual reports will be generated by this project. Papers for publication in scientific journals will be prepared.

C. Visual Data

All visual data will be included in quarterly and annual reports. This data will be in map, diagram, and table form.

D. Other Nondigital Data

None

DATA PRODUCTS SCHEDULE

Data Type	Media	Estimated Volume	OSCEAP Format	Processing and Formating done by P.I.	Collection Period (Mo/Yr to Mo/Yr)	Submission (Mo/Yr) * To APO	To DataBase
Specimen collection data, weights, measurements, reproductive data and age	Coded data sheets cards, mag tapes	up to 50 specimens 5000 cards, 1 tape	025	format-yes processing-no (through Arctic Project Office)	10/77 to 12/77	2/78	6/78
Specimen collection data, weight measurements, reproductive data and age	coded data sheets cards, mag tapes	up to 50 specimens. 5000 cards, 1 tape	025	format-yes processing-no (through Arctic Project Office)	1/78 to 3/78	5/78	9/78
Specimen collection data, weights, measurements, reproductive data and age	coded data sheets, cards, mag tapes	up to 200 specimens, 20,000 cards, 6 tapes	025	format-yes processing-no (through Arctic Project Office)	4/78 to 6/78	8/78	12/78
Specimen collection data, weight, measurements, reproductive data and age	coded data sheets, cards, mag tapes	up to 150 specimens, 15,00 cards, 3 tapes	025	format-yes processing-no (through Arctic Project Office)	7/78 to 9/78	10/78	3/79

* Length of time for total data submission to data base due to special nature of age/reproductive data.

E. Data Submission Schedule

Data collection for FY 78 will begin 1 October 1977 and will end 30 September 1978. Data will be submitted according to OCSEAP policy and at least once each quarter. Submission dates are shown in the attached Data Products Schedule.

XI. Information Required from Other Investigators: Trophic relationships information on bearded and ringed seals will be analyzed by OCSEAP RU#232. In addition, necessary information on the relationships of marine mammal distribution, densities and activities to sea ice conditions will be provided by OCSEAP RU#248/249.

Tissue samples are obtained from as many specimens as possible and the samples are frozen in aluminum foil for later analyses. A project needs to be instituted that will determine the contaminant levels in these tissues for comparison to behavioral, biological, and ecological data obtained through this Research Unit, as well as RU#232.

XII. Quality Assurance Plans: Procedures for taking measurements and collecting specimens are standardized by the joint-processing of specimens by all collectors at least twice a year. The identification of parasites will be verified by comparison to reference collection or by forwarding specimens to taxonomic experts. Data submitted under our data management plan will be checked by two investigators before keypunching and by at least one investigator after keypunching and before submission.

XIII. Special Sample and Voucher Specimen Archival Plans: It is anticipated that no material, other than reports and publications will be archived. Important biological specimens are presently turned over to museums for use by other investigators. A reference collection is maintained at the Fairbanks Office of the Alaska Department of Fish and Game.

XIV. Logistic Requirements: See attached forms.

XV. Management Plan:

1. Fiscal management of funds which may be obtained for this project will be handled through Mr. John Stewart, Division of Administration, Alaska Department of Fish and Game, Juneau. This division provides monthly accountings of expenditures and encumbrances as well as current information on all financial aspects of the contract in accordance with mutual requirements of the contractor and contractee.

2. Scientific management within ADF&G will be the responsibility of John Burns, Fairbanks. Responsibilities include general coordination of all aspects including commitments relating to data management, field operations, logistic requirements, laboratory work and editing of reports.

3. Research activities are the responsibility of John J. Burns, Thomas J. Eley, and Kathryn J. Frost. These co-principal investigators are responsible for actually accomplishing the scientific studies called for under terms of the contract.

4. Outside coordination, review and direction will be provided by the OCS Arctic Project Office, Geophysical Institute, University of Alaska.

5. Activity/Milestone/Data Management Charts are attached.

XVI. **Outlook:** Our goals for FY 78 are to summarize historical data concerning ringed and bearded seal biology and population dynamics in Alaskan and adjacent waters and to compare these data to the data collected under the aegis of OCSEAP. In addition, we should be able to summarize general aspects of the reproductive biology, pre- and post-natal growth rates, and densities of ringed and bearded seals in the Bering and Chukchi Seas. Our field work will concentrate on obtaining specimens during the winter from which an adequate sample size has not yet been obtained.

During FY 79, we plan to again attempt any collections which were not accomplished during FY 78. In addition, we will be directing a major effort to obtain specimens from the Beaufort Sea. Unfortunately along the Beaufort Sea coast there are few villages where seal hunting is important, so the responsibility for specimen collection rests entirely with the principal investigators, with OCSEAP financed logistics. Our synthesis and interpretation of data will become more extensive and we will concentrate on determination of regional differences in age specific productivity and population structure. A funding level of $110,000 should be sufficient for FY 79 and logistic requirements should be similar to FY 78.

Pending the success of our collection efforts in FY 78 and 79, our collection efforts in FY 80 should be significantly reduced and will generally concentrate in leasing areas. Our major emphasis will be analysis and interpretation of data and the synthesis of our data with that of other projects. A funding level of $80,000 should be sufficient for FY 80 and logistic requirements should be similar in nature but reduced in magnitude from FY 78 and 79.

XVII. Standard Statements:

1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labeled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when these are used, and sexes where these are morphologically distinguishable.

4. At the option of the Project Office the P.I. is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following standard acknowledgment is acceptable.

"This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

For OCSEAP use only.
RU # ____________
Discipline
Area of Discipline ______

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION ADF&G FAIRBANKS PRINCIPAL INVESTIGATOR Burns et al.

A. SHIP SUPPORT Ice Reinforced vessel - Norton Sound

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. We would like to work in the ice in the Norton Sound, Bering Strait and St. Lawrence Island area. Work can be done at stations designed optimally for all projects participating.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. On tracks, observations will be made on distribution, abundance and behavior of phocid seals. On station, small boats will be used to collect seals which will be analyzed for age, sex, physical condition and reproductive status and history.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? 8-28 November would be optimum. A departure of 4 days earlier or later would be acceptable.

4. How many sea days are required for each leg? 20

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Operations can run concurrently with other biological and/or oceanographic projects.

   Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling time on station and sample processing time between stations. We would hunt seals during all daylight hours. Observations made during transit will not interrupt ships operations. Sample processing will be done during all transit hours, the time required being dependent on collection success.

6. What equipment and personnel would you expect the ship to provide? 1 small boat (17 foot Boston Whaler is optimum) and associated equipment, deck space with flowing sea water for autopsy of seals. Materials to construct a 4' x 10' autopsy table, laboratory space for work up of specimens.

7. What is the approximate weight and volume of equipment you will bring?

   600 Pounds 100 Cubic feet

8. Will your data or equipment require special handling? NO If yes, please describe:

9. Will you require any gasses and/or chemicals? Formalin If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If yes, please name the vessel and give the reason for so specifying. YES - the NOAA ship SURVEYOR is necessary because it is the only NOAA vessel equipped with a helicopter

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availabilty?

    N/A

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.

    Three persons will be specifically named at a later date.

For OCSEAP use only.
RU # ______
Discipline
Area of Discipline ______

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION ADF&G FAIRBANKS PRINCIPAL INVESTIGATOR Burns et al.

A. SHIP SUPPORT Icebreaker in Beaufort Sea

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions.
   We would like to work along and in the edge of the pack ice of the Northern Chukchi and Beaufort Seas between 166°W and 141°W longitude.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. On tracks, observations will be made on distribution, abundance and behavior of phocid seals. On station, small boats will be used to collect seals which will be analyzed for age, sex, physical condition and reproductive status and history.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times?
   Between August 1 and September 10

4. How many sea days are required for each leg?
   21

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Operations can run concurrently with other biological and/or oceanographic projects.
   Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling time on station and sample processing time between stations. We would hunt seals during all daylight hours. Observations made during transit will not interrupt ships operations. Sample processing will be done during all transit hours, the time required being dependent on collection success.

6. What equipment and personnel would you expect the ship to provide? 1 small boat (17 foot Boston Whaler is optimum) and associated equipment, deck space with flowing sea water for autopsy of seals. Materials to construct a 4' x 10' autopsy table, laboratory space for work up of specimens.

7. What is the approximate weight and volume of equipment you will bring?
   600 Pounds 100 Cubic feet

8. Will your data or equipment require special handling? NO If yes, please describe

9. Will you require any gasses and/or chemicals? Formalin If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If yes, please name the vessel and give the reason for so specifying.
    U.S. Coast Guard Icebreaker

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availabilty?
    N/A

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.

    Three persons will be specifically named at a later date.

For OCSEAP use only.
RU # ______
Discipline
Area of Discipline ______

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION ADF&G FAIRBANKS PRINCIPAL INVESTIGATOR Burns et al.

A. SHIP SUPPORT Ice Reinforced vessel - St. George Basin/Bristol Bay - Winter Period

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. We would like to work in the seasonal ice of the Bering Sea from the southern most edge, north to at least 61° and between latitudes 174°W and 162°W. Work can be done at stations designed optimally for all projects participating.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. On tracks, observations will be made on distribution, abundance and behavior of phocid seals. On station, small boats will be used to collect seals which will be analyzed for age, sex, physical condition and reproductive status and history.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? 1-22 February would be optimum. A departure of 1 week earlier or later would be acceptable.

4. How many sea days are required for each leg?

21

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Operations can run concurrently with other biological and/or oceanographic projects.

Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling time on station and sample processing time between stations. We would hunt seals during all daylight hours. Observations made during transit will not interrupt ships operations. Sample processing will be done during all transit hours, the time required being dependent on collection success.

6. What equipment and personnel would you expect the ship to provide? 1 small boat (17 foot Boston Whaler is optimum) and associated equipment, deck space with flowing sea water for autopsy of seals. Materials to construct a 4' x 10' autopsy table, laboratory space for work up of specimens.

7. What is the approximate weight and volume of equipment you will bring?

600 Pounds 100 Cubic Feet

8. Will your data or equipment require special handling? No If yes, please describe

9. Will you require any gasses and/or chemicals? Formalin If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If yes, please name the vessel and give the reason for so specifying.

U.S. Coast Guard Icebreaker

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availabilty?

N/A

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.

Three persons will be specifically named at a later date.

For OCSEAP use only.
RU # ______
Discipline
Area of Discipline ______

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION ADF&G Fairbanks PRINCIPAL INVESTIGATOR Burns et al.

A. SHIP SUPPORT Ice Reinforced Vessel - St. George Basin/Bristol Bay

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. We would like to work in the seasonal ice front and ice remnants of the northern Bering Sea. Locations of stations will depend on ice conditions. Stations can be located optimally for all projects participating

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. On tracks, observations will be made on distribution, abundance and behavior of phocid seals. On station, small boats will be used to collect seals which will be analyzed for age, sex, physical condition and reproductive status and history.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? Single cruise 1 May to 15 June optimal. I 2 legs nec., 1st 1-20 May, 2nd from 26 May to 15 June.

4. How many sea days are required for each leg? 45 sea days in a single leg is optimum. Two legs of 20 sea days apiece would be acceptable.

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Operations can run concurrently with other biological and/or oceanographic projects
   Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling time on station and sample processing time between stations. We would hunt seals during all daylight hours. Observations made during transit will not interrupt ships operations. Sample processing will be done during all transit hours, the time required being dependent on collection success.

6. What equipment and personnel would you expect the ship to provide? 1 small boat (17 foot Boston Whaler is optimum) and associated equipment, deck space with flowing sea water for autopsy of seals. Materials to construct a 4' x 10' autopsy table, laboratory space for work up of specimens.

7. What is the approximate weight and volume of equipment you will bring?

   600 Pounds 100 Cubic Feet

8. Will your data or equipment require special handling? NO If yes, please describe

9. Will you require any gasses and/or chemicals? Formalin If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If yes, please name the vessel and give the reason for so specifying. Yes - the NOAA ship SURVEYOR is necessary because it is the only NOAA vessel equipped with a helicopter.

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availabilty?
    N/A

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.

    Three persons will be specifically named at a later date.

AIRCRAFT SUPPORT - FIXED-WING   Barrow

1. Delineate proposed flight lines on a chart of the area. Indicate desired flight altitude on each line. (Note: If flights are for transportation only, chart submission is not necessary but origin and destination points should be listed.)

   Three fixed wing flights (Cessna 180 and/or Twin Otter) in areas of landfast ice between Point Lay and Barter Island

2. Describe types of observations to be made.

   Survey of ringed seals in the nearshore fast ice areas. Correlation of density with ice conditions.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.)

   Significant changes in seal density have occurred in the last seven years. Our surveys are always conducted during the peak of seal molting - 8 to 18 June

4. How many days of flight operation are required and how many flight hours per day?

   2 to 3 flight days

   Total flight hours?

   15 to 17 flight hours

5. Do you consider your investigation to the principal one for the flight thus precluding other activities or requiring other activities to piggyback or could you piggyback?

   Principal Investigation

6. What types of special equipment are required for the aircraft (noncarry-on)?

   GNS or On Trac Navigation system in Twin Otter

   What are the weights, dimensions, power requirements and installation problems unique to the specific equipment.

   None (should be part of aircraft equipment)

7. What are the weights, dimensions and power requirements of carry-on equipment?

   None

8. What type of aircraft is best suited for the purpose?

   C-180 or Twin Otter

9. Do you recommend a source for the aircraft?   Yes

   If yes, please name the source and the reason for your recommendation.

   NARL

10. What is the per hour charter cost of the aircraft?

    C-180 = $85/hr   Twin Otter = $350/hr

11. How many people are required on board for each flight (exclusive of flight crew)?

    Two

12. Where do you recommend that flights be staged from?

    Barrow

. AIRCRAFT SUPPORT - FIXED-WING   Cover plane for helicopter in CHukchi and Beaufort Seas

1. Delineate proposed flight lines on a chart of the area. Indicate desired flight altitude on each line. (Note: If flights are for transportation only, chart submission is not necessary but origin and destination points should be listed.)

   Fixed wing aircraft will accompany helicopter during collection operations in the Chukchi and Beaufort Seas. Most flying will be within 60 miles of the coast.

2. Describe types of observations to be made.

   Collection of seals and observations of ice conditions and distribution and abundance of seals. This plane will carry fuel in support of the helicopter.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item when necessary for clarification.)

   Approximate dates of operation are: Cape Lisburne 15-25 March, Barrow 26-31 March, Deadhorse 1-15 April

4. How many days of flight operation are required and how many flight hours per day?

   Approximately 20 days of flight operations will be required with about 4 hours flight time per day

   Total flight hours?

   80

5. Do you consider your investigation to the principal one for the flight thus precluding other activities or requiring other activities to piggyback or could you piggyback?

   Investigators from RU#248/249 can be accommodated

6. What types of special equipment are required for the aircraft (noncarry-on)?

   Long-range fuel tanks and wheel skiis are imperative

   What are the weights, dimensions, power requirements and installation problems unique to the specific equipment.

   N/A

7. What are the weights, dimensions and power requirements of carry-on equipment?

   20 - 5 gallon cans of fixed wing and helicopter fuel

8. What type of aircraft is best suited for the purpose?

   Cessna 180 or 185

9. Do you recommend a source for the aircraft?

   If yes, please name the source and the reason for your recommendation.

   No

10. What is the per hour charter cost of the aircraft?

   Unknown

11. How many people are required on board for each flight (exclusive of flight crew)?

   None

12. Where do you recommend that flights be staged from?

   Cape Lisburne, Barrow, Deadhorse

C. AIRCRAFT SUPPORT - HELICOPTER To accompany SURVEYOR in November

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed.)

   Flights will be conducted within a 50 mile radius (or as deemed appropriate by ship's personnel) of the ship's position.

2. Describe types of observations to be made.

   Surveys of marine mammals and ice conditions and collection of seal specimens.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   8-28 November would be optimum. A departure of 4 days earlier or later would be acceptable.

4. How many days of helicopter operations are required and how many flight hours per day?

   6 to 8 hours per day with a total of 20 possible flying days

   Total flight hours? 120-160

5. How many people are required on board for each flight (exclusive of the pilot)?

   Two

6. What are the weights and dimensions of equipment or supplies to be transported?

   100 pounds of personal gear including rifles, packs and field gear. We anticipate carrying seals weighing up to 600 pounds.

7. What type of helicopter do you recommend for your operations and why?

   Bell 206B equipped with floats. We have found this type of helicopter to be very satisfactory in our previous work of this type.

8. Do you recommend a particular source for the helicopter? If yes, please name the source and the reason for your recommendation.

   NOAA

9. What is the per hour charter cost of the helicopter?

   N/A

10. Where do you recommend that flights be staged from?

   OSS SURVEYOR in the Norton Sound, St. Lawrence Island, Bering Strait area.

11. Will special navigation and communications be required?

   Yes - Transponder, GNS-500 navigation system, 30 human body bags, slings and sling ropes, floats, baskets on each float, intercom for two passengers and pilot.

C. AIRCRAFT SUPPORT - HELICOPTER Chukchi and Beaufort Seas

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed.)

   We would propose to fly over the shore ice of the northeastern Chukchi and Beaufort Seas to leads where we will collect seals. Most flying will be within 60 miles of the coast. Operations would be based from Cape Lisburne (first), Barrow (second), and Deadhorse (third).

2. Describe types of observations to be made.

   Surveys of marine mammals and ice conditions and collection of seal specimens.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   Approximate dates for operations are: Cape Lisburne 15-25 March, Barrow 26-31 March, Deadhorse 1-15 April

4. How many days of helicopter operations are required and how many flight hours per day?

   Approximately 20 days of helicopter operations will be required with about 4 hours of flight time per day

   Total flight hours?

   80

5. How many people are required on board for each flight (exclusive of the pilot)?

   Two

6. What are the weights and dimensions of equipment or supplies to be transported?

   100 pounds of personal gear including rifles, packs and field gear. We anticipate carrying seals weighing up to 600 pounds.

7. What type of helicopter do you recommend for your operations and why?

   Bell 206B equipped with floats. We have found this type of helicopter to be very satisfactory in our previous work of this type.

8. Do you recommend a particular source for the helicopter? If yes, please name the source and the reason for your recommendation.

   NO

9. What is the per hour charter cost of the helicopter?

   Unknown

10. Where do you recommend that flights be staged from?

    Cape Lisburne, Barrow, Deadhorse

11. Will special navigation and communications be required?

    Yes - Transponder, GNS-500 navigation system, 30 human body bags, slings and sling ropes, floats, baskets on each float, intercom for two passengers and pilot.

C. AIRCRAFT SUPPORT - HELICOPTER Beaufort Sea

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed.)

   We would propose to base a helicopter at Deadhorse and fly over the shore ice to leads at which we would collect seals. Most flying would be within 25 miles of the coast.

2. Describe types of observations to be made.

   Collection of seal specimens and observations of ice conditions and distribution and abundance of seals.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   5-20 November would be optimum. A departure of 3 days earlier or later would be acceptable.

4. How many days of helicopter operations are required and how many flight hours per day?

   Approximately 10 days of helicopter operations will be required with about 4 hours of flight time per day

   Total flight hours?

   40

5. How many people are required on board for each flight (exclusive of the pilot)?

   Two

6. What are the weights and dimensions of equipment or supplies to be transported?

   100 pounds of personal gear including rifles, packs and field gear. We anticipate carrying seals weighing up to 600 pounds.

7. What type of helicopter do you recommend for your operations and why?

   Bell 206B equipped with floats. We have found this type of helicopter to be very satisfactory in our previous work of this type.

8. Do you recommend a particular source for the helicopter? If yes, please name the source and the reason for your recommendation.

   No

9. What is the per hour charter cost of the helicopter?

   Unknown

10. Where do you recommend that flights be staged from?

    Deadhorse

11. Will special navigation and communications be required?

    Yes - Transponder, GNS-500 navigation system, 30 human body bags, slings and sling ropes, floats, baskets on each float, intercom for two passengers and pilot

C. AIRCRAFT SUPPORT - HELICOPTER <u>To accompany SURVEYOR in May and June</u>

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camp and visa versa, chart submission is not necessary but origin and destination points should be listed.)

   Flights will be conducted within a 50 mile radius (or as deemed appropriate by ship's personnel) of the ship's position.

2. Describe types of observations to be made.

   Surveys of marine mammals and ice conditions and collection of seal specimens.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   1 May to 15 June or 1-20 May and 26 May-15 June

4. How many days of helicopter operations are required and how many flight hours per day?

   6-8 flight hours per day for a maximum of 40 days

   Total flight hours?

   approximately 250

5. How many people are required on board for each flight (exclusive of the pilot)?

   Two

6. What are the weights and dimensions of equipment or supplies to be transported?

   100 pounds of personal gear including rifles, packs and field gear. We anticipate carrying seals weighing up to 600 pounds.

7. What type of helicopter do you recommend for your operations and why?

   Bell 206B equipped with floats. We have found this type of helicopter to be very satisfactory in our previous work of this type.

8. Do you recommend a particular source for the helicopter? If yes, please name the source and the reason for your recommendation.

   NOAA

9. What is the per hour charter cost of the helicopter?

   N/A

10. Where do you recommend that flights be staged from?

    OSS SURVEYOR in the Bering Sea ice front and ice remnants.

11. Will special navigation and communications be required?

    Yes - Transponder, GNS-500 navigation system, 30 human body bags, slings and sling ropes, floats, baskets on each float, intercom for two passengers and pilot.

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period.)

Location	Dates	Number of Persons*	Total Person Days
Cape Lisburne	15-25 March	4	40
Barrow (NARL)	26-31 March	4	20
Deadhorse	1-15 April	4	60
Barrow(NARL)	various	4	60

2. Do you recommend a particular source for this support? If yes, please name the source and the reason for your recommendation.

N/A

3. What is your estimated per man day cost for this support at each location?

UNKNOWN

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

E. SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your propsoal and how do you propose that the problem be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you.)

The major logistics problem will be that of obtaining icebreaker support for the mid-winter cruise.

Project: RU # 230

PI: Burns, Eley, [illegible]st

MILESTONE CHART

MAJOR MILESTONES - Specimen Collection	1977 - 1978											
	O	N	D	J	F	M	A	M	J	J	A	S
Beaufort Sea												
Barrow		△	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	△	
Helicopter based		△				△	△		△			
Icebreaker											△	△
Chukchi Sea												
Wainwright				△	- - -	△				△	△	
Shishmaref									△	△		
Helicopter based						△	△					
Norton Sound												
Nome		△	- - -	- - -	- - -	- - -	- - -	- - -	△			
Ice-reinforced vessel with helicopter		△										
St. George Basin - Bristol Bay												
Icebreaker					△							
Ice-reinforced vessel with helicopter								△	△			

Project: RU # 230

PI: Burns, Eley, F[illegible]st

MILESTONE CHART

MAJOR MILESTONES - Specimen Collection	1977 - 1978											
	O	N	D	J	F	M	A	M	J	J	A	S
St. Lawrence Island		△	- - -	- - -	- - -	- - -	- - -	- - -	△			
Central Bering Sea (Tanunak or Hooper Bay)		△	- - -	- - -	- - -	△						

Project: RU # 230

PI: Burns, Eley, Frost

MILESTONE CHART

MAJOR MILESTONES - Other Project Activities	1977 - 1978											
	O	N	D	J	F	M	A	M	J	J	A	S
Shorefast ice marine mammal survey									△			
Age determination of specimens	△	—	—	—	—	—	—	—	—	—	—	△
Examination and analyses of reproductive data	△	—	—	—	—	—	—	—	—	—	—	△
Analyses of growth rates	△	—	—	—	—	—	—	—	—	—	—	△
Submission of data		△			△			△			△	
Quarterly report preparation			△			△			△			△
Preparation of FY 79 proposal								△				
Annual Report preparation						△						

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Title: Trophic relationships among ice inhabiting phocid seals

Research Unit Number 232

Principal Investigators: Lloyd F. Lowry, John J. Burns and Kathryn J. Frost

Total Cost of Proposal: $109,211

Institution: Alaska Department of Fish and Game
Division of Game
1300 College Road
Fairbanks, Alaska 99701

Date of Proposal: 1 July 1977

Required Signatures:

Principal Investigators:

Names Lloyd F. Lowry — Date 1 July 1977
John J. Burns
Kathryn J. Frost

Address Alaska Department of Fish and Game, 1300 College Road, Fairbanks, Alaska 99701

Telephone Number 452-1531

Required Organization Approval:

Name [illegible] — Date 1 July 1977

Address Alaska Department of Fish and Game, Subport Building, Juneau, Alaska 99801

Telephone Number 465-4190

Organization Financial Officer:

Name [illegible] — Date 1 July 1977

Address Alaska Department of Fish and Game, Subport Building, Juneau, Alaska 99801

Telephone Number 465-4120

Technical Proposal

I. Title: Trophic relationships among ice inhabiting phocid seals
Research unit number: 232
Contract number: 03-5-022-53
Proposed dates of contract: 1 October 1977 to 30 September 1978

II. Principal Investigators: Lloyd F. Lowry, John J. Burns and Kathryn J. Frost

III. Cost of Proposal: $109,200

IV. Background:

Four species of ice inhabiting phocid seals are the focus of this investigation. These are the ringed seal, Phoca (Pusa) hispida; the bearded seal, Erignathus barbatus; the spotted (also commonly called largha) seal, Phoca vitulina largha; and the ribbon seal, Phoca (Histriophoca) fasciata. The ringed seal and the bearded seal are circumpolar in distribution while the ribbon and spotted seal are restricted to the Bering, Chukchi and Okhotsk Seas. The total numbers of these four species in Alaskan waters is approximately 1.5 to 2 million animals. About 10,000 of these seals, in aggregate, are taken annually by Alaskan Eskimo subsistence hunters. Ringed seals, and to a much lesser extent bearded seals, are the primary food items of polar bears. Information on feeding habits and trophic interactions of these seals is particularly lacking and is of direct and important relevance to OCS development.

We propose in this study to continue gathering and analyzing material necessary to completely and accurately delineate the trophic relationships of the four species being investigated. We have to date analyzed a considerable amount of material from certain areas and times of year, particularly the northern Bering and Chukchi Seas in late spring and early summer when the majority of the hunting by coastal residents occurs. We intend in the next year to continue to gather data from these areas in order to assess the adequacy of our samples and examine year to year variability in diet. In addition, much effort will be directed toward areas and seasons where material has been difficult to obtain. Such sampling, although difficult and costly, is essential to a complete understanding of the topics addressed by this project.

Prior to our investigations, published information on the foods of ice inhabiting seals in Alaskan waters was limited to three studies, all quite limited in temporal or geographical coverage (Burns 1967, Kenyon 1962, Johnson et al. 1968). Considerable work in this field has been done by Soviet investigators. We have recently translated several important papers previously available only in Russian (see 1977 Annual Report RU#232) and are pesently collaborating with those persons active in this work (Bukhtiyarov, Lowry and Frost in prep.). Our work will provide input to other studies on the biology of marine mammals in the areas concerned (RU #230), baseline studies of hydrocarbons and heavy metals in the marine environment (RU#s 288, 276), and studies of ecosystem dynamics (RU#99). We will extensively utilize information gathered by many studies concerned with the abundance, distribution, natural history and hydrocarbon sensitivity of invertebrates, fishes, birds and marine mammals (e.g. RU#s 5/303, 6, 175) in the evaluation of our results.

V. Objectives

1. Compilation of existing literature and unpublished data on food habits of ringed seals, bearded seals, spotted seals and ribbon seals. Pertinent works by Soviet investigators will be located and translated. In addition, available information on distribution, abundance and natural history of potentially important prey species is being gathered. This will allow an assessment of the present state of knowledge and facilitate identification of major information gaps which require immediate study by OCSEAP.

2. Collection of sufficient specimen material (stomachs) for determination of the spectrum of prey items utilized by the species being studied throughout the geographic range involved and during all times of year that the species occurs in a particular area. The contents of these stomachs will be sorted, identified and quantified. This information will be analyzed for geographical and temporal variability in prey utilization patterns as well as for species, sex and age related dietary differences. This will result in identification of critical prey species which merit in-depth study by other OCSEAP projects. Critical foraging areas (if such exist) will be delineated. This may have direct effect on the suitability of certain tracts for leasing.

3. Analysis of feeding patterns in relation to distribution, abundance and other life history parameters of key prey species. This will involve determination of the degree of selectivity demonstrated by each species of seal as well as the availability and suitability of primary and alternative food sources. To whatever extent possible the effect of seal foraging activities on populations of prey species will be examined in light of observed rates of food consumption and foraging behavior. Such analyses are an initial step toward ecosystem level evaluation of the possible effects of OCS development on the species being investigated. The accomplishment of this objective is largely dependent on information gathered by other OCSEAP projects involving benthic and planktonic organisms.

4. Analysis of trophic interactions among these species and other potential competitors such as walruses, whales, marine birds, fishes and humans (c.f. Lowry, Frost and Burns, in prep.). Input from other OCSEAP studies will be critical in this phase of the project.

5. With the understanding thus obtained of the trophic interrelationships of ice inhabiting phocids in the Bering-Chukchi and Beaufort marine systems, evaluate the probable kinds and magnitude of effects of OCS development on these species of seals. This will involve both direct effects such as disruption of habitat in critical feeding areas or alterations of populations of key prey species and indirect effects such as influences on populations of competitors for food resources.

VI. General Strategy and Approach

The strategy proposed to evaluate the trophic relationships among ice inhabiting seals is as follows:

1. A large number of stomachs from the four seal species will be collected from coastal and offshore localities in the Bering and Chukchi Seas at various times of year (see Section VII). Particular emphasis will be placed on sampling in the Beaufort Sea.

2. Volume of stomach contents will be determined and prey items identified and quantified (see Section VIII).

3. From these samples, the major food dependencies of each seal species will be correlated with the important variables of age, sex, season and geographical areas.

4. Prey utilization will be compared with prey abundance (as indicated by the literature, results of other OCSEAP projects, and trawling conducted by this project) to determine degree of selectivity and availability of primary and alternate food sources (see Section VII).

5. Trophic interactions among the ice inhabiting phocids as well as trophic interactions between these species and other major components of the marine system will be examined.

6. Finally, we will integrate information on life histories of important prey items with the information described above and evaluate at the system level the potential impact of OCS development on the species of seals being considered.

VII. Sampling Methods:

As during the previous contract years, we will obtain specimen material in two primary ways:

1) The bulk of our specimen material will be collected at coastal hunting villages located in the study areas.

2) In areas and at seasons of the year where specimen material cannot be obtained in the above manner (e.g. St. George Basin), we will collect specimen material ourselves, mainly from ships and helicopters. When collecting from ships we will sample the available food resource by means of otter trawls.

Location	Sampling Schedule
Village Collections	
Beaufort Sea (Barrow)	intermittent November-August
Northern Chukchi Sea (Wainwright)	January-March, July-August
Hope Basin (Shishmaref)	November, June-July
Norton Sound	intermittent November-June
St. Lawrence Island	intermittent November-June
Ship and Helicopter collections	
Beaufort Sea	
helicopter	November, April
icebreaker	August
Norton Sound	
ice reinforced vessel	November
St. George Basin-Bristol Bay	
icebreaker	February
ice reinforced vessel	May-June

Every attempt will be made to provide thorough geographical and temporal coverage. Emphasis will be on obtaining samples from all times of year in the Beaufort Sea and for winter months in other areas. At coastal villages, all available material will be collected to provide large samples to test within sample variability. When animals are collected by the investigators, sample size will necessarily be smaller. The adequacy of these samples will be evaluated in light of variability as determined from the larger samples.

VIII. Analytical Methods

Seal stomachs collected will be preserved and taken to the ADF&G office in Fairbanks. The contents will be separated and identified using appropriate keys and comparative material in hand. Some identifications will be made at the University of Alaska Marine Museum/Sorting Center. Estimates of the numbers and sizes of individuals, and measurements of volume (water displacement) will be made for each prey type. Results will be compiled and tabularized and comparisons will be made of foods utilized by species, age group, sex, locality and time of year. Comparisons will also be made of food utilization in relation to availability, both on a narrow scale by comparing the results of otter trawls in areas where seals are collected with the food items found in seal stomachs, and on a broad scale by comparing overall distribution and abundance of prey (as determined by other investigators) with stomach contents of seals taken from the same geographical area. Many of the techniques used and problems encountered in investigations of feeding habits of pinnipeds have been discussed by Spalding (1964).

IX. Anticipated problems:

The success of field collections of seal specimen material is by nature somewhat unpredictable. Certain periods of very active hunting in coastal villages are quite predictable. Some specimens have already been collected from these periods. During the times for which specimen material is most needed, hunting is much more sporadic and collection attempts can be expected to be less productive.

Several of the proposed collections listed in Section VII require vessel or helicopter support. We have to date had adequate logistics for spring work in the Bering Sea ice front (OSS SURVEYOR) and along the northern Bering and Chukchi Sea coasts (Bell Jet Ranger helicopter). In order to sample during the critical winter period in the Bering Sea, icebreaker support is essential. Long range helicopter support will be needed for other winter and early spring operations. The lack of appropriate logistics is the most severe problem we anticipate in this next fiscal year.

X. Deliverable products:

A. Digital Data

1) Parameters recorded

a) species of seal
b) sex of seal
c) age of seal
d) date and time of collection
e) collection location
f) total volume of stomach contents
g) identity of items in stomach
h) volume and number of each item

2) List of digital products
See attached Data Products Schedule

B. Narrative Reports

It is not anticipated that any reports other than quarterly and annual reports will be generated by this project.

C. Visual Data

All visual data will be included in quarterly and annual reports. This data will be in map, diagram, and table form.

D. Other Nondigital Data

None

E. Data Submission Schedule

Data collection for FY 78 will begin 1 October 1977 and will end 30 September 1978. Data will be submitted quarterly. Submission dates are shown in the attached Data Products Schedule.

DATA PRODUCTS SCHEDULE

Data Type	Media	Estimated Volume	OCSEAP Format	Processing and Formating done by P.I.	Collection Period (Mo/Yr to Mo/Yr)	Submission (Mo/Yr)
total volume of stomach contents and volume and number of individuals of each species found in contents	coded data sheets, cards mag tape	up to 50 stomach samples, 1500 cards 1 tape	025	format-yes processing-no (through Arctic Project Office)	10/77 to 12/77	1/78
total volume of stomach contents and volume and number of individuals of each species found in contents	coded data sheets, cards mag tape	up to 50 stomach samples, 1500 cards 1 tape	025	format-yes processing-no (through Arctic Project Office)	1/78 to 3/78	4/78
total volume of stomach contents and volume and number of individuals of each species found in contents	coded data sheets, cards mag tape	up to 250 stomach samples, 7500 cards 1 tape	025	format-yes processing-no (through Arctic Project Office)	4/78 to 6/78	7/78
total volume of stomach contents and volume and number of individuals of each species found in contents	coded data sheets, cards mag tape	up to 150 stomach samples, 4500 cards 1 tape	025	format-yes processing-no (through Arctic Project Office)	7/78 to 9/78	10/78

XI. Information Required from Other Investigators:

Supporting information on the natural history of two of the four species of seals being studied (ringed and bearded) will be provided by OCSEAP RU#230. Information on ribbon and spotted seals is available from other sources including unpublished data of ADF&G.

Detailed information on the distribution, abundance, natural history and hydrocarbon sensitivity of key food items is needed in order to assess potential effects of OCS development on the seal species being studied. Listings of key prey species and the types of information needed have been made repeatedly in quarterly and annual reports of this project and in direct communications with project office personnel. Some examples are included in Section E-5.

XII. Quality Assurance Plans

The identification of prey items found will be verified as necessary by the University of Alaska Marine Museum/Sorting Center, or other experts as appropriate. Additionally, field work, especially on ships, will involve direct collaboration with investigators of other disciplines. Comparison of findings with results of other studies conducted in Canada and the USSR will continue to be undertaken.

XIII. Special Sample and Archival Plans

A reference collection of representative organisms found in the stomachs of seals is being assembled and stored at the ADF&G office in Fairbanks. Examples of unusual specimens will be given to the University of Alaska Marine Museum/Sorting Center. Specimens of special interest to other investigators will be made available whenever possible.

XIV. Logistics Requirements

See attached logistics requirements forms

XV. Management Plan

1. Fiscal management of funds which may be obtained for this project will be handled through Mr. John Stewart, Division of Administration, Alaska Department of Fish and Game, Juneau. This division provides monthly accountings of expenditures and encumberances as well as current information on all financial aspects of the contract in accordance with mutual requirements of the contractor and contractee.

2. Scientific management within ADF&G will be the responsibility of John Burns, Fairbanks. Responsibilities include general coordination of all aspects including commitments relating to data management, field operations, logistic requirements, laboratory work and editing of reports.

3. Research activities are the responsibility of Lloyd Lowry, John Burns, and Kathryn Frost. These principal investigators are responsible for actually accomplishing the scientific studies called for under terms of the contract. They shall actively lead the proposed work and shall take full responsibility for timely completion of all objectives.

4. Outside coordination, review and direction will be provided by the OCS Arctic Project Office, Geophysical Institute, University of Alaska.

XVI. Outlook

Due to the relatively unpredictable nature of collections in coastal villages and the uncertainty of proper logistics, it is difficult to assess at this point what field efforts will be most needed in the future. It should be emphasized that if proper logistics for working in heavy winter ice conditions are not provided during FY 78, essentially no winter data will be available for any lease area except Norton Sound.

During FY 79 we would plan to attempt again any collections which were not feasible during FY 78. Increased emphasis would be placed on times of year from which few or no specimens are available. Collections would be continued at several productive areas (e.g. Shishmaref) in order to obtain sufficiently large samples to test for age and sex related dietary differences. In order to assess year to year variability, certain collections would be repeated, especially those in areas of dynamic habitat such as the Bering Sea ice front. Intensive work involving more localities and more specimens will be done in areas which are scheduled for imminent leasing. Extensive synthesis and interpretation will be begun as information from other projects becomes available and lease sale dates are set. A funding level of $110,000 should be adequate for FY 79. No additional major equipment will be required. Logistics requirements will be similar to FY 78.

During FY 80 we would expect a significant reduction in the magnitude of our field collection effort. Field collections would be done to increase geographical and temporal coverage where results obtained in previous years indicate such would be desirable. Area intensive collections will be done where leasing schedules or tract selections require such data. Emphasis will be placed on analysis and interpretation of data and synthesis with information collected by other projects. A funding level of $80,000 should be adequate for FY 80. No additional major equipment will be required. Logistics requirements will be reduced in magnitude from FY 78 and 79 but similar in nature.

XVII. 1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labeled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when these are used, and sexes where these are morphologically distinguishable.

4. At the option of the Project Office the P.I. is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship.

Institutional contributions:

Equipment, office and lab facilities available at Barrow, Kotzebue, Nome, King Salmon and Bethel
Clerical and secretarial services
Assistance, without cost, of area biologists stationed in Barrow, Nome, Bethel and King Salmon
Library facilities

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RU # ______
Discipline ______
Area of Discipline ______

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION ADF&G, Fairbanks PRINCIPAL INVESTIGATOR Lowry et al

A. SHIP SUPPORT Ice-reinforced vessel - Norton Sound

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. We would like to work in the ice in the Norton Sound, Bering Strait, St. Lawrence Island area. Work can be done at stations designed optimally for all projects participating.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. On stations, small boats will be used to collect seals which will be analyzed for stomach contents, age and physical condition. Material will be provided to other projects. Twenty minute bottom tows will be made with a small otter trawl.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? 8 - 28 November would be optimum. A departure of 4 days earlier or later would be acceptable.

4. How many sea days are required for each leg? 20

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Our operations can run concurrently with other biological and/or oceanographic projects. Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling time on station and sample processing time between stations. We would hunt seals during all daylight hours. Otter trawls will require approx. 2 hours per day on station. Sample processing will be done during all transit hours, the time required being dependent on collection success.

6. What equipment and personnel would you expect the ship to provide? Small boats (17 foot Boston Whaler is optimum) and associated equipment, deck space with flowing sea water for autopsy of seals, materials to construct 4' X 10' autopsy table, laboratory space for workup of specimens.

7. What is the approximate weight and volume of equipment you will bring? 800 pounds 120 cubic feet

8. Will your data or equipment require special handling? no If yes, please describe.

9. Will you require any gasses and/or chemicals? Formalin If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If yes, please name the vessel and give the reason for so specifying. Yes - NOAA ship SURVEYOR is necessary because it is the only NOAA vessel equipped with a helicopter.

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availabilty? N/A

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals. Three persons will be specifically named at a later date. None will be foreign nationals.

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RU #
Discipline
Area of Discipline

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION ADF&G, Fairbanks PRINCIPAL INVESTIGATOR Lowry et al

A. SHIP SUPPORT Icebreaker in St. George Basin and Bristol Bay

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. We would like to work in the seasonal ice of the Bering Sea from the southern edge, north to at least 61° and between latitudes 174° W and 162° W. Work can be done at stations designed optimally for all projects participating.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. On stations, small boats will be used to collect seals which will be analyzed for stomach contents, age and physical condition. Material will be provided to other projects. Twenty minute bottom tows will be made with a small otter trawl.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? 1 - 22 February would be optimum. A departure of 1 week earlier or later would be acceptable.

4. How many sea days are required for each leg?
21

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Our operations can run concurrently with other biological and/or oceanographic projects.
Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling time on station and sample processing time between stations. We would hunt seals during all daylight hours. Otter trawls will require approx. 2 hours per day on station. Sample processing will be done during all transit hours, the time required being dependent on collection success.

6. What equipment and personnel would you expect the ship to provide? Small boats (17 foot Boston Whaler is optimum) and associated equipment, deck space with flowing sea water for autopsy of seals, materials to construct 4' X 10' autopsy table, laboratory space for workup of specimens.

7. What is the approximate weight and volume of equipment you will bring?
800 pounds 120 cubic feet

8. Will your data or equipment require special handling? no If yes, please describe:

9. Will you require any gasses and/or chemicals? Formalin If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If yes, please name the vessel and give the reason for so specifying.
U. S. Coast Guard Icebreaker

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availabilty?
N/A

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.

Three persons will be specifically named at a later date. None will be foreign nationals.

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RU # ____________
Discipline
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LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION ADF&G, Fairbanks PRINCIPAL INVESTIGATOR Lowry et al

A. SHIP SUPPORT Ice-reinforced vessel - St. George Basin/Bristol Bay

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. We would like to work in the seasonal ice front and ice remnants of the Northern Bering Sea. Locations of stations will depend on ice conditions. Stations can be located optimally for all projects participating.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. On stations, small boats will be used to collect seals which will be analyzed for stomach contents, age and physical condition. Material will be provided to other projects. Twenty minute bottom tows will be made with a small otter trawl.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? Single cruise 1 May to 15 June optimal. If 2 legs nec., 1st 1-20 May, 2nd from 26 May to 15 June.

4. How many sea days are required for each leg? 45 sea days in single leg optimum. Two legs of 20 days apiece would be acceptable.

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Our operations can run concurrently with other biological and/or oceanographic projects.
Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling time on station and sample processing time between stations. We would hunt seals during all daylight hours. Otter trawls will require approx. 2 hours per day on station. Sample processing will be done during all transit hours, the time required being dependent on collection success.

6. What equipment and personnel would you expect the ship to provide? Small boats (17 foot Boston Whaler is optimum) and associated equipment, deck space with flowing sea water for autopsy of seals, materials to construct 4' X 10' autopsy table, laboratory space for workup of specimens.

7. What is the approximate weight and volume of equipment you will bring?
800 pounds 120 cubic feet

8. Will your data or equipment require special handling? no If yes, please describe:

9. Will you require any gasses and/or chemicals? Formalin If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If yes, please name the vessel and give the reason for so specifying. Yes - The NOAA ship SURVEYOR is necessary because it is the only NOAA vessel equipped with a helicopter.

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availabilty?
N/A

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.
Three persons will be specifically named at a later date. None will be foreign nationals.

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Discipline
Area of Discipline

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION ADF&G, Fairbanks PRINCIPAL INVESTIGATOR Lowry et al

A. SHIP SUPPORT Icebreaker in Beaufort Sea

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. We would like to work along and in the edge of the pack ice from 166 to 141° W. Work can be done at stations designed optimally for all projects. Provision should be made to work at length in areas of exceptional biological interest.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. On station, small boats will be used to collect seals which will be analyzed for stomach contents, age and physical condition. Material will be provided to other projects. Twenty minute bottom tows will be made with a small otter trawl.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times?
Any three-week period between August 1 and September 10.

4. How many sea days are required for each leg?
21

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Our operations can run concurrently with other biological and/or oceanographic projects.
Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling time on station and sample processing time between stations. We would hunt seals during all daylight hours. Otter trawls will require approx. 2 hours per day on station. Sample processing will be done during all transit hours, the time required being dependent on collection success.

6. What equipment and personnel would you expect the ship to provide? Small boats (17 foot Boston Whaler is optimum) and associated equipment, deck space with flowing sea water for autopsy of seals, materials to construct 4' X 10' autopsy table, laboratory space for workup of specimens.

7. What is the approximate weight and volume of equipment you will bring?
800 pounds 120 cubic feet

8. Will your data or equipment require special handling? no If yes, please describe

9. Will you require any gasses and/or chemicals? Formalin If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If yes, please name the vessel and give the reason for so specifying. U. S. Coast Guard Icebreaker

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availabilty? N/A

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals. Three persons will be specifically named at a later date. None will be foreign nationals.

C. AIRCRAFT SUPPORT - HELICOPTER To accompany SURVEYOR in November

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed.)

   Flights will be conducted within a 50-mile radius (or as deemed appropriate by ship's personnel) of the ship's position.

2. Describe types of observations to be made.

   Collection of seal specimens.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   8 - 28 November would be optimum. A departure of 4 days earlier or later would be acceptable.

4. How many days of helicopter operations are required and how many flight hours per day?

   6 to 8 hours per day with a total of twenty possible days of flying.

   Total flight hours? 120 - 160

5. How many people are required on board for each flight (exclusive of the pilot)?

   2

6. What are the weights and dimensions of equipment or supplies to be transported?

   100 pounds of personal gear including rifles, packs and field gear. We anticipate carrying seals weighing up to 600 pounds.

7. What type of helicopter do you recommend for your operations and why?

   Bell 206B equipped with floats. We have found this type of helicopter to be very satisfactory in our previous work of this type.

8. Do you recommend a particular source for the helicopter? If yes, please name the source and the reason for your recommendation.

   NOAA

9. What is the per hour charter cost of the helicopter?

   N/A

10. Where do you recommend that flights be staged from?

    OSS SURVEYOR in the Norton Sound, St. Lawrence Island, Bering Strait area.

11. Will special navigation and communications be required?

    Yes - Transponder, GNS - 500 Navigation System, 30 human body bags, slings and sling ropes, floats, baskets on each float, intercom for 2 passengers and pilot.

C. AIRCRAFT SUPPORT - HELICOPTER To accompany SURVEYOR in May and June

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed.)

   Flights will be conducted within a 50-mile radius (or as deemed appropriate by ship's personnel) of the ship's position.

2. Describe types of observations to be made.

   Collection of seal specimens.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   1 May to 15 June or 1 - 20 May and 26 May - 15 June

4. How many days of helicopter operations are required and how many flight hours per day?

   6 - 8 flight hours per day for a maximum of 40 possible days.

   Total flight hours? approximately 250

5. How many people are required on board for each flight (exclusive of the pilot)?

   2

6. What are the weights and dimensions of equipment or supplies to be transported?

   100 pounds of personal gear including rifles, packs and field gear. We anticipate carrying seals weighing up to 600 pounds.

7. What type of helicopter do you recommend for your operations and why?

   Bell 206B equipped with floats. We have found this type of helicopter to be very satisfactory in our previous work of this type.

8. Do you recommend a particular source for the helicopter? If yes, please name the source and the reason for your recommendation.

   NOAA

9. What is the per hour charter cost of the helicopter?

   N/A

10. Where do you recommend that flights be staged from?

    OSS SURVEYOR in the Bering Sea ice front and ice remnants.

11. Will special navigation and communications be required?

    Yes - Transponder, GNS - 500 Navigation System, 30 human body bags, slings and sling ropes, floats, baskets on each float, intercom for 2 passengers and pilot.

C. AIRCRAFT SUPPORT - HELICOPTER Beaufort Sea

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed.)

   We would propose to base a helicopter at Deadhorse and fly over the shore ice to leads at which we would collect seals. Most flying should be within 25 miles of the coast.

2. Describe types of observations to be made.

   Collection of seal specimens.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   5 - 20 November would be optimum. A departure of 3 days earlier or later would be acceptable.

4. How many days of helicopter operations are required and how many flight hours per day?

   Approximately 10 days of helicopter operations will be required with about 4 hours of flight per day.

   Total flight hours?

   40

5. How many people are required on board for each flight (exclusive of the pilot)?

   2

6. What are the weights and dimensions of equipment or supplies to be transported?

   100 pounds of personal gear including rifles, packs and field gear. We anticipate carrying seals weighing up to 600 pounds.

7. What type of helicopter do you recommend for your operations and why?

   Bell 206B equipped with floats. We have found this type of helicopter to be very satisfactory in our previous work of this type.

8. Do you recommend a particular source for the helicopter? If yes, please name the source and the reason for your recommendation.

   No

9. What is the per hour charter cost of the helicopter?

   Unknown

10. Where do you recommend that flights be staged from?

    Deadhorse

11. Will special navigation and communications be required?

    Yes - Transponder, GNS - 500 Navigation System, 30 human body bags, slings and sling ropes, floats, baskets on each float, intercom for 2 passengers and pilot.

C. AIRCRAFT SUPPORT - HELICOPTER Beaufort Sea

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed.)

We would propose to base a helicopter at Deadhorse and fly over the shore ice to leads at which we would collect seals. Most flying would be within 60 miles of the coast.

2. Describe types of observations to be made.

Collections of seal specimens.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

1 - 15 April would be optimum. A departure of 7 days earlier or later would be acceptable.

4. How many days of helicopter operations are required and how many flight hours per day?

Approximately 10 days of helicopter operations will be required with about 4 hours of flight time per day.

Total flight hours?

40

5. How many people are required on board for each flight (exclusive of the pilot)?

2

6. What are the weights and dimensions of equipment or supplies to be transported?

100 pounds of personal gear including rifles, packs and field gear. We anticipate carrying seals weighing up to 600 pounds.

7. What type of helicopter do you recommend for your operations and why?

Bell 206B equipped with floats. We have found this type of helicopter to be very satisfactory in our previous work of this type.

8. Do you recommend a particular source for the helicopter? If yes, please name the source and the reason for your recommendation.

No

9. What is the per hour charter cost of the helicopter?

Unknown

10. Where do you recommend that flights be staged from?

Deadhorse

11. Will special navigation and communications be required?

Yes - Transponder, GNS - 500 Navigation System, 30 human body bags, slings and sling ropes, floats, baskets on each float, intercom for 2 passengers and pilot.

B. AIRCRAFT SUPPORT - FIXED-WING   Cover plane for helicopter in Beaufort Sea.

1. Delineate proposed flight lines on a chart of the area. Indicate desired flight altitude on each line. (Note: If flights are for transportation only, chart submission is not necessary but origin and destination points should be listed.)

   Fixed-wing aircraft will accompany helicopter during collection operations over ice. Most flying will be in the central Beaufort Sea within 60 miles of the coast.

2. Describe types of observations to be made.

   Collection of seals. This plane will carry fuel in support of the helicopter.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.)

   1 - 15 April would be optimum. A departure of 7 days earlier or later would be acceptable.

4. How many days of flight operation are required and how many flight hours per day?

   Approx. 10 days of flight operations will be required with about 4 hrs. flight time/day.

   Total flight hours? 40

5. Do you consider your investigation to the principal one for the flight thus precluding other activities or requiring other activities to piggyback or could you piggyback?

   Investigators from RU #248/249 can be accommodated.

6. What types of special equipment are required for the aircraft (noncarry-on)?

   Long-range fuel tanks and wheel skis are imperative.

   What are the weights, dimensions, power requirements and installation problems unique to the specific equipment. N/A

7. What are the weights, dimensions and power requirements of carry-on equipment?

   20 - 5 gallon cans of fixed-wing and helicopter fuel.

8. What type of aircraft is best suited for the purpose?

   Cessna 180 or 185.

9. Do you recommend a source for the aircraft? No

   If yes, please name the source and the reason for your recommendation.

10. What is the per hour charter cost of the aircraft?

   Unknown

11. How many people are required on board for each flight (exclusive of flight crew)?

   None

12. Where do you recommend that flights be staged from?

   Deadhorse.

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period.)

Location	Dates	Number of Persons*	Total Person Days
Deadhorse	5-20 November	3	45
Deadhorse	1-15 April	4	60
Barrow (NARL)	Various	4	60

* includes pilots

2. Do you recommend a particular source for this support? If yes, please name the source and the reason for your recommendation.

No

3. What is your estimated per man day cost for this support at each location?

$90.00

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

Estimate from project office personnel and is based on rates at established facilities.

Project: 232

PI: Lowry, Burns and Frost

MILESTONE CHART

MAJOR MILESTONES - Specimen Collections	1978-79 O	N	D	J	F	M	A	M	J	J	A	S
Beaufort Sea												
Barrow		Δ	- -	- -	- -	- -	- -	- -	- -	- -	Δ	
Helicopter based		Δ					Δ					
Icebreaker											Δ	
Chukchi Sea												
Wainwright				Δ	- -	Δ				Δ	Δ	
Shishmaref		Δ							Δ	Δ		
Norton Sound												
Nome		Δ	- -	- -	- -	- -	- -	- -	Δ			
Ice reinforced vessel with helicopter		Δ										
St. George Basin - Bristol Bay												
Icebreaker					Δ							
Ice reinforced vessel with helicopter								Δ	Δ			

Project: 232

PI: Lowry, Burns, Frost

MILESTONE CHART

MAJOR MILESTONES - Other project activities	1978-79 O	N	D	J	F	M	A	M	J	J	A	S
Acquisition and archival of reference specimens	Δ											Δ
Processing of stomach contents	Δ											Δ
Submission of data	Δ			Δ			Δ			Δ		
Preparation of reports			Δ			Δ			Δ			Δ
Attendance at synthesis meetings (dates unknown)												
Preparation of FY 79 proposal								Δ				

References

Bukhtiyarov, Yu. A., L. F. Lowry and K. J. Frost. In prep. Food of the largha in the Bering Sea pack ice.

Burns, J. J. 1967. The Pacific bearded seal. Alaska Department Fish and Game, Juneau. 66pp.

Johnson, M. L., C. H. Fiscus, B. T. Ostenson and M. L. Barbour. 1966. Marine mammals, pp. 897-924 in N. J. Wilimovsky and J. N. Wolfe (ed.). Environment of the Cape Thompson region, Alaska. U. S. Atomic Energy Commission, Oak Ridge, Tennessee.

Kenyon, K. W. 1962. Notes on the phocid seals at Little Diomede Island, Alaska. J. Wildl. Manage. 26:380-387.

Lowry, L. F., K. J. Frost and J. J. Burns. In prep. Observations on the food habits of ringed seals and bowhead whales in the region of Pt. Barrow, Alaska.

Spalding, D. J. 1964. Comparative feeding habits of the fur seal, sea lion and harbour seal on the British Columbia coast. Fish. Res. Bd. Can. Bull. 146. 52pp.

kj

FORM CD-45
(REV. 3-76)

U. S. DEPARTMENT OF COMMERCE

SUPPLY, EQUIPMENT OR SERVICE ORDER

FOR: NOAA/ERL/OCSEAP

2. CHECK APPROPRIATE BLOCK

☐ PROCUREMENT ☒ OTHER *(Specify)*

Contract Modification

1. THE NUMBER SHOWN IN BLOCK 5 MUST APPEAR ON ALL SHIPMENTS AND/OR DOCUMENTS RELATING TO THIS ORDER

3. REQUISITIONER DOCUMENT NO	4. BUREAU CONTROL NO.	5. PURCHASE ORDER NO.
RK-8-0075		

6. ISSUED TO:
State of Alaska
Dept. of Fish & Game
Subport Building
Juneau, AK 99801

7. DESTINATION
SHIP TO
OCS Program Office
NOAA/ERL, Rx4
Boulder, CO 80302

8. ACCOUNTING CODE	9. QUOTATION REF. OR CONTRACT NO.	10. DISCOUNT TERMS
RK0000 R7120815	03-5-022-69	
11. DELIVERY F.O.B.	12. GOVT. B/L NO.	13. DELIVERY DATE

14. FUNDS AVAILABLE *(Budget Office)*	14a. STATION

15. LINE NO.	16. DO NOT USE	17. DESCRIPTION	18. QUANTITY	19. UNIT	20. ESTIMATED TOTAL COST	21. ACTUAL UNIT PRICE	TOTAL COST
	APPROVED: Director, ERL	Additional funds for 03-5-022-69, T. O. #10 for RU#232's use for ice breaker cruise as per attached Total funded to date: ~~$365,999~~ 265,878 AMOUNT OF THIS ACTION: $ 2,963 Total funded to date: ~~$368,962~~ 268,841			2,963		

22. SIGNATURE OF REQUISITIONER	DATE	23. SIGNATURE APPROVING OFFICER	DATE
TITLE		TITLE Director, OCSEAP	3-24-78

24. ACCOUNTABLE PROPERTY ☐	INITIALS	25. NOT AVAILABLE-BUREAU STOCK/EXCESS ☐	INITIALS	26. SIGNATURE-BUREAU CONTROL OFFICER	27. NOT AVAILABLE-DEPARTMENT STOCK/EXCESS ☐	INITIALS

28. APPROVAL	DATE	29. PURCHASING AGENT	DATE

30. RECEIPT ACTION - Quantities shown in Column 18 above have been received and accepted, except as follows: *(If additional space is needed, use reverse side.)*

31. SIGNATURE-RECEIVING OFFICER	DATE	32. PROPERTY CONTROL NO.	☐ TRADE-IN ☐ RECEIVING REPORT

33. SEND INVOICES IN DUPLICATE TO: →

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL RESEARCH LABORATORIES
Boulder, Colorado 80302
OCS Arctic Project Office
506 Elvey - Geophysical Inst.
University of Alaska
Fairbanks, AK 99701

February 28, 1978

MEMO

TO: Doug Wolfe

FROM: Gunter Weller

SUBJECT: Trophics Studies in the Beaufort Sea

Kathy Frost is taking the task of integrating and coordinating the Beaufort Sea trophics studies, given to her at the last synthesis meeting, very seriously. Her attached memo outlines tentative objectives and approaches, which will be discussed further.

Additional funding is also required. During FY 78, we require the following additional funds for the ice breaker cruise this summer (see attachments):

RU 232, Contract #03-5-022-69,T.O.#10 (Lowry, ADF&G)	$ 2,963.00
RU 194, Contract #03-5-022-56,T.O.# 8 (Fay, U of AK)	3,830.00
Total FY 78:	$ 6,793.00

During FY 79, the cost of trophics integration/coordination plus additional funds for field studies/analysis will require $50 k. We will negotiate this at proposal submission time, and can perhaps delete some of the field work as discussed with you over the phone.

If you agree to go ahead with the FY 78 request of $6,793.00, please have Kay issue the necessary requisitions to add the above amounts to the respective contracts. This should be accomplished as soon as possible.

GW:tmj

encl.

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

JAY S. HAMMOND, GOVERNOR

1300 COLLEGE ROAD
FAIRBANKS 99701

February 24, 1978

Dr. Gunter Weller
OCSEAP Arctic Project Office
Geophysical Institute
University of Alaska
Fairbanks, AK 99701

Dear Gunter:

Enclosed is a cost breakdown for additional trophics work to be done by RU#232 during FY78. The work to be done will be as requested by the Arctic Project Office. The funding requested ($2,963) will provide for collection of material during the 1978 GLACIER cruise in preparation for analysis of distribution and abundance of epibenthic invertebrates and demersal fishes and work on polar cod life history and trophics. If funding is approved, please allocate funds to RU#232 and make the necessary modifications to the contract.

Sincerely,

Lloyd F. Lowry

Lloyd F. Lowry
Marine Mammals Biologist
Division of Game

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

JAY S. HAMMOND, GOVERNOR

1300 COLLEGE ROAD
FAIRBANKS 99701

February 16, 1978

Dr. Gunter Weller
OCS Arctic Project Office
Geophysical Institute
University of Alaska
Fairbanks, AK 99701

Dear Gunter:

Lloyd and I have spent considerable time during the last week thinking about Beaufort Sea trophic interactions and the direction of future work. We have come to the not so startling conclusion, as have many others before us, that "we" (the marine mammal team, OCS, and/or the scientific community) can't learn everything about everything, and even if we could we probably wouldn't understand all the implications. We can, however, make a better stab at some parts of the system than at others. We can probably make a reasonable evaluation of pelagic food webs - identification of important species and interactions among those species. In the Beaufort Sea, the pelagic system is in general less species-rich, the energy inputs are fewer, and the higher trophic level species, i.e. mammals and birds, are more obvious than in the benthic system.

Benthic communities are a much different story. In many parts of the world they have been much studied and are still a puzzle. They will probably remain so in the Beaufort Sea for some time. Ideally we should know something about the diversity and standing stock of the benthos, species composition, and seasonality of all those parameters. Some of this information is available at present, particularly for infauna. Additionally we should know something about production rates within the system, the input and flow of energy and materials, and the interaction of species. This we simply do not have the time or money to do a good job on. There are too many species and too many connections within the benthic community. The best we can do is accumulate data on community structure and as time goes on hope to fill in bits and pieces on interspecies dependencies.

One of the prime data needs in the benthic system is information on the gross distribution of the invertebrate epifauna. In addition to species lists and distributions we need identification of epifaunal associations e.g. identifiable epifaunal communities. We might then be able to rank the importance of the various communities to the ecosystem as a whole and develop priorities relative to what areas development should or should not be impacted.

One of the reasons the pelagic system is more approachable is that food webs are fairly simple and key species for future research have already been identified. This, to date, has not been done in the benthic system. If epifaunal associations or communities could be identified, one could then determine one or two characteristic or "key" species from a community and proceed to determine physical and trophic sensitivities of those few species. We at present have no focal point within the benthos. Data exist on a variety of species but there is no adequate way to prioritize importance within the community.

The ideal situation, for those of us doing the science and for user agencies, would be a perfect understanding of all links within the system. Such understanding would allow the development of a model which could give complete predictability of the consequences of petroleum-associated development. Obviously such complete understanding is not within reach. Desirable, though less than ideal, would be thorough understanding of at least the major links within the system, effects of natural variation on those links, and reliable predictability of the effects of human-caused perturbations. Even this is probably not attainable. What the study of trophic interactions within a system can do is provide partial understanding of small parts of the system and actual or hypothetical interactions among some of those parts. With this understanding of parts we can make educated guesses as to possible or probable ramifications of disruption to the system. We cannot make absolute statements about what will happen. We <u>can</u> identify potential differential sensitivity of parts of the system, evaluate which times or places or species appear to be most or least vulnerable, and make recommendations as to how to minimize potential detrimental effects of OCS development.

Some realistically obtainable goals, which should increase our understanding of the system, are as follows:

1) Delineation of major species interactions or "key links" in the Beaufort Sea. We can do this in a general manner for the benthic food web and in a much more specific manner for the pelagic/planktonic food web.

2) Assessment of the sensitivity of key links to both natural fluctuations and to expected human-caused perturbation.

3) Extrapolation from the sensitivity of parts to the sensitivity of entire systems or subsystems.

An example of delineation of species interactions within a subsystem is as follows:

Sun → phytoplankton → copepods → arctic cod → seals, birds, people

Prior to this summer the link now entitled copepods would have read zooplankton. In light of data acquired during the 1977 GLACIER cruise, we now know that in offshore areas during the summer copepods form the bulk of the arctic cod diet. Additionally it appears that arctic cod may select for a certain size or species of copepod (Calanus hyperboreas and Euchaeta glacialis, large predominantly deep water arctic species, were two of the most abundant prey items). This is a subsystem we can really do something with. Some historical data are available on copepod distribution. Determining physical parameters are known for at least some species in some parts of the world, and some species have been tested for hydrocarbon sensitivity (Calanus hyperboreas was treated in the Canadian arctic and found to be "surprisingly resistant to oils tested"). Analysis of data such as these should provide a basis for beginning to assess sensitivity. About arctic cod we know relatively little. We do, however, know enough to establish it as a key link. Ringed seals utilize a very few prey species in the Beaufort Sea. Of these prey species some seem to be only seasonally available in large quantities (euphausiids, hyperiid amphipods) while others are available in smaller numbers and amounts (amphipods, mysids) but apparently over a wider temporal and geographical range. Arctic cod is the remaining major prey item. Cod are available year-round in apparently more or less constant numbers. They are relatively large and energetically efficient prey species. They seem to be a mainstay item in the diet of ringed seals. With the aforementioned information we can extrapolate as to the sensitivity of that subsystem. Were copepod numbers to be depleted by a large-scale environmental perturbation it seems reasonable to guess that offshore arctic cod will be affected. This might be in the form of worsened physical condition and heightened susceptibility to predation, movement of arctic cod to unaffected areas, or arrested production and development of next year's young. Any of these may result in lessened availability of food to ringed seals. Depending on time and location this may lead to poorer physical condition, causing increased susceptibility to disease or predation, production of fewer or smaller young, or migration from the area.

Examination of the above system does provide us with a basis upon which to predict effects of perturbation. It will probably not lead to recommendations of where or when to develop, but it does begin to allow evaluation of the magnitude of effects of catastrophic events and give us a baseline picture of what the system looks like.

A second type of subsystem analysis might give information which would bear on lease tract selections. For example, bearded seals are closely tied to the benthic food web. Upon identification of benthic community types, it would be possible to evaluate which of those types are most suitable as bearded seal foraging areas. With information on geographical distribution of those communities we can recommend sensitive areas where, for example, the sinking of oil or perturbation of the bottom would not be desirable.

All of this is leading up to a slightly different approach to the 1978 Beaufort Sea trophics cruise, and to the trophics work in general. As has been discussed previously, we would like to have a three-week plankton, fish, benthic invertebrate, and marine mammal cruise. Participants would include Alaska Department of Fish and Game and University of Alaska personnel, Rita Horner and Drew Carey. Sampling operations to take place on board would include trawling, plankton tows, grabs, and seal collecting. Presumably a second cruise would address similar questions from the bird point of view. We would attempt to further delineate species interactions in the pelagic system and determine basic community composition in the benthic/epifauna system. Projects would break down as follows:

Phytoplankton and zooplankton - Rita Horner
Benthos - Drew Carey
Epifauna, demersal fishes, seals - Frost/Lowry/Mueller, Fay/Shults

Table 1 outlines a suggested field sampling program.

We would like to sample several discrete areas or "stations" rather than do survey type sampling. Recommended station locations for the three-week cruise are: the edge of pack ice at approximately 156° (off Barrow); 153° (off Pitt Point) to accommodate historical benthic sampling at that location; 14°-150° (between Prudhoe and Harrison Bays); and 145° (off Camden Bay). These locations bracket the proposed lease area and incorporate areas where historical data are available. In addition to these designated stations we need to retain the flexibility to stop and examine areas of high biological activity. From last summer's work it is obvious that the Beaufort Sea is not homogenous as regards biological activity. If critical areas do in fact exist they will be in areas of greater activity. At present we have little way to predict where they may be.

A model cruise for the first three weeks would be:

Aug. 1	onload in Barrow, proceed to station off Barrow
Aug. 2-4	work Barrow station
Aug. 5	transit and trawls
Aug. 6-9	Pitt Point station-historical benthic and station work
Aug. 10	transit, trawls, etc.
Aug. 11-15	Prudhoe/Harrison station
Aug. 16	transit, trawls, etc.
Aug. 17-20	Camden Bay station
Aug. 21	transit to Prudhoe, offload mammal people

In addition to field sampling, we would suggest the following associated data analyses:

Frost/Mueller - analyze trawl data for patterns of epifaunal invertebrate distribution, and identification of epifaunal communities.

Carey - analysis of feeding types within the benthos, identification of major trophic links.

Horner - compilation of historical information on fluctuations in algal production, analysis of determinants of annual algal production (e.g. light, temperature, salinity, ice cover, nutrients, etc.).

Table 1. Field sampling.

Phytoplankton	Horner	Production, how does ice affect production, etc.		
Zooplankton	Horner	Sample fish food availability concurrent with otter trawls (esp. copepods)		
	Horner	Sample seal, bird and bowhead whale food availability concurrent with bird or mammal collections		
	Horner & Carey	Sample underice and pelagic amphipods and determine food habits (do this on a seasonal basis)		
Benthos (Grabs)	Carey	Pitt Point - continue present work on seasonality		
	Carey & Horner	Sample benthic amphipods and determine foods on a seasonal basis. Compare with pelagic and underice amphipods		
	Carey	Sample demersal fish food availability by sampling infauna concurrently with otter trawls. Grabs to be worked up primarily for those species or groups appearing as food items.		
Epifauna/ Demersal Fish	Frost/Lowry	Demersal fish distribution	Carey	Demersal fish food habits
	Frost/Lowry	Polar cod natural history	Lowry/Mueller	Polar cod food habits
	Frost/Mueller	Epifaunal invertebrate distribution, community structure		
	Fay/Shults	Parasitology/pathology of demersal fishes		
	Carey	Food habits, predator/prey ratios of major invertebrate species (Hyas, sea stars, snails, etc.)		
Seals	Frost/Lowry	Seal food habits		
	Fay/Shults	Parasitology/pathology of seals		

Horner - analysis of historical data and literature for requirements of Thysanoessa spp., Mysis spp., and Parathemisto spp. - relation to temperature and salinity, and what's known about reproductive periodicity, life span, seasonal and yearly fluctuations in distribution and abundance, food habits with whatever seasonal variation might be known.

Frost/Lowry - analysis of demersal fish distribution.

Fay/Shults - estimate parasite load, rates of occurrence of pathogens and pathological conditions in seals of the Beaufort Sea and compare these with rates in like hosts over a wide area of the Alaskan continental shelf.

Success of this sampling approach will depend on timely sample analysis and good communication and data exchange among investigators. If sample analyses could be complete within 4-6 months, or at least major crucial comparative station work done, there could be time to put together synthetic reports by the spring, reevaluate the year's effort, and redirect sampling effort for the following summer if desirable.

The following products might result from this sampling approach:

1) An assessment of the sources of offshore production, integrated with available ice, oceanographic, and meteorologic data. Magnitude and causes of natural variation should be discussed, relative rates of production in open water vs. under sea ice be compared, and the predicted effects of heavy or light ice years on algal production presented. With this information one should be able to delineate areas and/or times which oil spills would be most detrimental to production, i.e. under the ice or in open water, during winter or summer months. Horner

2) Analysis of historical data and compilation of existing Beaufort Sea records on distribution and abundance of Thysanoessa spp., Mysis spp., and Paramethisto spp., and delineation of determining factors. Compilation and analysis of literature on life history events, seasonal food habits, reproductive periodicity, etc. of the same species. This should give us some idea of the kinds and magnitude of natural variation to expect, and of the sensitivity of species to changing environmental parameters. Until we have some idea of natural variation and sensitivity, we stand little chance of being able to evaluate man-caused perturbations.

Horner

3) Comparison of arctic cod foods with copepod distribution and determining factors. This species interaction is a key link in the pelagic/planktonic system. By examining prey specificity, seasonal variation in prey, availability of alternate prey items, determining factors for those prey items, and sensitivity of prey to hydrocarbons, we can evaluate the sensitivity of this particular trophic link.

Lowry/Mueller and Horner

4) Comparative seasonal food habits of benthic and under ice amphipods. Gammarid amphipods seem to be widely distributed and available throughout the year. They are a major link between production/detritus

and fishes, birds, and mammals. An understanding of what sustains them in winter as well as summer months is important in predicting how sensitive they may be to disrupted algal production or contamination of the bottom. Comparison of food items with availability of those species would be valuable when possible. Seasonal information may be partially obtainable through analysis of archived samples. Horner and Carey

5) Comparison of demersal fish stomach contents and bottom grab samples from the same location should identify some key benthic links. Species dependencies can be looked at in relation to distribution of both predator and prey species. Carey and Frost/Lowry

6) Identification of epifaunal associations/communities. This should give a place to start looking for key species within those communities, critical needs of key species, and their susceptibility to disturbance. Frost/Mueller

7) Food habits of key epifaunal invertebrate species, feeding type analysis of major benthic invertebrates, and predator/prey relationships within the benthos/epibenthos. Carey

8) Occurrence of parasites, pathogens, and pathological conditions in seals of the Beaufort Sea. Examination of host/parasite relationships in conjunction with food habits of seals should help delineate mechanisms for transfer of parasites through the food web. Magnitude of parasite load and pathogen occurrence, correlated with physical condition of the seals, may shed light on the recent decline in numbers of ringed seals in the Beaufort Sea. Fay/Shults

In addition to the summer icebreaker cruise we would suggest extending this general sampling scheme to a winter program. Phytoplankton studies could be modified to concentrate more on ice algae. Zooplankton studies could be continued through the ice with the use of, for example, a one meter vertical plankton net and under ice tows from hole to hole. Fish and epibenthos could not be sampled in the same manner as in summer. However, arctic cod could be sampled by jig fishing. Seals could be sampled from the same general geographical area. Such winter sampling could be done at either two or three different times during the winter - for example, November and April, or November, February-March and May-June. Joint sampling efforts would be desirable - all participants could utilize the same ice holes and logistic support. Somewhere off the Prudhoe Bay area would be a logical winter station. There is a possibility that industry cooperation and/or assistance could be enlisted in providing equipment with which to get through the ice, lab space, etc. Were it deemed desirable, such a seasonal sampling program could be implemented as early as this spring in order to provide the maximum amount of data possible by leasing time.

Gunter, I think I've written a book and I'm worn out. Hope these thoughts are useful.

Sincerely,

Kathryn J Frost

Kathryn J. Frost
Marine Mammals Biologist
Division of Game

Title of Proposal: Site Intensive Studies of Marine Birds at Selected Localities in the Northern Bering Sea and Bering Straits, Alaska.

OCSEAP Research Unit #237

Principal Investigator: William H. Drury

Total Cost of Proposal: $84,210.00

Period of Proposal: 1 October 1977 - 30 September 1978

Institution: College of the Atlantic, Bar Harbor, Maine 04609

Principal Investigator

Name: William H. Drury Date: 10/4/77

Address: College of the Atlantic, Bar Harbor, ME, 04609

Telephone Number: 207-288-5015

Required Organization Approval

Name: Edward G. Kaelber Date: 10/4/77

Position: President

Address: College of the Atlantic, Bar Harbor, ME, 04609

Telephone Number: 207-288-5015

Organization Financial Officer

Name: R C Rienhardt Date: 10/4/77

Title: Contracts Officer

Address: College of the Atlantic, Bar Harbor, ME, 04609

Telephone Number: 207-288-5015

TECHNICAL PROPOSAL FORM

I. Title: Site Intensive Studies of Marine Birds at Selected Localities in the Northern Bering Sea and Bering Straits, Alaska.

Research Unit Number: 237

Contract Number: NOAA Contract #03-6-022-35208

Proposed Dates of Contract: 1 October 1977 - 30 September 1978

II. Principal Investigator: William H. Drury

University: College of the Atlantic

Title: Faculty Member in Biology

Percent of time devoted to project and role: more than 35% supervision of field work; analysis; and reporting.

III. Cost of Proposal

$84,210.00

Lease Area: Norton Sound to southern border of Chukchi Sea

IV. Background

R.U. 237 was undertaken to assess and survey repeatedly habitats in which seabirds, waterfowl and shorebirds gather during migration and the breeding season on the southern shores of the Seward Peninsula, primarily at Bluff Cliffs and Sledge Island.

Subsequently, King Island was added to the intensive sites under investigation in FY 1976 (R.U. 447). King Island proved to be difficult of access for political as well as physical reasons in 1976 and the topography of the island did not lend itself to intensive scientific investigation. Little Diomede Island was added to the array in FY 1977 (still under R.U. 447). The physical and political access to this island is much less difficult than those of King Island, however access to these outer islands and the surrounding seas would be greatly improved by having the use of a moderately sized vessel. Therefore we have requested the availability of a charter boat similar to the crab fisherman (@ 60 feet overall) used by USFWS in 1976.

It is further proposed to undertake radar observations of bird movements in spring from Cape Prince of Wales toward Siberia in close coordination with other field studies. This would be undertaken by a subcontractor well-experienced in this specialized work. This undertaking is an extension of the survey of waterfowl and shorebird dependence on coastal habitats of the south shore of the Seward Peninsula which was part of the original task description of R.U. 238. Thus, this project in part fulfills the same tasks in Norton Sound that RU 3/4 does in the Gulf of Alaska, and did north of Norton Sound through 1976 and that R.U. 488 has dealt with in other portions of the Northern Bering Sea.

If access is permitted to all sites, the P.I. may retreat from some pursuits to get the most out of the study opportunities at King Island and Little Diomede Island.

The need for inventory, process, and trophic studies on the Bering Straits avifauna is acute, because the Diomedes, King Island, and other localities represent northernmost limits of distribution for several species of marine birds, and because there is exchange of Bering and arctic water, ice, and biota through this region.

V. Objectives

A. To provide estimates of nesting success of principal species of marine birds.

B. To establish and describe sampling areas which may be utilized in subsequent years or by other persons for monitoring the status of populations.

C. To determine the amount and kinds of foods utilized by the principal species, and to describe daily foraging patterns; when possible to determine the relationship of food selected to that available.

D. To describe the chronology and phenology of events in the biology of breeding birds, including changes in populations and their habitat distribution, from site occupation in the spring through departure in the fall.

E. To provide comparison of current data with recent historical data.

F. To determine the number and distribution of principal species at spring arrival, during breeding season and in fall gatherings, as these are related to characteristics of available habitat within the area.

G. To describe the chronology and phenology of events in the use of coastal habitats by waterfowl, and shorebirds.

VI. General Strategy

Methods of gathering data have been described in detail in the Annual Reports for Research Units #237 and #447 prepared for the field season of 1976.

A. Nesting Seabirds

1. To determine the number and distribution of each species, we will count individuals and identify them to species within selected sections of the cliffs and talus slopes. We will make sketch maps of the colony, take a photographic record of sample areas, and identify landmarks for later use.

   We will repeat censuses and counts at sampling sites and study sites at different times of day and at different stages during the breeding cycle.

2. To provide estimates of reproductive success we have established study sites, identified (located on sketch maps) nests, recorded contents of nests and followed individual nests through the season during 1975 and 1976, and 1977. Because a major aspect of this work is gathering comparative data, we will do this same work, trying to visit both Little Diomede and Bluff Cliffs during the critical periods of egg-laying and fledging. If possible, we will put a small party on King Island temporarily during early July to observe Kittiwake egg laying.

   In 1975 and 1976 we counted nests and large chicks of Pelagic Cormorants. We need to improve our data on Glaucous Gulls and do not have satisfactory techniques for measuring success in Horned and Tufted Puffins, or the three species of Auklets.

   We had difficulty identifying the breeding individuals among Common and Thick-billed Murres. The postures taken by incubating and brooding birds are unfortunately also assumed by non-breeding birds. Data gathered in the 1976 and 1977 field season suggest that seeing the egg or chick itself to identify successful nests can be used to measure reproductive success. This technique requires detailed work from 5 August to 5 September. The technique seems to be adequate to measure the large differences between years which are observed between 1975, 1976, and 1977.

For observing the factors affecting reproductive success among Kittiwakes, it is important to make observations during the peak of egg-laying, 25 June to 10 July, and during the time when a maximum number of young are on the cliffs, 10-20 August.

3. We have established, mapped, photographed and described sampling areas which can be used by other research workers in later years at King Island, Little Diomede Island and at Sledge Island, and at the main study area at Bluff Cliffs.

4. To determine the amount and kinds of food utilized, we will collect samples of food dropped by adults on and under the breeding ledges.

   We will continue watches to observe the movements of birds to and from the cliffs.

   A full assessment of the extent and use of feeding grounds will require work to be done many miles from the colony, in low-flying aircraft and in a moderate sized vessel. A proposal to expand this part of the research is referred to below under B. Feeding Grounds.

5. To gather additional data on the schedule and phenology of events at the cliffs we will keep regular records at study plots. It is important to inspect the cliffs early in the season, as the birds first gather in the leads. In 1977 we used twin engined aircraft to make these inspections, and had a party at the Bluff Cliffs and Little Diomede Island by May 20, 1977.

6. To provide comparison of current data with past and future data, we will review the scarce published information and interview local residents. The photographs we took in 1975 and 1976 proved satisfactory for counting Kittiwakes, but not satisfactory for Murres.

We have data on how the seabird occupation of the cliffs changes from hour to hour and day to day, both with season and between years. Knowledge of these variations is necessary to assess counts made in the future and to judge what actual population changes may have occurred. It may be that during population minima, nesting birds will be equally distributed but less dense or it may be that the nesting birds will gather together at preferred sites.

B. Feeding Grounds

Work during 1978 will be a reconnaissance survey of feeding areas and food used.

We hope to visit the feeding grounds by boat during times of courtship, of incubation and of feeding young. The purpose of the visit will be to find where birds are feeding, to observe them, and to shoot samples of the feeding birds. We will make air transects over the area to get estimates of the density and distribution of birds at sea. We agree with C. Harrison of USF&WLS that good data can be gathered and more cheaply from aircraft than from a boat.

We will sample birds and their foods in these major areas. A secure anchorage for a moderate sized vessel is available in Golovin Lagoon for work in Norton Sound. An adequate lee is available at Sledge Island and good shelter is available in Port Clarence and Grantley Harbor for work in the Chirikov Basin and the Bering Strait. Our experience during 1975, 1976 and 1977 indicates that weather reporting is adequate to allow a moderate vessel to seek shelter during storms, and that the weather in Norton Sound and Chirikov Basin is more favorable for our work than that in Bristol Bay, Aleutian Islands and Gulf of Alaska. However, we expect that many days will be lost to weather that prevents use of a fast small boat to collect birds.

C. Waterfowl and Shorebirds in Coastal Areas

In order to survey coastal waters and lagoons for use by waterfowl and shorebirds:

1. We will, if possible within our other commitments, census the important areas such as Woolley Lagoon, Safety Lagoon, and the estuary of the Fish River at Golovin Bay, the mouth of the Kwiniuk and Kwik Rivers at Moses Point, and the area between the Koyuk River and Inglutalik River in Norton Bay.

2. We will identify species present, count numbers, identify whether the birds are feeding or resting, and how the activity is associated with tides and weather.

D. Birds Migrating Across the Bering Straits

Dr. Warren Flock of the University of Colorado at Boulder has used the radar at Tin City to watch birds migrating across the Bering Strait in May and early June. This movement of intercontinental migrants is an important constituent of the wildlife on the Bering Straits area. If my party were working on Little Diomede, we could establish regular hours for observing visible migration and coordinate our observations with those at Tin City and perhaps with observations on the Siberian mainland made by Dr. Vladimir Jacobi. Dr. Flock would be responsible for archiving data and reporting results. My party will take part in the observations and I can act as coordinator of this work.

VII. Sampling Methods

We will continue and refine the sampling methods used so far in the study. We have established 19 sampling sites along 4 km of bird cliffs at Bluff, 2 at Square Rock, 2 along 400 meters of cliffs at Sledge Island, 7 along 1 km on the south shore of King Island, and 25 sites along 3 km of cliffs at Little Diomede Island. These sites have been chosen, and future sites will be selected, for their accessibility (independent of weather or sea conditions) and for their clear view of an adequate sample of nests for statistical analysis.

During the field season of 1976 and 1977 we visited the study sites at Bluff every two days between late May and late September. We were not able to maintain such a regular schedule at King Island or Little Diomede Island. We hope to make sample visits during egg-laying and during the period while young are on the cliffs during 1978 by use of the vessel described below.

During 1978 we will try to have a party on Little Diomede during critical stages of arrival, egg-laying, and fledging of young. We will make up this party as well as the temporary parties at other colonies by reassigning members of the party. We will have to decide on what can be done at King Island as the politics indicate.

As indicated under A-6, reconnaissance visits are desirable early in the spring while birds are occupying the cliffs and late in the summer as the cliffs are being left. However, we have found that the proportion of useful data gathered relative to the time and effort expended is low both early and late in the season.

In our previous work on colonial seabirds, we used standard tests for statistical significance. The data gathered in 1975 did not deserve statistical treatment. We used Chi-square tests on some data gathered in 1976.

Remarks: In my experience with fieldwork, it has proven useful to have thought out several plans for gathering data that contribute to a central problem. Once in the field, it is necessary to adjust plans as opportunities are afforded. Changes in the behavior of birds, weather and the sea, as well as failure of arrangements, can be expected to prevent carrying out some plans and to offer unusually good chances to carry out others. These eventualities played an unusually large part in our program during 1977: getting to Little Diomede Island proved to be unexpectedly easy and making overwater transects proved to be unexpectedly difficult.

VIII. Analytical Methods

A. In determining the number and distribution of each species according to habitat and breeding season, we will make regular surveys of the entire colony as well as counts of sample plots. We will make photographic records of each study site and of other sample parts of the colony as far as is possible and relevant to the purposes of OCSEAP.

In measuring breeding success we will compare numbers of pairs which have established territories or which have built nests to the number of eggs laid and to the numbers of young reaching some arbitrary age such as fledging or three weeks of age (the end of the period of major mortality).

B. In surveying coastal areas for waterfowl and shorebirds, we will fly transects in small aircraft. The results of these transects are inevitably imprecise but we use standardized methods. These methods are to count birds in a uniform swath under the airplane and record time at each 2 or 5 minutes during the flight, and (2) to fly at a constant altitude and speed.

Although the correspondence of the data gathered to what is actually on the ground is not clear, we should be able to use the data to make gross comparisons among areas, among months and years as we have done in our Annual Report for R.U. #237 for 1976.

C. In establishing the distribution of seabirds at sea, we plan to use the techniques already developed by shipboard observers in the OCSEA Program.

The first stages of our work on food and feeding will be descriptive, i.e. establishing locations where birds were collected, identifying food in the gut and interpreting these data relative to other observations. If we are to make more sophisticated observations, we must have data on the distribution, density, age and breeding condition of prey species at sea, but at present there seems little likelihood of those data being gathered.

IX. Anticipated Problems

A. We will not know whether we can get necessary permissions for the 1978 season until we get to Nome and talk with the native corporations. We have had the good fortune of getting approval and establishing a party on Little Diomede in May 1977. We hope that arrangement can be continued.

We anticipate problems in getting accesss to living facilities on the major seabird islands: King Island and Little Diomede Island. So far this problem has not existed at Bluff Cliffs.

The major issues can probably be solved with money.

We do not need to have a party on those islands continuously because the structure of the cliffs and because the recent/continuing human predation interfere with detailed studies. Having a vessel to visit the island periodically may work out to be a preferred solution. Because leasing costs are so high, it may be cheaper to establish a party on the island for long periods and to pay the price required by the villagers.

B. One problem is to get to the sites early enough and late enough in the season to establish how the birds arrive and take up territories and how they leave. A related problem is transportation to island study areas during the awkward period of spring breakup of the sea ice. We will try to overcome this difficulty by using aircraft to make reconnaissance flights. In 1976 we got generous help from the U.S. Coast Guard in getting to King Island, In 1977 our party was flown to Little Diomede before the ice broke up.

C. Because the seabird cliffs rise vertically out of the sea, it is difficult to work along their foot unless the sea is calm. We must reserve each day when the sea is calm for the job of visiting the foot of the cliffs. This means that some duplication of effort and equipment is necessary so as to have working parties ready at each important study site when the sea is calm.

D. We have suggested that it may be possible to use photographs of cliffs to measure the breeding success of Black-legged Kittiwakes by identifying and counting chicks and nests. Our results from 1975 and 1976 are marginally encouraging but not adequate for general use. We were unable to test this technique in 1977 because of bad weather which postponed other higher priority work.

Associated with this, we need also to make more measurements of the impact of close over-flights of the cliffs on all species, especially Murres. We believe that the best time for photography is after most Murres have left the cliff, but we need to measure the impact of air-craft both at cliffs at Bluff where aircraft fly past frequently, and those at King Island, Sledge Island or Little Diomede where aircraft rarely visit.

We will need to charter twin-engined aircraft for this work to visit King Island and/or Little Diomede during the proper periods.

X. Deliverable Products

A. Digital Data

Media	Estimated Volume
Coding sheets	$<$ 500 coding sheets
Punch cards	$<$ 10,000 cards

We will prepare coding sheets in the field and either have these coded onto punch cards or deliver the coding sheets to M. Crane of A.D.I.C. We will have coding sheets prepared within 120 days of the end of the field season. We cannot guarantee delivery of punch cards or "floppy disks" because we do not have facilities to prepare them at our institution and must depend on subcontracting.

B. & C. Narrative Reports and Visual Data

The information products will be similar to the form and content of those already presented as annual reports for Task #237 and 447.

We will prepare sketch maps, and descriptions of study sites and supply numerical data in tabular form for censuses and data gathered at study sites.

We will prepare reports on special problems including comments on population biology and ecology, as done in our annual reports for 1975 and 1976.

The product will include: A report on studies at nesting cliffs at Bluff and the islands, species list, numbers, schedule and success of reproduction, feeding areas, food and special studies. For 1978 we will include a special section on the studies made at sea.

We will report on data on the species present, their numbers, the schedule and phenology of the breeding season, measurement of reproductive success, their food and their feeding areas. We will prepare an annual report due on 1 March 1979 which will report the data collected, discuss interesting observations and special problems, present our conclusions and speculate on their application to the larger biological and oceanographic context of our study. We will also discuss the relevance of our data and the interpretations of those data to mineral development on the Alaska outer continental shelf. We will, where possible, prepare verbal models of the parts ecosystems which we analyze. These models should help in predicting the impact of development.

Examples of the sort of reports we intend to submit include, e.g., semiannual report November 1, 1975; annual reports of April 1976 and 1977; the letters to Jay Quast, OCSEAP Juneau Project Office in December, 1975 and January 1976; to Curl, Kelley and Norton in November 1976 and to Representative John Seiberling in April 1977.

We can deliver interpretations of data and discussions of the relevance to OCSEAP of the fieldwork in 1975, 1976 and 1977 by the end of March, 1978.

<u>Note</u> that in each fiscal year, four months salary for the Principal Investigator and assistants has been budgeted for work on reports. These funds are regularly expended after the end of the regular contract period, but are manifestly part of the contract. The four months is necessary because the Principal Investigator will take leave of absence for an academic term each year. Terms at the College are not divisible. We plan to have extra assistants during 1977/78 to prepare reports during college term time so that the Principal Investigator can get into the field in late April or early May of 1978.

D. N/A

E. Data Submission Schedule

Data will be submitted after the end of the field season. The first data will be collected in <u>May 1978</u>. The data collection effort will be finished in <u>September 1978</u>.

Data will be submitted to the Project Offices for inclusion in the data base at the following times:

<u>Collection Period</u>	<u>Data Submission</u>
May 1978 to October 1978	March, 1979 (coding sheets within 120 days)

XI. Information required from other investigators

A. We will need biological oceanographic data such as:

1. The distribution, spawning, growth rates, etc., of small bait fish - Ammodytes, Osmerus, Mallotus, Onchorhynchus, Boreogadus, Lumpenus, Stichaeus.

2. The distribution, spawning, growth rates, etc., of larger planktonic crustacea - Thysannoessa, Calanus, Eucalanus, Parathemisto, Mysidacea, and Gammaridae.

B. We will want general oceanographic data on the "no-mans-land" between depths of 1 meter and 40 meters.

C. We will need information which will allow us to prepare a picture of the physical oceanography of Norton Sound and Saint Lawrence Island waters according to which we can identify origin, characteristics and movements of water masses.

XII. Quality Assurance Plans

We do not have special instruments that need calibration (other than the differences between observers in estimating numbers).

XIII. Special Sample and Voucher Specimen Archival Plans

The only special samples will be colored photographs. We may have collections of specimens of fish and may have stomachs of birds collected, but these can be stored in the College collection. If studies at sea result in accretion of so many samples that their storage becomes a problem, we will have to take additional steps. We intend to keep voucher samples of the organisms studied, but consider that unnecessary for the bird species which are the main subjects of our study.

XIV. Logistics Requirements

A. Ship Support

1. Proposed tracks and/or sampling grids, by leg are shown on a chart of the area. Stations are Nome, Bluff, Sledge Island, King Island, and Little Diomede Island.

2. Observations will be made of the kinds and numbers of seabirds during shipboard transects. We will carry out sample watches when at sea and especially when near (within 25 nautical miles) nesting cliffs. The purpose is to learn where feeding birds disperse to and aggregate. Stops will be made to launch a small, high speed boat to chase down and shoot feeding birds.

3. Optimum Chronology of Observations

   As to season,

   a. One set of air transects during the period June 10-July 1 (pre-egg laying).
   b. One set of sea transects between July 10 and August 1 (incubation).
   c. To run at least one set of air and sea transects between August 5 and August 20 (feeding young).

   We would prefer to run these transects when there is as little seaway as possible, and we prefer to avoid the time of day when most seabirds are at their cliffs.

4. About 45 sea days are required

5. Our investigation should be the principal one for the operation.

   The studies of feeding activities of marine birds should be the principal ones or associated with studies of surface fauna.

   Observations and collections at sea must be made during daylight.

   Observations for censuses of cliffs should have five hours at each colony - Bluff, Sledge Island, King Island, Fairway Rock, Little Diomede Island, Cape Denbigh, and Egg Island. We can process samples between stations.

6. We expect the ship to supply a place to eat and sleep and a platform from which to make our observations when at sea. We provide our own observers, but will share the work of the vessel. We provide our own specialized equipment for making observations and shooting seabirds.

7. The approximate weight and volume of the equipment is: for transects, 1,000 lbs. equipment, occupying a volume of 3' x 4' x 6'.

8. N/A

9. N/A

10. We prefer non-NOAA ships, so as to have a small vessel whose operation is flexible.

11. We are requesting authorization of funds for a charter at $1,000.00 per day. We have already found a suitable vessel and captain based at Kodiak.

12. We will need 3-4 persons on board for each leg. William Drury; perhaps John Drury; Mark Libby; Karsten Hartel and others. No foreign nationals. We do not have our party planned for 1978 yet.

B. Aircraft Support - Fixed Wing

1. Proposed at-sea transects are shown on accompanying charts. Flight altitude should be 100-120 feet.

   a. We require twin engined aircraft for this work.
   b. We require aircraft for transects and surveys of the coastal waters, lakes and lagoons between Cape Prince of Wales and Norton Bay.
   c. We also require aircraft for logistic support, equipment and supplies between Nome and Bluff, between Nome and Sinuk River Mouth, and between Nome and Wales or Teller.

2. We will identify species and count or estimate numbers of individuals in order to define the distribution of feeding grounds. Records of birds observed are kept in 5-minute units.

3. We propose to make transects:

   a. In the period June 10-July 1 (the pre-egg laying period).
   b. In the period July 10-August 1 (the incubation period).
   c. In the period August 5-August 20 (when the nestlings are on the cliff and being fed by adults).

4. To make transects at sea, we need at least nine days of 4-6 hours of flying (twin engine). To make coastwise surveys, we should have 4-5 days of 5-8 hours (single engine). To move equipment and supplies we will need 20-40 hours of flying if we do all supplying by aircraft (single engine). We will have to weigh alternatives and judge the importance of needs as they develop. Maximum total flight hours on transects and surveys, about 30. Maximum total flight hours to supply field parties, 30.

5. Our investigation must be the principal one for the flight. Reconnaissance surveys need a low-flying, light aircraft, and it would not be practical to share with other projects.

6. We need no special equipment for transects that we do not carry on.
   We need space and an aircraft light enough to land on the sea beach or upland tundra to supply field parties with equipment and supplies.

7. Our carry-on equipment is less than 4 cubic feet in volume and less than 50 pounds in weight.

8. Cessna Sky Master is available from Anchorage for transects of the sea. We have used Cessna 175 and Piper aircraft for coastal reconnaissance. These aircraft are available at Nome.

9. Arctic Aviation at Kenai has supplied the Cessna Skymaster. The Cessna and Piper aircraft are available from Martin Olson Air Taxi Service of Golovin and Nome, and Seward Peninsula Flying Service, Lloyd Hardy, at Nome.

10. Twin aircraft commercial charter rates are about $125.00 per hour. Single engine charter is $100.00 per hour.

11. A minimum of two observers are required for waterfowl censuses. Four observers are preferred for over water transects.

12. We recommend that flights be staged from Nome.

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

Location	Calendar Period	Personnel Per Day	Total Man Days
Little Diomede/King Island/Sledge/Bluff	15 June-15 Sept.	5	450
Tin City/Wales/ Little Diomede	15 May-20 June	2	70
Boat	20 June-10 July	5	100
	15 Aug.-5 Sept.	5	100

TOTAL PERSON DAYS = 720

We plan to spend a minimum amount of time in Nome, but need housing and storage space throughout the period.

2. **Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.** We have made tentative arrangements for charter of a suitable "crab-boat" out of Kodiak. We have tacit approval for using miners' cabins at Daniels Creek and Koyana Creek at Bluff. We are renting living space at Nome and storage space in a Quonset hut. We must negotiate for facilities at King Island or Little Diomede Island.

3. **What is your estimated per man day cost for this support at each location?** We estimate $10.00 per person per day cost for food, based on experience at Nome in 1975, 1976 and 1977.

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp? The cost of renting our rooms at Nome will be $1600 or $400/ month in 1977. We were charged $10 per person per day at King Island in 1975 or $6000 if work were planned for 1978. We were charged $300 per month for use of the schoolhouse at Little Diomede in 1977.

We have so far not been charged for quarters at Bluff but we have spent perhaps $250 on building repairs and must do a lot more in 1977.

Our actual per person per day cost for food was about $6.50 in 1976. An average hotel room at Nome in 1975 was $65 per day per double room and a minimum of $20 per day to eat in restaurants.

E. SPECIAL LOGISTICS PROBLEMS

What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

The main logistics problems are transportation to the islands, to feeding grounds and to King Island or Little Diomede Island.

The needs at Nome are for space to sort and organize equipment before and after periods in the field. We also need ample space for setting up field kitchen, air mattresses on the floor, honey pot for 2-8 people for 2 days to 2 weeks, according to the weather. Access to a shower is a boon.

We need storage space where our gear will not be moved by visitors. We have arranged to rent suitable storage space for 1977 and 1978.

Major transportation needs should be satisfied by use of aircraft and chartered vessel in 1978.

XV. Management Plan: Briefly describe how you will manage your project. Also provide an Activity/Milestone chart.

I will have two assistants whom I can leave in charge of field projects. They will be responsible for gathering data on daily data forms.

Although I will make regular visits to and be in occasional radio contact with the Bluff party, I will return to Maine for several weeks at some time during the field season.

The field data will be partially collated and put in coding sheets for archiving while in the field. I will have an assistant during fall and winter to process field data and write reports.

I will take leave of absence from teaching duties during the spring of 1978 in order to get to the cliffs by early May.

We will change plans for 1978 as a result of our experience during 1977.

Activity/Milestone Chart attached.

XVI. Outlook

A. Major final results and data products.

I will use "data" to mean the observations or numbers upon which are based conclusions, recommendations or models. I will use "results" to mean the contribution of the research to the preparation of an Environmental Impact Statement, or, more broadly, to the understanding of the environmental biology of some birds in this area. In this discussion I am trying to identify the needs of a full understanding of the problem without considering my own, any financial or other practical limitations.

1. As to "data," the observations and numbers we have collected so far (see Significant Milestones) supply the groundwork for a monitoring program. As such, these data could either be made into a final data product or expanded and refined to increase comprehension of variation.

   a. It would be valuable to continue the study at Bluff Cliffs for five years to observe annual variations, to measure the impact of predators such as Ravens and Glaucous Gulls. It is not critical that these be five consecutive years. The kinds and changes in food brought to the cliffs should be studied in more detail and the breeding success monitored at Bluff, Sledge Island, Topkok, Little Rocky Point and Cape Denbigh. The cliffs at Bluff have conspicuous advantages for detailed long-term scientific studies. It is unlikely that these conditions can be duplicated elsewhere. Unfortunately the variety of species is relatively low.

   b. Similar detailed work should be continued for several years at Little Diomede Island if that place turns out to be a favorable site for study both scientifically and politically. Diomede appears to have much more productive surrounding seas and more diverse breeding population of sea birds than Bluff.

      It is possible to monitor water-fowl and shorebird numbers and concentrations in the context of this program of detailed site-specific studies.

2. As to "results," in order to assess the contribution of this research to understanding the biology of the Northern Bering Sea, we need to consider why we should study sea birds.

   a. At the most primitive level it is important to study seabirds because a predictable public outcry will result if sea bird populations are damaged by operations or chemicals associated with oil development. This is especially the case in this well-known world center of numbers and diversity of sea birds. It is necessary to know the present condition of the sea bird population as a baseline against which to compare future populations.

   b. At a more sophisticated level, the Beringian area is well-known for several significant biological peculiarities. Among other features, the area lies where the Eurasian-Siberian fauna and flora meet the North American, and it has an important endemic flora and fauna of its own. It is an area where "vigorous and colonizing" species meet and interact with "conservative species of limited" distribution. It is an area of very high biological productivity. There are many scientific reasons why this area needs to be surveyed before further development is "unleashed."

c. Again at a more sophisticated level, but adding a practical element, sea birds can be used as indicator species of the condition of the sea. They, like walrus and seals, are conspicuous, numerous and relatively easy to census or to study. Because they feed on crustacea and small fish, sea birds are sensitive to the local oceanic conditions. They provide probably the easiest and hence best measurement of how well primary productivity and the transfer of energy among the first consumer levels is proceeding.

d. Hence, a major "final result" in this area will be our contributions to understanding the biological activity in the water column of the Shallow Sea. As I have outlined in other reports, there is a major dichotomy of conditions to the East or to the West of a line drawn from Northeast Cape on Saint Lawrence Island to the York Mountains on the Seward Peninsula.

The distribution of sea ice and fog characteristically differs on the two sides of the line. The daily weather on the west regularly differs markedly from that on the east. Relatively warm and low saline water from the Yukon River dominates the sea to the east, while relatively cold and highly saline water from the Anadyr Basin dominates the sea to the west. The numbers of gray whales and sea birds seen feeding is conspicuously higher on the west side of the line and Auklets (three species endemic to the Bering Sea) nest in large numbers to the west but in small numbers (if at all) to the east.

It would seem obvious that this conspicuous difference should be understood as a first step toward understanding the ecology of the region.

i. At a simple level it is important to know more about the differences in water masses to the East and West, and more about what happens in the area where the masses shear against each other and in the area where they are confined as they pass through the Bering Strait.

ii. At a more complex level the use of sea birds as indicators is predicated on knowledge of the relation of the performance (survival and reproduction) of sea birds to the age structure, growth rates and spawning of their prey. At this point it is not clear in theory or in practice the degree to which this convenient unit of study (Sea birds) and their prey (much more difficult to study) is "coupled" with the rest of the biological communities which combine into what is called productivity. For the purposes of this study and the final product, then, we suggest confining our investigation to the sea birds and their prey species. The degree to which these studies should include understanding the biology of the prey species is considered below.

e. All of these goals suggest that the major "thrust" of our project should be to gather data suitable for making comparisons among the events at the several colonies during the breeding of seabirds. The value of the work at Bluff is its comparison with results found at King Island or Little Diomede Island, and the reverse is also true.

B. Significant Milestones

By milestones I mean the steps in gathering data and understanding the interrelations among the data by which we can progressively explain more and more of the biological structure of the area.

1. Present state of the work undertaken

The present survey of the sea birds, shore birds and waterfowl on the south shore of Seward Peninsula and adjacent waters has reached a first preliminary plateau.

a. We have data
   i. on the kinds, numbers and distribution of the important species
   ii. on the schedule of the breeding season
   iii. on the major concentrations
   iv. on the conspicuous movements
   v. on the feeding distribution of sea birds
   vi. on the impact of the distribution of land and sea ice on movements and aggregations during migration.
b. We also have three years of measurements showing annual differences in reproductive success and have some data on the major food items brought by sea birds (i.e. 75% level of use) to their young. We have these data at three major sites and some partial data at five minor sea bird colonies in the area.
c. We have observations on the impact of predators such as Ravens and Glaucous Gulls on these species and on the relation of sea birds to the natives' original and present, subsidized, economy.
d. It is our plan and will be an important way to round out this study to observe the birds migrating across the Bering Strait in spring using radar.

These data can probably be used satisfactorily for an overall monitoring system based on the assumption that the numbers and distributions of sea birds do indeed depend on the condition of prey items, water masses and their overall productivity.

We are in a position to conclude this research now, to continue detailed monitoring studies at one site such as Bluff or Little Diomede, or at two sites, or to embark on the next level of study.

2. The next step should be a study of what sea birds are feeding on at sea and to try to relate that to what happens on the cliffs.

a. We should extend our over-water transects which have already shown where concentrations of feeding sea birds occur. There is a great increase in numbers and kinds of seabirds west of "the line" as compared to east of it.
b. We should take preliminary samples by shooting feeding sea birds and examining the contents of their throat and stomach at a number of places and at several times of year. This is to find out what they feed upon themselves and should be combined with more extensive studies at study sites on the nesting cliffs to learn what the adults bring to feed their young.

c Ideally we should relate distribution,abundance and schedule of movement of the prey to the health (weight) of adults and their reproductive success. It is not immediately clear how the data collected at sea will be related to events on the breeding sites, but learning or clarifying that relation should be a major part of our interpretation of the data.

There is a further problem of effort involved in measuring reproductive success. For example, we have found measuring breeding success in Kittiwakes to be easy but the measurements are more difficult for Murres. Our results so far suggest that the success of the two species vary from year to year in the same way. It may be possible then to use Kittiwakes as an indicator species. Measuring success among Puffins and Auklets is even more difficult and the relation of their success to that of Kittiwakes is even more obscure. We would not be able to clarify this relation without further detailed work on an island such as Little Diomede.

It seems adviseable to discuss the importance of these several problems related to the more sophisticated aspects of our work and to set priorities after the discussions.

d. We should take preliminary samples of the kinds of potential prey available to the sea birds in several parts of the area and at several times of year.

3. The next level of understanding includes two sorts of information.

   a. One step is to investigate the spawning times and rates, and the movements, age-structure and growth rates of major prey items. This study should accompany or be a part of fundamental fisheries studies.
   b. Another step is to investigate further the differences in biological and other characteristics of the water masses to the East and West of "the line."

   This would be an important study of the natural history of a highly productive area of shallow continental shelf water - a type of study largely neglected to date. It is clearly possible to spend a great deal of effort collecting increasingly detailed information on any one aspect of this panorama of information.

4. Our contribution, level of participation, and pace.

   a. We can undertake a study of the food being caught by the birds at sea and take some samples of the sorts and numbers of prey species available in order to assess the degree of selectivity shown by sea birds. For this work we will need additional vessel support, as well as support for assistants. We will need to be taught the classification and identification of potential prey items. We must depend upon others to gather data on age structure, spawning, the growth rates of fish and crustacea, the data on productivity and the data on the chemical and physical characteristics of water masses.

b. Level of participation and pace are interrelated. It is easy to recruit competant and enthusiastic members of field parties. The problems involve expense for the field parties and expense and effort for reducing data, writing reports, keeping accounts and archiving data. Our experience in 1977, for example, indicates that simply preparing coding sheets in the field displaces 20% of the time available for field work.

i. To this end I am confident we could do competant work at one Murre and Kittwake station in Norton Sound, at one Murre, Kittiwake and Auklet station in or near the Bering Strait, and on a vessel doing feeding studies. This level of involvement would allow us to gather data at the fastest rate and produce summaries and syntheses of data as soon as possible.

This would also make unrealistic demands upon my time as Principal Investigator because I have a full-time appointment at College of the Atlantic and NOAA work has required too large a portion of my time in 1976/77. I acknowledge this project is a most important research and conservation effort, a valuable enrichment and experience for me and for many students.

I intend to have an assistant for most of late 1977 and early 1978 until the annual reports, accounts and archiving requirements are met. This summer I am spending two months on field work and one month on College-related work. We will see whether that is satisfactory.

ii. Undertaking to relate onshore events to happenings on the feeding grounds adds as minimum the expense of a vessel, at least $1000.00 per day for approximately 45 days. It also adds the effort required to reduce data collected on the vessel (transects, measurements of bird specimens, identification and measurement of food specimens, identification and measurement of Nekton specimens, temperature and other data) and to prepare coding sheets for all of these.

iii. It may be necessary to hire an additional specially-trained assistant to undertake this additional work if the food studies at sea proceed. That additional demand may require more secretarial and part-time student help.

It may be advisable to ask one of my present assistants to take more responsibility for reducing data and especially for undertaking a major part in writing up and organizing field work. All have other winter jobs or are beginning graduate work and are therefore resistant to committing much time during the winter.

I will look into the possibility of hiring a more advanced graduate student or established biologist. It would be advantageous to have them close to the field work. Hiring such a person will considerably increase costs because they would have to be paid much more than I have paid assistants so far. Furthermore, if they are based near the field work, it will make it harder for me to communicate with them during the process of preparing reports. That and the indefiniteness of our plans for 1977 kept me from including more advanced students in our party this year.

iv. How can effort be reduced, i.e. what aspects can be cut back?

*The most obvious step is to eliminate one of the study sites and because birds are concentrated to the west, Bluff would be the first candidate for elimination. As a first alternative we should count on having a field party at only one site in 1978 and having a small party at that site.

However, we do not know yet whether Little Diomede will be good enough to serve as a major land study site or whether we will be welcome to continue our studies there. We do not know whether we could be as effective in continuing our studies of Ravens and Glaucous Gulls there as at Bluff. If we have only one shore site, we would not have the benefit of direct comparison of data from West of the line with data from East of the line.

We may be able to gather some of the necessary data without having a party at the alternate site all year. Data on the reproductive success of Kittiwakes can be gathered from a vessel by 1 to 3 visits in late August, but we have not yet established the degree to which Kittiwake reproductive success is linked to that of Murres. Results from 1975 and 1976 are very promising. We do not know whether reproductive rates in Kittiwakes are related to reproductive rates among Auklets.

We will use the results of the 1977 field season to decide whether to work at Little Diomede Island as compared to Bluff.

We will use these results to decide, in consultation with the members of the Arctic Project office, which site should be continued during 1978.

*Another obvious step is to have a different party carry out the sea bird feeding and fisheries studies. That might relieve our commitment but would increase the total costs to NOAA.

v. Summary

Our commitment has become over-extended during the period of data reduction and writing of reports, primarily as a result of adding new obligations to the original undertaking. These additions include a new research unit and the archiving of data.

Additional further work on feeding grounds of sea birds will compound the problem and greatly increase the cost of field work, reducing data, and archiving data. We do not have problem finding willing and capable field assistants.

We will plan to reduce the commitment of time and money by cutting back on the studies at sea bird cliffs and by assigning more work to assistants during the winter.

During 1978 it may be necessary for me to reduce the amount of time I spend on field work, although this is the aspect of the project at which I am best qualified and most interested.

We will be looking for other ways to solve these problems within the context of continuing this important work and perhaps sharing part of the responsibilitywith another Principal Investigator.

Once the problem of being over-extended is recognized, it should be possible to mitigate the problem by discussing the scope of the work and by setting priorities or by subdividing the responsibility.

If only one shore site were to be supported, I think it will be best to look at the quality, amount, and relevance of the data collected at Little Diomede before deciding whether to work there or at Bluff. We are confident that we can continue good work at Bluff, but I don't yet know what can be done at Little Diomede, for a variety of reasons.

XVII. 1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly Reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, Annual Reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labelled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when these are used, and sexes where these are morphologically distinguishable.

4. At the option of the Project Office the PI is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

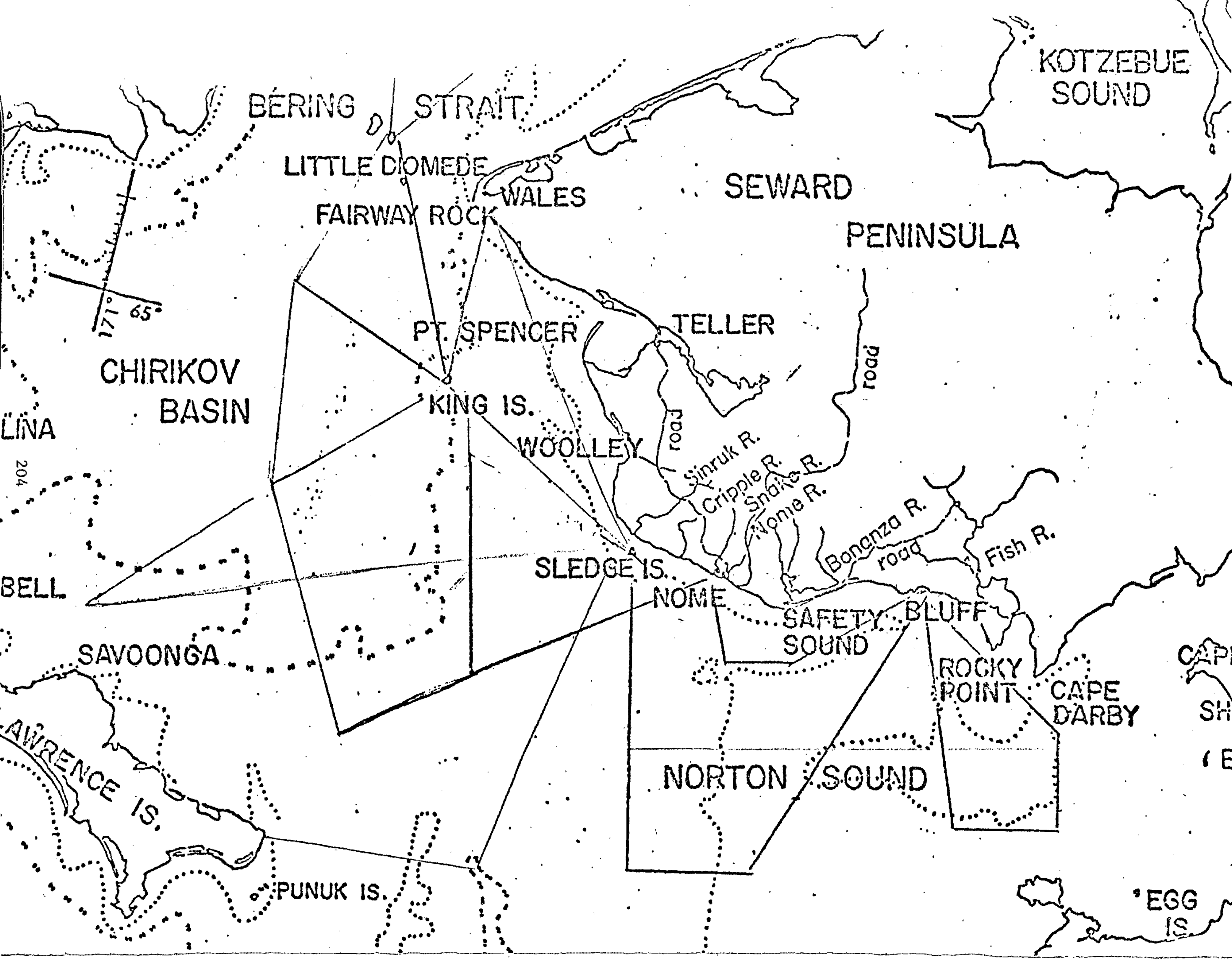
5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release for information and for forwarding to BLM. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.


BERING STRAIT
KOTZEBUE SOUND
LITTLE DIOMEDE
WALES
SEWARD PENINSULA
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KING IS.
LINA
WOOLLEY
Sinruk R.
Cripple R.
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Nome R.
Bonanza R.
road
Fish R.
SLEDGE IS.
BELL
NOME
SAFETY SOUND
BLUFF
SAVOONGA
ROCKY POINT
CAPE DARBY
LAWRENCE IS.
NORTON SOUND
PUNUK IS.
EGG IS.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following acknowledgement is standard:

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

MILESTONE CHART

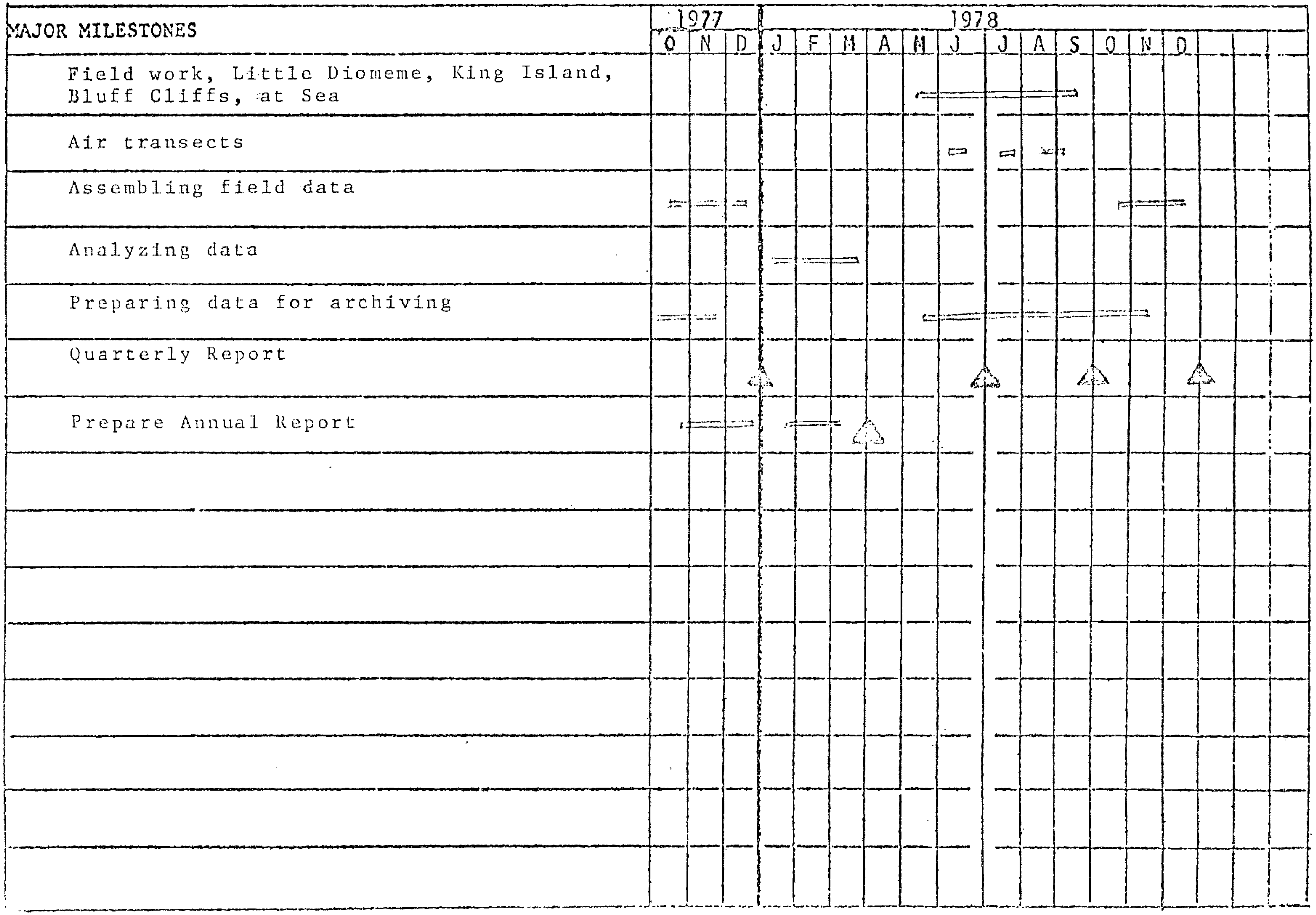
RU #: 237

PI: William H. Drury

△ Planned Completion Date

▲ Actual Completion Date

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.



5/20/77

POPULATION ASSESSMENT, ECOLOGY AND TROPHIC RELATIONSHIPS OF STELLER SEA LIONS IN THE GULF OF ALASKA

Research Unit #243

Principal Investigators

Donald G. Calkins
and
Kenneth W. Pitcher

Total Cost $155,069

June 9, 1977

Alaska Department of Fish and Game

Division of Game

Technical Proposal

I. Title:

Population Assessment, Ecology and Trophic Relationships of Steller sea lions in the Gulf of Alaska.

Research Unit No. - 243

Contract No. - 03-5-022-69

Proposed dates of Contract - Oct. 1, 1977 - Sept. 30, 1978

II. Principal Investigators:

Donald G. Calkins

Kenneth W. Pitcher

III. Cost of Proposal:

Total - $155,069

Distribution by lease area:

Kodiak	- 48%
Lower Cook Inlet	- 17%
Negoa	- 35%

IV. Background

Steller sea lions *Eumatopias jubatus* are abundant and conspicuous marine mammals along much of the coast of the Gulf of Alaska, with a population estimated at more than 95,000 animals (Alaska Department of Fish and Game 1973 and Calkins et al. 1975). Being at the tertiary consumer trophic level, they are an important component of marine ecosystems in the Gulf. There are at least 62 hauling grounds and rookeries in the area which are used on a regular, predictable basis with 44 more used on a casual basis.

While restricted to land for breeding, pupping and to some extent resting, sea lions are known to be somewhat pelagic feeders and nomadic wanderers (Fiscus and Baines 1966). They have been reported at distances of 70 and 85 miles from shore (Kenyon and Rice 1961) and have been seen at many localities offshore in the northern Gulf of Alaska (Fiscus and Baines 1966). We have noted individual movements of 900 miles away from their birthplace.

Population assessment work carried out during this study is the first to be accomplished since 1956-1958 (Mathisen and Lopp 1963). Changes in seasonal distribution are becoming clearer although much work remains to be done in this area. It is apparent that there is considerable movement from exposed summer rookeries and haul outs to more protected winter areas. There may also be a net movement offshore in winter although this is not clearly understood. Large scale movements by sea lions in Oregon have been noted by Mate

(1973). Bartholomew and Boolootian (1960) suggest seasonal migratory movements correlated with age and sex in California. Seasonal movements are known to occur in British Columbia although they are not fully understood (Spalding 1964 and Smith 1972).

Sex and age segregation by sea lions using the various rookeries and hauling areas throughout the Gulf of Alaska definitely does occur but as yet is not completely understood. A knowledge of the degree of segregation is important so that any localized disturbance or kill of animals can be evaluated in terms of importance to the total population. Data collected so far indicates that there is considerable interchange between rookeries and haul out areas. It appears as though animals from the large rookeries at Sugarloaf Island in the Barren Islands and Marmot Island off Afognak Island move extensively throughout the Gulf. We do not know if these animals will return to their birth place to breed. This information will begin to become available in the next two years as the first females branded during this study reach sexual maturity and enter the breeding population.

Adequate information is lacking on reproduction and growth in the Steller sea lion. Data from other species of marine mammals (Sergeant 1966, 1973) suggest that population productivity may be a good indicator of relationship to carrying capacity. Law (1959) showed that seals with plentiful food supplies grew faster and became sexually mature earlier, thus increasing population productivity.

There are some indications that reproductive rates of sea lions in Alaska are lower than in other portions of their range (Brooks 1957, Pike and Maxwell 1958 and Thorsteinson and Lensink 1962). Why is this so? Have populations in some areas reached carrying capacity? There is some evidence that this is the case. Recent studies in Prince William Sound indicate that numbers are much the same now as they were 18 years ago (Pitcher in prep.). What are the various biological parameters exhibited by a stable (?) population of marine mammals?

The role of sea lions in the Gulf of Alaska and their impact on the marine system cannot be overlooked. For the sake of general discussion it is useful, using conservative values, to estimate the annual food requirements of these animals. Assuming a population of 95,000 animals (excluding pups), a mean weight of 700 pounds, a daily food intake of 6 percent of body weight (Richardson 1973 and Sergeant 1973) for 300 days per year, sea lions in Gulf waters of Alaska would consume 3,990,000 pounds of food per day, or 598,500 tons per year. Fiscus and Baines (1966) found that food contained in the stomach of a non-captive steller sea lion amounted to 9.4 percent of its body weight. Food habits of sea lions in the Gulf of Alaska remain essentially unknown. Previous studies of food habits have mostly been incidental in nature and nearly all during summer months (Mathisen, et al. 1962, Spalding 1964, Imler and Sarber 1947, Fiscus and Baines 1966 and Pike 1968).

The importance of establishing trophic relations in the Gulf of Alaska prior to development is evident. With data now being collected in a number of O.C.S.-Gulf of Alaska biological studies it should be possible, through continuation of extensive food habit studies initiated under this contract, to establish the role of the sea lion in the food web.

Knowledge of sea lion populations is crucial to intelligent decisions concerning sea lions in relation to oil and gas development and production. If consideration is to be given to conservation of this species with respect to development in the Gulf of Alaska, it is of primary importance that we fully understand the extent of the poulation as well as it's movements and distribution, and productivity.

Collection of materials for baseline data on heavy metal loads will continue throughout this project. Environmental contaminants are concentrated in top level predators such as the sea lion.

Sea otters

Sea otters are the most vulnerable of all marine mammals to the effects of oil spills. They rely on a layer of air trapped in their dense fur for insulation and buoyancy. When soiled the fur loses its water repellency and insulative qualities. As a high trophic level species sea otters are vulnerable to impacts through the food chain.

Sea otter populations in many areas are still recovering from the period of overexploitation during the 18th and 19th centuries. Some populations have very restricted ranges and could be eliminated by single oil spills. Other populations are expanding their ranges into unoccupied former sea otter habitat. Oil spills could retard this range expansion for many years.

It is essential that areas critical to the survival and expansion of sea otter populations be identified prior to selection of lease tracts, onshore facilities and transportation routes. This can be done by delineating and monitoring changes in the distribution of sea otters. Adequate baseline data are available for Prince William Sound (Pitcher 1975) Kenai Peninsula, Lower Cook Inlet, northern Kodiak (Schneider 1976a) and southwestern Bristol Bay (Schneider 1976b). Adequate information is available from the eastern Aleutians but has not been assembled in a useful form. Data from southern Kodiak and the northeast Gulf of Alaska are inadequate. Several significant changes in sea otter distribution have been observed recently but these have not been made available to OCSEAP.

The need for distribution information is greater for sea otters than other marine mammals because of their known vulnerability to direct impacts and unique population status. This does not diminish the need for information on potential indirect impacts such as food habits. However, sea otter food species vary greatly from area to area and can be expected to change in time in many areas as predation by sea otters restructures the community. Present techniques would limit the size of the area that could be adequately sampled and the results might not be valid for the life of the OCS program. Since the types of organisms eaten by sea otters are generally known a more productive initial approach would be to conduct benthic studies in known sea otter feeding areas and to determine vulnerability of those organisms known to be eaten by sea otters to oil and other contaminants.

V. Objectives

To determine numbers and biomass of Steller sea lions in the Gulf of Alaska. To establish sex and age compostion of groups of sea lions utilizing the various rookeries and hauling grounds. To determine patterns of animal movement, population identity and population discreteness of sea lions in the Gulf. To determine changes in seasonal distribution.

To investigate population productivity and growth rates of Steller sea lions in the Gulf of Alaska with emphasis on determining age of sexual maturity, overall birth rates, age specific birth rates, duration of reproductive activity and survival rates for various sex and age classes.

To determine food habits of Steller sea lions in the Gulf of Alaska with emphasis on variation with season and habitat type. An effort will be made to relate food habits with prey abundance and distribution. Effects of sea lion predation on prey populations will be examined.

To determine daily and seasonal activity patterns of sea lions. To investigate the use of specific rookeries and haul outs on a short term basis. To determine the optimum time to survey sea lions, and to provide information crucial to the interpretation of survey data already in hand.

To incidentally collect information on pathology, environmental contaminant loads, critical habitat and fishery depredations.

To determine the distribution of sea otters and identify areas critical to the survival of populations or the repopulation of former sea otter habitat.

To delineate seasonal distribution and numbers of belukha whales in Cook Inlet. To incidentally collect distribution information on all cetaceans in Cook Inlet.

VI. General Strategy

Sea lion studies will continue in the Gulf of Alaska much the same as in FY 77 but with some modifications. Distribution and movements studies will be carried out with increased emphasis on locating branded sea lions at rookeries and hauling grounds over the entire Gulf of Alaska. This will include some areas outside the normal Gulf of Alaska O.C.S. lease, study areas. Rookeries and hauling areas will be visited in the area from Dixon Entrance to Cape Spencer at least once during the contract period to search for branded animals. Major rookeries and hauling areas within the O.C.S. lease areas in the Gulf of Alaska will be visited on a seasonal basis for sex and age compostion counts and search for branded animals.

All known major pupping rookeries in the Gulf of Alaska from Cape Spencer to Scotch Cap will be visited shortly after the peek of pupping. In addition to sex and age composition counts an attempt will be made to count all pups present. These data will be used in overall Gulf of Alaska sea lion pup production calculations.

Sea lion specimen material will be collected, as in the past, through the use of chartered vessels and skiffs. Collected specimens will be analyzed for food habits, reproductive biology, growth and body conditions, pesticides, hydrocarbons, mineral elements, heavy metals, diseases and parasites, harmones and blood chemistry for population parameters.

A long term study will begin on one or two selected haul outs. This study will investigate daily sea lion movements and distribution on specific haul out areas. Information will be gathered on optimum timing for survey work. Results of this type of work will have direct and significant implications on the interpretation of data already gathered by survey work under this research unit as well as several other research projects.

Existing information on sea otter distribution not previously reported will be summarized and written descriptions of the status of sea otter populations not discussed by Pitcher (1975) or Schneider (1976a and 1976b) will be prepared. Additional information will be gathered opportunistically in the course of other activities. Significant changes from previously described distribution patterns will be reported. Aerial surveys will be used to fill significant data gaps. Emphasis will be placed on delineating the distribution of sea otters in the southern Kodiak-Chirikof Island area.

Surveys will be flown with fixed wing aircraft to search for and enumerate belukha whales. ADF&G personnel stationed in Homer and Kenai will participate in these surveys, making it possible to survey the entire inlet at little or no extra costs.

VII. Sampling Methods

Sampling methods will remain essentially the same in FY 78 as they have been in the past. Prince William Sound and Icy Bay, Kayak Island and Middleton Island will be visited in the fall. These trips will be primarily for collecting specimens although branded animals will be searched for as the opportunity arises.

Prince William Sound will be visited again in the winter as well as the haul outs along the Kenai Peninsula, the Barren Islands and around Kodiak Island. In each of these areas, all accessable hauling areas and rookeries will be visited for sex and age composition count (see Harstadt 1975) and branded animals will be searched for.

All known major sea lion pupping areas in the Gulf of Alaska will be visited in late June or early July for sex and age compostion counts and pup counts.

Two people will be stationed at the Capt St. Elias lighthouse from mid March through mid July and at Sugarloaf Island from early May through mid July. These people will carry out intensive, daily searches for branded sea lions as well as study sea lion daily activity patterns.

From the above visits we will derive sex and age composition, distribution and abundance, and movements information, productivity, daily activities and optimum survey times.

Methods of delineating sea otter distribution will be similar to those used under RU #240 and 241. Because of the extensive offshore sea otter habitat in the southern Kodiak area a systematic ship or line transect survey will be employed. Type of transect will be dictated by densities of sea otters and survey conditions.

Belukha surveys will be flown monthly in Cook Inlet. During periods of peek abundance survey frequency will increase.

VII. Analytical Methods

Analysis of population data including distribution and abundance and seasonal movements will be similar to methods used by Mathisen and Lopp (1962), Kenyon and Rice (1961), Pike and Maxwell (1958), Smith (1972) and Mate (1973). Analysis of daily activity patterns will be similar to those used by Sandgren (1970).

Specimens collected from animals will be analyzed in the following manner:

A. Age determination: laboratory techniques include decalcification of a premolar tooth from each animal, using a microtome to produce thin sections and staining with a hematoxylin hot bath (Johnson and Lucier 1975). Actual age determinations are made by microscopic counts of annual growth layers in the teeth (see Klevezal and Kleinenberg 1967 for review of techniques and their basis).

B. Female reproduction: ovaries and uteri are collected from each female sea lion. Standard laboratory techniques (Bishop 1967, Bigg 1969 and Fisher 1954) for reproductive analyses are used through which the presence or absence of a conceptus is established and a partial reproductive history is reconstructed by examination of ovarian structures.

C. Weights and measurements are taken from each collected animal (see Scheffer 1967).

D. Stomach contents from each sea lion are preserved in formalin. Weights and volumes are determined for all contents. Identifications of prey species are made by examination of recognizable individuals and skeletal materials of diagnostic value. Frequency of occurrence of prey species is then determined (Spalding 1964).

E. Intestinal contents from each sea lion are strained through mesh sieves to recover fish otoliths. Otoliths, which are diagnostic to species, are compared to a reference collection and identified (Pitcher MS).

F. Tissue samples are being collected and frozen so that baseline levels of heavy metals, pesticide residues and hydrocarbons can be determined.

IX. Anticipated Problems

None

X. Deliverable Products

A. Digital morphometric, reproductive ecology, sighting, food habits, and census data submitted in OCSEAP format under File Types 025 - Mammal Specimen, 026 - Mammal Sighting 02, and 027 - Mammal Sighting 01 as appropriate.

B. Narrative reports containing descriptions of (a) observation and collection locations, (b) observation and collection frequencies, (c) measurement and analytical techniques, (d) results of analyses, and (e) conclusions. Specific subject areas to be addressed include population size and discreteness, major breeding rookeries, hauling grounds, migration routes, seasonal changes in density and foraging areas, reproductive ecology, food habits and selected biological parameters.

C. The following visual data representations will be supplied:

°Maps identifying (a) major sea lion rookeries and hauling grounds, (b) marked sea lion release and recovery locations, (c) sampling locations, and distribution of sea otters.

°Charts illustrating (a) seasonal abundance and distribution of sea lions, (b) seasonal changes in their foraging areas, and (c) their major migration routes.

°As appropriate, figures or tables illustrating:

(a) Condition of sea lion populations, including seasonal census information, age and sex composition, growth rates, and seasonal condition;

(b) Reproductive colony of sea lions at major rookeries, including age of maturity, age specific reproductive rates, breeding season, age specific mortality rates, and progression of life history events (i.e. birth, lactation, weaning and molting);

(c) Food habits of sea lions as a function of sex, life stage and area.

D. Other non-digital data:

None

E. First data will be collected in October 1977 and last data will be collected in September 1978.

XI. Information required from other investigators.

In order to complete our analysis of marine mammal movements and distribution we will require information from the data system. The Juneau project office will supply us with computer printouts of all sightings of sea lions and sea otters submitted under the OCS program.

XII. Quality Assurance Plans

No equipment calibration is necessary. Methods for surveying sea lions were developed jointly between RU #67 (Cliff Fiscus) and RU #243 (Donald Calkins). Quality control procedures will remain essentially the same with keypunched data checked entirely prior to submission. Field by field identification of data to be submitted with reasonable limits are shown in Table 1 and Table 2.

XIII. Special Sample and Voucher Specimen Archival

No samples collected for future reference.

XIV. Logistics Requirements

See attached logistics form.

Table 1. Types of data, limits and frequency of collection for RU 243 (file type 027 only).

Data field used	Normal limits	Frequency of coll.
Flight Sta. No.	NA	Always
Starting date/time	NA	Always
Starting Lat/Long	NA	Always
Ending Lat/Long	NA	Always
Sighting date/time	NA	Always
Sighting Lat/Long	NA	Always
Taxanomic Code	NA	Always
Number of individuals	0 to 300,000	Always
Number of adults	0 to 10,000	Sometimes
Number of pups	0 to 10,000	Sometimes
Total subadults	0 to 10,000	Sometimes
Total adult males	0 to 10,000	Sometimes
Total adult females	0 to 10,000	Sometimes
Marked animal code	0 to 10,000	Sometimes
Text	NA	Sometimes

Table 2. Types of data, limits and frequency of collection, file type 025, RU 243.

Data field	Normal limits	Frequency of coll.
Location of collection	NA	Always
Date of collection	NA	Always
Time of collection	NA	Most of the time
Taxonomic code	9221010501	Always
Sex code	0-2	Always
Lactating	Y-N	Occasionally
Mammal sunk	Y-N	Most of the time
Group size	0-15,000	Most of the time
Curvilinear length	0.0-500.0	Most of the time
Girth	0.0-500.0	Most of the time
Hind flipper length	0.0-100.0	Most of the time
Blubber thickness sternum	0.0-10.0	Most of the time
Blubber thickness chest	0.0-10.0	Most of the time
Age	0-50	Most of the time
Age unit code	1 or 2	Most of the time
Age determination technique	1 thru 4	Most of the time
Baculum length	10-200	Some of the time
Baculum weight	0.1-30.0	Some of the time
Testes weight with epididymis	1.0-200.0	Most of the time
Testes weight without epididymis	0.5-200.0	Most of the time
Testes volume	0.0-200.0	Most of the time
Testes length	1-150	Most of the time
Testes width	1-100	Most of the time
Presence of sperm in epididymis	0-3	Most of the time
Sperm method of determination	0-2	Most of the time
Reproductive status code	0-3	Most of the time
Reproductive condition code	0-8	Most of the time
Number of fetuses	0-2	Most of the time
Ovary weight	0-3	Most of the time
Number of Corpora lutea	0-30.0	Most of the time
Diameter of longest Corpora lutea	0-300	Most of the time
Number of Corpora Albicantia	0-10	Most of the time
Diameter of longest Corpora Albicantia	0-200	Most of the time
Number of follicles greater than 5mm in diameter	0-10	Most of the time
Diameter of largest follicle	0-300	Most of the time
Number of uterine scars	0-3	Some of the time
Weight of food contents	0-7000.0	Some of the time
Total volume of food content	0-7000.0	Some of the time
Taxonomic code	NODC code	Most of the time
Life history code	0-9	Occasionally
Miscellaneous stomach contents	01-11	Occasionally
Number of items identified	0-10,000	Some of the time
Volume of items identified	0-7000.0	Some of the time
Weight of items identified	0-7000.0	Some of the time
Mean length of items identified	0-1000	Occasionally
Maximum length of item identified	0-1000	Occasionally
Minimum length of item identified	0-100	Occasionally

For OCSEAP use only.
RU # ______
Discipline ______
Area of Operation ______

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION Alaska Department of Fish & Game PRINCIPAL INVESTIGATOR Donald G. Calkins

A. SHIP SUPPORT

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. Leg 1 - Southern Kodiak
Leg 2 - Cape St Elias to ColdBay

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. No ship board sampling operations - all observations will be made from Helicopter or skiffs.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.)
Leg 1 - Late summer - Aug. 15 to Sept 15
Leg 2 - mid summer - June 20 to July 15
No departure allowable

4. How many sea days are required for each leg? (Assume vessel cruising speed of 14 knots for NOAA vessels. Do not include running time from port to beginning point and from end point to port and do not include a weather factor.)
Leg 1 - 7 sea days Leg 2 - 14 sea days

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback?
Must be principal on both Legs

Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling-time on station and sample processing time between stations.

8 hours per day

6. What equipment and personnel would you expect the ship to provide?
Jet Ranger helicoper and pilot
Lifting gear and operators for skiffs

7. What is the approximate weight and volume of equipment you will bring?
2 Boston Whaler skiffs

8. Will your data or equipment require special handling? No If yes, please describe:

9. Will you require any gasses and/or chemicals? No If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If "yes" please name the vessel and give the reason for so specifying.
Yes NOAA Ship Surveyor with hilicoptor

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availability

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals. 5 All Aalska Dept. of Fish and Game employees, no foreign nationals - Donald Calkins, Kenneth Pitcher and 3 others.

C. AIRCRAFT SUPPORT - HELICOPTER

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed)

Jet Ranger On board NOAA Ship (See ship support section)

2. Describe types of observations to be made.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

4. How many days of helicopter operations are required and how many flight hours per day?

Total flight hours?

5. How many people are required on board for each flight (exclusive of the pilot)?

6. What are the weights and dimensions of equipment or supplies to be transported?

7. What type of helicopter do you recommend for your operations and why?

8. Do you recommend a particular source for the helicopter? If "yes" please name the source and the reason for your recommendation.

9. What is the per hour charter cost of the helicopter?

10. Where do you recommend that flights be staged from?

11. Will special navigation and communications be required?

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

Quarters and subsistance to be provided through normal State of Alaska requirements

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

3. What is your estimated per man day cost for this support at each location?

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

E. SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

The only special logistics problem involved with this request is the limited optimum time for this work to be performed. Leg 1 is scheduled for the purpose of surveying sea otters in the southern Kodiak area. The timing is critical because we intend to survey harbor seals on the Trinity Islands concurrently. Late August and early September is the only time when the entire population of harbor seals can be expected to be seen. The optimum date would be August 25.

Leg 2 is scheduled to survey the entire sea lion pup population in the Gulf of Alaska. The majority of pups are born by June 20 but by mid July they may begin to leave the rookeries as their ability to swim is developed. We can only reasonably survey these animals between June 20 to July 15 and only with a ship born helicopter.

XV. Management Plan

All work proposed will be accomplished by or under the direct supervision of the principal investigators. Population dynamics, photographic surveys, distribution and abundance work and seasonal movements studies will be conducted by Donald G. Calkins. Population productivity work will be accomplished by Kenneth W. Pitcher. Studies on growth, body conditions, environmental contaminants and age determination will be carried out by both principal investigators as well as qualified laboratory personnel and temporary field and laboratory assistants with the Alaska Department of Fish and Game. Data analysis will be accomplished by both principal investigators with the assistance of an Alaska Department of Fish and Game Biometrician. Report writing will be done by both principal investigators.

XVI. Outlook

The outlook for the future from this point appears to be a continuance of the distribution and movements studies for one more year at the present intensity followed by a gradual reduction for 2 more years. At the same time site specific studies on selected rookeries and hauling areas will be intensified.

Observational studies of sea otters will begin in the future. These studies will focus on behavior and ecology of sea otters in the Afognak-Marmot Islands area, and will be carried out in conjunction with site specific, observational studies of sea lions in the same area.

Funding levels should remain essentially the same for one more year with a gradual reduction following. No additional major equipment is anticipated.

The final results should consist of delineation of movements of sea lions in the Gulf of Alaska, refinement of survey techniques and data in hand, elucidation of sea otter feeding habits and behavior in the northern Kodiak area.

XVII.1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labeled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when these are used, and sexes where these are morphologically distinguishable.

4. At the option of the project Office the PI is prepared to travel to the project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release for information and for forwarding to BLM. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following acknowledgment is standard.

11. In the past, some confusion has developed on the schedule for data submission in the specimen format of RU 243. The confusion has arisen because of the eight record types which are submitted at various intervals after the initial animal collection. Record types 1-3 all involve data which are related to environmental conditions at the time of collection and physical measurements of the animal i.e. measurements and weights. These data are available immediately after collection and are submitted within 120 days of collection. Record types 4 and 5 involve age and reproductive analyses both of which involve somewhat lengthy laboratory procedures. Record types 6 and 7, food habit analyses, also involve lengthy laboratory procedures. The time lag is even greater than for record types 4 and 5 because material must be submitted to outside authorities for verification of identifications. Again, data will be submitted within 120 days after analyses are completed.

"This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan Continental Shelf Environmental Assessment Program (OCSEAP) Office."

Data Products Schedule

Data Type (ie. Intertidal, Benthic Organisms, etc.)	Media (Cards, coding sheets, tapes, disks)	Estimated Volume (Volume of processed data)	OCSEAP Format (If known)	Processing and Formating done by PI (Yes or No)	Collection Period (Month/Year to Month/Year)	Submission (Month/Year)
Sea lion Specimen data	Mag tapes	75 animals at 12 cards per animal	File types 025, 026	Yes	Oct. 1977 through Sept. 1978	Dec. 31, 1978
Sea lion Sighting data	Mag tapes	Undetermined	File type 027	Yes	Oct. 1977 through Sept. 1978	Dec. 31, 1978
Sea otter Sighting data	Mag tapes	Undetermined	File type 027	Yes	Oct. 1977 through Sept. 1978	Dec. 31, 1978

MILESTONE CHART

RU #: 243 PI: Donald G. Calkins

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977 O	N	D	1978 J	F	M	A	M	J	J	A	S	O	N	D
Vessel Charters (Private) Collecting		△				△				△					
Vessel Charters (NOAA) Surveys	△								△		△				
Helicopter Surveys on Rookeries					△	△									
Field Camps Established						△		△	△						
Quarterly Report			△			△			△				△		
Annual Report						△									
Lab Analysis															
Raw Data Analysis		△	△					△			△	△			
Data Punching and Verification			△			△			△				△		
Submission of Data to OCSEAP				△			△			△				△	
Submission of Final (If Contract Terminates)															△

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GI 77-100

PROPOSAL TO

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

FOR

THE RELATIONSHIPS OF MARINE MAMMAL DISTRIBUTIONS, DENSITIES AND ACTIVITIES TO SEA ICE CONDITIONS

OCS EAP RESEARCH UNIT NO.:	248
CO-PRINCIPAL INVESTIGATORS	John J. Burns Francis H. Fay Lewis A. Shapiro
TOTAL COST OF PROJECT:	$68,575
PERIOD OF WORK:	October 1, 1977, to September 30, 1978
INSTITUTE AND DEPARTMENT:	Geophysical Institute University of Alaska Fairbanks, Alaska 99701

L. H. Shapiro Date 6/30/77
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T. Neil Davis Date 6/30/77
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K. B. Mather Date 7/1/77
Keith B. Mather
Vice Chancellor for Research and Advanced Study
University of Alaska
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C. TECHNICAL PROPOSAL

I. A. Title: The Relationships of Marine Mammal Distributions, Densities, and Activities to Sea Ice Conditions

B. Research Unit Number: 248
C. Contract Number: 03-5-022-55
D. Proposed Dates of Contract: October 1, 1977, to September 30, 1978

II. Principal Investigator(s):

A. John J. Burns
B. Francis H. Fay
C. Lewis A. Shapiro

III. Cost of Proposal Federal Fiscal Year 1978:

Total: $68,575

Distribution of Effort by Lease Area:

1.	Bristol Bay-St. George Basin	25%
2.	Norton Sound	25%
3.	Chukchi Sea	15%
4.	Beaufort Sea	15%
5.	Non-lease area laboratory and management	20%

IV. Background:

Several species of pinnipeds, a few species of whales, the polar bear, and, to a lesser extent, the arctic fox have evolved life cycle strategies that make use of certain characteristics of sea ice of the northern hemisphere. In association with other marine mammal projects (R. U. #230, R. U. #232) and other ice work (R. U. #257, R. U. #259, R. U. #261), this research analyzes the annually predictable ice events in the Bering, Chukchi, and Beaufort Seas on which those mammals depend, as well as the deviations from the norm. The goal of this analysis is development of a spatial model that will predict the habitat dependencies of these mammals in relation to OCS lease area developments.

V. Objectives:

1. Determine extent and distribution of regularly occurring ice-dominated marine mammal habitats in the Bering, Chukchi, and Beaufort Seas.

2. Describe analytically and delineate these habitats.

3. Determine physical environmental factors that produce these habitats.

4. Determine distribution and densities of the various marine mammals in these different habitats, as analytically described.

5. Determine how dynamic changes in quality and distribution of sea ice habitats affect major events in mammal life cycles (e.g., birth, nurture of young, mating, molt, migration, growth rates).

VI. General Strategy and Approach:

By FY 1978, much of the framework of this research project will be in hand, problems with backlogs of analytical work will be solved. Ice event classifications will be worked out. Additional attention in 1978 will be required in the Beaufort Sea, but as many major seasonal ice events and features take form in the Bering and Chukchi Seas, it is not practical to shift emphasis totally to any one of the three regions. Moreover, many of the empirical observations should be completed, and work during 1978 will be aimed largely at refining overall predictive capability although a continuing need for selected inputs of ground truth, and continuing collection and analysis of satellite imagery is foreseen.

VII. Sampling Methods:

1. Analysis of satellite imagery for frequency and persistence of major pack ice features (NOAA) and smaller scale habitat features (LANDSAT).

2. Ground truth from ship and aircraft surveys and from land-based sampling throughout on both mammals and ice conditions.

3. Correlative and predictive narrative model formulation.

4. Analysis of satellite imagery: NOAA system-visual only; LANDSAT-microdensitometer scanning of photographic images.

5. Plotting of pre-OCSEAP and OCSEAP era mammal information on chart overlays.

VIII. Deliverable Products:

A. Digital data:

Numerical records of ice observations as obtained from aircraft, ships, small boats and coastal sites, including the following data:

Time
Date
Location
Transect or station number
Ice type (drifting, land-fast or grounded)
Coverage composed of this ice (oktas)
Size of floes (thin ice)
Coverage composed of medium thickness ice (oktas)
Size of floes (medium thickness ice)
Coverage composed of thick ice (oktas)
Size of floes (thick ice)
Percent deformation
Transect width

Numerical records of major marine mammals correlates including:

Time
Date
Location
Transect or station number
Species I.D.
Numbers observed
Densities
Numbers of pups (when applicable)

B. Narrative Reports:

Narrative outputs, as prescribed in progress and result reporting for all NOAA-OCSEAP projects. Specifically this project will report on a classification system for all ice habitats, their frequencies and densities of occurrence over a multi-year span, and the distribution of mammals in spatio-temporal relation to these ice habitats. The investigators will also make and report on a functional analysis of the origins of key ice habitat features, of use to developing a predictive model that will be important during OCS activities, to determine what mammals are at risk under different ice conditions.

C. Visual Data:

This project utilizes intensively the imagery from NOAA 2/3 and Landsat satellites. These data will be used directly. Other visual data will include graphs, tables, figures, distribution maps (or photographic images) of sea-ice features and overlays of documented marine mammal densities, by season, lease area, major ice events, etc.

Satellite images are archived at the University of Alaska, Geophysical Institute. The submission of all visual data will be as part of required reports and resulting publications.

D. Other Non-Digital Data:

N/A

E. Data Submission Schedule:

Data will be submitted by quarter in accordance with the attached data products schedule

Data Products Schedule Attached

DATA PRODUCTS SCHEDULE

Data Type	Media	Estimated Volume	OSCEAP Format	Processing and Formating done by P.I.	Collection Period (Mo/Yr to Mo/Yr)	Submission (Mo/Yr)
A. Digitized compilations of ice observations	Coding sheets			Formating by P.I.s	Oct-Dec 1977	March 1978
	cards	600 cards	026		Jan-Mar 1978	June 1978
B. Digitized records of marine mammal correlates	tapes	1 tape		Computer services through Arctic Project Office	Apr-June 1978	Sept. 1978
					July-Sept 1978	Dec. 1978

Note: Data will be submitted by quarter.

XI. Information Required from Other Investigators:

Data are required from other investigators including those involved in OCSEAP programs and those working in the study areas but independent of OCSEAP sponsorship. Appropriate contacts and arrangements for acquisition of information have been made and are presently operative. Some of the projects involved are as follows:

OCSEAP Programs

RU#230	(Burns, Eley, Frost)
RU#232	(Lowry, Burns, Frost)
RU# 70	(Braham; through use of information in quarterly and annual reports)
RU# 67	(Braham, Krogman; through collaboration of programs and use of quarterly and annual reports)
RU#194	(Fay)
RU# 87	(Martin; exchange of information)
RU#250	(Shapiro)
RU#267	(Belon)

One of the major sources of information from other investigators during FY 77 was the Beaufort Sea Synthesis Meeting held at Barrow.

Non-OCSEAP Programs

US-USSR studies of marine mammals in the Bering Sea
Alaska Department of Fish and Game studies of marine mammals in the Bering and Chukchi Seas
U.S. Fish and Wildlife Service studies of marine mammals in the Bering, Chukchi and Beaufort Seas (mainly polar bears)

XII. Quality Assurance Plans:

The major source of quality assurance is in the intensive collaboration with investigators from other disciplines. However, this project is largely concerned with the study of physical and biological relationship which have not been previously undertaken. Peer review is a significant aspect of quality assurance, as are the results of statistical treatment of data and "ground truth" comparison with findings. Coordination review and direction will also be provided by the OCS Arctic Project Office, Geophysical Institute, University of Alaska.

XIII. Special Sample and Voucher Specimen Archival Plans:

The reference collection of satellite imagery is maintained at the University of Alaska, Geophysical Institute. Digitized data are submitted in accordance with OCSEAP requirements. Raw data and data forms are maintained by the investigators. This project does not involve the archiving of biological specimens and therefore no special arrangements for such material are required.

XIV. Logistics Requirements (see attached form):

Logistics requirements are substantial, however, all of them are also requested in support of projects R. U. #230 and R. U. #232. One very important request which may be difficult to arrange is indicated on the attached logistic requirement forms.

For OCSEAP use only.
RU # 248
Discipline
Area of Discipline Sea Ice-MARINE MAMMALS

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION UNIVERSITY OF ALASKA PRINCIPAL INVESTIGATOR BURNS, FAY, SHAPIRO

A. SHIP SUPPORT Ice breaker St-George Basin and Bristol Bay

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions.

   To work in the southern Bering Sea from the ice edge north to 62° and between the latitudes of 174°W and 162°W, in collaboration with other projects.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible.

   Observations of regional differences in ice conditions and movement patterns. Measurements of regional ice conditions. Observations of distribution, abundance and species composition of Marine Mammals

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? 1-22 February is optimum. Prefer no departure from this time--one week either way if necessary.

4. How many sea days are required for each leg? 21

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Our request is planned to be compatible with others.

   Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling time on station and sample processing time between stations.

   Program is operative during daylight hours only. Sampling time would be during the hours 0800 - 1600 (Feb. daylength) concurrent with other projects

6. What equipment and personnel would you expect the ship to provide?

   Small boat, access of observers to bridge and loft, work space on deck with running sea water, lab space, and area for paper work. Ship must also provide helicopter.

7. What is the approximate weight and volume of equipment you will bring?

   500 lbs. 100 cubic feet

8. Will your data or equipment require special handling? NO If yes, please describe

9. Will you require any gasses and/or chemicals? Formaldehyde If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If yes, please name the vessel and give the reason for so specifying.

    Coast Guard Icebreaker

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availabilty?

    N/A

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.

    Two - to be named at a later date.

C. AIRCRAFT SUPPORT - HELICOPTER To operate from Coast Guark Icebreaker

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed.)

   Flights will be within a 50 mile radius of ship at all locations where ship operates within area extending from ice front to 62° N and 162° W to 174°W.

2. Describe types of observations to be made.

   Ice characteristics, ice trajectories, ice topography and mammal distributions.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   Month of February, preferably 1 - 22 February

4. How many days of helicopter operations are required and how many flight hours per day?

   One flight per day; 3 hours per flight, est 18 days.

   Total flight hours?

   54 hours

5. How many people are required on board for each flight (exclusive of the pilot)?

   Two

6. What are the weights and dimensions of equipment or supplies to be transported?

   Recording equipment; 50 lbs.; 2 sq. ft.

7. What type of helicopter do you recommend for your operations and why?

   N/A - (Constrained by type of helicopter assigned to ship) - Prefer Bell 206 or comparable

8. Do you recommend a particular source for the helicopter? If yes, please name the source and the reason for your recommendation.

   N/A

9. What is the per hour charter cost of the helicopter?

   N/A

10. Where do you recommend that flights be staged from?

   N/A

11. Will special navigation and communications be required?

   Would prefer availability of a Global Navigation or On Trac III navigation system.

C SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your propsoal and how do you propose that the problem be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you.)

Our major special logistics problem is the necessity for an bona fide icebreaker to operate during midwinter within the ice pack of eastern Bering Sea. Normal vessels, including those classified as ice-strengthened, are not adequate to undertake the work proposed during February.

XV. Management Plan:

1. Fiscal management of funds which may be obtained for this project will be handled by the business manager, Geophysical Institute, University of Alaska. The University provides monthly summary of expenditures and encumbrances as well as current information on all financial aspects of the contract in accordance with mutual requirements of the contractor and contractee.

2. Scientific management within ADF&G will be the responsibility of the principal investigators. Responsibilities include general coordination of all aspects including commitments relating to data management, field operations, logistic requirements, laboratory work, and editing of reports.

3. Research activities are the responsibility of John Burns, Francis Fay, and Lewis Shapiro. These principal investigators are responsible for actually accomplishing the scientific studies called for under terms of the contract. They shall actively lead the proposed work and shall take full responsibility for timely completion of all objectives.

4. Outside coordination, review and direction will be provided by the OCS Arctic Project Office, Geophysical Institute, University of Alaska.

See attached Milestone Chart

XVI. Outlook:

1. Nature of final results and data products:

This project is rapidly approaching the point where it will be possible to examine, in synoptic fashion, those ice-dominated habitats of the Bering and Chukchi Seas which are extensively utilized by marine mammals. During FY 78 major emphasis will be directed toward summarizing and reporting on the information acquired to date and testing our tentative conclusions through field observation as proposed in the schedule of activities. We will also be directing a greater proportion of effort to investigation of sea ice-marine mammal associations in the Beaufort Sea.

Final results and data products will be in the form of narrative reports and maps of ice habitats and mammal distributions (temporal and spatial aspects).

2. Significant milestones:

Significant milestones will be the near completion of studies in the Bering and Chukchi Sea lease areas and initiation of intensive studies in the Beaufort Sea.

3. Cost by fiscal year:

Cost by fiscal year is anticipated to be $60,000 in FY 78, and $60,000 in FY 79. These costs do not include computer services or data management beyond the point of putting data in an approved format suitable for keypunching. These costs are estimated to be an additional $6,650 per year.

4. Additional major equipment required:

No additional major equipment is required.

5. Location of future field efforts:

Future field efforts will involve more intensive investigation in the Beaufort Sea.

6. Logistics requirements:

Logistics requirements will not differ greatly from those indicated for FY 78.

XVII. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist. If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR two working days prior to release.

10. The following acknowledgment of sponsorship will be used:

> "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

Project: RU#248

PI: Burns, Fay Shapiro

MILESTONE CHART

MAJOR MILESTONES - Data collection, integrated with RU230& 232	1977 - 1978											
	O	N	D	J	F	M	A	M	J	J	A	S
Beaufort Sea												
Barrow		△	—	—	—	—	—	—	△			
Icebreaker											△	△
Helicopter (Barrow - Deadhorse)		△										
Helicopter and fixed wing cover plane (Deadhorse)							△					
Chukchi Sea												
Helicopter (Cape Lisburne and Barrow)						△						
Point Hope (village based)				△				△				
Shishmaref (village based)		△							△	△		
Wainwright (village based)										△	△	
Bering Sea												
Norton Sound (Nome area)		△	—	—	—	—	—	—	△			
Tanunak or Hooper Bay (village based)					△							
Norton Sound (vessel based)		△										

Project: RU #248

PI: Burns, Fay Shapiro

MILESTONE CHART

MAJOR MILESTONES - Data collection (continued)	1977 - 1978											
	O	N	D	J	F	M	A	M	J	J	A	S
St. George Basin/Bristol Bay (Icebreaker)					△							
St. George Basin/Bristol Bay (NOAA vessel)								△	△			

PI: Burns, Fay, Shapiro

MILESTONE CHART

MAJOR MILESTONES *Other Project Activities*	1977 - 1978											
	O	N	D	J	F	M	A	M	J	J	A	S
Submission of data			△			△			△			△
Preparation of reports			△			△			△			△
Acquisition and archival of satellite imagery	△	—	—	—	—		—	—	—	—	—	△
Preparation of FY 79 proposal									△			
Attendance at synthesis meetings (dates unknown)												
Analysis of past and current data	△	—	—	—	—		—	—	—	—		△

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PROPOSAL TO

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

FOR

MECHANICS OF ORIGIN OF PRESSURE RIDGES, SHEAR RIDGES AND HUMMOCK FIELDS IN LANDFAST ICE

OCS EAP RESEARCH UNIT NO.:	250
CO-PRINCIPAL INVESTIGATORS:	Lewis H. Shapiro William D. Harrison Howard F. Bates
TOTAL COST OF PROJECT:	$27,633
PERIOD OF WORK:	October 1, 1977, to September 30, 1978
INSTITUTION AND DEPARTMENT:	Geophysical Institute University of Alaska Fairbanks, Alaska 99701

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C. TECHNICAL PROPOSAL

I. A. Title: Mechanics of Origin of Pressure Ridges, Shear Ridges and Hummock Fields in Landfast Ice

B. Research Unit Number: 250
C. Contract Number: 03-5-022-55
D. Proposed Dates of Contract: October 1, 1977-September 30, 1978

II. Principal Investigator(s):

A. Lewis H. Shapiro

B. William D. Harrison

C. Howard F. Bates

III. Cost of Proposal Federal Fiscal Year 1978:

Total: $27,633

Distribution of Effort by Lease Area:

1. Aleutians
2. Beaufort Sea 100%
3. Bristol Bay
4. Chukchi Sea
5. Kodiak
6. Lower Cook Inlet
7. NEGOA
8. Norton Sound
9. St. George Basin
10. Non-lease-area laboratory or management

IV. Background

Landfast ice is the subject of several OCSEAP projects (Barry, R.U. #244; Weeks and Kovacs, R.U. #88; Stringer, R.U. #257) in addition to the studies proposed here. This project is concerned with mechanisms and processes involved in the deformation of landfast ice including ridging and hummocking and the forces associated with these and the interaction of the ice with the sea floor and the shoreline.

Earlier phases of this project have been directed towards the study of the distribution and morphology of ridges formed within the field-of-view of the University of Alaska sea ice radar system at Barrow. The most productive aspect of this work has been the study of the formation of ridges along the beach line in late spring. The absence of snow cover, ease of accessibility, and availability of the radar system and an 8 mm time-lapse motion picture camera have permitted detailed observations to be made of the movement of the ice during the ridging process, the nature of the ridging process, the morphology of the ridges, and modes of failure of the ice. It is intended that this work be continued.

Two additional studies are proposed here, one of which has been in progress for part of the past year. This involves the examination of the relationship between rising stress levels and vibration of the ice sheet. Data from several stress transducer arrays, a tide gauge operated at Barrow, and time-lapse motion pictures of the ice sheet have documented the association of vibrations of the ice sheet, with a period in the range of 6 to 10 minutes, with increases in the magnitude of the stresses being transmitted through the ice. There is presently no theory which adequately describes this phenomena, and the data are not of sufficient quality to permit such a theory to be tested if it were available. However, this phenomena merits further study because of interest in the processes of stress transmission in floating ice sheets, and as a potential "early warning system" of stress increases around offshore structures.

The second additional project is a cooperative study (with P. Barnes of the U.S.G.S.) of ice gouging in the Barrow area, aimed at gathering data on the rate of formation of gouges on the sea floor. As described below, the project is designed to utilize the sea ice radar system at Barrow as well as ground and air observations to monitor ice movements in an area where repeated side-scan sonar surveys are made. In this manner, the change in the gouge density between surveys can be determined and associated with ice conditions.

V. Objectives

The objectives of this project are to examine the mechanics of origin of ridges and hummock fields within the area normally occupied by landfast ice and, if possible, to develop a procedure for predicting the occurrence of heavily deformed ice in the landfast ice zone.

Specific objectives for the period covered by this proposal are:

1. to determine the morphology and mode of origin of ridges formed along the beach at Barrow in late spring, and of any other ridges which form within the field-of-view of the sea-ice radar system at Barrow during the winter of 1977-78.

2. to cooperate with P. Barnes (U.S.G.S.) in conducting a side-scan sonar survey of the sea floor within the field-of-view of the radar system to determine the extent of gouging.

3. to gather data to examine the relationship between vibration of the ice sheet and increasing stress levels.

VI. General Strategy and Approach

Ridging and hummocking in sea ice are processes which reflect high stress concentrations resulting in failure of the ice sheet. Thus, in order to develop an understanding of these processes, it is necessary to know the failure mechanisms which operate during ridging, the forces required, and other parameters (such as relative motion of the ice across the prospective ridge line and water depth) which influence the final form of the resulting ridges. As noted, the study of the formation of ridges along the beach at Barrow in late spring has produced useful results toward filling the requirements listed. This work will be continued, along with studies of pressure ridges formed within the field of view of the radar system during winter. These observations will be integrated into calculated models regarding the growth of grounded pressure ridges and interactions along the interface between landfast ice and drifting pack ice.

The problem of the relationship between rising stress levels and long-period vibration of the ice is being examined theoretically using stability theory. The results to date suggest that a Hooke's law (buoyancy) coupling of the ice-sea system can indeed produce the observed long-period waves, but the existence of these waves has not yet been demonstrated to be dependent upon increasing stresses. However, as noted above, there are data which indicate that this is indeed the case, but these consist of a series of fortuitous (as opposed to systematic) observations from instruments which were not installed for this purpose. Thus, data from a properly designed system must be acquired in order to provide a basis for further theoretical work, and this is the primary objective of the work proposed here.

The study of gouging of the sea floor will be initiated in August, 1977, when a side-scan sonar survey of the area within the field-of-view of the sea-ice radar will be conducted. During the period covered by this proposal, the ice movements and conditions in the area will be monitored by the radar system, supplemented by air photos and ground observations. An attempt will be made to identify grounded ridges or large blocks of multi-year ice on the radar screen and to identify the paths by which these enter the area in fall and leave during break-up. Then, the side-scan sonar survey will be repeated after break-up in 1978, and the results compared to those of the 1977 survey with a particular effort made to identify gouges associated with the paths of the larger blocks and ridges. It is anticipated that this will provide a basis for estimating the rate of formation of gouges and, quite possibly, permit the association of particular gouges and blocks. Note, also, that the identification of gouges at the site of formation of ridges in the area would provide important data regarding the role of gouging as an energy sink during the ridging process.

VII. Deliverable Products

A. Digital Data:

None

B. Narrative Reports:

Narrative of observations, methods, and procedures and results.

C. Visual Data:

Maps and cross-sections of ridges and maps gouge distribution to be included with narrative reports. Time lapse movies from sea-ice radar screen and 8 mm camera mounted on radar tower.

D. Other Non-Digital Data:

None

E. Data Submission Schedule:

N/A

XI. Information Required from Other Investigators:

We are interested in the reports of other projects involving landfast ice, but have no need for immediate access to data.

C. AIRCRAFT SUPPORT - HELICOPTER

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed)

Barrow area - transport equipment for up to two miles if ice conditions do not permit over-ice transportation.

2. Describe types of observations to be made.

None

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

Anytime in late April to early May.

4. How many days of helicopter operations are required and how many flight hours per day? 2-3 flights, 1/4 hour each.

Total flight hours? Maximum, 1 hour.

5. How many people are required on board for each flight (exclusive of the pilot)?

2

6. What are the weights and dimensions of equipment or supplies to be transported?

Approximately 300 lbs., 4-5 cubic feet.

7. What type of helicopter do you recommend for your operations and why?

Open

8. Do you recommend a particular source for the helicopter? If "yes" please name the source and the reason for your recommendation.

NOAA, usually available at Barrow

9. What is the per hour charter cost of the helicopter?

10. Where do you recommend that flights be staged from?

Barrow

11. Will special navigation and communications be required?

No.

B. AIRCRAFT SUPPORT REQUIREMENTS

1. Delineate proposed flight lines on a chart of the area. Indicate desired flight altitude on each line. (Note: If flights are for transportation only, chart submission is not necessary but origin and destination points should be listed)

   Local flights in Barrow area.

2. Describe types of observations to be made.

   Ice conditions.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification)

   1 flight anytime in February or March
   1 probable flight in June

4. How many days of flight operations are required and how many flight hours per day?

   Two flights, 1 hour maximum each flight.

   Total flight hours? 2

5. Do you consider your investigation to the principal one for the flight thus precluding other activities or requiring other activities to piggyback or could you piggyback?

   Could piggyback.

6. What types of special equipment are required for the aircraft (non carry-on)?

   None

   What are the weights, dimensions, power requirements, and installation problems unique to the specific equipment.

7. What are the weights, dimensions and power requirements of carry-on equipment?

   None

8. What type of aircraft is best suited for the purpose?

   C-180

9. Do you recommend a source for the aircraft? Yes.

   If "yes" please name the source and the reason for your recommendation.

   N.A.R.L.

10. What is the per hour charter cost of the aircraft?

   $85

11. How many people are required on board for each flight (exclusive of flight crew)?

   1

12. Where do you recommend that flights be staged from?

   N.A.R.L.

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

N.A.R.L., Barrow

Maximum of 30 man/days at various times in May, June-July, and August.

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

N.A.R.L.

3. What is your estimated per man day cost for this support at each location?

$79

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

Set cost.

E. SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

The project requires that the wannigan which currently houses the University of Alaska sea-ice radar system at Barrow be maintained. This is also the recording site for the tide gauge and stress transducers noted above.

XV. Management Plan

1. Fiscal management of funds which may be obtained for this project will be handled by the business manager, Geophysical Institute, University of Alaska. The University provides monthly summary of expenditures and encumbrances as well as current information on all financial aspects of the contract in accordance with mutual requirements of the contractor.

2. Scientific management will be the responsibility of the principal investigators who will lead and supervise all phases of the proposed work and assure the timely completion of the objectives.

3. Outside coordination, review and direction will be provided by the OCS Arctic Project Office, Geophysical Institute, University of Alaska.

XVI. Outlook

The final result of this project is as stated in the objectives above. That is, to develop an understanding of the mechanisms and processes by which ridges and hummock fields form in landfast ice. The emphasis is on mechanisms and, therefore, the rate at which data are acquired depends less on the actions of the investigator, than on the occurrence of certain natural events at an appropriate time and location. To date, the most significant data gap is in the study of pressure and shear ridges which form during fall and winter. Only minor examples of these have formed in the study area during the time the project has been active, but the data are required to test models developed earlier in the project. It should be noted that two successive winters with no significant ridges formed at Barrow is unusual, and it is hoped that the requisite data can be acquired during the coming winter. If this is done, then an estimate of how closely the final result can be approached may be available by the end of this contract period.

Similarly, the study of ice gouging and of vibration of the ice sheet under stress are in the first stages, and predictions as to when milestones will be reached are premature. In particular, it will be necessary to improve the equipment with which the observations of vibration and stress build-up are made before any major effort is devoted to theoretical work. An effort will be made this year to upgrade the equipment, and if this is done, the theoretical work can probably be completed in FY 79. However, funding will have to increase in order to fund the investigator (Bates) who is doing the theoretical work.

There are no changes anticipated in field location or logistics requirements.

XVII. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist. If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR two working days prior to release.

10. The following acknowledgment of sponsorship will be used:

> "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

MILESTONE CHART

RU #: 250 PI: Shapiro/Harrison/Bates

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977 O	N	D	1978 J	F	M	A	M	J	J	A	S	O	N	D
Installation of tide gauge and stress transducer array.					Δ										
Field study of winter ridges.								Δ							
Field study of beach ridges.										Δ					
Side-scan sonar survey.											Δ				
Complete data analysis.												Δ			
Quarterly Reports			Δ						Δ						
Annual Report						Δ									
Submit final report												Δ			

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PROPOSAL TO

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

FOR

SEISMIC AND VOLCANIC RISK STUDIES - WESTERN GULF OF ALASKA

OCSEAP RESEARCH UNIT NO.: 251

PRINCIPAL INVESTIGATORS: Hans Pulpan

Juergen Kienle

TOTAL COST OF PROPOSAL: $165,097

PERIOD OF WORK: October 1, 1977 to September 30, 1978

INSTITUTION AND DEPARTMENT: University of Alaska
Geophysical Institute
Fairbanks, Alaska 99701

June 1977

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Technical Proposal

I. A. Title: Seismic and Volcanic Risk Studies - Western Gulf of Alaska

B. Research Unit Number: 251

C. Contract Number: 03-5-022-55

D. Proposed Dates of Contract: October 1, 1977
September 30, 1978

II. Principal Investigator(s)

A. Hans Pulpan

B. Juergen Kienle

III. Cost of Proposal Federal Fiscal Year 1978

C. Total: $165,097

D. Distribution of effort by lease area:

1. Aleutians
2. Beaufort Sea
3. Bristol Bay
4. Chukchi Sea
5. Kodiak 50%
6. Lower Cook Inlet 50%
7. NEGOA
8. Norton Sound
9. St. George Basin
10. Non-lease-area laboratory or management

IV. Background:

A regional network of short-period seismic stations is being operated to cover the Lower Cook Inlet, Kodiak Island, and the Alaska Peninsula offsore area between the west coast of Kodiak Island and the Semidi Islands. A large portion of this seismic network has been installed under the current program. The operation of the Alaska Peninsula portion of the system is largely funded through a grant from the United States Energy Research and Development Agency (ERDA). The network constitutes the central section of a system of seismic stations, monitoring the high-level seismicity associated with an approximately 2000 km long section of the active boundaries of the Pacific and North American tectonic plates, respectively. The eastern section of this system is operated by the United States Geological Survey (USGS), while the western portion is operated by Lamont-Doherty Geological Observatory of Columbia University (LDGO).

Hypocenter data files and epicenter maps have been generated routinely since January, 1976. Besides providing seismicity data with greatly improved accuracy and lower magnitude level, the system monitors the seismic activity associated with several active Cook Inlet volcanoes. The system also provides complimentary data in association with ocean bottom seismometry conducted in offshore areas of special interest. (One such study will take place in July in the offshore area south of Kodiak Island.)

Volcanic risk studies are presently being conducted primarily on Augustine Volcano. Preliminary results of the 1976 eruption of this volcano have been presented. Related research includes a geothermal study of Augustine Volcano, sponsored by ERDA, which is now being completed. The Alaska State Division of Geological and Geophysical Surveys has and will continue to contribute to our volcano hazard studies. A proposal to study the mechanism of emplacement of the 1976 pyroclastic flows and surges is pending with the National Science Foundation.

Tentative risk maps are presently in preparation. Continued maintenance of the seismic network will greatly improve the data base for evaluation of the seismic and volcanic risk.

V. Objectives

It is the objective of the proposed work to

(1) Determine the seismicity of the study area, its relationship to identifiable tectonic features such as faults, and the associated seismic risks to resource development facilities.

(2) Monitor the microearthquake activity of active volcanoes and combine these data with observations of historic eruptions to determine eruption potential and associated risks.

VI. General Strategy and Approach:

Operation of the regional seismic network and the stations on Augustine and Redoubt Volcanos will be continued. Technical changes and modification of the network layout initiated during the last contract period will be completed and will result in a further increase of the reliability of operation in the Kodiak and Peninsula area. Routine processing of the data from these networks in combination with historic data will provide the basic parameters on which to assess the seismicity of the area.

Relocation of and special investigation into certain events will continue. We have begun investigations into the November 1974 earthquake series (maximum magnitude 5.5) near Kamishak Bay with respect to its association with the Bruin Bay fault. We are also beginning a special investigation into the southern offshore area of Kodiak Island. While our present system cannot provide very accurate hypocenter locations in that area a short-term cooperative program between USGS, LDGO, and the University of Alaska which will employ ocean bottom seismometers might produce a "master event" that could be used for improving locations from the data acquired by the land-based system.

We are hoping to complete the Augustine volcanic risk assessment during the new contract period and will begin similar studies on Redoubt Volcano. Little additional field work will be required to complete the mapping and petrological sampling relevant to the Augustine volcanic risk study.

As a first step for the Redoubt study, we propose to acquire aerial stereo color photo coverage of (1) the volcano itself and (2) the Drift River Valley, which flash-flooded following the January, 1966, summit eruptions. This photography will provide the basis for photogeologic and field mapping. This phase will be followed by on-the-ground geologic reconnaissance mapping and petrologic sampling by a two-to-three man field team. In addition, we are planning to establish benchmarks and geodetic base lines in the summit crater of the volcano in order to monitor elevation changes of the snow and ice surface as it responds to temperal changes in heat flow. This study will be patterned after the Wrangell Volcano-Glacier interaction studies, conducted by the glaciology group of the Geophysical Institute. In the past few years, dramatic ice volume changes in the North Pit Crater of the Wrangell Caldera have signaled a strong heating trend.

VII. Anticipated Problems:

Redoubt is a glacier cloud, rugged volcanic peak, 10,197 feet high. Deployment of the ground team of geologists will require adequate helicopter support.

VIII. Deliverable Products:

A. Digital Data:

1. Recorded Parameters:

Analog time history of seismic waves arriving at remotely installed seismograph stations. The original data will remain in the Geophysical Institute Archives and will be provided upon request.

2. List of Digital Products:

Earthquake parameters on punched cards in standard archive format.

B. Narrative Reports:

Reports will provide a detailed description of the operation of the seismic network, including number and spatial distribution of instruments and resulting accuracy of derived earthquake parameters. A summary of seismic events recorded during the operation will be included and interpreted. Seismic and volcanic risk maps will be accompanied by interpretive reports. We shall compile specific recommendations as to the type of geophysical monitoring systems that might have to be established on the two volcanoes at a later stage of the program, perhaps best labelled as "Environmental Monitoring".

C. Visual Data:

Monthly, quarterly and cummulative epicenter maps. Seismic and volcanic risk maps.

D. Other Non-Digital Data:

E. Data Submission Schedule:

Digital earthquake parameters and epicenter maps will continue to be delivered quarterly with a three-month delay to allow for data processing (see submission schedule).

Data Products Schedule

Data Type (ie. Intertidal, Benthic Organisms, etc.)	Media (Cards, coding sheets, tapes, disks)	Estimated Volume (Volume of processed data)	OCSEAP Format (If known)	Processing and Formating done by PI (Yes or No)	Collection Period (Month/Year to Month/Year)		Submission (Month/Year)
Seismic	Punched cards	100 cards/mo.		Yes	Oct/77	Dec/77	March/78
					Jan/78	March/78	June/78
					April/78	June/78	Sept/78
					July/78	Sept/78	Dec/78

GL 77-94

IX. Information Required form other Investigators:

Data from the USGS and LDGO networks are required occasionally. Such data are being exchanged routinely between the three agencies involved in seismic risk studies in the area. Results from studies of offshore faulting in the western Gulf of Alaska (Research Unit 327) are relevant and complementary to our attempt of delineating active fault from earthquake data.

X. Quality Assurance Plans

Intercomparison with other seismic systems is achieved by providing the harmonic system magnification as a function of frequency. This is determined by the seismometer sensitivity, the amplifier gain, the telemetry system gain, and the recorder-display sensitivity. In the laboratory, the seismometer parameters are measured and the seismometer sensitivity determined. The amplifier gain is determined in the lab for different gain settings, and the setting noted after installation in the field. Recorder-display gain is determined by feeding a known signal into that system.

XI. Logistics Requirements. (see attached form)

EXPLANATION:

C9, Aircraft Support - Fixed Wing

This support will be required in the case of emergency visits in case of failure of a crucial station. These visits will generally have to be made on relatively short notice. Three possibilities exist:

(1) A suitable NOAA aircraft is in the area of the station to be visited and can be diverted for a short period of time.

(2) The USCG air station has several times given helicopter support on short notice upon request through the district commander's office in Juneau.

(3) Local charter of fixed wing aircraft on tundra tires, floats, or skis, as warranted.

About 5 hours of fixed wing aircraft will be required for ground truth investigations in the Drift River valley in connection with Redoubt Volcano hazard studies.

C1, Aircraft Support - Helicopter

About 8 hours of helicopter flying time will be required for in connection with risk studies on Redoubt Volcano.

GI 77-9

For OCSEAP use only.
RU # 251
Discipline Geology
Area of Operation Kodiak Cook Inlet, Alaska Peninsu

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION University of Alaska PRINCIPAL INVESTIGATOR Hans Pulpan

A. SHIP SUPPORT

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. Seismic stations on Chowiet Island and Chirikof Island (see attached map).

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. Maintenance on existing field sites.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.)
   No chronology requirements. Time period June-August ± one month.

4. How many sea days are required for each leg? (Assume vessel cruising speed of 14 knots for NOAA vessels. Do not include running time from port to beginning point and from end point to port and do not include a weather factor.)
   N/A

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback?
   Can piggyback.

   Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling-time on station and sample processing time between stations.
   Time required at each station, approximately 3-4 hours.

6. What equipment and personnel would you expect the ship to provide?
   Helicopter

7. What is the approximate weight and volume of equipment you will bring?
   500 lbs.

8. Will your data or equipment require special handling? No If yes, please describe:

9. Will you require any gasses and/or chemicals? No If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If "yes" please name the vessel and give the reason for so specifying.
    NOAA ship Surveyor, since it has helicopter pad.

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availability

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.
    One person

B. AIRCRAFT SUPPORT - FIXED WING

1. Delineate proposed flight lines on a chart of the area. Indicate desired flight altitude on each line. (Note: If flights are for transportation only, chart submission is not necessary but origin and destination points should be listed)

    1) Any of seismic stations indicated on attached map.
    2) Drift River valley

2. Describe types of observations to be made.

    1) Emergency visits to seismic installations in case of failure.
    2) Ground truth investigation of Drift River valley.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification)

    Unpredictable

4. How many days of flight operations are required and how many flight hours per day?

    Total flight hours? 20-25 hours

5. Do you consider your investigation to the principal one for the flight thus precluding other activities or requiring other activities to piggyback or could you piggyback?

    Principal

6. What types of special equipment are required for the aircraft (non carry-on)?

    Floats or skis as warranted.

    What are the weights, dimensions, power requirements, and installation problems unique to the specific equipment.

7. What are the weights, dimensions and power requirements of carry-on equipment?

    100 lbs.

8. What type of aircraft is best suited for the purpose?

    Any single 6-engine, 180-200 HP

9. Do you recommend a source for the aircraft?
    If "yes" please name the source and the reason for your recommendation.

    Local companies. Trips have to be made on short notice. See attached statement.

10. What is the per hour charter cost of the aircraft?

    $80-$100 per hour

11. How many people are required on board for each flight (exclusive of flight crew)?

    1 to 2

12. Where do you recommend that flights be staged from?

    1) Kodiak, King Salmon or Homer, as warranted for seismic stations.
    2) Kenai for Drift River valley.

C. AIRCRAFT SUPPORT - HELICOPTER

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed)

   1) All stations on attached maps, except for CHI, CHO, which require ship-based operation; also see attached.

2. Describe types of observations to be made.

   Annual service and maintenance of seismic station.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   July 1 through September 1 ± 1 month

4. How many days of helicopter operations are required and how many flight hours per day? 20-25 days at 5 hours per day

   Total flight hours? 100-125 hours

5. How many people are required on board for each flight (exclusive of the pilot)?

   2-4

6. What are the weights and dimensions of equipment or supplies to be transported?

   200-250 lbs./station

7. What type of helicopter do you recommend for your operations and why?

   UH1H or Bell 206B. Both aircraft have proven satisfactory in the past.

8. Do you recommend a particular source for the helicopter? If "yes" please name the source and the reason for your recommendation.

   NOAA

9. What is the per hour charter cost of the helicopter?

   N/A

10. Where do you recommend that flights be staged from?

   Kodiak, King Salmon, Port Heiden, and Homer.

11. Will special navigation and communications be required?

   No.

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

(A) Accommodations required during service trips to seismic stations in Kodiak, Homer and King Salmon.

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

Kodiak: U.S. Coast Guard Station
Homer: Geophysical Institute Facilities
King Salmon: U.S. Fisheries cabin or commercial facility.

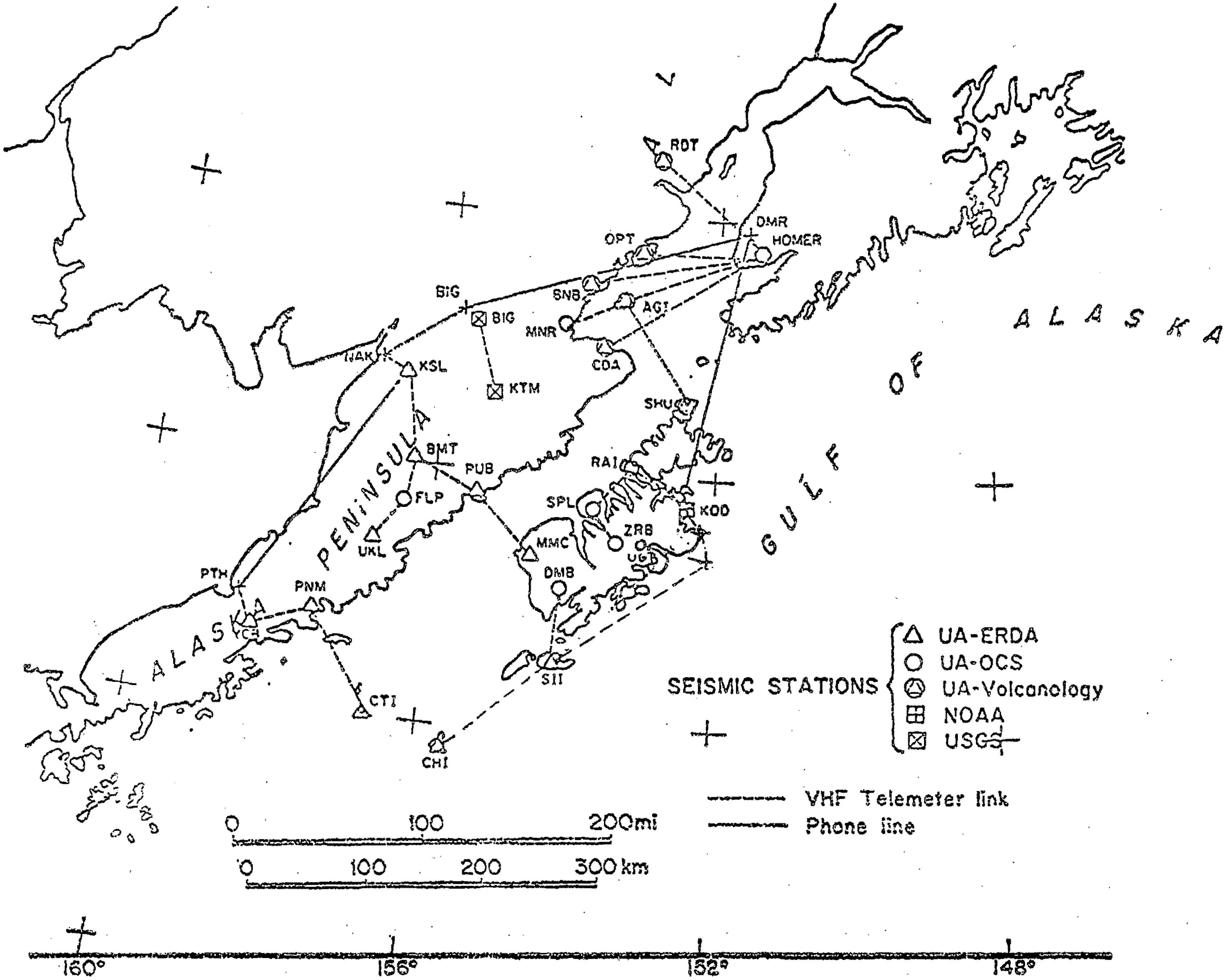
The above have proven the most convenient and cheapest accommodation in the past.

3. What is your estimated per man day cost for this support at each location?

$30.00

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

30% quarters, 70% subsistence based on past experience. Costs will be higher if commercial facilities have to be used everywhere.



Seismic stations presently recorded in Homer.

UNIVERSITY OF ALASKA

LOWER COOK INLET, KODIAK ISLAND,

AND ALASKA PENINSULA SEISMIC NETWORK

STATION NAME	CODE	LATITUDE (NORTH)	LONGITUDE (WEST)	ELEVATION (METERS)	COMPONETS
AUGUSTINE IS. KAMISHAK	AUK	59 20.05	153 25.62	259	SPZ
AUGUSTINE IS. MOUND	AUM	59 22.26	153 21.17	106	SPZ
AUGUSTINE IS. WEST	AUW	59 23.16	153 33.02	80	SPZ
BLUE MOUNTIAN	BMT	58 02.8	156 20.2	548	SPZ
BRUIN BAY	BRB	59 25.20	153 56.78	500	SPZ
CAPE DOUGLAS	CDA	58 57.32	153 31.77	386	SPZ
CHIRIKOF ISLAND	CHI	55 48.5	155 38.6	250	SPZ,SPE-
CHOWIET ISLAND	CHO	56 02.0	156 42.7	160	SPZ
DEADMAN BAY	DMB	57 05.23	153 57.63	300	SPZ
FEATHERLY PASS	FLP	57 42.7	156 15.9	485	SPZ
HOMER	HOM	59 39.50	151 38.60	198	SPZ
KING SALMON	KSL	58 42.2	156 39.7	25	SPZ
SITKINAK ISLAND	SII	56 33.60	154 10.92	500	SPZ
MCNEIL RIVER	MCN	59 06.06	154 11.99	273	SPZ
MIDDLE CAPE	MMC	57 20.00	154 38.1	340	SPZ
OIL POINT	OPT	59 39.16	153 13.78	625	SPZ
PINNACLE MOUNTIAN	PNM	56 48.3	157 35.0	442	SPZ
PUALE BAY	PUB	57 46.4	155 31.0	280	SPZ
RASPBERRY ISLAND	RAI	58 03.63	153 09.55	520	SPZ
REDOUBT VOLCANO	RED	60 25.14	152 46.32	1067	SPZ
SHUYAK ISLAND	SHU	58 37.68	152 20.93	34	SPZ
SPIRIDON LAKE	SPL	57 45.55	153 46.28	600	SPZ
UGAK BAY	UGB	57 29.00	152 55.00	100	SPZ
UGASHIK LAKE	UKL	57 24.1	156 51.3	410	SPZ
YELLOW CREEK BULFF	YCB	56 39.9	158 40.9	320	SPZ
ZACHER BAY	ZRB	57 32.58	153 34.68	770	SPZ

TELEMETER REPEATER SITES

STATION NAME	CODE	LATITUDE (NORTH)	LONGITUDE (WEST)	ELEVATION (METERS)	COMPONENTS
Spruce Island	SIR	57 54.5	152 26.1	240	
Cape Chimiak	CCR	57 37.1	152 09.2	30	
Ugak Island	UGI	57 26.4	152 12.2	300	
Naknek	NAK	58 58.8	156 44.5	40	
Big Mountain	BIG	59 25.4	155 13.6	720	

XII. Management Plan:

A major portion of the project is directed towards operating a 28-station seismic network in the study area. The principal investigators, under whose direction the system was built up over a time period of several years, will maintain overall supervision. Technical matters and instrument repair will be handled by electronic technicians who have been associated with the system over the past years.

Data processing (film reading, routine computer processing) will primarily be performed by graduate students. Data analysis and preparation of information products will be handled by the principal investigators with J. Kienle concentrating on the volcanic risk aspects and H. Pulpan on the seismic risk aspects.

A quarterly, semi-annual, and annual report will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, April, July, and October. The annual report will be prepared in consultation with principal investigators working on seismic risk assessments in the Bering Sea and the Eastern Gulf of Alaska.

Combined Activity/Milestone/Data Management charts will be submitted (updated) quarterly.

See attached Milestone Chart

XIII. Outlook:

A) Seismic Risk

(1) Operation of the regional seismic network

Towards the end of the FY 78 program the results derived from the operation of the seismic networks will be assessed with respect to their relevance to risk studies associated with resource development in the area. On the basis of this assessment, a decision should be made whether or to what extent to continue the operation of the system. We anticipate, however, an additional year of operation especially in the Kodiak area at the present configuration. Milestones, logistics, and cost requirements will be similar to those of the seismicity aspects of the current contract.

(2) Risk studies

During the FY 78 program, more emphasis will be placed upon risk analysis proper than during the past stages of the program which were largely concerned with bringing the regional monitoring system to a reliable level of performance. Successful completion of the risk studies would imply that the fundamental seismological input parameters for seismic zoning and microzoning are available. We then see the focus of our studies shifting towards the engineering seismological aspects of the risk problem. These studies would be conducted towards

(a) which of the many risk and site evaluation schemes presently in use are the most valid ones for the study area, and

(b) what type of surface and subsurface geologic and soil conditions present the greatest seismic risks and what is their distribution. Such work would primarily involve analysis work and could be conducted at an annual cost of about $45,000.

B. Volcanic Risk

The first milestone of the volcanic risk studies in Cook Inlet will be the identification of volcanic hazards on the flanks and vicinity of the two most active Cook Inlet volcanoes: Augustine and Redoubt. This work will result in a volcanic risk zoning of the immediate vicinity of the two volcanoes. The next logical step would be to extend the study to the other three Cook Inlet volcanoes: Spurr, Iliamna, and Douglas. All three present lesser threats to offshore oil development, restricted to poisonous fumes and ash fallouts. Douglas Volcano has some tsunami generating potential through impact of mud and pyroclastic flows on the ocean surface along its northern slopes.

Hazards from poisonous fumes and ash fallouts from volcanoes on the Alaska Peninsula probably pose little problems for the Kodiak shelf base area, but should be considered for Shelikof Strait and Bristol Bay. All of these studies could be conducted at the present funding level.

Geophysical monitoring of selected volcanoes, such as Augustine and Redoubt, and the development of a early warning system may become necessary as the OCS assessment program matures into an environmental monitoring stage. At the present time, geophysical monitoring of volcanoes in Alaska has been restricted to short-period seismology, which proved to be fairly successful. There are, however, other precursors to eruptions besides increased seismicity which have proven quite useful for eruption prediction in other volcanic areas of the world; those are temperature surface deformation and gas chemistry. In anticipation of the necessity to eventually monitor active volcanoes near developing offshore areas, we would propose beyond 1978 to test the usefulness of temperature, surface deformation, and gas chemistry measurements for continuous, telemetered monitoring. The requirement of continuous and telemetered monitoring, which we feel is essential in Cook Inlet, mandates instrumental development. We would anticipate increased funding levels for the volcanologic aspect of our program, and it may then become necessary to separate our seismic and volcanic research into two research proposals.

XIV. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist. If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR two working days prior to release.

10. The following acknowledgment of sponsorship will be used:

    "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

RU #: 251 PI: Hans Pulpan, Juergen Kienle

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Earthquake Parameter and Epicenter Maps completed for period Oct 77-Dec 77						Δ									
Jan 78-March 78									Δ						
April 78-June 78												Δ			
July 78-Sept 78															Δ
Augustine risk map and assessment			Δ									Δ			
Redoubt risk map and assessment												Δ			
Seismic risk map and assessment			Δ									Δ			
Annual seism. station service									Δ						
Redoubt field work									Δ						
Quarterly reports			Δ			Δ			Δ			Δ			

E. OTHER INFORMATION

The principal investigators have both been involved in recent projects related to the program tasks. J. Kienle has held several contracts concerning volcanological research and has been studying and instrumenting Alaskan volcanoes since 1965. Since 1970 his efforts have concentrated on Augustine Volcano. He was in charge of the emergency investigations of the recent Augustine eruptions. H. Pulpan has, over the past years, been in charge of installing and operating a seismic network on the Alaska Peninsula, which is part of the regional network providing the data base for the proposed studies. He has also been involved in Engineering Seismology work and has recently completed a study of seismic risk problems associated with the Denali fault.

The following studies presently conducted by the Principal Investigators overlap in part with the proposed program:

Operation of a Telemetered Seismic Network on the Alaska Peninsula, (ERDA, H. Pulpan).
Volcanic Hazards in Cook Inlet (State of Alaska, Dept. of Natural Resources, Division of Geologic and Geophysical Surveys, J. Kienle).
Mechanism of Emplacement and Welding of Pyroclastic Flows, Augustine Volcano, (NSF - pending, J. Kienle and M. F. Sheridan).

The principal investigators will devote 25% of their time towards the fulfillment of the contract obligations and shall take full responsibilities for timely completion.

PUBLICATIONS:

Published Articles

Pulpan, H. and A. E. Scheidegger, Calculations of tectonic stresses from hydraulic well fracturing data, J. of the Inst. Petr., 51, 169-176, 1965.

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Pulpan, H., A complex variable technique for the stress field around an elliptic underground inhomogeneity, Pure & Appl. Geoph., 76, 137-146, 1969.

Pulpan, H. and A. E. Scheidegger, Compressional angles of isallo stress theory for a circular-cylindrical, spherical and elliptic-cylindrical elastic inhomogeneity in an elastic medium, Pure & Appl. Geoph., 76, 147-152, 1969.

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Pulpan, H and R. B. Forbes Seismic risk and the Denali Fault, Part 2., Soil response and simulated earthquake motion. Prepared for Gulf Interstate Engineering Co., 1977.

April 1977

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Published Articles

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Berg, E., L. Gedney, S. Kubota, K. Hanson and J. Kienle, The June 21, 1967 earthquake series at Fairbanks, Alaska: aftershock locations, depth and magnitudes, Scientific Report, Geophysical Institute, University of Alaska, UAG R-193, 1967.

Kienle, J., Alaskan volcano studies, with special reference to Augustine volcano, The Utilization of Volcano Energy, Proceedings U.S.-Japan Cooperative Science Seminar Hilo, Hawaii, Feb. 4-8, 1974, Ed. J. L. Colp and A. F. Furumoto, 205-224, 1974.

Davies, J. N., L. House, K. H. Jacob, R. Billiam, V. F. Cormier and J. Kienle, A comprehensive study of the seismotectonics of the Aleutian Arc, Ann. Progress Rept., U. S. ERDA-Contract (11-1)3134, Lamont-Doherty Geol. Obs. of Columbia University, 69pp. , 1976.

Professional Meetings

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February 1977

GEOPHYSICAL INSTITUTE
C. T. ELVEY BUILDING
UNIVERSITY OF ALASKA
FAIRBANKS, ALASKA 99701

August 5, 1977

Dr. Herbert E. Bruce
Bering Sea-Gulf of Alaska Project Manager
OCSEAP
P.O. Box 1808
Juneau, Alaksa 99802

Ref: Research Unit 251

Dear Dr. Bruce,

Thank you for your letter of July 27, 1977 concerning the FY 78 renewal proposal entitled "Seismic and Volcanic Risk Studies - Western Gulf of Alaska.

We agree to your request conditions to incorporate into our next report a concise description of the telemetry gear used in our seismic recording network and each quarter to report the percentage up/down time of the instrumentation. We shall also describe any changes made in the seismic system and to summerize the history and success rate of instrumentation in the annual reports.

As requested I am sending a copy of this letter to Boulder.

Sincerely,

Hans Pulpan
Assistant Professor of Geophysics

HP:plm

cc: OCSEAP/NOAA
RX4
325, Broadway
Boulder, CO 80302

Outer Continental Shelf Environmental
Assessment Program
Bering Sea-Gulf of Alaska Project Office
P. O. Box 1808
Juneau, Alaska 99802
PH: 907-586-7432

RFx41-251-545

27 JUL 1977

Dr. Hans Pulpan
Dr. Jurgen Kienle
Geophysical Institute
University of Alaska
Fairbanks, AK 99701

Ref: Research Unit 251

Dear Drs. Pulpan and Kienle:

Your FY 78 renewal proposal titled "Seismic and Volcanic Risk studies-Western Gulf of Alaska" has been reviewed by the Juneau Project Office. I'm happy to state that the proposal is acceptable at your requested level of $165,097 with one addition.

1. Please incorporate into your next report a concise description of the telemetry gear used in your seismic recording network, and, each quarter, please report the percentage up/down time for the instrumentation. When major changes in the seismic or telemetering apparatus are contemplated, please describe the changes in the quarterly reports and summarize the history and success rate of instrumentation in the annual report.

We were glad to see that you'll be extending your volcanic risk studies to Mt. Redoubt. The Augustine material has been most interesting.

If you have questions concerning any of the above guidance, please phone the Juneau Project Office, (907) 586-7436.

Your letter agreeing to these changes, or a revised work statement, must be sent to and received in the Juneau Project Office, with a copy to Boulder no later than August 1, 1977. If there are extenuating circumstances which prevent you from meeting this schedule, please phone the Project Office. The short deadline is required to ensure continuous funding of your project in FY 78.

Upon receipt of your work statement, revised in accordance with the above guidelines, we will initiate contracting procedures for FY 78. I look forward to your continued involvement in our program.

Please be advised that the final funding commitment and level are contingent on the approval of the FY 78 OCSEAP budget by BLM.

Sincerely,

Original signed by
Herbert E. Bruce

Herbert E. Bruce
Bering Sea-Gulf of Alaska Project Manager

cc: Program Office

GI 77-96

PROPOSAL TO

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

FOR

SUBSEA PERMAFROST: PROBING, THERMAL REGIME AND DATA ANALYSIS

OCS EAP RESEARCH UNIT NO.:	253
CO-PRINCIPAL INVESTIGATORS:	T. E. Osterkamp W. D. Harrison
TOTAL COST OF PROJECT:	$82,955
PERIOD OF WORK:	October 1, 1977, to September 30, 1978
INSTITUTION AND DEPARTMENT:	Geophysical Institute University of Alaska Fairbanks, Alaska 99701

T. E. Osterkamp /WDH Date 6/28/77
T. E. Osterkamp
Co-Principal Investigator
Geophysical Institute
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Fairbanks, Alaska 99701
Telephone Number: (907) 479-7548

Neta J. Stilkey Date 6/28/77
Neta J. Stilkey
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W. D. Harrison Date 6/28/77
W. D. Harrison
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T. Neil Davis Date 6/29/77
T. Neil Davis, Acting Director
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Telephone Number: (907) 479-7393

Keith B. Mather /fs Date 6/29/77
Keith B. Mather, Vice Chancellor for
Research and Advanced Study
University of Alaska
Fairbanks, Alaska 99701
Telephone Number: (907) 479-7282

aB

C. TECHNICAL PROPOSAL

I. A. Title: Subsea Permafrost: Probing, Thermal Regime and Data Analysis

B. Research Unit Number: 253

C. Contract Number: 03-05-022-55

D. Proposed Dates of Contract: October 1, 1977-September 30, 1978

II. Principal Investigator(s)

A. T. E. Osterkamp

B. W. D. Harrison

III. Cost of Proposal Federal Fiscal Year 1978

Total: $82,955

Distribution of Effort by Lease Area

1. Aleutians
2. Beaufort Sea $58,000
3. Bristol Bay
4. Chukchi Sea $24,955
5. Kodiak
6. Lower Cook Inlet
7. NEGOA
8. Norton Sound (see Section VI)
9. St. George Basin
10. Non-lease-area laboratory or management

IV. Background

The existence and some of the characteristics of subsea permafrost have been established at Prudhoe Bay, Barrow, and other locations in the Beaufort and Chukchi Seas by drilling, probing, and seismic methods, as well as studies of shoreline history, sea bed temperature, and regional geology. Theoretical concepts of the nature of the heat and salt transport mechanisms have begun to shed some additional light on the distribution and nature of subsea permafrost. The approach is to complete measurements made in key representative areas, and to make measurements in other new areas, while using the theoretical concepts to infer characteristics of unstudied regions. This work is coordinated with other related OCSEAP studies, particularly the drilling efforts of R.U. 105, the seismic work of R.U. 271 and the shoreline studies of R.U. 473.

V. Objectives

Develop the capability to predict the presence or absence of subsea permafrost and its properties by:

(1) collecting and analyzing environmental data (regional geology, sea bottom temperature, ice cover, sediment characteristics and shoreline history)

(2) using these data in existing models or models under development to predict the extent and states of subsea permafrost.

Detailed objectives are described in the next section.

VI. General Strategy and Approach

Because of the thousands of kilometers of Alaskan coast potentially subject to offshore permafrost conditions, the work so far has involved sampling at a few representative offshore sites, with wider inferences made on the basis of regional geology, shoreline history, and heat and salt transport models. As noted earlier, coordinated efforts among a number of investigators using different techniques have been made. Our present project is to investigate subsea conditions with the help of light-weight probes, and to infer larger-scale conditions from other data, and from theory.

Broadly speaking, our strategy in the Beaufort Sea has been to concentrate our efforts at sites in two major areas--west of Harrison Bay and east of Harrison Bay--which are characterized by very different permafrost conditions, at least onshore. West of Harrison Bay, the permafrost is thin (≃ 350 m) with low ice content at depth and fine-grained soils. East of Harrison Bay the permafrost is thick (≃ 600 m) with high ice contents at depth and coarse-grained soils. It is tentatively assumed that these conditions can be extrapolated offshore. By concentrating our efforts at a few sites in these two areas, we hope to be able to extrapolate the information obtained over most of the areas. To date, most of our and other research has been performed at Prudhoe Bay and at Elson Lagoon near Barrow with only fragmentary evidence from other sites.

Many questions remain to be answered, but in the Beaufort Sea we feel that in the next year the highest priority should be to complete important data collection at the sites under most intensive study

(Prudhoe Bay and Elson Lagoon), and to set up a line of holes in an area of rapid coastal retreat, probably Cape Simpson. Even less is known about the Chukchi Sea, but given funding and timing constraints, we feel that work must be limited to the Barrow area in the next year. The southern extent of subsea permafrost is an important question, and there seems to be at least some possibility of establishing a hole in Norton Sound in the next year. A list of the detailed field objectives of the work in the coming year, divided into primary and secondary categories, is as follows:

Primary field objectives:

(i) to measure temperature in a jetted hole about 10 km outside the barrier islands in the Beaufort Sea off Prudhoe Bay.

(ii) to measure temperature and interstitial water salinity in a line of holes in the Beaufort Sea at a location of rapid shoreline retreat, probably Cape Simpson.

(iii) to measure interstitial water salinity in two holes in Elson Lagoon, and possibly temperature in one deep hole. These measurements are to complement those made at this site in spring 1977.

(iv) to measure interstitial water salinity and temperature in one or two near-shore holes in the Chukchi Sea near Barrow.

Secondary field objectives:

(i) to measure temperature at a second offshore hole at Prudhoe Bay.

(ii) to measure intersitital water salinity at closely spaced intervals in one near-shore hole at Prudhoe Bay.

(iii) to measure temperature in one hole in Norton Sound.

Probably only one, or possibly two, of these secondary objectives will be achieved.

Larger-scale subsea permafrost conditions will be discussed using geologic and seismic data, shoreline history, and theory, as noted previously.

It is recognized that this list of priorities leaves some obvious important gaps; these are discussed in Section XVI.

VII. Sampling Methods

Data beneath the sea bed will be obtained by the driving or jetting of probes that can be transported by snow machine, airplane, or helicopter. The depth accessible depends upon soil type; 38 m below the sea bed is our record so far. Temperature and interstitial water salinity can be determined by this technique, although the latter is slow in fine-grained soils. The technique for determination of salinity has been developed with NSF support. Ice thickness, sea bed temperature, and water depth profiles are also measured.

VIII. Analytical Methods

The results can be used as control for a seismic search for a bonded subsea permafrost table (R.U. 271). The results of these studies can be extended over a larger area with the help of shoreline history data (R.U. 473), sea bed temperature data, and the regional geology, as noted earlier. We plan an analysis using existing knowledge of heat and salt transport mechanisms in subsea permafrost. These mechanisms are under investigation in NSF and Sea Grant sponsored research.

IX. Anticipated Problems

Success of the offshore hole at Prudhoe Bay depends on the ice movement. Based on experience gained in spring 1977, the chances are good that we can succeed, but the chances for failure should be recognized.

A chronic problem for planning field work and analysis is the lack of near-shore bathymetry on the coastal charts in the southern Chukchi Sea.

X. Deliverable Products

A. Digital Data:

N/A

1. Recorded Parameters:

2. List of Digital Products:

B. Narrative Reports:

Narrative reports containing data, graphs, tables, etc., and discussion of larger-scale permafrost distribution. Most of the data will be collected in May, 1978, and submitted in the quarterly reports as soon as reduced. A description of the data obtained will be given in the June, 1978, quarterly report.

C. Visual Data:

N/A

XI. Information Required from Other Investigators

Data from other investigators will be obtained through channels already established. Our data analysis will proceed in cooperation and consultation with other workers.

Oceanographic data from Chukchi and Beaufort Seas will be needed as it becomes available.

XII. Quality Assurance Plans

Our thermistor probes are calibrated in ice baths, triple-point-of-water cells and controlled temperature baths. The accuracy of these calibrations is about $\pm 0.01°C$ in the range of temperatures that we normally encounter in the field. Salinity measurements are compared with those made on standard solutions. The rest of our measurements are routine and require the use of simple tape measures, counting procedures, crude timing of events, etc.

B. AIRCRAFT SUPPORT FIXED WING

Transport 4 men from Prudhoe Bay-Deadhorse to Cape Simpson, together with about 2500# of equipment from Prudhoe Bay, and hut and other living gear from Barrow. This would be about May 1. About 2 weeks later all the gear and the men would be returned to Barrow. Probably 2 Cessna 180 flights would be required about May 25, to Simpson for hole logging.

One of our secondary objectives would require transportation of 2 men and 600 pounds of equipment to inner Norton Sound, probably from Nome. This could be either fixed wing or helicopter, as long as sea ice landings are possible. Accurate positioning would increase the value of our work and for this the Global Navigation System of the NOAA Bell 205 helicopter would be ideal. The operation could be done in 1 day, but the aircraft would have to stand by several hours, or return. The site would need to be revisited about 1 week later.

C. AIRCRAFT SUPPORT - HELICOPTER

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed)

   Need to occupy 1 or 2 stations 10 km N of Reindeer Island off Prudhoe Bay, and to return twice during following week. Need priority on helicopter use, because ice motion may destroy holes before they are logged. Need working Global Navigation System.

2. Describe types of observations to be made.

   Holes are to be jetted into sea bed by two men with light equipment, and logged several times for temperature.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   The work should begin May 1. A few days earlier would be satisfactory, but later would seriously complicate the rest of our program.

4. How many days of helicopter operations are required and how many flight hours per day? Three flights would be required during a 1-week period. The helicopter could stand by for several hours or pick up the men later.

   Total flight hours? About three.

5. How many people are required on board for each flight (exclusive of the pilot)?

   2

6. What are the weights and dimensions of equipment or supplies to be transported?

   Small boxes and 5½' pallets of pipe that will easily fit into NOAA 205. Total equipment weight about 600# for first flight; about 100# for subsequent flights.

7. What type of helicopter do you recommend for your operations and why?

   The NOAA Bell 205 would be ideal, partly because of its Global Navigation System. Others could be used if they can determine position accurately.

8. Do you recommend a particular source for the helicopter? If "yes" please name the source and the reason for your recommendation.

   NOAA (see above).

9. What is the per hour charter cost of the helicopter?

10. Where do you recommend that flights be staged from?

    Deadhorse.

11. Will special navigation and communications be required?

    Global Navigation System or equivalent.

12. See also discussion under "Fixed Wing" for possible helicopter use.

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

Location	Approximate Date	No. of Personnel Per Day
Prudhoe Bay	May 1 - May 6	4
Cape Simpson	May 6 - May 20	4
Barrow	May 20 - May 31	4

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

Prudhoe Bay - camp such as VE with OCS contract.

Cape Simpson - portable building in which 4 men can cook and sleep. Get NARL to supply? Fly in by DC-3?

Barrow - NARL.

3. What is your estimated per man day cost for this support at each location?
Roughly $75/day at Prudhoe and NARL, based on previous experience.
The cost at Cape Simpson would be higher because of the initial cost of the building, but it could be used again, perhaps elsewhere.

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

E. SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

The most obvious logistics problem is that of shelter at Cape Simpson. We would like to see OCS or NARL look into portable buildings.

XV. Management Plan

Management will be by the principal investigators, with help from the Geophysical Institute business office. Our schedule is outlined in the Milestone Chart.

See attached Milestone Chart

XVI. Outlook

Conspicuously absent from our 1978 plan is most of the Chukchi Sea, where conditions seem likely to be highly variable, and where we have only sampled sites near Barrow, Cape Krusenstern, and Kotzebue. We hope to put in several lines of holes near shore in spring of 1979 and 1980.

Also conspicuously absent from our 1978 plan is the barrier island-lagoon system. On the islands the only data available so far are temperature data from one hole a few meters from Tapkaluk Island, a driller's log from Reindeer Island, and seismic data from Barrow and Prudhoe Bay. Both relic and migrating islands need to be studied, and the work could profitably be done at the same time as the seismic work of R.U. 271. Two possible candidates are Pingok and Stump Islands. Probably visits during two summer seasons would be required to jet and drive holes, as well as spring measurements off the ice near the islands.

We still know little about the effect of large rivers on the subsea permafrost regime. Our two Spring 1977 holes in Harrison Bay were a step in this direction, but additional holes near the main channels of the Colville River need to be obtained.

The largest potential subsea permafrost area of all is the vast shelf underlying the entire Chukchi Sea, and no borehole data at all have been obtained except very near shore. With luck, this may be accessible to our jetting technique. Although this area may not be as important to OCSEAP as the areas nearer shore, it needs to be studied to give a rounded view of potential offshore permafrost problems in Alaskan waters.

Roughly 40% of our subsea permafrost work is supported by NSF, and comparable support from Sea Grant has been available in the past. The NSF work tends to be focussed on the more fundamental problems, such as the mechanism of heat and salt transport and development of theoretical models, but we have used it to support development of salinity probes and for field work as well. Assuming this and OCSEAP support were to continue at roughly the same level, the Chukchi Sea near-shore work, and the barrier island-lagoon system measurements could be done in 1979 and 1980. An increase of about $15,000 per year would permit us to duplicate our equipment and send two 3-man parties into the field (as opposed to one 4-man party), thus almost doubling the amount of data obtained. This should enable us to accomplish the Colville River work during the same two-year period.

Additional problems will undoubtedly be uncovered during the course of future work, even though at present these appear to be the obvious ones. Also, although every effort is made to assimilate data as they become available, a larger effort to synthesize all results may be necessary when most of the field work is completed.

One of the ultimate aims of our and other work is to produce a map showing the most likely areas for subsea permafrost in the Beaufort and Chukchi Seas and elsewhere, and some of its properties.

XVII. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist. If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR two working days prior to release.

10. The following acknowledgment of sponsorship will be used:

> "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

RU #: 253 PI: Osterkamp/Harrison

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Analysis of data obtained in 1977.						Δ									
Review of all available on- and offshore data in regions of proposed 1978 field sites.						Δ									
Planning, equipment purchase, and construction, calibration.						Δ									
Preparation of annual report, summarizing results and analysis from 1977 work.						Δ									
Field work.								Δ							
Quarterly report describing type of data obtained.									Δ						
Quarterly report giving reduced data and analysis to date.												Δ			

PUBLICATIONS:

Published Articles

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July 1976

GI 77-99

PROPOSAL TO

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

FOR

MORPHOLOGY OF BEAUFORT, CHUKCHI AND BERING SEA NEAR SHORE ICE CONDITION BY MEANS OF SATELLITE AND AERIAL REMOTE SENSING

OCSEAP RESEARCH UNIT NO.:	257/258
PRINCIPAL INVESTIGATOR:	W. J. Stringer
TOTAL COST OF PROPOSAL:	$49,870
PERIOD OF WORK:	October 1, 1977 to September 30, 1978
INSTITUTION AND DEPARTMENT:	University of Alaska Geophysical Institute Fairbanks, Alaska 99701

JUNE 1977

Date 6/30/77
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C. TECHNICAL PROPOSAL

I. A. Title: Morphology of Beaufort, Chukchi and Bering Sea Near Shore Ice Conditiona by Means of Satellite and Aerial Remote Sensing

B. Research Unit Number: 257/258

C. Contract Number: 03-5-022-55

D. Proposed Dates of Contract: Octoberl, 1977 to September 30, 1978

II. Principal Investigator(s)

A. W. J. Stringer

III. Cost of Proposal Federal Fiscal year 1978

C. Total: $49,870

D. Distribution of effort by lease area

1. Aleutians
2. Beaufort Sea 50%
3. Bristol Bay 10%
4. Chukchi Sea 20%
5. Kodiak
6. Lower Cook Inlet
7. NEGOA
8. Norton Sound 10%
9. St. George Basin 10%
10. Non-lease-area laboratory or management

IV. Background:

This project has been developed because of the relevance of ice-related phenomena to petroleum extraction activities. This relevance should be considered in terms of the three main phases of petroleum-related activities:

Exploration, development and extraction. Each phase has particular ice-related problems.

1. Exploration. This work, mainly by seismic crews is being carried out currently in the Beaufort Sea --- mainly from fast ice. This reasearch unit has already acted in an advisory role with an oil firm sending seismic crews out on the fast ice. The chief problem here is the relative stability of the ice and the safety of the crews and equipment. Through compilation of persistence values for near shore ice and determination of the relationship of those persistence values to grounded ice features and other factors responsible for ice stability, predictive methods will be developed to determine ice safety in specific areas at specific times.

2. Development. During this phase of petroleum-related activities, permanent structures are constructed for drilling of permanent wells and extraction facilities. Collector pipelines are laid and other permanent facilities are constructed. The considerations involved in the placement of these structures include the probability of ice piling around and upon man-made islands, ridge keel gouging of pipelines and also the effect of the facility on the morphology of near shore ice and this in turn on the quality and nature of habitats.

   The information provided by this research unit will obviously yield information about ice piling and the probability of gouging. Through the development of a morphology of near shore ice, including the dynamics of ice behavior near natural obstructions to ice motions, we hope to provide descriptive models of the impact of the creation of man-made islands on the morphology of near shore ice. This can then in turn be related to impact on near shore habitats.

3. Production. This phase of petroleum-related activities would take place over a span of many years. Within this period the greatest environmental problem would be the danger of an oil spill which would become incorporated into the ice. This research unit, through analysis of the fate and trajectories which would be taken by site specific spills will provide information concerning the favorable location of production facilities and anticipate the techniques which may be required to deal with specific spills through prediction of the ice behavior in the location of the spill.

V. Objectives

The overall objective of this study is to develop a comprehensive morphology of near shore ice conditions along the ice-frequented portions of the Beaufort, Chukchi and Bering Sea coasts of Alaska.

Specifically, this comprehensive morphology will include a synoptic picture of the development and extent of fast ice, the construction and location of pressure and shear ridges, the location and persistence of grounded ice features including ice islands, stamuki, ridges and hummock fields and the interrelationships among these phenomena.

The general assumption is that near shore sea ice behavorial patterns can be analyzed to yield some predictability in terms of offshore sea ice hazards to oil and gas development. An a result, geographical zones of different design and construction criteria as well as oil spill management plans can be established in the offshore areas taking into consideration the probability of damage to structures and problems encountered by clean-up operations due to adverse ice conditions. This should in turn allow the relative risk imposed to the adjacent ecosystems to be evaluated.

VI. General Strategy and Approach:

A comprehensive morphology of Alaskan near shore ice conditions will be developed. This morphology will include a synoptic picture of the development and decay of fast ice and related features along the Bering/Beaufort coasts, and, in the absence of fast ice, the nature of other ice (pack ice, tide-driven ice, hummock fields, etc.) which may occupy the near shore areas in other seasons. Special emphasis will be given to consideration of potential hazards to offshore facilities and operations created by near shore ice dynamics. A historical perspective of near shore ice dynamics will be developed to aid in determining the statistical rate of occurrence of ice hazards.

During past quarters Landsat and aerial photographic data have been used to compile a series of maps of the ice-bound coasts of Alaska describing near shore ice behavior. This year the statistical analysis will be completed and documentation of site specific phenomena (flaw leads, polynyas, hummock fields, etc.) both supporting and representing exceptions to the statistical results will be compiled and incorporated into the morphological picture.

In addition, results reported by other investigators studying related subjects (shear zone ice dynamics, pressure ridge modeling, sea mammal habitat, ice-petroleum interaction, statistical weather records, fast ice break-up, and historical studies) will be incorporated and reconciled with the morphological picture being developed.

VII. Sampling Methods:

During this contract period Landsat and aerial photographic data already collected and archived will be used to describe and document site specific phenomena. Sampling methods in this case are tied to the availability of data and the significance of the particular phenomenon to the morphological picture of near shore ice dynamics.

Examples of specific study items include:

A. Beaufort Sea:

1. Recurring hummock fields on shoals off Harrison Bay.
2. Massive ridge system off Prudhoe Bay, which endured an entire melt season.
3. Evidence that particular ridge systems mapped as grounded features were indeed grounded.
4. Documentation of size and contrast limitations on features identified and mapped from Landsat data.
5. Recurrence of areas of early melt season open water.
6. Propagation of lead systems into Beaufort Sea region during Chukchi Sea break-out events.
7. Recurrence of large tension cracks in near shore ice.
8. Occasional extension of landfast ice to great distances (>100 km) off the Beaufort coast.

B. Chukchi Sea

1. Documentation of recurring Chukchi flaw lead.
2. Documentation of specific ice piling event observed north of Cape Lisburne possibly yielding information regarding ice strength and crushing characteristics.
3. Documentation of major ice piling events at Bering Strait.

C. Norton Sound

1. Documentation of recurring polynya in Norton Sound and resulting continuous production of new ice in that area.
2. Documentation of ice piling events at mouth of Yukon and reconciliation with Beaufort/Chukchi ice dynamics.

D. St. George Basin

1. Documentation of fast ice around islands and interaction of pack ice with island fast ice.

E. Bristol Bay

1. Documentation of major ridging event along Alaska Peninsula coast.
2. Analysis of dependability of new ice migration away from north coast of Bristol Bay.

VIII. Analytical Methods:

Previously, Landsat data have been selected for analysis on the basis of image quality and availability of adjacent scenes for comprehensive mapping of a major portion of the coastal zone. Photographic prints at 1:500,000 scale are obtained from the Sioux Falls EROS Laboratory for mapping of ice features. In order to achieve positional accuracy, the 1:500,000 scale prints were overlaid with acetate tracings of 1:500,000 maps. This technique allowed a clear definition of the coastline and other features (shoals, islands, etc.). Bathymetric data, transferred to this scale from coastal charts, were also added by this technique. Finally, a near shore ice map was traced showing shoreline features, offshore structures, bathymetric configuration, and major near shore ice features.

These maps, produced for each selected Landsat image, have been used to define the location of hazardous ice conditions, and compare coastal ice conditions from month to month to help develop a statistical morphology of near shore ice conditions.

During this contract period, specific features and events identified on these maps will be documented in detail using all available data including Landsat imagery and aerial photography. Documentation of dynamic events creating potentially hazardous near shore ice conditions will include analysis of meteorological conditions for possible causal relationships. Major emphasis will be placed on incorporation of data from other research units.

IX. Anticipated Problems:

No major difficulties are anticipated.

X. Deliverable Products:

A. Digital Data: None

1. Recorded Parameters: Does not apply

2. List of Digital Products: Does not apply

B. Narrative Reports:

Scheduled quarterly and annual reports will contain detailed narrative descriptions containing maps and photographic products of specific ice events and features. Because of the close relationship between maps and reports produced by this project, these data products are detailed in section "C."

C. Visual Data:

Interim Products: Narrative reports including maps and photographic products will be prepared for recurring ice features and ice events of special note.

Final Product: A detailed narrative report including maps and photographs describing the detailed morphology of Alaskan near shore ice conditions, relating these conditions to meteorological events.

D. Other Non-Digital Data: None

E. Data Submission Schedule: Normal Quarterly and Annual Report

Data Products Schedule Attached

Data Products Schedule

Data Type (ie. Intertidal, Benthic Organisms, etc.)	Media (Cards, coding sheets, tapes, disks)	Estimated Volume (Volume of processed data)	OCSEAP Format (If known)	Processing and Formating done by PI (Yes or No)	Collection Period (Month/Year to Month/Year)	Submission (Month/Year)
Narrative reports	Paper			Yes	Continuous	With quarterly and Annual Report

XI. Information Required from other Investigators:

1. Historical Data: Historical data usually describes events remembered because of severity or some other characteristic which places the event at an end point of the spectrum of dynamic behavior. This information is particularly useful in developing a morphology.

2. Meteorological Statistics: The morphology developed will link ice behavioral characteristics with weather patterns. Frequency distribution of dynamic ice episodes will be determined by frequency distribution of weather patterns linked to ice dynamics. This is necessary because while only 5 years of ice data exists, the meteorological data spans a period ten times greater.

3. Description of Site Specific Ice-related Phenomena: It is anticipated that this information can be obtained chiefly through reports by other research units.

XII. Quality Assurance Plans

Quality Assurance of ice maps prepared from LANDSAT imagery is provided by aerial photography and surface observations. The proposer performed aerial photographic reconnaissance of Alaskan near shore ice in 1973 and 1974. Since that time the OCS project has provided aerial reconnaissance. The University of Alaska LANDSAT program coordinated U-2 photographic missions with NASA in 1974 to provide very high altitude mapping photography.

Calibration is performed in the following way: Aerial photography is searched for ice features identified on LANDSAT imagery. The search for identifiable features is extended to smaller features until the smallest identifiable features are discovered. This exercise trains the mapping personnel to recognize ice features on LANDSAT imagery and gives perspective in terms of size of the identifiable objects.

B. AIRCRAFT SUPPORT - ...

1. Delineate proposed flight lines on a chart of the area. Indicate desired flight altitude on each line. (Note: If flights are for transportation only, chart submission is not necessary but origin and destination points should be listed)

Would like to obtain near shore reconnaissance flights at all points along ice bound coasts.

2. Describe types of observations to be made.

We want to obtain 35 mm photographic verification of near shore ice conditions mapped on the basis of LANDSAT imagery.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification)

there are two periods of interest: All ice bound coastal areas in late March.
Beaufort coast in late June.

4. How many days of flight operations are required and how many flight hours per day?

Total flight hours? Open

5. Do you consider your investigation to the principal one for the flight thus precluding other activities or requiring other activities to piggyback or could you piggyback?

Could piggyback

6. What types of special equipment are required for the aircraft (non carry-on)?
None
What are the weights, dimensions, power requirements, and installation problems unique to the specific equipment.
None

7. What are the weights, dimensions and power requirements of carry-on equipment?

10 pounds, 1 cu. ft., no power

8. What type of aircraft is best suited for the purpose?
Only requirement is good visibility from windows

9. Do you recommend a source for the aircraft?
If "yes" please name the source and the reason for your recommendation.
No

10. What is the per hour charter cost of the aircraft?
Unknown

11. How many people are required on board for each flight (exclusive of flight crew)?
One or two

12. Where do you recommend that flights be staged from?

No recommendations

XV. Management Plan:

This project will be a continuation of OCS Research Unit #257/258. At the end of the current contract it is anticipated that a statistical morphology of Alaskan near shore ice conditions will have been developed based on five years' Landsat data. During fiscal 1978, emphasis will be placed on documentation of site-specific ice events and features and discussions of their relationships to the morphology of near shore ice conditions. The documentation will consist of individual short papers on each subject item. These papers will be included in the quarterly reports as they are prepared. Emphasis will be determined in accordance with the distribution of effort by lease area as described on page 2.

XVI. Outlook:

1. Nature of final results and data products:

By the end of this contract period we will have developed a morphology of Alaskan near shore ice conditions based on five seasons' Landsat data. This morphology will include: annotated maps describing near shore ice conditions along the entire ice-bound Alaskan coast, special event maps describing particularly interesting events (ridge building, stranded ice island fragments blocking ice flow, polynya formation, etc.) which are useful documentation to the annotated maps, and a dynamic morphology relating ice motions in near shore areas with currents and weather patterns. Throughout these products, major attention will be given to ice conditions which might possibly have a bearing on activities related to petroleum exploration or extraction.

2. Significant milestones:

Completion of detailed narrative report scheduled for delivery at end of September, 1978.

3. Cost by fiscal year:

Fiscal 1978 - 100%

4. Additional major equipment required:

NONE

5. Location of future field efforts:
We would like to obtain verification oblique aerial photography at various selected locations along the ice-bound coast of Alaska

6. Logistics Requirements:

A fixed wing, 4-place aircraft would be required for approximately one week in March and June 1978 (see separate section on Logistics)

XVII. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist. If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR two working days prior to release.

10. The following acknowledgment of sponsorship will be used:

    "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

MILESTONE CHART

RU #: 257/258 PI: W. J. Stringer

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977 O	N	D	1978 J	F	M	A	M	J	J	A	S	O	N	D
Completion of 1976-77 ice season maps			X												
Completion of updated morphology maps						X									
Completion of updated descriptive morphology									X						
Completion of 1978 field work										X					
Completion of detailed narrative report													X		

PUBLICATIONS

Journal Articles

Stringer, W. J., A. E. Belon and S.-I. Akaosfu, The latitude of auroral activity during periods of zero and very weak magnetic disturbance, J. Atmos. Terr. Phys., 27, 1039-1044, 1965.

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Other Publications

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Stringer, W. J., Analysis of H-beta line profiles, Presented at Western Regional meeting of the American Geophysical Union, San Francisco, 1969.

PRESENTATIONS (Cont'd):

Stringer, W. J., Remote sensing of Alaskan archaeological village sites, A preliminary report, Presented at the 24th Alaskan Science Conference, Fairbanks, Alaska, 1972.

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Stringer, W. J., Remote sensing activities at the Arctic Environmental Information and Data Center. Presented at the 1974 Alaskan Surveying and Mapping Convention, Anchorage, Alaska, February 1974.

Stringer, W. J., Making maps from ERTS digital data, Presented at Eleventh Annual Alaska Surveying and Mapping Convention, Anchorage, Alaska, January 1976.

Stringer, W. J., and S. A. Barrett, Growth and Decay of Katie's Floeberg, Northwest Regional Meeting, AGU, Victoria, B. C., September 30, 1976.

February 1977

PROPOSAL TO

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

FOR

IN-SITU MEASUREMENTS OF THE MECHANICAL PROPERTIES OF SEA ICE

OCS EAP RESEARCH UNIT NO.:	265
CO-PRINCIPAL INVESTIGATORS:	Lewis H. Shapiro Richard D. Nelson
TOTAL COST OF PROJECT:	$100,478
PERIOD OF WORK:	October 1, 1977, to September 30, 1978
INSTITUTION AND DEPARTMENT:	Geophysical Institute University of Alaska Fairbanks, Alaska 99701

_____________________ Date _____
Lewis H. Shapiro
Co-Principal Investigator
Geophysical Institute
University of Alaska
Fairbanks, Alaska 99701
Telephone Number: (907) 479-7196

_____________________ Date _____
Neta J. Stilkey
Business Manager
Geophysical Institute
University of Alaska
Fairbanks, Alaska 99701
Telephone Number: (907) 479-7644

_____________________ Date _____
Richard D. Nelson
Co-Principal Investigator
Geophysical Institute
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Telephone Number: (907) 479-7137

_____________________ Date _____
T. Neil Davis
Acting Director
Geophysical Institute
University of Alaska
Fairbanks, Alaska 99701
Telephone Number: (907) 479-7393

_____________________ Date _____
Keith B. Mather
Vice Chancellor for Research
and Advanced Study
University of Alaska
Fairbanks, Alaska 99701
Telephone Number: (907) 479-7282

C. TECHNICAL PROPOSAL

I. A. Title: In-Situ Measurements of the Mechanical Properties of Sea Ice

B. Research Unit Number: 265

C. Contract Number: 03-5-022-55

D. Proposed Dates of Contract: October 1, 1977-September 30, 1978

II. Principal Investigator(s)

A. Lewis H. Shapiro

B. Richard D. Nelson

Contributing Scientist: Earl R. Hoskins

III. Cost of Proposal Federal Fiscal Year 1978

Total: $100,478

Distribution of effort by lease area:

1. Aleutians
2. Beaufort Sea 100%
3. Bristol Bay
4. Chukchi Sea
5. Kodiak
6. Lower Cook Inlet
7. NEGOA
8. Norton Sound
9. St. George Basin
10. Non-lease-area laboratory or management

IV. Background

The most significant hazard to offshore activities in the Beaufort and Chukchi Seas is that presented by sea ice. In a recent review, Schwarz and Weeks (1977) identified data requirements for various subject areas in sea ice engineering including ship transit, offshore structure design, vertical loading of ice sheets and ice gouging. They point out that virtually all aspects of these subjects require information on the mechanical properties of sea ice, and then proceed to describe the state of knowledge regarding these properties. They conclude that large data gaps exist, some of which are fundamental.

The studies proposed here for the coming year are designed to contribute towards filling gaps in the data in two areas: static elastic properties and compressive strength as a function of loading rate and confining pressure. The latter requires consideration of the viscoelastic properties of sea ice, a subject which (as discussed below) has been examined under this project. The required measurements will be made in situ, using the techniques and procedures developed during the past two years.

It should be recognized that those responsible for the evaluation of the design of installations or vessels which will be utilized for offshore development require the same information as is available to the designer. In addition, other investigators concerned with the movement, deformation, and failure of sea ice (as in ridging processes) have need of similar data, particularly regarding the strength of sea ice. However, with the exception of this project, there is little work in progress in the public domain regarding the determination of the mechanical properties of sea ice.

V. Objectives

Within the period covered by this proposal, the following studies will be done:

1. A series of in-situ tests will be run in uniaxial and biaxial compression to provide data for determination of elastic and viscoelastic properties and strength of sea ice.

2. A short laboratory study for the purpose of examining the use of embedded wire strain gauges for strain measurements was begun during the present contract year and will be completed in the coming year.

3. Work on the non-linear viscoelastic stress-strain law developed during the past year will be continued. In particular, the law will be applied to the strength and load rate experimental data presented by Peyton (1966), and to the data obtained in the proposed experimental program.

The objectives of this work are:

1. to establish a reliable data set on the mechanical properties listed above as a basis of comparison with future tests and with Peyton's (1966) laboratory results, and

2. to continue to improve the techniques and procedures for in-situ testing which have been developed in the past two years.

VI. General Strategy and Approach

The mechanical properties of sea ice depend upon several variables including temperature, salinity, grain size and fabric, and the rate of loading or strain at which the testing is done. In addition, the size of the samples used in testing may influence the results, as can the strain and temperature history. As a result a relatively large number of tests must be performed in order to develop representative values for various properties over the range of conditions which can exist in nature.

At present, there is a need to establish a reliable data set which can be used as a basis for comparison with laboratory results, and as a guide in designing later experimental programs. Therefore, during the period covered by this proposal, the emphasis of this project will be on performing a large number of tests on near-surface ice specimens which are relatively fine-grained and isotropic. All samples will be the same size. The use of uniformly sized samples of near-surface ice eliminates sample size, grain size and fabric from the list of variables to be considered. In addition, such tests are relatively easy to set up so that preparation time is held to a minimum. This is an important consideration, because of the limited time available for the field program. Finally, Peyton's (1966) data includes an extensive series of tests on ice of this type to which the results of the <u>in-situ</u> tests can be compared.

VII. Sampling Methods

The test specimens used in the proposed program will be rectangular prisms with dimensions of 30 x 30 x 60 cm. These will be cut from the ice sheet, the bottom of the resulting hole lined with two layers of plastic sheeting, and the block replaced and frozen back in. The plastic sheeting eliminates any shear stress at the base of the block during loading, and permits a uniaxial or biaxial state of stress to be set up in the specimen. Loads will be applied through flatjacks installed at the block margins, and strain will be measured by a combination of extensometers fixed to the surface of the specimen, and wire strain gauges embedded within it. The data will be analyzed using procedures described in the next section.

Each sequence of tests will involve ten to twenty samples, each of which will be run through the following loading cycle:

1. Rapid loading and unloading to determine static elastic parameters.
2. A one- or two-stage creep test for viscoelastic properties.
3. Load to failure to determine strength.

Most of the tests will be done with uniaxial compression, with loading to failure done at a different constant load rate for each specimen. The remaining tests will be in biaxial compression to determine the effect of confining pressure on elastic and viscoelastic properties. Loading to failure will be done at the same rate for all tests so that this variable is eliminated, and the variation of strength with confining pressure can be determined.

Ice temperatures will be monitored continuously, and salinity measurements will be taken throughout the test program. Grain size and orientation will be determined prior to the start of the program.

Based upon rates of work estimated during past programs, it is anticipated that a complete series of 20 tests can be set up and run in each three-week period so that a total of 80-100 tests can be run during one field season.

VIII. Analytical Methods

The procedures for calculating Young's Modulus and Poisson's ratio from uniaxial and biaxial tests follow directly from the stress-strain law for linear elasticity and are well known. Viscoelastic properties will be determined by fitting a strain-time curve, calculated from a viscoelastic stress-strain law, to the experimental creep curves. The viscoelastic stress-strain law to be used was developed under this program and tested against Peyton's (1966) laboratory data for creep of sea ice. Results to date have been satisfactory. The law was derived from a four parameter spring-dashpot model in which the dashpot elements incorporate a hyperbolic sine relationship between stress and strain-rate. The result is a one-dimensional, non-linear stress-strain law which describes the deformation of the material through the primary and secondary creep stages. A yield criterion, to permit calculation of the strain through the tertiary creep stage, is currently being developed.

IX. Deliverable Products

A. Digital Data:

1. Recorded Parameters:

None

2. List of Digital Products:

None

B. Narrative Reports:

Narrative reports of methods of testing and results of in-situ tests, further work on derivations of stress-strain laws and failure criteria, and comparison of the laboratory and field data sets.

C. Visual Data:

Plots of various test results generally incorporated into narrative reports.

D. QUARTERS and SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

    Naval Arctic Research Laboratory, Barrow, Alaska

    January 15, 1978 - May 15, 1978

    Two personnel full time during this period.

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

    Naval Arctic Research Laboratory

3. What is your estimated per man day cost for this support at each location?

    $79

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

    Rate set by Naval Arctic Research Laboratory.

E. SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

One wannigan, equipped with arctic entry, heat and power, to be moved onto the ice at the test site. In addition, local transportation and equipment rental and repair will be required periodically. Finally, a single lab will be needed during the time project personnel are located at Barrow.

X. Management Plan

1. Fiscal management of funds which may be obtained for this project will be handled by the business manager, Geophysical Institute, University of Alaska. The University provides monthly summary of expenditures and encumbrances as well as current information on all financial aspects of the contract in accordance with mutual requirements of the contractor.

2. Scientific management will be the responsibility of the principal investigators who will lead and supervise all phases of the proposed work and assure the timely completion of the objectives.

3. Outside coordination, review, and direction will be provided by the OCS Arctic Project Office, Geophysical Institute, University of Alaska.

XI. Outlook

Assuming the successful completion of the program described above, it will be necessary to conduct a similar program in FY 79 to determine the effect of anisotropy resulting from preferred orientation of the crystals which make up the ice sheet. Preparation of the required tests will involve quarrying into the ice sheet to obtain samples, thereby increasing the set-up time and reducing the number of tests which can be run during the field season from that when near-surface ice is used. However, it is anticipated that the number of tests which need to be run will also be lower, because of the availability of the data to be acquired in FY 78. That is, the test program can be designed to compare results at selected points on the curves rather than to establish curves.

If progress in the mathematical aspects of the development of the stress-strain law and failure criterion keeps pace with the experimental work, it can be anticipated that a description of the behavior of sea ice in uniaxial and biaxial compression, which might be satisfactory for engineering applications, will be available by the end of FY 79. At that time, it would be advisable to consider a program of experiments on the full thickness of the ice sheet in order to test the results. Similarly, an additional field season should be devoted to experiments to test the law in other loading modes (i.e., tension and shear). The procedure for conducting the appropriate tests have been developed and are described in the reports submitted for this project.

A program of experiments on the full thickness of the ice sheet would require a substantial increase in funding. With this exception, the remaining work can be satisfactorily conducted at present funding levels.

No changes are anticipated in logistics requirements or in the site of field operations.

XII. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist. If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR two working days prior to release.

10. The following acknowledgment of sponsorship will be used:

> "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

MILESTONE CHART

RU #: 265 PI: Shapiro/Nelson

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978														
	O	N	D	J	F	M	A	M	J	J	A	S						
Completion of planning of field program and equipment purchase	Δ																	
Completion of fabrication of equipment			Δ															
Complete laboratory program			Δ															
Start field work				Δ														
End field work								Δ										
Complete analysis of results of field work											Δ							
Complete report for field work													Δ					

PUBLICATIONS:

Shapiro, L. H. and J. P. Gries, Ore deposits in Paleozoic Rocks, Northern Black Hills, South Dakota; Guidebook, 20th Ann. Field Conference, Wyoming Geological Association, pp. 179-186, 1968.

Shapiro, L. H., Structural geology of the Fanny Peak Lineament, Black Hills, Wyoming-South Dakota; Guidebook, 23rd Ann. Field Conference, Wyoming Geological Association, pp. 61-64, 1971.

Shapiro, L. H. and J. J. Burns, Satellite observations of sea ice movement in the Bering Strait region, in Climate of the Arctic, G. Weller and S. A. Bowling, ed., Proc, 24th Ann. Alaska Sci. Conf., 379-386, 1973.

Shapiro, L. H. and E. R. Hoskins, Use of flatjacks for the in-situ determination of mechanical properties of sea ice. Proc. 3rd Int. Conf. on Port and Ocean Eng. under Arctic Conditions, Fairbanks, Alaska, August 1975 (in press).

Rogers, J. C., L. H. Shapiro, L. D. Gedney and J. D. VanWormer, Near shore permafrost in the vicinity of Point Barrow, Alaska. Proc. 3rd Int. Conf. on Port and Ocean Engineering under Arctic Conditions, Fairbanks, Alaska, August 1975 (in press).

Shapiro, L. H., A preliminary study of the formation of landfast ice at Barrow, Alaska, using radar data, Proc. 3rd Int. Conf. on Port and Ocean Eng. under Arctic Conditions, Fairbanks, Alaska, August 1975 (in press).

Reports

Shapiro, L. H. and J. P. Gries, Ore Deposits in Paleozoic Rocks, Northern Black Hills, South Dakota; U.S.G.S. Open File Report, pp. 235, 18 plates, 1970.

Shapiro, L. T., Structural Geology of the Black Hills Region, Ph.D. Thesis, University of Minnesota, pp. 213, 12 plates, 1971.

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Gedney, L., L. Shapiro, J. D. VanWormer and F. Weber, Earthquake epicenters in interior Alaska, 1968-1971, and their correlation with mapped faults, Geophysical Institute, University of Alaska Scientific Report UAG R-218, 1972.

Gedney, L., L. Shapiro, J. D. VanWormer and F. Weber, Correlation of epicenters with mapped faults, east-central Alaska, 1968-1971, U.S. Geological Survey, Open-File Report, 1972.

REPORTS (Cont'd):

Anderson, J. H., L. H. Shapiro and A. E. Belon, Vegetative and géologic mapping of the western Seward Peninsula, Alaska, based on ERTS-1 imagery: Proc. of Symposium on Significant Results Obtained from ERTS-1, NASA/GSFC, March 5-9, 1973.

Stringer, W. J., L. H. Shapiro and J. H. Anderson, Application of satellite remote sensing data to land selection and management activities of Doyon, Ltd. of Interior Alaska, Final Rept., Bureau of Indian Affairs Contract No. E00C14201079, 129 pp., May 1975.

Rogers, J. C., W. D. Harrison, L. H. Shapiro, T. E. Osterkamp, L. D. Gedney and J. D. VanWormer, Nearshore permafrost studies in the vicinity of Point Barrow, Alaska, University of Alaska, Geophysical Institute Report UGA R-237, 71 pp., May 1975.

Shapiro, L. H. and J. J. Burns, Major late-winter features of ice in northern Bering and Chukchi Seas as determined from satellite imagery, University of Alaska, Geophysical Institute Report UAG R-236, 16 pp., June 1975.

Shapiro, L. H., A preliminary study of the formation of landfast ice at Barrow, Alaska, winter 1973-74, University of Alaska, Geophysical Institute Report UAG R-235, 44 pp., June 1975.

Gedney, L. and L. H. Shapiro, Structural lineaments, seismicity and geology of the Talkeetna Mountains area, Alaska, Final Report for U. S. Army Corps of Engineers, Alaska District, 18 pp., 1975.

Papers

Gnirk, P. F. and L. H. Shapiro, On the viscoelastic behavior of porous media for particular cases of body symmetry, I-isotropic solids: 10th Symposium on Rock Mechanics, University of Texas, May 1968.

VanWormer, D., L. Gedney, J. Davies and L. H. Shapiro, Central Alaska Seismicity, 1972; Seism. Soc. Am. Ann. Mtg., May 16-19, 1973, Golden, Colorado.

Gedney, L., J. D. VanWormer and L. H. Shapiro, Tectonic lineaments and plate tectonics in southcentral Alaska: First International Symposium on the New Basement Tectonics, Salt Lake City, Utah, June 1974.

Shapiro, L. H. and J. J. Burns, Major late-winter features of ice in northern Bering and Chukchi Seas, as determined from satellite imagery: EOS Trans. Am. Geophys. Un., 56, 1139, 1974.

Stringer, W. J., L. H. Shapiro, J. H. Anderson and J. Haines, Earth Resources Technology satellite data applied to Alaska native lands settlement, 27th Ann. Alaska Div. AAAS Conf., Anchorage, Alaska, October 19, 1974.

Stringer, W. J., J. Miller, A. E. Belon, L. H. Shapiro and J. H. Anderson, Application of satellite remote sensing data to land selection and management, NASA, Earth Resources Survey Symposium, Houston, Texas, June 8-13, 1975.

PUBLICATIONS:

R. D. Nelson and J. Frisch, "Anisotropic Friction between Aluminum Single Crystals in Ultrahigh Vacuum", Engineering Report No. MD-68-1, University of California, Berkeley, May, 1968.

J. Frisch, R. D. Nelson, and P. Pfaelzer, "Friction in Ultrahigh Vacuum", Engineering Report No. MD-65-8, University of California, Berkeley, 1965.

R. D. Nelson, M. Tauriainen and J. Borghorst, "Techniques for Measuring Stress in Sea Ice", Final Report to Alaska Sea Grant Program, in process of publication by IAEE and Sea Grant, March 1973.

R. D. Nelson, "Measurements of tide and temperature generated stresses in shorefast area ice", presented to A.I.N.A. Conference on Beaufort Sea, January 7-10, 1974, San Francisco, California.

J. C. Rogers, W. M. Sackinger and R. D. Nelson, "Arctic Coastal Sea Ice Dynamics", to be presented at 1974 Off-Shore Technology Conference, May, 1974, Houston, Texas.

CD-45 (-76)

U. S. DEPARTMENT OF COMMERCE

SUPPLY, EQUIPMENT OR SERVICE ORDER

FOR: NOAA/ERL/OCSEAP

2. CHECK APPROPRIATE BLOCK

☐ PROCUREMENT ☒ OTHER *(Specify)*

Contract Modification

THE NUMBER SHOWN IN BLOCK 5 MUST APPEAR ON ALL SHIPMENTS AND/OR DOCUMENTS RELATING TO THIS ORDER

REQUISITIONER DOCUMENT NO.	4. BUREAU CONTROL NO.	5. PURCHASE ORDER NO.
RK-8-0084		

ISSUED TO:

Geophysical Institute
University of Alaska
Fairbanks, AK 99701

7. DESTINATION — SHIP TO

OCS Program Office
NOAA/ERL, Rx4
Boulder, CO 80302

ACCOUNTING CODE	9. QUOTATION REF. OR CONTRACT NO.	10. DISCOUNT TERMS
RK0000 R7120815	03-5-022-55	

DELIVERY	12. GOVT. B/L NO.	13. DELIVERY DATE

FUNDS AVAILABLE *(Budget Office)*

14a. STATION

ITEM NUMBER — DO NOT USE	17. DESCRIPTION	18. QUANTITY	19. UNIT	20. ESTIMATED TOTAL COST	21. ACTUAL UNIT PRICE	ACTUAL TOTAL COST
	Additional funds for contract 03-5-022-55, T. O. #6, RU#265 for "Historical References to Severe Winter-Spring Ice Conditions along the Beaufort Sea Coast of Alaska" attached.					
	Total funded to date: $320,278					
	AMOUNT OF THIS ACTION: $ 6,000			6,000		
	Total funded to date: $326,278					

APPROVED:

Director, ERL

SIGNATURE OF REQUISITIONER	DATE	23. SIGNATURE APPROVING OFFICER	DATE
TITLE		TITLE Director, OCSEAP	5-9-78

ACCOUNTABLE PROPERTY ☐	INITIALS	25. NOT AVAILABLE-BUREAU STOCK/EXCESS ☐	INITIALS	26. SIGNATURE-BUREAU CONTROL OFFICER	27. NOT AVAILABLE-DEPARTMENT STOCK/EXCESS ☐	INITIALS

APPROVAL	DATE	29. PURCHASING AGENT	DATE

RECEIPT ACTION - Quantities shown in Column 18 above have been received and accepted, except as follows: *(If additional space is needed, use reverse side.)*

SIGNATURE-RECEIVING OFFICER	DATE	32. PROPERTY CONTROL NO.	☐ TRADE-IN ☐ RECEIVING REPORT

INVOICES
DUPLICATE

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL RESEARCH LABORATORIES
Boulder, Colorado 80302

OCS Arctic Project Office
506 Elvey - Geophysical Inst.
University of Alaska
Fairbanks, AK. 99701

24 April 1978

MEMO

TO: Rudy Engelmann

FROM: Gunter Weller GW by DWS

SUBJECT: Historical ice information from the Eskimo community

We have been urged by everybody to make use of the information on historical ice conditions, residing with the older Eskimo community. Here is a chance to do so (see enclosure). If nothing else, it will serve a good political purpose, but useful information may well be forthcoming. We recommend that the requested $6k be added to RU 265 (Shapiro) as quickly as possible, in order to carry out the first phase of this undertaking.

GW/djb

enclosure

GEOPHYSICAL INSTITUTE
C. T. ELVEY BUILDING
UNIVERSITY OF ALASKA
FAIRBANKS, ALASKA 99701

April 21, 1978

Dr. Gunter Weller
Dr. David Norton
OCS - Arctic Project Office
506 Elvey Building
Geophysical Institute
University of Alaska
Fairbanks, Alaska 99701

Gentlemen:

The following constitutes a letter proposal for a project entitled "Historical References to Severe Winter-Spring Ice Conditions Along the Beaufort Sea Coast of Alaska". This study will supplement work done by Hunt and Naske (RU #261) whose information is generally restricted to the summer when the ice conditions provided access for ship transit of the area. The method of approach will be to gather the desired information through interviews with local residents who lived at various locations along the north coast in past years.

The existing data base regarding 'average' or 'normal' and extreme ice conditions along the northern coast of Alaska is based primarily on observations made within the last several years. This naturally followed from the interest in the area resulting from the discovery of oil at Prudhoe Bay and the subsequent recognition that similar deposits may occur in the adjacent continental shelf. Since that time, observations of ice conditions in the region have been intensified, and an understanding of the ice motions in the nearshore area has begun to emerge. In the near future, decisions will be made regarding the procedures for exploration and development of these offshore areas which will be based, in part, upon the available information regarding the potential for major ice motion in various area.

It may be true that the most severe conditions likely to be encountered during the exploration, development and production of oil from the continental shelf along the Beaufort Sea coast of Alaska have occurred during the years since the observations noted above were begun. However, there is no plan for determining whether this is the case until the data base, upon which such a conclusion might rest, is extended forward in time. Should winter and spring ice conditions during recent years prove to have been anamolously mild, or if severe storms involving large movements of the ice do occur during those times of year, then serious consequence could result from basing decisions on the current data base only.

However, the potential to extend the data base backward in time does exist. Within the past fifty years numerous people have resided along the north coast of Alaska throughout the year. These people were primarily engaged in hunting and trapping on the sea ice, and through these activities had both the opportunity and the incentive to carefully observe ice conditions in the area. It is therefore possible that these residents have observed events related to motion of the sea ice which are far more severe than those which have occurred witin the years since oil discovery. As an example, residents of the area tell of events in which winter movements of the ice sheared the tops of barrier island completely off, so that the islands in effect disappeared below sea level. If verified, this is an important observation in terms of setting operational standards involving the use of barrier islands. However, such events have not been observed during recent years, and it is possible that such decisions could be made without considering the possibility that the process noted above could occur.

The retrieval of this information can be accomplished only by interviews and discussions with those former residents of the area, and the work done under this proposal is to proceed in that manner in two stages.

The first stage is participation in the "Conference of Elders" to be held at Barrow starting (tentatively) on May 22, 1978, under the sponsorship of Inupiat University of the North. It is the intention of the conference to gather together several of the older residents of Barrow, Point Hope, Wainwright, and other villages, for discussions of the past history and customs of the Inupiat people, with the objective of preserving this knowledge for future generations. The absence of a written history dictates this approach, and the planned conference follows the model of a similar conference held earlier at Kotzebue. At our request, a session is being included regarding ice and weather, which will involve former north coast residents.

It is anticipated that this session will be chaired by a local resident designated by us, who will insure that those points of interest to us will be discussed. The proceedings are to be recorded and later translated and transcribed.

The cost of this phase of the project is $6,000 of which $4,000 is to be donated to the conference organizers to be used for translation and transcription of the proceedings. The remaining funds will be used to pay the session chairman, and for transportation and other expenses to be incurred during our attendance at the conference, and for rearrangement of the conference transcript into a suitable report.

The results of the conference should provide a useful introduction to the type of information which can be obtained in this manner, as well as providing the names of other individuals who were not in attendance, but have experience in the area of interest and should be interviewed at a later time.

The second stage of the project would involve conducting interviews with the individuals noted above, if the results of the conference indicate that useful information can indeed be obtained in this manner. A second proposal dealing with this stage will be submitted following evaluation of the results of the conference.

Sincerely,

Lew H Shapiro

Lewis H. Shapiro
Assistant Professor of Geology

LHS:plm

PROPOSAL TO

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

FOR

OPERATION OF AN ALASKAN FACILITY FOR APPLICATIONS OF REMOTE-SENSING DATA TO OCS STUDIES

OCSEAP RESEARCH UNIT NO.:	267
PRINCIPAL INVESTIGATOR:	Albert E. Belon
TOTAL COST OF PROPOSAL:	$100,000
PERIOD OF WORK:	October 1, 1977, to September 30, 1978
INSTITUTION AND DEPARTMENT:	University of Alaska Geophysical Institute Fairbanks, Alaska 99701

June 15, 1977

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C. TECHNICAL PROPOSAL

I. TITLE: Operation of an Alaskan Facility for Applications of Remote-Sensing Data to OCS Studies
RESEARCH UNIT NUMBER: OCSEAP R.U. 267
CONTRACT NUMBER: 03-5-022-55, Task Order No. 10
PROPOSED DATES OF CONTRACT: October 1, 1977, to September 30, 1978

II. PRINCIPAL INVESTIGATOR: Albert E. Belon
Professor of Physics
Geophysical Institute
University of Alaska

The Principal Investigator will spend 25% time, and will be involved in all phases of the project. He also will serve as remote-sensing advisor to OCSEAP.

III. COST OF PROPOSAL:

Total - $151,300
Distribution of effort by lease area -

Beaufort	- $50,000
Chukchi	- $30,000
Norton	- $ 5,000
Kodiak	- $ 5,000
LCI	- $ 5,000
Bristol	- $ 5,000

IV. BACKGROUND:

Remote sensing, by satellites and aircraft, of the vast and varied continental shelf of Alaska is an important, and in many cases the only, tool for environmental assessments. This project has collected, compiled, cataloged, and distributed all available remote-sensing data in the coastal areas of Alaska and has provided services and advice in analyzing and interpreting the imagery. From 30-50 OCSEAP projects have routinely and repeatedly used the services and facilities of this project, which will hopefully be continued for the duration of OCSEAP.

V. OBJECTIVES:

The principal objective of the project is to make remote-sensing data processing facilities and interpretation techniques available to OCSEAP investigators by:

1. the acquisition, cataloging and distribution of all available imagery.

2. the operation of a facility for photographic, optical and digital processing of remote-sensing data.

3. the development of photographic, optical and computer techniques for processing data.

4. the active interaction (including assistance in data search and processing) with all OCSEAP R.U.'s needing remote-sensing data and data analysis/interpretation assistance.

VI. GENERAL STRATEGY AND APPROACH:

Three basic approaches are followed in the performance of the project:

1. Search, acquisition, cataloging and dissemination (in Arctic Project Bulletins) of all relevant LANDSAT and NOAA satellite data, and aircraft remote-sensing data (USGS, NASA, NOAA, U.S. Army, etc.).

2. Development and adaptation of photographic, optical and computer methods for analyzing remote-sensing data, including contrast stretching, density slicing, color coding, and computer-aided physical and ecological classification of digital satellite data.

3. Applications of remote-sensing data to OCS studies in cooperation with other OCSEAP projects.

VII. SAMPLING METHODS:

Satellites - For mapping of sea-ice, sediments, and coastal ecosystems.

- LANDSAT multispectral imagery of coastal zone with less than 30% cloud cover.
  Coverage: 185 x 185 km; ground resolution: 80 m; frequency: every 18 days.
- NOAA visible and infrared imagery irrespective of cloud cover
  Coverage: 1000 x 1000 km; ground resolution: 1 km; frequency: daily

Aircraft - For detailed mapping and, in conjunction with satellite data, multistage sampling of sea-ice, sediment patterns, and coastal zone ecosytems.

- High altitude (65,000 ft) natural color and color-infrared aerial photography obtained by NASA - Mostly historical data.

- Medium altitude (30,000 ft) color and black and white aerial photography obtained by NASA - Historical data
- Low altitude (5,000 to 10,000 ft) color and black and white aerial photography, and all-weather side-looking radar (SLAR) imagery. Historical and current data obtained for OCSEAP by USGS, NOAA/NOS, U.S. Army, etc.

VIII. ANALYTICAL METHODS:

The available remote-sensing data from satellite and aircraft will be searched for their applicability to the OCS program with respect to spatial and temporal coverage, cloud cover, quality and usefulness for specific disciplinary objectives. Selected imagery will be ordered and a catalog will be published through the OCS Arctic Project Bulletins for dissemination to OCS investigators.

The analytical methods for processing and interpreting remote-sensing data will be developed for, and in cooperation with, the OCS users of remote-sensing data. Therefore, it is not possible at this time to state precisely and comprehensively what these methods will be; but on the basis of previous experience, they are expected to be:

- visual photo interpretation of enhanced remote-sensing images primarily to map sea-ice and sea-surface suspended sediment patterns
- optical processing and color-coding of multispectral or multidate data for studies of temporal variability
- analog density slicing (using a VP-8 image analyzer) to enhance and quantify offshore sediment patterns and sea-ice distributions
- computer analysis of imagery in digital format for digital density-slicing, spectral reflectance signatures of sea-ice and landform types, thematic classification of sea-ice and onshore ecosystems and landforms.

Reference:

Belon, A. E., J. M. Miller, and W. J. Stringer, Environmental assessment of resource development in the Alaskan coastal zone based on LANDSAT imagery, Proceedings of the NASA Earth Resources Survey Symposium, NASA/JSC, Vol. II-B, 242-260, 1975. Also, OCSEAP Arctic Project Bulletin, Nos. 6 and 7, 1975.

IX. ANTICIPATED PROBLEMS:

In general it is not anticipated that insurmountable problems will prevent the successful achievement of the project's objectives. In practice, the most significant problem for remote-sensing data acquisition projects, which are limited in space and time, will be the prevailing cloud-cover and availability of remote-sensing aircraft. In particular, close coordination will be required to insure the success of multistage sampling experiments which depend on the concurrent acquisition of ground-based (or sea-based) data, and cloud-free aircraft and satellite data. The recommended solution to this problem is to include a (weather-insensitive) side-looking radar (SLAR) as part of the aircraft remote-sensing instruments.

X. DELIVERABLE PRODUCTS:

Raw remote-sensing data will be acquired and archived by the project for the use of OCSEAP principal investigators. Therefore, delivery of these data to OCSEAP under the contract would be counterproductive. However, catalogs of available remote-sensing data will be prepared and delivered under the contract through the series of Arctic Project Bulletins. Interpreted data will be generated for, and in cooperation with, other OCSEAP projects. Therefore, they will be reported and delivered by the user projects.

With these qualifications, the deliverable products of the project are expected to be:

A. Digital data
   1) Selected tapes of LANDSAT and NOAA satellite images
   2) Analyzed tapes of sea-ice reflectance profiles and of thematic classification of sea-ice and coastal ecosystems

B. Narrative reports
   1) Catalogs of available satellite and aircraft remote-sensing data of the Alaskan coastal zone, to be distributed through the series of Arctic Project Bulletins
   2) Narrative description of project activities, facilities and analysis/interpretation techniques, to be distributed through project reports and, when appropriate, through the series of Arctic Project Bulletins

C. Visual data
   1) Satellite (LANDSAT and NOAA) imagery, including custom mosaics of imagery
   2) Aircraft (photographic and side-looking radar) imagery

D. Other non-digital data
   None

E. Data submission schedule
   All remote-sensing data will be retained by the project for the use of OCSEAP investigators. Catalogs of available data will be published and distributed quarterly in the series of Arctic Project Bulletins

XI. INFORMATION REQUIRED FROM OTHER INVESTIGATORS:

The principal objective of the project is to make remote-sensing data, processing facilities and interpretation techniques available to the OCS investigators so that the promising applications and cost-effectiveness of remote-sensing techniques can be incorporated in their disciplinary investigations. Therefore, in principle, the project will supply data and interpretation assistance to the other investigators and will only require a request or statement of need from the other investigators. In practice, particularly for cooperative projects, the project will need field data to correlate with remote-sensing data as part of the multistage sampling technique. We anticipate no problems in obtaining these field data because the investigation will be performed at the request of, and in cooperation with, the user project which obtained the field data.

XII. QUALITY ASSURANCE PLANS:

Satellite-acquired remote-sensing data include a density step tablet which calibrates the densities on the film with reflectance of the ground or sea, as well as providing a system (relative) calibration. Absolute calibration in terms of environmental parameters (e.g., sediment load in offshore waters) requires concurrent field measurements.

Aircraft-acquired remote-sensing data, particularly aerial photography, seldom include accurate calibrations. For these data, calibration will be obtained, when necessary, by cross-calibrations with concurrent satellite and/or field data.

XIII. SPECIAL SAMPLE AND VOUCHER SPECIMEN ARCHIVAL PLANS:

The original remote-sensing data from satellites and NASA aircraft are already archived and entered in the public domain (USGS/EROS and NOAA/NESS) when copies are obtained by the project.

Remote-sensing data acquired by aircraft programs under contract with OCSEAP are stored under appropriate controlled conditions in the library archives of the Geophysical Institute.

Catalogs of all acquired data are published in the series of Arctic Project Bulletins.

XIV. LOGISTICS REQUIREMENTS:

None anticipated

XV. MANAGEMENT PLAN:

The activities of the project will be managed in three main groupings. With reference to the activity/milestone chart on the next page, these are:

A. Continuous Support Activities - (1, 2, 5, and 6). These cover the most important support functions of the project. They involve direct daily interaction of the project's personnel with OCS investigators. The usual point of contact will be the remote-sensing data librarian and secretary who will answer requests for data and refer requests for data processing assistance to the principal investigator and remote-sensing specialist, photographer, computer programmer, or instrument technician, as appropriate.

B) Research and Coordination Activities - (3 and 4). These activities cover the coordination of the aircraft data acquisition program and the development of remote-sensing data processing and interpretation techniques, often in anticipation of the needs of the OCS investigators, rather than their stated short-term needs. These activities will be handled by the principal investigator of the project with the assistance of the remote-sensing specialist and other support personnel.

C) Reporting Activities - (7, 8, and 9). These activities cover the publication of remote-sensing data catalogs, reduced and interpreted data, progress reports, and articles. These activities will be performed by the principal investigator with the assistance of the data librarian and secretary.

Financial management of the project will be handled by the Geophysical Institute Business Manager and the principal investigator.

XVI. OUTLOOK:

On the basis of the experience of the last two years, it is expected that there will be a continuing need for the contributions of the project for the duration of OCSEAP. The number of OCS users of the project's services has gradually increased from 10-15 initially to currently 30-50. As investigators phase their activities from field data collection to data analysis and synthesis, the synoptic characteristics and value of remote-sensing data will increasingly become essential ingredients of the final environmental assessment.

It is expected that the scope and level of effort of the project will be maintained over the duration of OCSEAP; however, the cost will increase each year in relation to inflation in the cost of labor and materials. In particular, the cost of LANDSAT data has nearly tripled during the past year, and although we are keeping the requested budget level by being much more selective in the purchase of remote-sensing data from USGS/EROS, further cutbacks in the acquisition of data would be deleterious to the program.

XVII. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist. If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR two working days prior to release.

10. The following acknowledgment of sponsorship will be used:

> "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

MILESTONE CHART

RU #: 267 PI: Albert E. Belon, University of Alaska

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1. Search for, select, and acquire available satellite and aircraft remote-sensing data	Δ	←			continuous						→	Δ			
2. Maintain and operate remote-sensing data processing equipment and facilities	Δ	←			continuous						→	Δ			
3. Develop data processing and interpretation techniques	Δ	←			continuous						→	Δ			
4. Provide assistance to OCS investigators in remote-sensing data acquisition, processing, & interpretation	Δ	←			continuous						→	Δ			
5. Serve as remote-sensing advisor to OCSEAP	Δ	←			continuous						→	Δ			
6. Coordinate aircraft remote-sensing data acquisition	Δ	←			continuous						→	Δ			
7. Publish catalogs of remote-sensing data through OCSEAP Arctic Project Bulletins		Δ			Δ			Δ			Δ				
8. Submit quarterly report to OCSEAP	Δ			Δ			Δ			Δ			Δ		
9. Submit annual report to OCSEAP							Δ								

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PROPOSAL TO

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

AND

BEAUFORT AND CHUKCHI SEACOAST PERMAFROST STUDIES

OCSEAP RESEARCH UNIT NO.: 271

PRINCIPAL INVESTIGATOR: James D. Rogers

CO-PRINCIPAL INVESTIGATOR: John Morack

TOTAL COST OF PROPOSAL: $39,997

PERIOD OF WORK: October 1, 1977 to September 30, 1978

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C. TECHNICAL PROPOSAL

I. A. Title: Beaufort and Chukchi Seacoast Permafrost Studies

B. Research Unit Number: 271

C. Contract Number: 03-5-022-55, Task 3

D. Proposed Dates of Contract: October 1, 1977 - September 30, 1978

II. Principal Investigator(s)

A. James C. Rogers

B. John Morack

III. Cost of Proposal Federal Fiscal year 1978

Total: $39,997

Distribution of effort by lease area

1. Aleutians
2. Beaufort Sea - 50%
3. Bristol Bay
4. Chukchi Sea - 50%
5. Kodiak
6. Lower Cook Inlet
7. NEGOA
8. Norton Sound
9. St. George Basin
10. Non-lease-area laboratory or management

IV. Background:

A. Beaufort Sea

Subsea permafrost represents a hazard to offshore operation both from a human safety standpoint and from an environmental standpoint. In order to increase the small amount of information available about offshore permafrost, a continuing research effort has been conducted by this research unit and others including Hopkins (RU 204/473), Sellman (RU 105), and Osterkamp and Harrison (RU 255/256).

No single type of data is sufficient to determine the origin, state, distribution and dynamics of subsea permafrost. Thus, although bottom temperatures are considerably below 0° C in many places the sea bottom is not ice bonded. Hence, temperature data alone will not indicate the presence or absence of ice bonded materials. In most cases, temperature and salinity of interstitial fluids are needed to determine the state of the sub-bottom materials. These data are gathered only by drilling and represent local information only. Seismic refraction methods and reflection methods have been successfully used by this research unit to map the upper surface of the permafrost along a drill line produced by other research units and extending some 14 kilometers offshore at Prudhoe Bay. Several important conclusions regarding the nature of subsea permafrost have come from these coupled efforts. Among these is the necessity to distinguish between ice bearing materials and ice bonded materials. In some cases, notably on some of the offshore islands, drilling information indicates ice in drill cuttings but seismic velocities are low, thus indicating the materials are not ice bonded. This is an important distinction from the standpoint of the mechanical properties of the soils.

Other important features that have been discovered are the high degree of roughness of the upper permafrost surface and the presence of a possible window in the permafrost beneath Prudhoe Bay.

The work proposed here will extend the previous research effort to include a larger area around Prudhoe Bay. It will include the offshore islands nearby and the effects of the Sag River on the permafrost surface. Also, of interest is an extension of the work begun in Prudhoe Bay itself which has indicated a "thaw window" beneath the bay. Ultimately broad regional coverage of sub-sea permafrost distribution will be required and this will be dealt with by other research units using available industry data. The purpose of the seismic work proposed herein is close support of and complimentary to site specific studies so results of these studies can be synthesized into a broader understanding of the offshore permafrost hazard.

B. Chuckchi Sea

Preliminary investigation by Harrison and Osterkamp (RU 255/256) and Hopkins (RU 473) in the Chuckchi Sea have concluded that ice bearing permafrost is probably widespread in near shore areas. Their studies, which were focused on the Hope Basin lease area, represent some of the first information on sub-sea permafrost in the Chuckchi Sea. It is necessary to investigate the near shore areas to determine whether ice bonded materials are present, how far they extend offshore, and the depths of the overlying non-frozen sediments. Seismic refraction investigations in areas of rapid shoreline retreat and at locations where Harrison and Osterkamp found evidence of ice bonded materials are required. In the following sections a study to meet this need is described.

V. Objectives:

A. Beaufort Sea

1. To investigate the distribution of subsea permafrost at Prudhoe Bay through seismic investigation.
2. To investigate the distribution of permafrost beneath the barrier islands near Prudhoe Bay.
3. To map the apparent thaw window under Prudhoe Bay.
4. To relate the seismic data to drilling probing data gathered by others in order to synthesize a permafrost distribution picture in the Beaufort Sea.

B. Chuckchi Sea

1. To investigate the distribution of subsea permafrost along the shore of the Chuckchi Sea through seismic investigations.
2. To relate the seismic data to probing and shoreline history information gathered by others (RU 255, 256, 473) in a beginning attempt to synthesize a permafrost distribution picture for the Chuckchi Sea.

The relevance of the proposed work and objectives to an environmental assessment of the Alaskan Continental Shelf has been stated clearly in OCS Bulletin #15, Beaufort Sea Synthesis Report, Report of Group 4 and Earth Science Studies. Some potential problems related to the offshore permafrost hazard are: thaw subsidence of buried hot oil pipelines and well bores, frost heaving of bottom founded structures and cold gaslines, and variable engineering properties associated with salt brine laden materials. A primary concern to our studies is to provide adequate knowledge about subsea permafrost to enable proper design of oil exploration and development facilities.

VI. General Strategy and Approach:

Marine seismic refraction and reflection equipment will be used during the summer season to investigate subsea permafrost. In the Chuckchi Sea it will be necessary to use a shallow draft boat in the near shore region. A boat is described in a later section (XIV, E) that will provide a highly flexible platform for the required offshore permafrost investigation discussed in section V above. Also, the boat will provide transport and operating capability for summer probing work by RU 255 and 256. After fitting, the boat will be barged to Kotzebue on an early summer barge for the field season in the Chuckchi Sea. Three weeks of field work are anticipated in the last part of June and the first part of July. After completion of this work, the boat will be taken to Prudhoe Bay by a later barge for work during the last half of August and the first half of September. The shallow draft and complete dedication of the boat to the project can be expected to significantly increase the volume and quality of data gathered. Near shore work along the barrier islands will be possible as well as transport of probing equipment and land seismographs along the islands. It will thus be possible to add to the meager knowledge available regarding island permafrost. Also, the shallow northern shoal area of Prudhoe Bay can be examined to further determine the nature of the permafrost window beneath the bay.

The seismic source will be airguns and an analog recording system will be used as in past field seasons.

VII. Sampling Methods:

The sampling method will envolve periodic shots of the airguns while pulling a hydrophone streamer behind the boat. Lines will be reversed where necessary to determine surface slopes and some lines will be run on land to provide a velocity data base for interpretation of marine seismic velocities.

VIII. Analytical Methods

Standard seismic refraction and reflection data reduction methods will be used. Examples can be found in past annual and quarterly reports of this research unit.

IX. Anticipated Problems:

In past field seasons available boat time has been inadequate to obtain needed data coverage. The solution to this problem is addressed in section XIV below.

X. Deliverable Products

A. Digital Data - In keeping with memos dated August 24 and August 30, 1976 from F.M. Cava, Assistant Data Manager, NOAA/OCSEAP, Juneau Project Office, no digital data are required on magnetic tape. The quarterly reports and annual reports serve the data requirement.

B. Narrative Reports - N/A

C. Visual Data - N/A

D. Other Non-Digital Data - N/A

E. Data Submission Schedule

Data Collection Period: June, July, August 1978

Data will be submitted by quarters in quarterly reports.

XI. Information Required from other Investigators:

Location and information concerning the drill holes of Osterkamp and Harrison (RU 255, 256) will be needed. Continuing contacts are established to acquire this information. Also, shoreline history information will be required from Hopkins (RU 473).

XII. Quality Assurance Plans

The electronics will be tested and calibrated in the laboratory before actual field work. Onshore measurements of acoustic velocities in permafrost will be performed at all sites for instrument calibration. Additional testing will be performed at existing drill hole sites which have indicated ice bonded materials.

XIII. Special Sample and Voucher Specimen Plans - N/A

XIV. Logistics Requirements. (See attached form)

The following logistics support to be provided by OCSEAP will be required:

Kotzebue Area

Time Frame: Last two weeks in June through first week in July.

a) 42 man days at Kotzebue.

b) 21 days shallow draft boat.

Prudhoe Bay Area

Time Frame: Last two weeks in August through first week in September.

a) 42 man days at Prudhoe Bay.

b) 3 hours Bell 206 Helicopter from Deadhorse.

c) 21 days shallow draft boat.

A plan for providing the shallow draft boat needed for the field work is presented in the attachment Logistics Requirements, Part E, Special Logistic Problems.

GI 77-95

For OCSEAP use only.
RU #271
Discipline
Area of Operation: Kotzebue
and Prudhoe Bay

LOGISTICS REQUIREMENTS

INSTITUTION: Geophysical Institute   PRINCIPAL INVESTIGATOR: J.C. Rogers & J.L. Morack

A. Ship Support - N/A

B. Aircraft Support - Fixed Wing - N/A

C. Aircraft Support - Helicopter

Three hours, Bell 206 Helicopter will be used to carry two personnel and equipment from Deadhorse to offshore islands.

Time Frame: Last two weeks in August.

D. Quarters and Subsistence Support

I. a) Kotzebue

b) Last two weeks in June through first week in July

c) Two persons X 21 days = 42 man days

II. a) Prudhoe Bay

b) Last two weeks in August through first week in September

c) Two persons X 21 days = 42 man days

E. Special Logistics Problems

During 1975 and 1976 the USGS has provided approximately one week of ship time each year aboard the "Karluk", during which data near Point Barrow and Prudhoe Bay were collected. Again during the 1977 field season approximately one week of time will be available aboard the "Karluk" in the Prudhoe Bay area.

In the past this has been less than satisfactory for a variety of reasons. First, the total vessel time has been limited to about one week which provides only three or four days for data gathering after the time necessary for equipment shakedown and weather delays are considered. Second, the time alloted has been chosen such that it doesn't interfere with other research projects on board. This has led to situations where the available time was far from optimum for our case.

The sea ice has interferred with the schedule both years and prevented us from getting out of Prudhoe Bay during the 1976 season.

In order to meet the objectives of the subsea permafrost project it is necessary to develop independent logistical support that is more flexible. Furthermore, a major part of the work for 1978 will be in the Chuckchi Sea where the "Karluk" will not be available. Thus, at this time it is deemed necessary to buy or lease a skiff that would facilitate near shore activities, be easily transportable between work sites, and be available during the most advantageous work times in June, July, and August.

The capabilities that such a skiff should have for our work are:

a) Range of 50 miles necessary to travel to work sites and avoid inclement weather.

b) Load capacity of 2000 lbs. including two crew, 600 lb. cable, 500 lbs. of batteries and electronics and 200 lbs. of high pressure gas cylinders.

c) Electrical capability of approximately 25 amps at 12 volts to provide power for electronics.

d) Working room on board of approximately 70 $ft.^2$ (5 ft. X 14 ft.) necessary to store 450 m cable, electronic equipment, and gas cylinders.

e) Outrigger system capable of supporting airguns and cables approximately 10 ft. off each side of the skiff.

f) Minimal navigational and depth sounding capability necessary to locate and document work sites, should include a recording depth sounder and compass.

The following is an estimate of how the above requirements could be met.

Skiff - 21 ft. Boston Whaler with bulkhead and full canvas (Jacobson Marine, Seattle) and two 55 hp. outboard engines with large alternators.	$11,700
Boom System	1,500
Compass	100

Recording Fathometer	300
Communications Gear	300

These items have not been included in the proposed budget and will be provided by the OCS logistics branch.

XV. Management Plan:

Reduction of the 1977 field data will begin in November and be completed in time to be included in the annual report on April 1, 1978. Planning for the 1978 field season in Kotzebue and Prudhoe will begin in April. Offshore data will be collected in the Kotzebue area during the last two weeks in June and the first week in July. Island and offshore data will be collected in the Prudhoe Bay area from the third week in August through the first week in September. Preliminary data reduction will take place during September and October. (See attached Milestone Chart.)

XVI. Outlook

The work proposed for FY 78 includes the first near shore seismic refraction efforts in the Chuckchi Sea. This work will be in close support of the previous efforts by RU 255, 256 and 473 in an effort to extend their drilling information and knowledge of shoreline history. As such, the first work will be somewhat localized. It will be necessary to extend the coverage north along the Chuckchi coastline in the following research period to provide a broader picture of near shore permafrost in the Chuckchi. Additional cooperation with Harrison and Osterkamp (RU 255, 256) in linking temperature salinity measurements along the coast with seismic refraction measurements is anticipated. The final results should be a knowledge of the general nature and distribution of near shore permafrost along the shore of the Chuckchi Sea. Cooperative arrangements for summer field logistics including transport with the small boat proposed for FY 78 is anticipated between this research unit and RU 255, 256.

Beaufort Sea work proposed for FY 78 includes some work on the barrier islands near Prudhoe Bay and in the adjacent shallow waters. A cooperative effort with RU 255 and 256 to examine the temperature salinity and permafrost profile on selected islands in the Beaufort Sea is anticipated for FY 79 and FY 80. The results should provide a knowledge of the barrier islands effects on subsea permafrost. Also, work in the lagoons is anticipated. In particular, Elson lagoon has been probed by RU 255 and 256 and temperature and salinity measurements obtained. The RU 255 and 256 data, coupled with a knowledge of shoreline history and seismic data should further complete the understanding of permafrost beneath the lagoonal systems along the Beaufort Sea.

Logistics requirements for the Beaufort Sea work are tied closely with the boat proposed for FY 78. Only with a dedicated boat will it be possible to spend enough time gathering data to meet the goals described above.

It is anticipated that with the increased data gathering capability, more investigator time will be required for data analysis and interpretation. Thus, the Beaufort/Chuckchi proposal cost will be $50,000 for FY 79 and $60,000 for FY 80.

XVII. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist. If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR two working days prior to release.

10. The following acknowledgment of sponsorship will be used:

> "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

MILESTONE CHART

RU #: 271 PI: J.C. Rogers and J.L. Morack

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Data reduction of 1977 field work		X	X	X	X	X									
Planning for 1978 Field Season							X	X	X						
Field Work in Prudhoe Bay Area											X	X			
Field Work in Kotzebue Area									X	X					
Preliminary Reduction of 1978 Data												X	X		
Writing of Quarterly Reports			X				X		X			X			
Writing of Annual Report							X								

PUBLICATIONS:

Published Articles

Morack, J. L. and C. E. Fairchild, Measured lifetimes for the first excited J=1 ($^3P_1$) states in Argon and Krypton, Bull. of the Amer. Physical Society, 12, 890, 1967.

Morack, J. L. and C. E. Fairchild, Measured lifetime of the ($3p^5 4s$) $^3P_1$ state of Argon, Physical Review, 163, 125, 1967.

Morack, J. L. and C. E. Fairchild, Method for time sampling the anode current of magnetic electron multipliers, Rev. of Scient. Instr., 40, 1, 184-185, 1969.

Roberts, T. and J. L. Morack, Acoustical doppler shift experiment on linear air track, Engineering Education, 46-47, Sept.-Oct. 1971.

Morack, J. L. and T. D. Roberts, Sound Wave propagation in a moving medium and the Michelson-Morley experiment, American Journal of Physics, 39, 1203-1205, 1971.

Gray, D., J. L. Morack and T. D. Roberts, Radiative lifetime of the $A^2\pi_\mu$ (ν=2) level of N_2^+, Physics Letters, 37A, 25-26, 1971.

Gray, D., J. L. Morack and T. D. Roberts, Radiative lifetime of the $B^2\Sigma_\mu^+$ State of N_2, Bull. of the American Physical Society, 16, II, 848, 1971.

Gray, D. D., T. D. Roberts and J. L. Morack, Measured lifetimes of some $A^2\pi_\mu$ vibrational levels of N_2^+ molecules, J. of Chem. Physics, 57, 4190-4193, 1972.

Morack, John L., Section B, Experiment 3, Novel Experiments in Physics II, American Association of Physics Teachers Press, p. 81-84.

Morack, John L., Section B, Experiment 4, Novel Experiments in Physics II, American Association of Physics Teachers Press, p. 85-88.

Rogers, J. C. and J. L. Morack, Investigation of Offshore Permafrost, Prudhoe Bay, Alaska, Submitted for publication in Proceedings of Third International Conference on Permafrost.

Reports

Rogers, J. C. and J. L. Morack, Beaufort Seacoast Permafrost Studies, Contract #03-5-022-55, Research Unit #271, Annual Report, April 1, 1977, 44 pages.

Rogers, J. C. and J. L. Morack, Beaufort Seacoast Permafrost Studies, Contract #03-5-022-55, Research Unit #271, Quarterly Report, June 30, 1977, 3 pages.

PAPERS:

Papers

Morack, J. L. and C. E. Fairchild, Lifetime measurements in the noble gases, Proceeding of the First Beam Foil Spectroscopy Conference, 175, 1967.

PUBLICATIONS:

Gage, B., D. Reynolds and J. Rogers, Artificial excitation of schumann resonances in the earth-ionosphere cavity, J. Geophys. Res., 73(13), 4416-4420, 1968.

Peden, I. C. and J. C. Rogers, An experiment for determining the VLF permittivity of deep Antarctic ice, IEEE Trans. Geoscience Elect., GE-9(13), 224-233, 1971.

Rogers, J. C. and I. C. Peden, Effect of Byrd drill hole diameter variations on in situ electrical measurement of the ice sheet, Antarctic J. of the U.S., 165-166, September-October 1972.

Rogers, J. C. and E. R. LaChapelle, Measurement of vertical strain in drill holes, J. of Glaciology, 13(13), 1974.

Rogers, J. C. and I. C. Peden, The electrically short sheathed dipole: Experimental relationship between its measured admittance and permittivity of the external medium, IEEE Transaction on Antennas and Propagation, AP-21(6), Nov. 1973, 857-862.

Rogers, J. C. and I. C. Peden, VLF electrical properties of the ice sheet measured at Byrd Station, Antarctic Journal of the U. S., September-October 1973.

Sackinger, W. M., and J. C. Rogers, "Dynamics of Break up in Shorefast Ice" Proceedings of the Beaufort Sea symposium on coastal and shelf research, June 1974.

Rogers, J. C., W. M. Sackinger and R. D. Nelson, Arctic coastal sea ice dynamics, preprint Volume I, Off-Shore Technology Conference, May 1974.

Rogers, J. C. and I. C. Peden, The VLF complex permittivity of deep Antarctic ice measured in situ, Radio Science, 10(8), 763-771, 1975.

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Papers

Rogers, J. C. and I. C. Peden, The electrically short sheathed dipole: experimental relationship between measured admittance and permittivity of the external medium, 1972 G-AP International Symposium, 72 CHO 704-7AP, Williamsburg, Virginia.

Rogers, J. C. and E. R. LaChapelle, A new technique for measurement of vertical strain in glacier drill holes, U.S.-Japanese Glaciological Scientist Exchange, Sapporo, Japan.

Rogers, J. C. and I. C. Peden, VLF electrical properties of the ice sheet measured in-situ at Byrd Station, 1973 G-AP International Symposium Boulder, Colorado, 73CHO 764-1 AP.

Sackinger, W. M. and J. C. Rogers, Dynamics of breakup in shorefast ice, Arctic Institute of North America Beaufort Sea Symposium on Coastal and Shelf Research, January 7-9, 1974, San Francisco, California.

Rogers, J. C., W. M. Sackinger, and R. D. Nelson, Arctic Coastal Sea Ice dynamics, Off-Shore Technology Conference, May 1974. Houston, Texas.

Rogers, J. C., L. H. Shapiro, L. D. Gedney and D. VanWormer, Near shore permafrost in the vicinity of Pt. Barrow, Alaska, Third International Conference on Port and Ocean Engineering under Arctic Conditions, Fairbanks, August 11-15, 1975.

Rogers, J. C., Nearshore permafrost in Prudhoe Bay, Alaska, Symposium on "Permafrost Geophysics - Onshore and Offshore," Vancouver, B. C., October 1976.

Rogers, J. C. and W. M. Sackinger, 31st Annual Petroleum Mechanical Engineers Conference, Mexico City, September 1976.

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Rogers, J. C., W. D. Harrison, L. H. Shapiro, T. E. Osterkamp, L. D. Gedney, J. D. VanWormer, Near shore permafrost studies in the vicinity of Point Barrow, Alaska, University of Alaska, Geophysical Institute Report UAG R-237, Sea Grant Report 75-6, May 1975.

April 1976

RESEARCH PROPOSAL

to

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Outer Continental Shelf Environmental Assessment Program
Boulder, Colorado 80302

HYDROCARBONS: NATURAL DISTRIBUTION AND DYNAMICS ON THE ALASKAN OUTER CONTINENTAL SHELF

Research Unit 275

Total Costs $229,973

INSTITUTE OF MARINE SCIENCE
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November, 1977

I. Title and Task Statement Number

Hydrocarbons: Natural Distribution and Dynamics on the Alaskan Outer Continental Shelf. Task Statement No. 275.

II. Principal Investigator

Dr. D. G. Shaw

III. Cost of Proposal

C. Total $229,973

IV. Background

Hydrocarbon measurements have been a part of the Alaskan OCS studies since the program's beginning in 1975. These measurements provide the causal link between environmental changes which may appear in the future (such as the decline of some biological population) and a suspected cause (such as petroleum released in the course of OCS oil development). Thus, information about hydrocarbons has had and will continue to have a pivotal role in OCSEAP.

The initial task of this work was to document the ambient concentrations of hydrocarbons in the Alaskan OCS areas under consideration for oil development. This was necessary because of the almost total lack of prior measurements. In the first two and a half years of the program that task has been accomplished, not in minute detail, but with sufficient breadth to provide an overall characterization of the environment. Now two new tasks which follow logically from the first are being addressed. One is to characterize in greater detail the ambient hydrocarbon concentrations in some important environmental components. The other is to characterize processes affecting the transport and degradation of petroleum in the Alaskan OCS environment in order to improve the ability to predict the fate of added oil. Processes have been chosen for investigation which are qualitatively or quantitatively unique to the Alaskan OCS and thus for which data collected elsewhere will not be directly applicable.

V. Objectives

A. Beaufort:

To carry out detailed hydrocarbon measurements in conjunction with the Beaufort Sea Barrier Island Ecological Process Study. These measurements are particularly important since OCSEAP work to date has not provided any analyses of Beaufort Sea biota for hydrocarbons. Hydrocarbon data for biota which can be integrated with other background information would be most useful.

B. Lower Cook Inlet:

To examine hydrocarbons in three environments within Cook Inlet -- Kachemak Bay, an area of critical importance to fisheries which is bathed by water entering the Inlet from the Gulf; the areas of ongoing commercial oil production in the Upper Inlet; and Kamishak Bay, an area with natural oil seeps which is bathed by water exiting the Inlet. Cook Inlet is the ideal location for a comparative study of effects of offshore oil production and of behavior of hydrocarbons in the pelagic and benthic environments. We will begin such studies under controlled conditions.

VI. General Strategy and Approach

A. Beaufort:

Sample collection will focus on the nearshore area and be carried out in conjunction with other OCSEAP operations. Biota will be obtained in cooperation with the Ecological Process Study group.

B. Cook Inlet:

Field work will be carried out on three cruises to Cook Inlet. In November 1977, samples will be collected of biological materials identified by Dr. H. Feder (RU 005) as important members of the benthic detritus food chain. Materials will be frozen and returned to Fairbanks for analysis. In addition, live specimens will be taken to Seward for preliminary experiments in aquaria. In May 1978 additional biological materials will be obtained for hydrocarbon analysis and experimental study. In addition, two time series water column stations will be occupied, one in outer Kachemak Bay, the other in Trading Bay. At each of these stations samples will be collected at each high slack water (approximately each 12 hours) for 48 hours (four sample times). At each sample time a vertical zooplankton haul will be made and water and suspended matter will be collected from near surface and near bottom for heavy hydrocarbon analysis. We will attempt to obtain suspended matter by filtration and use the filtered water for hydrocarbon analysis. However, the high suspended sediment load of Cook Inlet may make this approach unworkable. We will be prepared to use alternate sampling procedures. On a third cruise in August 1978 biota, water, and suspended matter will be collected as described for May with modifications that may prove appropriate.

Live organisms taken to Seward will be used in a sequence of experiments designed to correlate the degree of hydrocarbon transfer through a marine food chain as a function of overall carbon and energy flux. These experiments will be carried out in collaboration with Drs. H. Feder (RU 005) and D. Burrell (RU 162). The first objective of this work will be to establish that all organisms can be maintained in culture. The second objective will be to determine the efficiency with which deposit feeders take up hydrocarbons from the substratum. In the following year we will carry out transfer experiments in which low members of the experimental food web, which have been previously allowed to accumulate oil, are introduced to the other members of the web in a large (44,000 ℓ) aquarium. We will then make relaxation kinetic measurements as the oil moves through the food web.

As resources permit we will continue to study the transfer of hydrocarbons from the pelogic to benthic environment via sorption to suspended sediments and incorporation into plankton feces.

VII. Sampling Methods

Sampling procedures have been described in detail in our annual reports to OCSEAP. A study of laboratory and environmental variability of samples is currently in progress in our laboratory. Results of this work will be used to modify our collection designs as necessary.

VIII. Analytical Methods

Hydrocarbons will be analysed by the methods that are being used in our current Alaskan OCSEAP work. Changes may be made from time-to-time with the advice of BLM's Hydrocarbon Methodology Review Group, of which the proposed Principal Investigator is a member.

X. Deliverable Products

This project will result in a narrative report including a discussion of objectives, methods, and techniques used in sampling, sample preparation, storage, and analysis. Discussion of data and results will include appropriate graphic and tabular presentations. We intend to negotiate with OCSEAP a revision of the University of Alaska Data Management Plan providing for submission of digital data.

XI. Information from Other Investigators

1. Benthic specimens and information about their trophodynamics and general biology from H. Feder
2. Sediment geochemical data from I. Kaplan
3. Sediment gram size analysis from C. Hoskin
4. Coordination and information exchange with D. Burrell.

XII. Quality Assurance

This laboratory will conduct a program of intra- and interlaboratory analytical performance assessment. This will include the use of the scheme set forth in the "Draft Performance Requirement" drawn up by the Hydrocarbon Methodology Review Group at a meeting held in Los Angeles in July, 1977 to assess intra-laboratory precision and to compare interlaboratory methods using a sediment sample to be provided by OCSEAP.

XIII. Archival Plans

We are continuing to archive replicate selected samples for future analysis as described in our previous proposals and reports. We will implement a voucher specimen plan when such is agreed upon by OCSEAP and the University of Alaska OCS Coordination Office.

XIV. Logistics

1. Beaufort Sea:
   August, 1978 - 15 day of coastal ship to collect biota
2. Cook Inlet
   Cruises of two weeks each in November 1977, May 1978 and August 1978.

XV. Management Plan

Technical management will be provided by the Principal Investigator. Fiscal and data management will be provided by the University of Alaska OCS Coordination Office.

XVII. Contractual Statements

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed-to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist.

   If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR.

10. The following acknowledgement of sponsorship is standard:

"This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

Publications: Shaw, D. G. 1972. Discrimination between PCB and DDT residues by a gas chromatographic-mass spectrometric technique. Bulletin of Environmental Contamination and Toxicology 8:208-211.

Shaw, D. G. 1973. Lipids in shallow bottom sediments. Environmental Science and Technology 7:740-742.

Shaw, D. G., A. J. Paul, L. M. Cheek and H. M. Feder. 1976. *Macoma balthica*: An indicator of oil pollution. Marine Pollution Bulletin 7:29-31.

Shaw, D. G. and L. M. Cheek. 1976. Hydrocarbon studies in the benthic environment at Prudhoe Bay, Alaska. *In* D. W. Hood and D. C. Burrell, eds. Assessment of the Arctic Marine Environment: Selected Topics, Occasional Publication No. 4, Institute of Marine Science, Univ. of Alaska, Fairbanks. pp. 425-431.

Gritz, R. L. and D. G. Shaw. 1977. A comparison of methods for hydrocarbon analysis of marine biota. Bulletin of Environmental Contamination and Toxicology 17:408-415.

Shaw, D. G., L. M. Cheek and A. J. Paul. 1977. Uptake and release of petroleum by intertidal sediments at Port Valdez, Alaska. Estuarine and Coastal Marine Science 5:429-436.

Shaw, D. G., A. J. Paul and E. R. Smith. 1977. Responses of the clam *Macoma balthica* to Prudhoe Bay crude oil. *In* Proceedings of the Joint Conference on Prevention and Control of Oil Spills. Publication No. 4284, American Petroleum Institute, Washington, D.C. pp. 493-494.

Shaw, D. G. 1977. Pelagic tar and plastic in the Gulf of Alaska and Bering Sea. The Science of the Total Environment (in press).

Shaw, D. G. 1977. Hydrocarbons in the water column. *In* Proceedings of Symposium on Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms (in press).

Abstracts: Shaw, D. G. 1972. An improved analytical procedure for the assay of chlorinated organic compounds in natural systems. 163rd National Meeting of the American Chemical Society, Boston.

Shaw, D. G., W. E. Clement and C. Akert. 1977. The hydrocarbon content of water in simulated oil spills. Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy.

Unpublished Reports:

Shaw, D. G. 1971. The aromatization of dewar benzene - a mechanistic study. Harvard University thesis.

Shaw, D. G. 1975. Environmental assessment of the northeastern Gulf of Alaska: Chemical oceanography (hydrocarbons). Inst. of Mar. Sci., Univ. of Alaska. 198 p.

Shaw, D. G. 1976. Hydrocarbons: Natural distributions and dynamics on the Alaskan Outer Continental Shelf. Inst. of Mar. Sci., Univ. of Alaska, Fairbanks. 120 p.

Feder, H. M., D. G. Shaw and A. S. Naidu. 1976. The arctic coastal environment of Alaska, vol. 1. The Nearshore Marine Environment at Prudhoe Bay, Alaska. Institute of Marine Science, Univ. of Alaska Report 76-1. 161 p.

Feder, H. M., D. G. Shaw and A. S. Naidu. 1976. The arctic coastal environment of Alaska, vol. 2. A Compilation and Review of Scientific Literature of the Arctic Marine Environment. Inst. Mar. Sci. Rept. 76-9, Univ. of Alaska, Fairbanks. 200 p.

Feder, H. M., L. M. Clark, P. Flanagan, S. C. Jewett, M. H. Johnson, A. S. Naidu, S. A. Norrell, A. J. Paul, A. Scarborough and D. G. Shaw. 1976. The sediment environment of Port Valdez, Alaska: The effect of oil on this ecosystem. Report EPA-600/3-76-086.

Feder, H. M., A. S. Naidu, D. Schamel, D. G. Shaw, E. R. Smith and G. W. Smith. 1977. The arctic coastal environment of Alaska, vol. III. The Nearshore Marine Environment in Prudhoe Bay, Alaska. Inst. Mar. Sci. Rept. R76-7, Univ. of Alaska, Fairbanks. 156 p.

Shaw, D. G. 1977. Hydrocarbons: Natural distribution and dynamics on the Alaskan Outer Continental Shelf. Inst. Mar. Sci., Univ. of Alaska, Fairbanks. 217 p.

University of Alaska, Fairbanks
Fairbanks, Alaska 99701
Institute of Marine Science

January 30, 1978

Dr. John Calder
OCSEAP
Environmental Research Laboratory
Boulder, Colorado 80302

Dear John:

As we agreed today I will redirect the remainder of my FY78 OCSEAP effort to eliminate further work on food chain transfer of hydrocarbons in a benthic food web of Lower Cook Inlet and instead to augment my effort in the Beaufort Sea. This augmented effort will include a survey of nearshore Beaufort Sea biota for hydrocarbons. In addition to the usual GC analysis, each sample will be subjected to a GC-MS search for 3, 4 and 5 ring arenes and their alkyl homologs using the same methods by which my group has detected these arenes in Beaufort sediments. I expect that 30 samples can be analysed provided that logistics and weather allow an appropriate suite of samples to be collected and provided that we receive a contract extension to allow time for the work. What constitutes an appropriate suite will be determined based on trophic relationships, geographical coverage and availability. A complete sampling plan will be presented to OCSEAP for comment before field work commences.

I will also attempt to obtain 2 box cores (one each from Simpson Lagoon and Prudhoe Bay) for analysis of arenes. Subsamples of these cores will be used for radiometric dating. Since IMS does not have facilities for Pb dating, this will require outside arrangements for dating. However, I do not expect that this will be a problem.

Sincerely,

D. G. Shaw

D. G. Shaw
Associate Professor

DGS/wms

OCS 77-18
OCS 78-6

RESEARCH PROPOSAL

to

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Outer Continental Shelf Environmental Assessment Program
Boulder, Colorado 80302

CIRCULATION AND WATER MASSES IN THE GULF OF ALASKA
Research Unit #289

Total Costs: $255,442

INSTITUTE OF MARINE SCIENCE
University of Alaska
Fairbanks, Alaska 99701

Thomas C. Royer
Principal Investigator
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K. B. Mather, Vice Chancellor
Research and Advance Study
University of Alaska
Fairbanks, Alaska 99701
(907) 479-7282

September 13, 1977

I. Title:

Circulation and Water Masses in the Gulf of Alaska
Research Unit #289

II. Principal Investigator:

Thomas C. Royer

III. Cost of Proposal

Total	$255,442
NEGOA	59%
Kodiak	31%
Lower Cook Inlet	4%
Aleutians	1%
Beaufort Sea	1%
Bristol Bay	1%
Chukchi Sea	1%
Norton Sound	1%
St. George Basin	1%

IV. Background:

The proposed work represents a continuation of the general hydrographic surveys taken in the Gulf of Alaska since 1974. A major part of next year's effort will involve the analysis of these data. Field efforts will continue. Focused efforts around Prince William Sound, Kayak Islands and Kodiak will be initiated. The work near Kodiak and Kayak Islands will be coordinated with the modelling efforts by R.U. 140 and the current meter measurements by R.U. 138. R.U. 140 will use the hydrographic data gathered by this research unit as input for the numerical model. The baroclinic flow fields will be combined with the R.U. 138's current meter data to obtain the baroclinic and baro tropic current components.

This proposed research will provide other studies with estimates of water properties and currents on approximately a seasonal basis. Interannual variations will also be provided. A summary of the previous data will be made with emphasis on the identification of the mechanisms responsible for the driving of the system, such as wind stress and runoff.

V. Objectives

The principal objectives include:

A. For the Gulf of Alaska, a seasonal description of

1. Ocean temperatures
2. Salinities
3. Densities
4. Dynamic topographies
5. Sea levels

B. Evaluation of the probable forces which alter the circulation in the Gulf of Alaska, such as

1. Precipitation

2. Differential heating and cooling

3. Runoff

4. Wind stress

5. Deep ocean circulation.

The above objectives will provide information on the "normal" circulation patterns and distribution of hydrographic parameters in the Gulf of Alaska. This information can then be used to predict probable paths of pollutants that might be released in the development of the Alaskan Continental Shelf. A knowledge of the driving mechanisms could allow predictions based on something other than the actual oceanographic data, such as the more readily available meteorological data.

VI. General Strategy and Approach

With two of the major goals of this research being the defining of the physical environment and prediction of pollutant pathways, the most important facet of this study has been the gathering of hydrographic data. These temperature and salinity data are being used to describe the mean and seasonal circulations on the Alaskan Shelf. Smaller scale studies will continue on the Kodiak shelf and Kayak Island areas. The two additional current meter moorings and 75 hydrographic stations (trimesterly) will be used to better define the circulation near Kayak Island. Analysis will also be focused on the region adjacent to Seward where the hydrographic and current meter data indicate flow reversals (that is, eastward). As a result of the Lagrangian drifter data (R.U. 217) and prior hydrographic data (R.U. 289), a new effort will be undertaken to measure the inflow and outflow in Prince William Sound. Present information designates this region as a probable recipient of pollutants released on the adjacent shelf. Sea surface temperatures as measured by NOAA satellites will be used in conjunction with the hydrographic data to map the surface circulation in the Gulf of Alaska. This has been proven to be an invaluable tool for interpolating between hydrographic section lines (Royer and Muench, 1977). Similar satellite data for the entire Alaskan coastline will be made available for use by all OCS Principal Investigators.

In addition to the gathering of field data and their analysis, for the enhancement of our understanding and prediction of the circulation, evaluation of the relative importance of the driving mechanisms is necessary. The potential forces include runoff, precipitation, wind stress differential heating and cooling and offshelf circulation, also known as global forcing. To manipulate these parameters a two dimensional, time dependent n-layered model has been implemented. Given the appropriate initial and boundary conditions, it will predict the velocities and hydrographic parameter distributions. The numerical modelling effort will be limited to evaluation of causes and effects in the circulation and does not duplicate efforts by R.U. 140.

Long term monitoring program recommendations will be developed such as the use of routine sea level measurements to determine local circulation.

VII. Sampling Methods:

Three survey grids will be occupied under this study. The Kodiak Island (KISS) grid of approximately sixty stations will continue and will provide input to the modelling efforts of R.U. 140. This grid will be occupied trimesterly beginning in fall 1977. The Cook Inlet and Wide Bay transects will continue to be run to provide continuity with the regional dynamics and historical data. The second grid will consist of a transect normal to the coast into Hinchinbrook Entrance, some stations within Prince William Sound and out Montague Strait toward the west. Current meter arrays will be deployed and maintained over the entire year both in Hinchinbrook Entrance and Montague Strait to monitor the exchange of water between Prince William Sound and the Gulf of Alaska. Each array will consist of five Aanderaa current meters and a bottom pressure guage. The five meters are necessary since no data are available on the vertical current shear in these constrictions. Pressure gauges are necessary to measure the sea level differences between these two passages and to compare them with sea levels along the coastline. Because possible flow reversals exist between Seward and Middleton Islands, and since the Seward line has the longest record of any transect in the northern Gulf of Alaska, the Seward line will be included in the NEGOA grid. This will provide additional hydrographic data on the flow between NEGOA and Kodiak lease area and give a measure of the "normal" circulation for the area. The third grid will be occupied trimesterly with approximately 75 stations (to be selected by R.U. 140) between Kayak Island and Resurrection Bay. The conjunction with this grid, two current meter arrays with two meters each will be deployed at locations specified by R.U. 140 between Montague and Kayak Islands.

The hydrographic data gathered at all station locations will be quasi-continuous profiles of salinity and temperature versus depth to approximately 10 m above the bottom or 1500 m (whichever is less). In addition, for NEGOA, light transmisssion versus depth will be measured in conjunction with the STD work. This added parameter will be evaluated for use to trace the sediment plumes from the Copper River area into Prince William Sound and in the coastal jet along the coast to Kodiak.

Daily surface wind data and associated wind transports will be obtained from the environmental buoys, and Bakun at NMFS, Monterey. Continuous sea level measurements are available from NOS for Yakatat, Cordova, Seward, Kodiak, and Dutch Harbor.

The NOAA VHRR (Very High Resolution Radiometer) satellites with simultaneous visible and infrared band coverage yield two passes per day over the study area. The passes will be monitored for cloudless regions and these will be retained for further analysis. This abundance of overpasses has the possibility of providing seasonal sea surface temperature coverage of the region. The hydrographic sections obtained by this work and the current meter work by

R.U. 138 represent line or point measurements. The satellite imagery can extend the surface particle trajectories over regions where no in-situ measurements are available. The imagery will be used to verify the results of R.U. 140, that is, are the predicted paths consistent with the distribution of sea surface temperatures?

VIII. Analytical Methods:

Analysis of the prior data sets will continue using standard techniques available. The salinity-temperature-depth distributions will be analyzed using standard oceanographic techniques for water mass analysis and dynamic height computations (See Sverdrup, Johnson, Fleming, 1942; Neumann-Pierson, 1966; and Fofonoff and Tabata, 1966). The conductivity (gathered with the CTD system) will be converted to salinity using the relationship described by Bennett (1976). The relationship between sea level and dynamic height developed by Reid and Mantyla (1976) will be employed.

Time series analysis such as spectra and progressive vector diagrams will be carried out on the current meter data. Transports will be adjusted using current meter data from PMEL and University of Alaska. The hydrographic data will be used as input for the numerical model developed and used by R.U. 140.

The satellite information will be used to describe surface features which are manifested as water temperature differences. Since surface temperature changes are dependent on both the surface heat exchange and the vertical density (salinity) structure, it is possible to obtain information on the density (salinity) structure from the sea surface temperature data. These types of information have proven to be useful in prior phases of the OCSEAP program (Galt, 1976; and Royer and Muench, 1977) and other work in the Bering and Beaufort Seas (Muench and Ahlnas, 1976). Both gyres and streamlike flows have been verified by the satellite imagery.

The analysis of the hydrographic data will include the manipulation of numerical models in an attempt to evaluate the important seasonal driving forces on the shelf. Alterations will be made on the coastal fresh water input, wind stress and global forcing to better understand the relative importance of each.

IX. Anticipated Problems

The major difficulty experienced this year and one expected to occur next year is the lack of responsiveness of the NOAA ships in dealing with field problems. While it is the goal of most OCSEAP scientists to allow the NOAA ships to gather hydrographic data without detailed guidance from the Principal Investigator, it must be the decision of the Principal Investigator as to when guidance is no longer necessary. The Principal Investigator is responsible for the data quality and should be provided with the opportunities to insure that quality.

With the installation of the 10 current meters in the Prince William Sound passages, the supply of current meters at the Institute of Marine Science University of Alaska for this study will be exhausted. Sixteen additional current meters and a pressure gauge will be required for the successful monitoring of this region throughout the year. It is being assumed that these meters could be borrowed from OCSEAP. During the period IMS borrows these meters, it will be responsible for their maintenance and repair. With the lack of pressure gauges it is requested that three additional gauges be borrowed for use in this study. It is expected that they would be delivered in time for the first mooring replacement in fall 1977.

The problems associated with the drifter study outlined in the RFP do not make such a study feasible. Drifter studies depend on an unbiased beach sampling. To say anything other than the circulation is capable of bringing drift cards from the release site to a recovery point, a statistical sampling of the entire population of all beaches that could be impacted is necessary. For example, if one percent of the recoveries are at a site, where are the other 99 percent? To get meaningful data, a majority of the cards would have to be accounted for, which is impossible. We are substituting the light transmission work in place of the proposed drifter study and it is believed that significant benefits will be gained in this substitution.

The problems inherent with the satellite data continue and are:

1. The requirement to continually monitor vast amounts of satellite imagery within a limited time period when negatives and digital tapes are available.

2. The selection of images that will be useful to the Principal Investigators.

3. The alerting of potential users about available data.

There is also the problem that the organization at Gilmore Greek that assists us in this satellite work is marginal in their capability to respond to our requests. We are attempting to alter the situation by using computer techniques on the digital tapes instead of photographic.

X. Deliverable products

A. Digital Data

1. Possible Parameters

Current meter measurements

Pressure gauge measurements

STD/CTD measurements.

2. List of digital products

Data Products Schedule
(See attached)

#2 continued

Data Products Schedule

Data Type	Media	Estimated Volume	OCSEAP Format	Processing and Formating done by P.I.	Collection Period	Submission
STD/CTD	Tape	1-2 tapes/cruise = 10 tapes	022	Yes	10/77-9/78	90 days after collection
Current Meter	Tape	20	015	Yes	10/77-9/78	90 days after collection
Pressure Gauge	Tape	4	017	Yes	10/77-9/78	90 days after collection

B. Narrative Reports:

Several Scientific papers are expected to be completed in the next year dealing with the descriptive aspects of the northern Gulf of Alaska circulation. Specific titles are not available at this time.

A catalogue of available satellite data will be forwarded to OCSEAP investigators.

C. Visual Data

Maps of the distribution of the hydrographic parameters in the NEGOA and Kodiak regions are planned for next year. Hydrographic data from June 1975 to the present will be displayed. Vertical profiles, cross-sections and maps of dynamic topography will be included such as current meter data, environmental data buoy information and/or coastal sea levels.

Photographs of the satellite data will be retained and forwarded upon request.

D. Other Non-Digital Data - none

E. Data Submission Schedule:

First data collected:	10/77
Last data collected:	9/78

Data will be submitted by cruise approximately 90 days after the termination of the cruise.

XI. Information Required from Other Investigators:

Coordination with R.U. 138 is necessary to determine the exact positions and scheduling of their current meter and pressure gauges. Information on desired station positions for modification of the KISS grid and Kayak Island - Resurrection Bay area is required from R.U. 140. Sea level and meteorological data is requested from those research units that have information not available to us. If current meters are to be borrowed from OCSEAP, calibration documents will be required. With the exception of the sea level and the meteorological data contacts have been made to obtain these data.

The work on satellite imagery will require information on the geographical areas of interest of the other Principal Investigators and feedback as to the usefulness of the satellite data. Surface temperature measurements will be required from Principal Investigators for calibration purposes.

XII. Quality Assurance Plans

The STD or CTD will be field corrected using samples gathered from bottles on the hydrographic wire. Temperatures will be measured with reversing thermometers which have recently (within the past two years) been calibrated at NRCC (Northwest Regional Calibration Center). Salinity samples will be run on salinometers using Copenhagen water as a standard. In addition, the STD or CTD will be frequently calibrated at NRCC. The current meters will be calibrated at NRCC.

It is necessary that the uncorrected data STD have a resolution of $\pm 0.02^{o}/oo$ and $\pm 0.01^{o}C$ with at least one sample per meter ($\pm 1m$) to 1500m or 10m above the bottom whichever is less. The satellite imagery will be calibrated using ground truth information when available. Otherwise, temperature differences will be emphasized.

XIII. Special Sample and Voucher Specimen Archival Plans

An archive of the prints from satellite photographs has been established at the Institute of Marine Science, University of Alaska. This archive contains "useable" passes from the NOAA satellites from 1974 to the present time. There are approximately 2,000 photos in the collection. The annual maintenance of this archive including a person to assist with its use is about $35,000.

XIV. Logistics Requirements

See attached.

XV. Management Plan

Analysis of existing hydrographic data for the region will continue by the Principal Investigator. Shipboard data gathered at stations previously described will be processed by personnel in Fairbanks. Data quality will be assured using available calibration information. Data displays will be prepared. Emphasis will be placed on the analysis of all data to produce a coherent representation of the coastal circulation in the Gulf of Alaska. The satellite imagery will be acquired on a continuing basis with correspondence with other Principal Investigators as necessary.

Technical management will be provided by the Principal Investigator. Fiscal and data management will be provided by the University of Alaska OCS Coordination Office. The University of Alaska agrees that Principal Investigator can travel to the Juneau Project Office at least twice during the contract year provided that such travel is in accordance with University of Alaska's travel policy and consistent with other duties of the Principal Investigator. No travel or per diem funds for this travel have been provided in this proposal. Cost of labor associated with this travel shall be considered chargeable to this contract in accordance with the provisions of contract 03-5-022-56.

XVI. Outlook

The work in FY '78 under this contract represents two types of field efforts. In the western Gulf of Alaska we are continuing to carry out general survey work in order to determine regions of potential impact due to oil and gas exploration. In NEGOA, through the use of our acquired data, we have now identified areas especially sensitive to oil development. In NEGOA, our studies are attempting to define the details of the important regions such as Prince William Sound and Kayak Island. It is expected that most of the research efforts in physical oceanography in the Gulf of Alaska in the future will focus on sites or important processes. The Kodiak Island Shelf Study is another example of the effort to look at a specific site. Others will probably be identified in the future such as the Unimak Pass area. In this light it is expected that this will mark the last year for the general hydrographic surveys. Future work will probably focus on Prince William Sound, Kayak Island, the Seward line, Kodiak Island, Unimak Pass and/or the offself circulation. Long term monitoring should continue to be carried out at selected sites in conjunction with the site studies.

Significant milestones of the site studies are not clear at this time, however, the wind down of the general survey work next year is a milestone. The cost by fiscal year would be approximately $100,000 per year per site for hydrographic and current meter work, dependent on the detail required. Approximately five new current meters, one pressure gauge and other associated equipment would be required each year ($40-50,000).

XVI. Contractual Statements

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist.

   If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR.

10. The following acknowledgement of sponsorship will be used:

> "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

For OCSEAP use only.
RU # ______
Discipline ______
Area of Operation ______

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION University of Alaska PRINCIPAL INVESTIGATOR Thomas C. Royer

A. SHIP SUPPORT

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible.
   STD/CTD operations, light transmission of the NEGOA stations
   Current Meter developments as indicated.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.)
   NEGOA - Nov, Feb, May, August ± 1 month
   KISS + ~~Western Gulf~~ - Nov, Mar, July ± 1 month

4. How many sea days are required for each leg? (Assume vessel cruising speed of 14 knots for NOAA vessels. Do not include running time from port to beginning point and from end point to port and do not include a weather factor.)
   NEGOA - 10 ~~6~~ days, ~~Western Gulf - 8 days~~, KISS - 4 ~~5~~ days

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? Principal

   Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling-time on station and sample processing time between stations.
   24 hours/day - about 1 hour per station - no sample processing time required

6. What equipment and personnel would you expect the ship to provide?
   STD/CTD system/data logger, Standard sea water, 6 Marine Technicians, Bottle racks, salinometer, Hydrographic winch, 1 Electronics Technician

7. What is the approximate weight and volume of equipment you will bring?
   600 ft.^{3} 2500 lbs.

8. Will your data or equipment require special handling? No If yes, please describe:

9. Will you require any gasses and/or chemicals? No If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If "yes" please name the vessel and give the reason for so specifying. Yes, for the NEGOA work the R/V *Acona* should be used as it will have equipment necessary for light transmission study.

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availability
    $3,300 Yes

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.

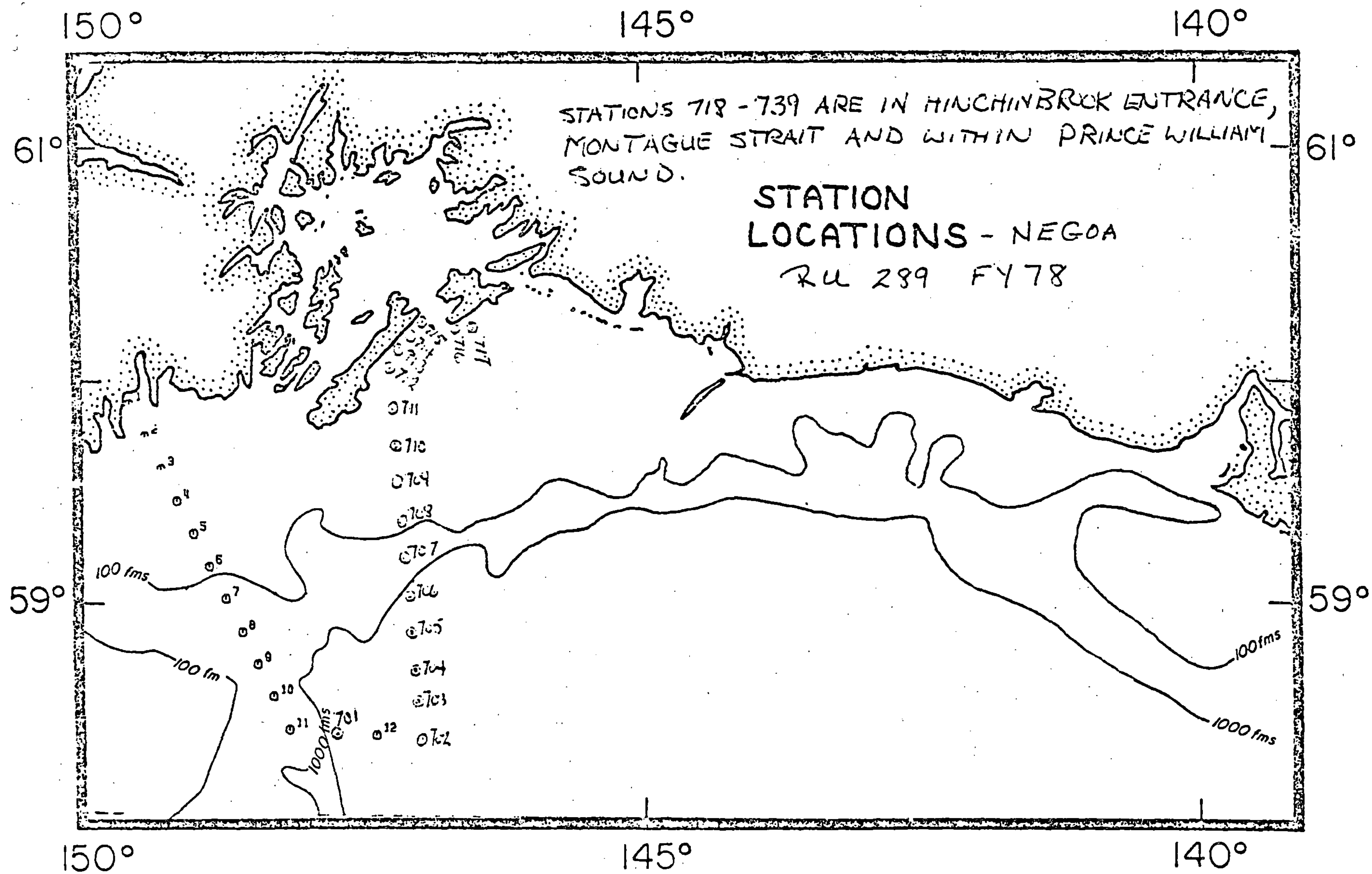
PLEASE SEE BACK

#12. 4 persons for non-NOAA
2 persons for NOAA ship

T. Royer
D. Nebert
J. Niebauer
J. Colonell
W. Kopplin
D. Livingstone - F. N.
Kee Soo Nam - F. N.
Unspecified graduate student

Station Positions - NEGOA - RU#289 FY 78

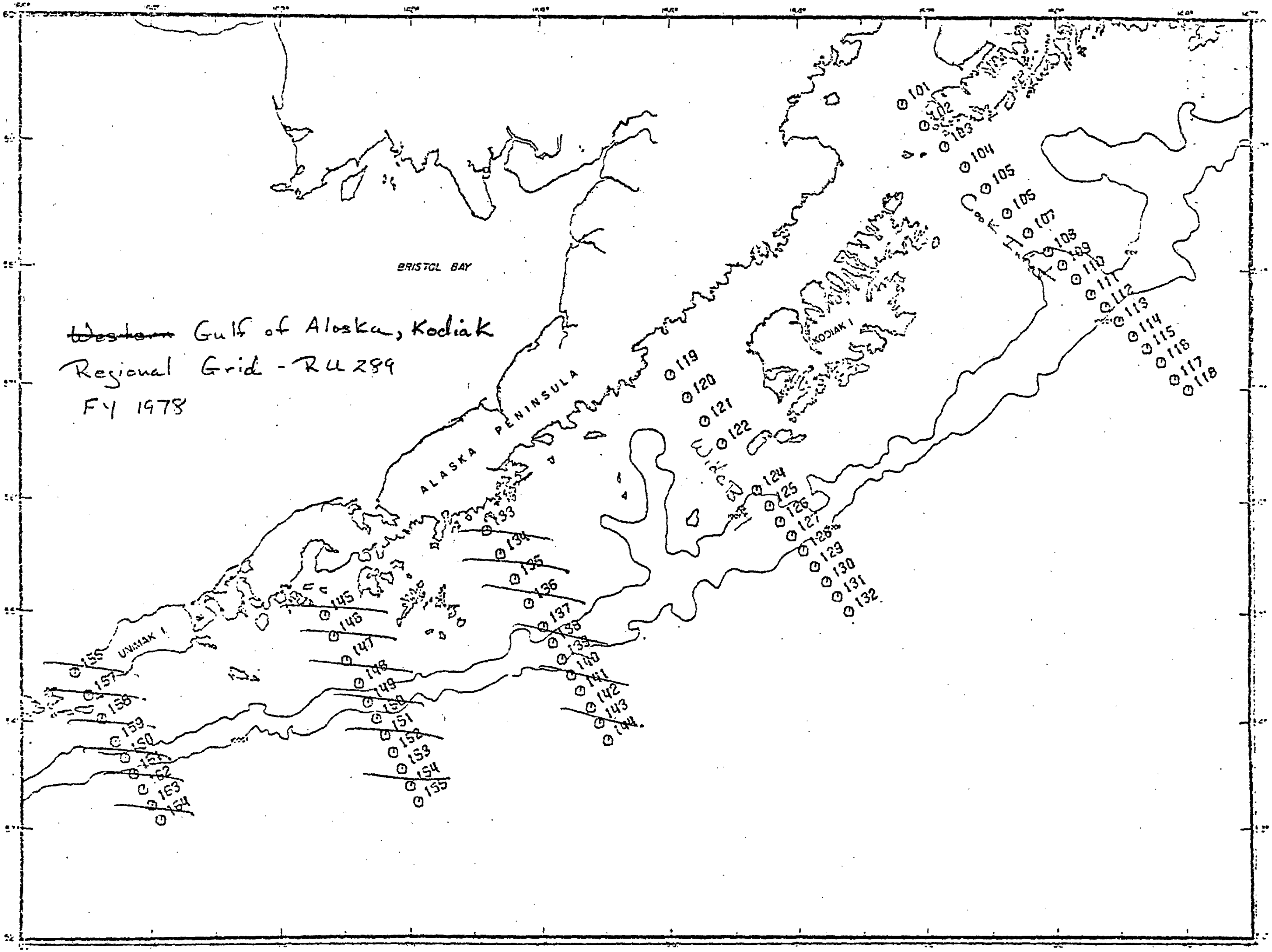
STATION NUMBER	POSITION Latitude(N)	Longitude(W)
1	59 50.7	149 28.0
2	59 41.5	149 22.0
3	59 33.0	149 13.2
4	59 24.5	149 04.9
5	59 16.0	148 56.0
6	59 07.2	148 47.5
7	58 58.7	148 38.7
8	58 49.7	148 30.0
9	58 41.1	148 21.6
10	58 32.3	148 13.2
11	58 23.2	148 04.8
701	48 22.9	147 53.4
12	58 22.6	147 42.0
702	58 22.4	147 30.4
703	58 31.8	147 26.9
704	58 41.1	147 23.4
705	58 50.5	147 19.9
706	58 59.9	147 16.3
707	59 09.3	147 12.8
708	59 18.6	147 09.3
709	59 28.0	147 05.8
710	59 38.3	147 06.0
711	59 48.3	147 06.4
712	60 03.5	147 05.0
713	60 08.3	147 04.8
714	60 11.1	147 01.8
715	60 13.9	146 58.7
716	60 11.2	146 37.7
717	60 11.7	146 28.5
718	60 18.5	146 51.9
719	60 19.0	146 49.0
720	60 19.7	146 45.7
721	60 27.0	146 54.0
722	60 32.5	146 36.0
723	60 33.7	146 45.6
724	60 35.0	146 55.0
725	60 42.0	147 00.0
726	60 46.1	147 01.6
727	60 35.6	147 04.8


STATIONS 718 - 739 ARE IN HINCHINBROOK ENTRANCE, MONTAGUE STRAIT AND WITHIN PRINCE WILLIAM SOUND.
STATION LOCATIONS - NEGOA
RU 289 FY78
150°
145°
140°
61°
59°
100 fms
100 fm
1000 fms
100fms
1000 fms
701
702
703
704
705
706
707
708
709
710
711
716
717

SHELF STUDY - ~~WESTERN GULF~~ (Revised October 1975) CRUISE NO. ____

Kodiak Revised September 1977

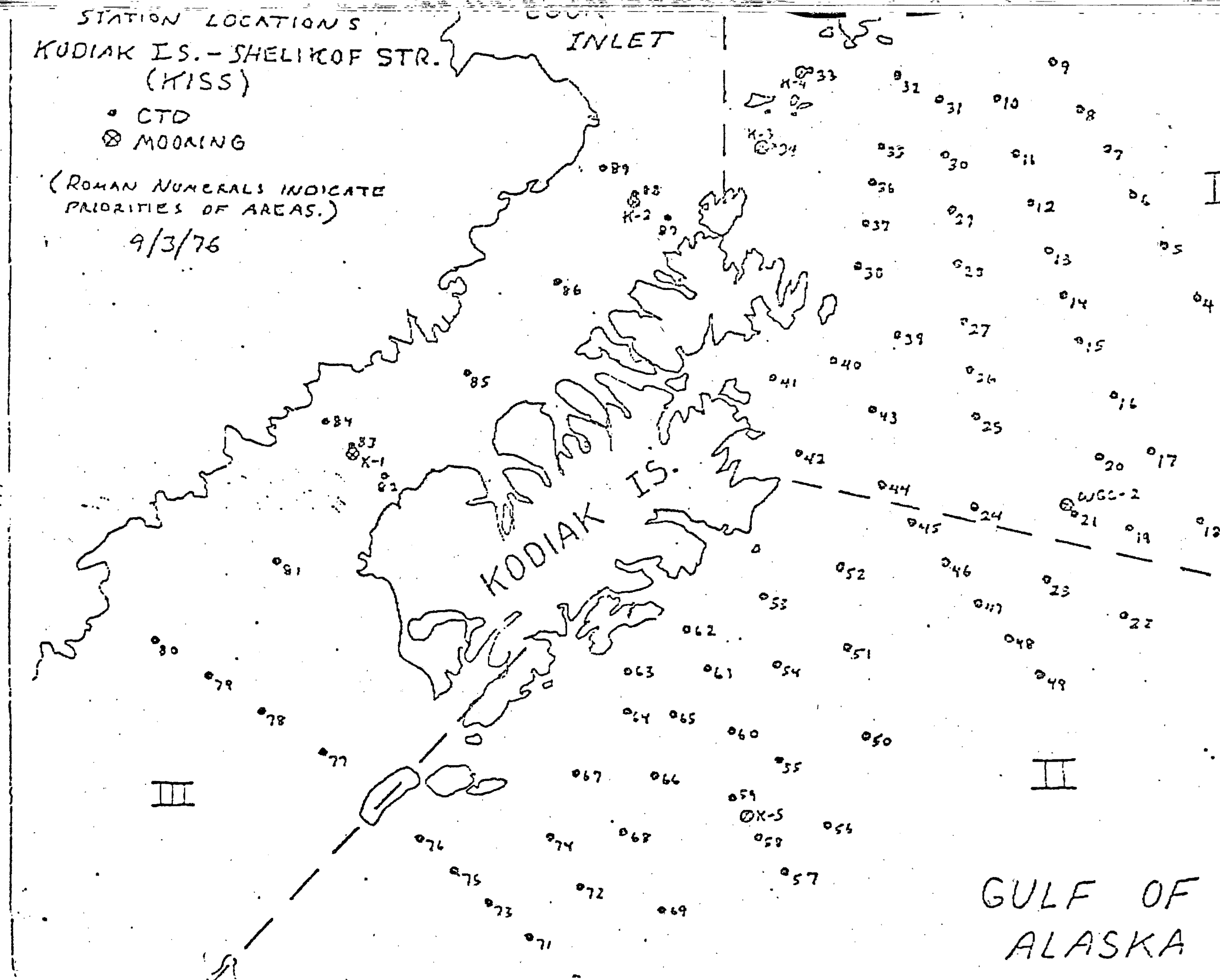
GASS STATION NUMBER	POSITION LATITUDE (N)	LONGITUDE (W)	APPROX. DEPTH (m)	ACTIVITIES
101	59 19.8	152 24.1	70	
102	59 09.9	152 04.1	101	
103	59 00.0	151 45.1	96	
104	58 50.0	151 26.4	100	
105	58 39.9	151 07.1	160	
106	58 28.1	150 47.7	86	
107	58 18.6	150 28.0	53	
108	58 09.1	150 09.1	57	
109	58 02.5	149 56.3	176	
110	57 55.8	149 43.4	180	
111	57 48.2	149 30.0	580	
112	57 41.6	149 17.1	1710	
113	57 34.8	149 03.9	2542	
114	57 27.0	148 51.3	2940	
115	57 20.6	148 38.7	4075	
116	57 14.0	148 25.5	4978	
117	57 05.5	148 12.7	4925	
118	57 00.0	148 00.0	4700	
119	57 06.9	156 00.0	250	
120	56 55.0	155 44.1	294	
121	56 43.2	155 27.9	238	
122	56 31.3	155 12.0	42	
~~123~~	~~56 19.1~~	~~154 55.1~~	~~12~~	
124	56 07.1	154 39.4	107	
125	55 58.9	154 28.5	565	
126	55 50.9	154 18.1	700	
127	55 43.1	154 07.4	540	
128	55 35.3	153 56.7	2385	
129	55 27.2	153 46.8	3804	
130	55 18.9	153 36.0	5460	
131	55 10.7	153 25.7	5150	
132	55 02.6	153 15.0	4545	
133	55 46.3	158 51.0	68	
134	55 33.4	158 38.3	152	
135	55 20.3	158 25.1	145	
136	55 07.5	158 12.4	144	
137	54 54.3	157 59.0	102	
138	54 45.7	157 50.6	340	
139	54 36.9	157 42.2	1183	
140	54 28.2	157 33.7	1913	
141	54 19.3	157 25.2	4198	
142	54 10.5	157 15.6	5315	
143	54 02.0	157 07.8	5676	
144	53 52.8	156 59.6	5023	
145	55.00.9	161 20.5	70	
146	54 49.4	161 12.5	67	
147	54 36.2	161 00.7	105	
148	54 23.5	160 49.1	109	
149	54 13.4	160 41.2	777	
150	54 04.4	160 33.2	1645	
151	53 55.3	160 25.4	2910	
152	53 46.1	160 17.8	3907	
153	53 37.0	160 09.9	5641	
154	53 27.6	160 02.1	5938	
155	53 18.8	159 54.6	5165	
			441	


~~Western~~ Gulf of Alaska, Kodiak
Regional Grid - RU 289
FY 1978
BRISTOL BAY
ALASKA PENINSULA
KODIAK I
UNIMAK I

STATION LOCATIONS FOR KODIAK ISLAND-SHELIKOF STRAIT (KISS) STUDY GRID

CTD STATIONS

Priority	Number	Coordinates	
I	1.	57°37.7'N	148°55.2'W
I	2.	57°54.8'N	149°12.0'W
I	3.	58°03.7'N	149°21.5'W
I	4.	58°13.7'N	149°32.0'W
I	5.	58°24.4'N	149°43.8'W
I	6.	58°34.5'N	149°55.0'W
I	7.	58°44.3'N	150°05.0'W
I	8.	58°53.7'N	150°15.0'W
I	9.	59°03.0'N	150°25.0'W
I	10.	58°54.0'N	150°44.2'W
I	11.	58°43.5'N	150°40.0'W
I	12.	58°34.0'N	150°35.0'W
I	13.	58°26.2'N	150°31.8'W
I	14.	58°15.6'N	150°28.0'W
I	15.	58°04.0'N	150°21.6'W
I	16.	57°52.4'N	150°06.2'W
I	17.	57°42.0'N	149°50.0'W
I	18.	57°27.3'N	149°29.0'W
I	19.	57°28.0'N	149°56.0'W
I	20.	57°39.2'N	150°15.5'W
I	21.	57°25.4'N	150°27.0'W
II	22.	57°07.8'N	150°02.0'W
II	23.	57°14.5'N	150°34.0'W
I	24.	57°31.4'N	151°01.0'W
I	25.	57°51.0'N	151°07.0'W
I	26.	58°01.0'N	151°07.8'W
I	27.	58°11.2'N	151°07.8'W
I	28.	58°21.7'N	151°07.8'W
I	29.	58°31.5'N	151°07.8'W
I	30.	58°41.6'N	151°07.8'W
I	31.	58°53.6'N	151°07.8'W
I	32.	59°00.3'N	151°26.5'W
I	33.	59°01.5'N	151°56.5'W
I	34.	58°45.6'N	152°11.0'W
I	35.	58°46.0'N	151°31.0'W
I	36.	58°36.8'N	151°34.5'W
I	37.	58°28.0'N	151°37.4'W
I	38.	58°20.0'N	151°39.6'W
I	39.	58°08.4'N	151°26.0'W
I	40.	58°02.2'N	151°47.0'W
I	41.	57°59.0'N	152°10.0'W
I	42.	57°43.8'N	152°00.0'W
I	43.	57°53.2'N	151°34.0'W
I	44.	57°32.0'N	151°34.5'W
II	45.	57°24.6'N	151°26.0'W
II	46.	57°15.0'N	151°12.4'W
II	47.	57°08.2'N	151°03.4'W
II	48.	57°00.0'N	150°52.7'W
II	49.	56°50.0'N	150°38.8'W
II	50.	56°43.0'N	151°29.5'W
II	51.	57°01.2'N	151°45.0'W
II	52.	57°14.0'N	151°49.3'W
II	53.	57°10.5'N	152°18.0'W
II	54.	56°57.0'N	152°15.0'W
II	55.	56°40.0'N	152°07.5'W
II	56.	56°25.8'N	151°38.5'W
II	57.	56°13.8'N	152°08.0'W
II	58.	56°17.8'N	152°19.5'W
II	59.	56°31.7'N	152°28.0'W
II	60.	56°44.5'N	152°31.0'W
II	61.	56°57.0'N	152°36.5'W
II	62.	57°05.5'N	152°47.0'W
II	63.	56°57.3'N	153°06.0'W
II	64.	56°49.5'N	153°07.5'W
II	65.	56°49.0'N	152°50.0'W
II	66.	56°36.0'N	152°56.5'W
II	67.	56°33.4'N	153°30.5'W
II	68.	56°25.5'N	153°05.0'W
II	69.	56°07.0'N	152°57.0'W
II	70.	55°51.7'N	153°28.5'W
II	71.	55°58.0'N	153°44.5'W
II	72.	56°10.4'N	153°25.0'W
II	73.	56°04.5'N	153°58.5'W
II	74.	56°21.8'N	153°36.5'W
II	75.	56°12.4'N	154°11.5'W
II	76.	56°20.8'N	154°25.0'W
III	77.	56°37.5'N	155°00.0'W
III	78.	56°45.7'N	155°19.5'W
III	79.	56°53.8'N	155°39.0'W
III	80.	57°02.0'N	156°00.0'W
III	81.	57°20.0'N	155°12.4'W
III	82.	57°39.0'N	154°36.0'W
III	83.	57°44.0'N	154°48.0'W
III	84.	57°49.0'N	154°57.5'W
III	85.	57°59.0'N	154°07.5'W
III	86.	58°17.5'N	153°34.5'W
III	87.	58°32.0'N	152°53.4'W
III	88.	58°37.0'N	153°04.5'W
III	89.	58°41.8'N	153°16.3'W



STATION LOCATIONS
KODIAK IS. - SHELIKOF STR.
(KISS)
CTD
MOORING
(ROMAN NUMERALS INDICATE PRIORITIES OF AREAS.)
9/3/76
INLET
KODIAK IS.
GULF OF ALASKA
I
II
III
K-1
K-2
K-3
K-4
X-5
WGC-2

MILESTONE CHART

RU #: 289 PI: THOMAS C. ROYER

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978														
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D			
Analysis of hydrographic data in Gulf of Alaska	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Acquisition of satellite data (visible & IR)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
NEGOA Hydrographic Data Gathering	X				X		X			X								
NEGOA Current-meter Installations	X				X		X			X								
KISS ~~and western Gulf of Alaska~~ and Kodiak Hydrographic Data Gathering		X				X				X								
Data Submission				X	X			X	X	X			X					
Kayak Island Data Gathering					X		X			X								
Kayak ~~Island~~ - Montague Island Current Meter Installations						X												

REFERENCES

Bennett, A. S. 1976. Conversion of *in situ* measurements of conductivity to salinity. *Deep-Sea Res.*, 23(2), 157-165

Fofonoff, N. P. and S. Tabata. 1966. Variability of oceanographic conditions between Ocean Station P and Swiftsure Bank off the Pacific Coast of Canada, *Fish. Res. Bd. Canada* 23(6):825-868.

Galt, J. 1976. Circulation Studies on the Alaskan Continental Shelf off the Copper River Delta, NOAA Tech. Dept.

Muench, R. D., and K. Ahlnas. 1976. Ice Movement and Distribution in the Bering Sea from March to June 1974. JGR 81(24), 4467-4476.

Neumann, G. and Pierson, W. J., Jr. 1966. Principles of Physical Oceanography, Prentice-Hall, Inc. Englewood Cliffs, N. J. 545 pp.

Reid, J. L., and A. W. Mantyla. 1976. The effect of the geostrophic flow upon coastal sea elevations in the Northern North Pacific Ocean. JGR 81(18), 3100-3110.

Royer, T. C., and R. D. Muench. 1976. On the Ocean Temperature Distribution in the Gulf of Alaska, 1974-1975. Jour. Phys. Oceanog. 7, 92-99.

Sverdrup, H. U., M. W. Johnson and R. H. Fleming. 1942. The Oceans, Prentice-Hall, Inc., Englewood Cliffs, N. J. 1087 pp.

FORM CD-45
(4-15-71)

U. S. DEPARTMENT OF COMMERCE

SUPPLY, EQUIPMENT OR SERVICE ORDER

PROCUREMENT DIVISION - OFFICE OF ADMINISTRATIVE SERVICES

FOR: NOAA/ERL/OCSEAP

2. CHECK APPROPRIATE BLOCK

☐ PROCUREMENT ☒ OTHER *(Specify)*

Contract Modification

1. THE NUMBER SHOWN IN BLOCK 5 MUST APPEAR ON ALL SHIPMENTS AND/OR DOCUMENTS RELATING TO THIS ORDER

3. REQUISITIONER DOCUMENT NO.: RK-8-0026

4. BUREAU CONTROL NO.:

5. PURCHASE ORDER NO.:

6. ISSUED TO:
University of Alaska
Fairbanks, AK 99701

7. DESTINATION
SHIP TO
OCS Program Office
NOAA/ERL, Rx4
Boulder, CO 80302

8. ACCOUNTING CODE: RK0000 R7120815 2513

9. QUOTATION REF. OR CONTRACT NO.: 03-5-022-56

10. DISCOUNT TERMS:

11. DELIVERY F.O.B.:

12. GOVT. B/L NO.:

13. DELIVERY DATE:

14. DO NOT USE

STATION

15. LINE NO.	16 DO NOT USE	17. DESCRIPTION	18. QUANTITY	19. UNIT	20. ESTIMATED TOTAL COST	21. ACTUAL UNIT PRICE	ACTUAL TOTAL COST
		Additional funds to cover work statement "Circulation and Water Masses in the Gulf of Alaska" proposal numbers OCS 77-18, OCS 78-6, contract 03-5-022-56, T. O. #19, RU#289 as modified*					
		Total funded to date: $613,654					
		AMOUNT OF THIS ACTION: $195,442			195,442		
		Total funded to date: $809,096					
		* Modification is substitution of new ~~of~~ figure for page 23, showing grid of 75 stations to be sampled, as shown in attached memo dated 10-19-77					

22. SIGNATURE OF REQUISITIONER — DATE

23. SIGNATURE APPROVING OFFICER: D A Wolfe

TITLE: Director, OCSEAP — DATE: 11-2-

24. ACCOUNTABLE PROPERTY ☐ — INITIALS

25. NOT AVAILABLE BUREAU STOCK/EXCESS ☐ — INITIALS: B

26. SIGNATURE-BUREAU CONTROL OFFICER

27. NOT AVAILABLE DEPARTMENT STOCK/EXCESS ☐ — IN

28. APPROVAL — DATE

29. PURCHASING AGENT — DATE

30. RECEIPT ACTION - Quantities shown in Column 18 above have been received and accepted, except as follows: *(If additional space is needed, use reverse side)*

31. SIGNATURE-RECEIVING OFFICER — DATE

32. PROPERTY CONTROL NO.

☐ TRADE-IN
☐ RECEIVING REPORT

33. SEND INVOICES IN DUPLICATE TO:
NOAA/BOULDER FIELD FINANCE OFFICE
1790 - 30th STREET, SUITE 320
BOULDER, CO 80302

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

November 1, 1977

Dr. Tom Royer
Institute of Marine Science
University of Alaska
Fairbanks, AK 99701

Reference: Contract 03-5-022-56, T.O.#19, RU#289

Dear Dr. Royer:

I am pleased to notify you that your FY78 proposal entitled, "Circulation and Water Masses in the Gulf of Alaska", Proposal Numbers OCS 77-18 and OCS 78-6, as revised by the incorporation of an additional figure, showing the grid of station locations discussed in the revised proposal, has been recommended to me for funding in the amount of $255,422. The new figure, which will be substituted for the station figure shown on page 23, shows a grid of 75 stations between Kayak Island and Resurrection Bay that will be sampled, as discussed in the revised proposal. Our Contracting Clerk, Kay Jentsch, will initiate contracting procedures as soon as possible. We are also notifying the Juneau Project Office and your institutional business office by copy of this letter. The contract period will be from October 1, 1977 through September 30, 1978. If you have any funding questions, please call Kay Jentsch, 303-499-1000, x6562, FTS 323-6562. Technical or scientific questions should be referred to your project office.

I thank you for your contributions to the OCSEA Program and look forward to another year of cooperative effort.

Sincerely,

Rudolf J. Engelmann, Director
Outer Continental Shelf Environmental
Assessment Program Office

cc: Ray Hadley
Juneau Project Office

bcc: read file
RU#289
Jentsch

FILE COPY

CODE	SURNAME	DATE	CODE	SURNAME	DATE

NOAA FORM 61-

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL RESEARCH LABORATORIES
[illegible]
[illegible]
[illegible] Project Office
[illegible]
[illegible]
[illegible]

RFx41-289-868

Date: OCT 19 1977

To : Rudy Engelmann, Director
OCSEAP - Alaska Program Office, Boulder

Donald S. Day for

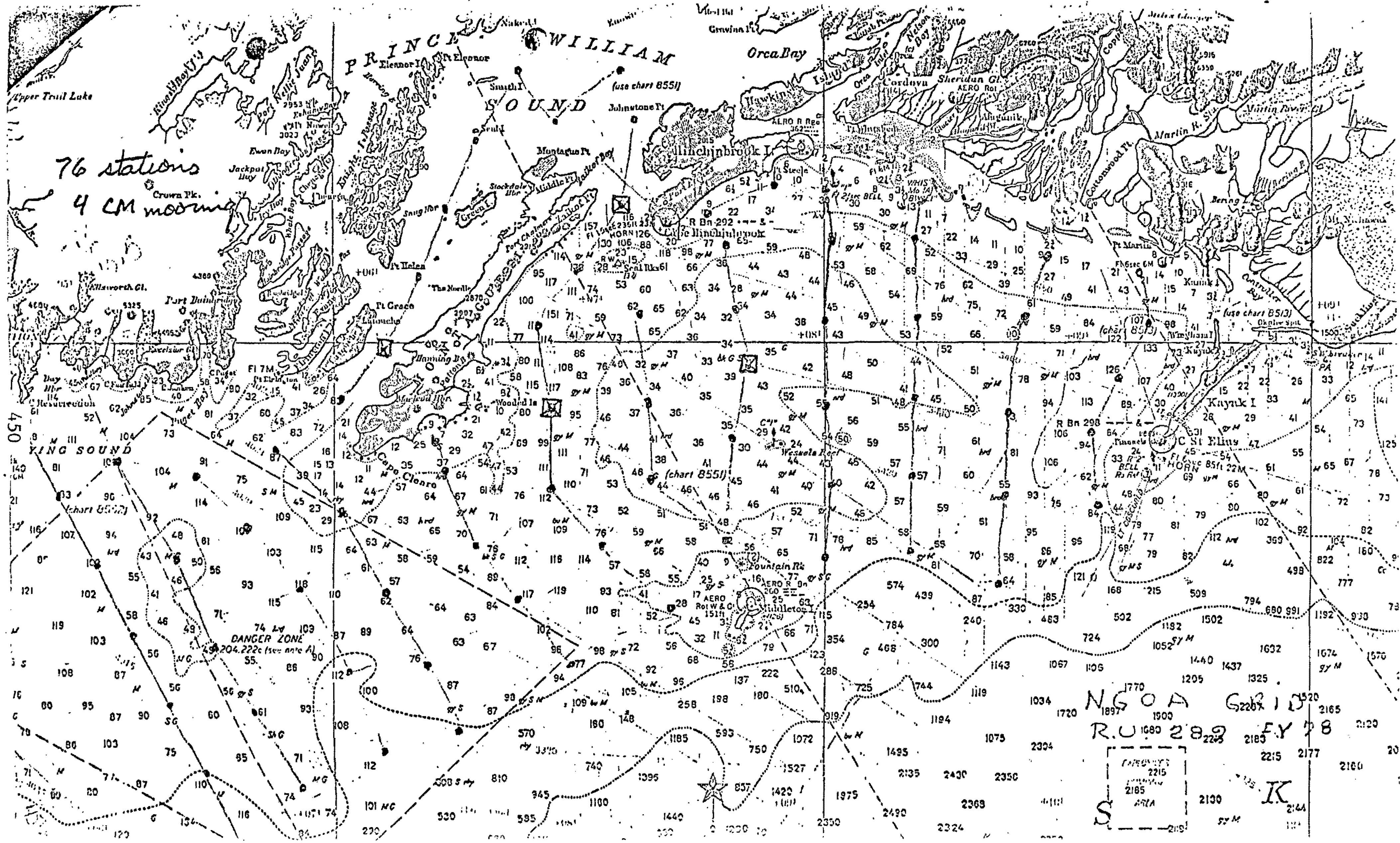
From: Herbert E. Bruce, Manager
OCSEAP - Juneau Project Office

Subj: OCSEAP Research Unit 289

Required Acceptance Letter for R.U. 289, Dr. Royer

The enclosed FY 78 renewal proposal (pages 1-39) for R.U. 289, entitled "Circulation and Water Masses in the Gulf of Alaska", has been reviewed in the Juneau Project Office and judged acceptable at the funding level of $255,442 with one revision recommended. This recommended revision is the incorporation of the attached Figure, which shows the grid of station locations discussed in paragraph 2 on page 4 of the revised proposal. The attached Figure should be substituted for the station figure shown on page 23 since the original figure was deemed incorrect during a conversation with Dr. Royer on October 3, 1977. The new figure shows a grid of 75 stations between Kayak Island and Resurrection Bay that will be sampled by Dr. Royer's group trimestrially as discussed in the revised proposal (paragraph 2 page 4).

Please send an acceptance letter to Dr. Royer and initiate contracting procedures with the University of Alaska, based on the revised figure and proposal.



76 stations
4 CM mooring
NGOA GRID
R.U. 289 FY 78
PRINCE WILLIAM SOUND
Orca Bay
Hinchinbrook I
Cape Hinchinbrook
Montague Pt
Johnstone Pt
Cordova
Sheridan Gl.
Hawkins Island
Kayak I
C St Elias
Middleton I
Wessels Reef
Fountain Rk
Seal Rks
Cape Cleare
Montague I
Port Bainbridge
Ellsworth Gl.
Crown Pk.
Upper Trail Lake
Green I.
Pt Helen
Pt Grace
Latouche
Cottonwood Pt.
Martin R. Sl.
Bering R.
Controller Bay
Okalee Spit
Pt Martin
Wingham I
C Puget
C Resurrection
Day Hbr
DANGER ZONE
(use chart 8551)
(chart 8551)
(use chart 8513)
(chart 8502)

OCS 77-17

RESEARCH PROPOSAL

to

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Outer Continental Shelf Environmental Assessment Program
Boulder, Colorado 80302

GRAIN SIZE ANALYSIS OF SEDIMENT FROM ALASKAN CONTINENTAL SHELVES
Research Unit 290

Total Cost $17,000

Institute of Marine Science
University of Alaska
Fairbanks, Alaska 99701

C. M. Hoskin
Principal Investigator
Institute of Marine Science
University of Alaska
Fairbanks, Alaska 99701
(907) 479-7724

A. B. Frol, Director
Administrative Services
University of Alaska
Bunnell Building
Fairbanks, Alaska 99701
(907) 479-7340

J. R. Moore, Director
Institute of Marine Science
University of Alaska
Fairbanks, Alaska 99701
(907) 479-7531

Keith B. Mather
Vice Chancellor for Research and
Advanced Study
University of Alaska
Fairbanks, Alaska 99701
(907) 479-7282

June 15, 1977

C. Technical Proposal

I. Title and Task Statement Number

Grain Size Analysis of Sediment from Alaskan Continental Shelves
Research Unit 290

II. Principal Investigator

Charles M. Hoskin, Ph.D.

III. Cost of Proposal

Total $17,000
Distribution of Effort by Lease Area:

Aleutian Shelf	12%
Beaufort Sea	17%
Bristol Bay	18%
Kodiak	17%
Lower Cook Inlet	18%
Norton Sound	18%

IV. Background

The work proposed here is entirely complementary to research of the benthic biologists, and hydrocarbon and trace metal chemists. Benthic organisms live on, in, and interact with the sedimentary substrate through feeding. Sorption reactions occur between hydrocarbons, trace metals, and sediment. Therefore, it is necessary to determine the grain size composition of the sediment as the fine-grained fraction in particular is susceptible to sorption and also is ingested by benthic organisms.

V. Objectives

The specific objective of the proposed work is to provide grain size data for samples submitted by OCSEAP benthic biologists and chemists. The relevance of this work to OCSEAP decision-making is that those places characterized by fine-grained sediment and large benthic biomass may be significantly impacted by human-caused perturbations of trace metal and hydrocarbon levels.

VI. General Strategy and Approach

Sediment samples submitted to me by OCSEAP benthic biologists and chemists will be analyzed for their grain size composition. The level of detail employed for these analyses will be determined by the needs of the persons submitting the samples.

VII. Sampling Methods

The choice of sampling devices and sampling design will be determined by the benthic biologists and chemists. Generally, it is expected that biologists use a Van Veen grab, and chemists use a Haps corer. These devices are entirely satisfactory for obtaining representative sediment samples.

VIII. Analytical Methods

Grain size analysis of sediments will be done in the laboratory following procedures established by Hoskin in the report referenced below.

Hoskin, C. M. 1976. Procedures and quality control for grain size analysis and data reduction of Bering Sea bottom sediments. Unpublished report to NOAA/OCSEAP, Institute of Marine Science, University of Alaska, 9. (copy attached).

IX. Anticipated Problems

Part of the grain size analysis procedure involves dry-sieving. This is done with a Tyler Ro-Tap, which is a noisy device. To minimize disturbance to other workers, the Ro-Tap is located in an out-of-the-way place, and thus ready access to a balance is eliminated. Most efficient dry-sieving should have the Ro-Tap and balance in the same work area. The best solution to this problem would be to purchase a rugged, top-loading electronic balance which can be set up and used with the Ro-Tap. This piece of equipment would greatly increase work productivity and eliminate accidental spills of sieve fractions that now must be carried to another building for weighing. Funds are being sought through R. S. Hadley for purchase of this instrument.

X. Deliverable Products

A. Digital Data

1. List of possible parameters was <u>not</u> attached. Depending on needs of biologists and chemists, the parameters that can be reported are:

Weight percent gravel, sand, silt, clay, mud

Weight percent per sieve fraction for the range 32.0 to 0.00098 mm

Graphic mean size, Mz in mm.

Graphic standard deviation, σ_I in ϕ

Skewness, SK_I

Kurtosis, K^1_G

Grain size mode(s) in mm.

B. Narrative Reports

No special reports.

C. Visual Data

None other than those included in reports.

D. Other Non-Digital Data

None.

E. Data Submission Schedule

Data collection is in the hands of biologists and chemists as no fieldwork will be done by Hoskin. Samples will be analyzed and data submitted to the Project Offices one quarter after receipt of samples.

XI. Information Required from Other Investigators

A sample number and aliquots of sediment samples are needed for this work from other investigators. These arrangements have been made.

XII. Quality Assurance Plans

No work planned.

XIII. Special Sample and Voucher Specimen Archival Plans

None.

XIV. Logistics Requirements

No support for logistics is required.

XV. Management Plan

C. M. Hoskin will manage the proposed work as Principal Investigator, and will coordinate efforts with Drs. David Burrell, Andrew Carey, Howard Feder, and David Shaw.

Technical management will be provided by the Principal Investigator. Fiscal and data management will be provided by the University of Alaska OCS Coordination Office.

XVI. Outlook

As the grain size work so far accepted by NOAA/OCSEAP has been entirely complementary to the work of biologists and chemists, no plans can be independently made by this investigator.

XVII. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, sumittted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedures."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist.

   If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR.

10. The following acknowledgement of sponsorship will be used:

    "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management Department of Interior."

Data Products Schedule

Data Type (ie. Intertidal, Benthic Organisms, etc.)	Media (Cards, coding sheets, tapes, disks)	Estimated Volume (Volume of processed data)	OCSEAP Format (If known)	Processing and Formating done by PI (Yes or No)	Collection Period (Month/Year to Month/Year)	Submission (Month/Year)
Sediment	Coding sheets	Depends upon number of samples submitted. Detailed analyses can be completed for no more than 100 samples; if abbreviated analyses are sufficient, more samples can be analysed.	073	no	October 1977 to September 1978	December 1978

MILESTONE CHART

RU #: 290 PI: C. M. Hoskin

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Data for samples submitted to Hoskin by OCSEAP biologists															
and chemists will be submitted to OCSEAP no later than															
one quarter after receipt of samples.															

PROCEDURES AND QUALITY CONTROL

FOR

GRAIN SIZE ANALYSIS AND DATA REDUCTION OF
BERING SEA BOTTOM SEDIMENTS

as used by

Charles M. Hoskin
Principle Investigator
Benthos - Sedimentary Substrate Interactions
Contract #03-5-022-56
Task Order #3, R.U. #291

I. Sample Collection

Samples were taken from a van Veen grab sample, the remainder of which was used in Benthic Biology Program. Samples were stored in plastic bags, sealed, and frozen. One sample was taken at each station occupied for Benthic Biology Program. Sample bags were labeled with cruise number and station numbers, all ancillary data was maintained in filed notes.

II. Storage

Raw samples are stored frozen. Samples are thawed at room temperature, split in half, one half being retained, the second half is used in Digestion III.

III. Digestion

Digestion is performed if organic matter is detected, either visually or by odor. The sample is covered with water, 20 ml portions of 30% H_2O_2 are added at room temperature until reaction ceases. The digest is allowed to settle and clear supernate removed and discarded. The sample proceeds to Wet Sieve IV.

IV. Wet Sieve

Place wet sample on an 8" diameter stainless steel screen

.0625 mm susp ded over a 2 gallon plastic pail. Wash sample with water until washes are clear. Retain both washed sample and washings. Washed sample is put in beaker and oven dried at 59°C., and this portion is used by Dry Sieving V. Permit washings to settle in bucket until supernate is clear, usually in 12 hours. If settling is incomplete after 2 days, add 20 ml saturated $Mg\ Cl_2$ and let settle to clarity. Siphon off supernate and discard. Store wet mud in tared container for Pipetting VI.

V. Dry Sieving

A. By hand, pass dried sediment through a 2.00 mm screen. Retained portion is gravel; it is weighed, labeled and stored. Sediment passing ccreen is sand with some silt. Place this portion on 0.0625 mm sive, shake on Ro-Tap for 15 minutes. Sample passing screen is silt and is added to stored wet mud from IV. Material retained is sand; it is weighed and proceeds to V B.

B. If sand weight = 50 g, sieve. If sand weight is greater than 50 g, pass through riffle splitter to yield aliquot weighing no more than 50 g.

Place 50 g sand aliquot in nested 8' screens of sizes:

1.68 mm

1.41

1.19

1.00

.84

.71

.59

.50

.42

.35

Pan

Secure nested sieves in Ro-Tap Sieve-Shaker, run for 10 minutes. Recover sediment retained on each screen, place in separate, labelled beakers, record weights of each fraction to nearest 0.01g.

Place sediment in pan onto nested 8" screens of sizes:

.30 mm

.25

.21

.177

.149

.125

.105

.088

.074

.0625

Pan

Secure . ted sieves in Ro-Tap Sieve-Sh r, run for 10 minutes. Recover sediment retained on each screen, place in separate, labelled beakers, record weights of each fraction (to -0 nearest or 01 g.).

The sand fraction is rerun through the above operations if the weight of sediment passing through the 0.0625 mm screen is greater than 0.2g.

Recombine sand fractions, store in labelled paper envelope.

C. Place stored gravel fractions on nested 8" screens of sizes:

32.0 mm
22.6
16.0
11.2
8.0
5.6
4.0
2.8
2.0
Pan

Shake screens by hand for 10 minutes. Recover sediment retained on each screen, record weight of each fraction to 0.01g. Recombine fractions, store in labelled paper envelope.

VI. Pipetting

Aspirate off clear supernate, weigh wet mud, subtract container weight, record weight of all wet mud to nearest 0.01g.

Stir mud to uniform slurry, weigh out approximately 40g wet mud into beaker, wash wet mud with Calgon solution (2.5 g/l) into blender cup, mix at moderate speed in blender for 2 minutes. Wash mud with Calgon solution into 1 l hydrometer jar, make up to 1 l with Calgon solution, stir with vertical motions. Place hydrometer jar (up to three at a time) in 27°C. thermostatically-controlled water bath, let equilibrate for 12 hours. Check for flocculation (all mud on bottom). If flocculated, prepare another mud aliquot, washing and centrifuging first to remove flocculating agent (usually salt).

Weigh eleven 50 ml beakers to 0.0001 g, labelled for sizes:

Ø	mm
Start	Start
4.5	.044
5.0	.031
5.5	.022
6.0	.0156
6.5	.0113
7.0	.0078
7.5	.0055
8.0	.0039
9.0	.0020
10.0	.00098

Stir mud sample in 1 l hydrometer cylin with vertical strokes for 1.0 minute. Collect size fractions according to schedule shown below with 20 ml pipet. Wash sample, rinse pipet into weighed, labelled 50 ml beakers.

Pipet sampling schedule: <u>for 27°C. only</u>

Sample Ø	Depth, cm	Time from cessation of stirring
Start	20	20 seconds
4.5	20	1 minute, 38 seconds
5.0	15	2 minutes, 27 seconds
5.5	10	3 minutes, 15 seconds
6.0	10	6 minutes, 32 seconds
6.5	10	12 minutes, 24 seconds
7.0	10	26 minutes, 6 seconds
7.5	10	50 minutes, 39 seconds
8.0	10	1 hour, 45 minutes
9.0	10	6 hours, 36 minutes
10.0	5	13 hours, 44 minutes

Place beakers with samples in 95°C. oven, evaporate. Remove beakers from oven, allow to equilibrate with air for one hour, record weight of each beaker to 0.0001 g.

VII. <u>Data Reduction</u>

A. From pipet analysis;

wt. beaker containing about 40 g wet mud -

wt. beaker = wt. wet mud pipetted.

B. Wt. beaker and oven-dried mud of "start" sample (20 second sample)

- wt. beaker - .05 (st. Calgon) x 50 = wt. dry mud pipetted.

C. wt. dry mud pipetted ÷ wt. wet mud pipetted = portion water in wet mud (usually = 0.5; 50%).

D. Wt. all wet mud (from V) x proportion water = wt. all dry mud.

E. Determination of total sample weight. Wt. all gravel + wt. all sand + wt. all dry mud = total sample wt.

F. Determination of weight percent for gravel and sand.

G. Determination of cumulative percent for gravel and sand.

Accumulative summation of individual weight percent, starting with 32.0 mm gravel through 0.0625 mm sand yields cumulative percent of sample coarser than 0.0625 mm.

H. Determination of cumulative percentages for mud

1. Wt. all dry mud ÷ wt. dry mud pipetted =

splitting factor (always greater than 1.0).

2. Wt. dry mud pipetted (20 seconds sample) x splitting factor = corrected wt. for all dry mud.

3. Wt. beaker containing dried mud - wt. beaker, - .05 (wt. Calgon), x 50 = wt. each mud fraction.

4. Wt. each mud fraction x splitting factor = corrected wt. for each mud fraction.

5. Total sample wt. - corrected wt. for each mud fraction x 100 = total sample wt.

   Cumulative percent coarser for each mud fraction.

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Research Unit 327

I. TITLE: Shallow Faulting, Bottom Instability, and Movement of Sediments in Lower Cook Inlet and Western Gulf of Alaska

II. PRINCIPAL INVESTIGATORS: Monty A. Hampton
Arnold H. Bouma

U. S. Geological Survey
Menlo Park, California 94025

III. GEOGRAPHICAL AREA AND INCLUSIVE DATES:

October 1, 1977 - September 30, 1978

Western Gulf of Alaska

The statements of work had not been received in finally approved form in time for publication.

TITLE: Determine the Frequency and Pathology of Marine Fish Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea

RESEARCH UNIT: 332

PRINCIPAL INVESTIGATORS: Bruce B. McCain, PhD
Harold O. Hodgins, PhD
Albert K. Sparks, PhD
William D. Gronlund, MS

TOTAL COST OF PROPOSAL: 47.3 K

INSTITUTION: Environmental Conservation Division
National Marine Fisheries Service, NOAA
Northwest & Alaska Fisheries Center
2725 Montlake Boulevard East
Seattle, Washington 98112

PERIOD: October 1, 1977 to September 30, 1978

PRINCIPAL INVESTIGATORS:

Name Bruce B. McCain Date 8/8/77 FTS 399-4806 206-442-4806
Address: NOAA, NMFS, Northwest & Alaska Fisheries Center, 2725 Montlake Blvd. E., Seattle, Washington 98112

Name Harold O. Hodgins Date 8/3/77 FTS 399-4638 206-442-4638
Address: NOAA, NMFS, Northwest & Alaska Fisheries Center, 2725 Montlake Blvd. E., Seattle, Washington 98112

Name Albert K. Sparks Date 8/3/77 FTS 399-0260 206-442-0260
Address: NOAA, NMFS, Northwest & Alaska Fisheries Center, 2725 Montlake Blvd. E., Seattle, Washington 98112

Name William D. Gronlund Date 8/5/77 FTS 399-7740 206-442-7740
Address: NOAA, NMFS, Northwest & Alaska Fisheries Center, 2725 Montlake Blvd. E., Seattle, Washington 98112

ORGANIZATION APPROVAL:

Name Donald C. Malins Date 8/3/77 FTS 399-7737 206-442-7737
Address: NOAA, NMFS, Northwest & Alaska Fisheries Center, 2725 Montlake Blvd. E., Seattle, Washington 98112

Name ____________ Date ______ FTS
Address:

ORGANIZATION FINANCIAL OFFICER:

Name ____________ Date ______ FTS
Address:

TECHNICAL PROPOSAL

I. TITLE: Determine the Frequency and Pathology of Marine Animal Diseases in the Bering Sea, Gulf of Alaska, and Beaufort Sea.

RESEARCH UNIT NUMBER: 332

CONTRACT NUMBER: R7170817

PROPOSED DATES OF CONTRACT: October 1, 1977, to September 30, 1978

II. PRINCIPAL INVESTIGATORS: Bruce B. McCain, PhD
Harold O. Hodgins, PhD
Albert K. Sparks, PhD
William D. Gronlund, MS

III. COST OF PROPOSAL:

Total $47.3K

Distribution of Effort by Lease Area: Northern GOA

IV. BACKGROUND

During FY 1976 to 1977, our unit investigated the baseline health status of fish and invertebrates in the offshore portions of the Bering and Chukchi Seas, Norton Sound, and the NEGOA.

Five major pathological conditions were found in fish, and they were as follows: epidermal papillomas of rock sole (*Lepidopsetta bilineata*) and flathead sole (*Hippoglossoides elassodon*), pseudobranchial tumors of cod (*Gadus macrocephalus*), and pollock (*Theragra chalcogramma*), lymphocystis of yellowfin sole (*Limanda aspera*), skin lesions in cod, and larval trematode infestations characterized by black spots in the skin of Pacific herring (*Clupea harengus pallasi*), toothed smelt (*Osmerus mordax dentex*), and saffron cod (*Eleginas gracilis*). The invertebrates had two important pathological conditions, infestation of sea stars (*Leptasterias* sp.) by parasitic gastropods, and extensive attachment of leech eggs to the appendages of shrimp (*Sclerocrangon boreas*) (McCain et al, 1977a, 1977b; Alpers et al, 1977; OCSEAP Annual Report for RU 332, 1977).

The near-shore coastal waters of Alaska have not yet been investigated for the baseline health status of demersal fishes and invertebrates. Several types of evidence indicate that it is extremely critical that the information on the distribution and prevalence of pathological conditions in these areas be obtained. During our offshore investigation in the Bering Sea and the NEGOA, the frequency of skin tumors in rock and flathead sole was very much higher in shallower waters; for example, in the Bering Sea during 1976 the mean frequncy of skin tumors in rock sole was 1.3%, but at the two shallowest stations (around 50 meters) the frequency of tumor-bearing sole was 21 and 59%. Also, the only sampling station at which tumor-bearing rock sole were captured in the NEGOA was the shallowest (63 meters).

Certain age classes and species are found in coastal waters that are not present in offshore areas, and there are indications that certain diseases may be more prevalent among the fish and invertebrates in these near-shore areas. The previously mentioned skin tumors on rock sole are a good example; two to four year old male rock sole which were captured almost exclusively at shallower off-shore sampling stations had an overall tumor frequency of 37%, as compared to 0.5% for male rock sole over four years of age from deeper waters.

The starry flounder is another good example, so far we have only examined adult starry flounders over 3 years old and none had tumors. Nevertheless, one of the first reports of skin tumors in Alaskan waters was a report by Turner (1886) describing starry flounder with such tumors captured in the near-shore waters of the Aleutian Islands. The main reason we have seen no or very few tumor-bearing starry flounder and rock sole in our offshore work is probably that the young flounder which would have the highest tumor frequency (Wellings et al, 1976) are found almost exclusively in estuaries and shallow waters (Clemens and Wilby, 1961).

Environmental stresses are known to make fish and invertebrates more susceptible to disease agents. Coastal and estuarine waters have greater extremes of these types of stress than do deeper waters, including higher and lower temperatures, more suspended sediments, lower salinity, and closer proximity to urban pollution. This may imply that disease is more prevalent and of greater significance in near-shore areas than in offshore areas, or, conversely, that species that survive there have been selected for greater resistance to stress-induced diseases.

In the investigation we are proposing, we are requesting support for continuing our cooperative efforts with the RACE Division of the NWAFC in examining the baseline health characteristics of fish and invertebrates in order to develop what may become extremely important data for evaluating future impacts of oil on these marine animals in the near-shore waters of the Northern GOA.

High frequencies of marine species with tumors or other diseases may be found associated with future near-shore oil-producing areas. If baseline studies such as these described in this proposal are not performed, and if our previous offshore work did not encounter substantial numbers of the affected species or life stages involved, then it may well be extremely difficult to judge the relationship of these diseases to petroleum-related activities.

V. OBJECTIVES

1. Determine the frequency, geographical distribution, and biological and pathological characteristics of demersal marine fish and macro-invertebrates in the Northern GOA with externally visible pathological conditions. Baseline data on the health of marine animals collected prior to the time when environmental impacts of oil exploration and production occur will aid in the assessment of the future effects of oil on marine life.

2. Characterize microorganisms isolated from diseased animals using standard microbiological procedures. Knowledge of the properties of microbial pathogens associated with pathological abnormalities in demersal animals will provide a clearer understanding of the ways in which exposure of a marine animal to oil could directly or indirectly affect the frequency and distribution of pathological conditions.

VI. GENERAL STRATEGY AND APPROACH

Baseline levels of pathological conditions in marine fish and macro-invertebrates in the near-shore waters of the Northern GOA will be investigated. The bulk of this research will be performed in cooperation with RACE Division of the NWAFC, Seattle, which will be performing resource assessment studies in this area aboard research vessels. As animals are captured, they will be examined for external visible pathological conditions and, when feasible, for readily recognizable internal disorders.

The following data will be collected: (1) the species, size, weight, sex, and age of affected individuals, and (2) the frequency and geographical distribution of each type of condition. The gross pathology of the conditions will be described, and appropriate tissue specimens preserved and brought to the laboratory where their histopathological properties will be examined. In addition, microorganisms (e.g., bacteria, viruses, and fungi) will be isolated from diseased animals and further characterized in the laboratory. Also, samples of apparently normal invertebrates will be collected and fixed in order to determine normal histology and to examine for lesion and parasites that are not grossly visible.

The field data will be recorded on computer cards and magnetic tape, and the biological properties of diseased animals will be compared with those of the normal population from the same general area.

VII. SAMPLING METHODS

In general, the temporal and spatial sampling scheme to be followed by our research unit in examining marine animals will be parallel that used by personnel of the RACE Division. The same samples or subsamples chosen by the resource assessment investigators for length and sex frequencies will be examined by us. In cases where species are captured and no length/sex frequencies are to be determined, we will examine the total sample or a subsample.

VIII. ANALYTICAL METHODS

Tissues from animals with abnormalities will be preserved by freezing and/or fixation for light and electron microscopy. These samples will be brought to the laboratory and subjected to histopathological and microbiological procedures using standard techniques.

IX. ANTICIPATED PROBLEMS: None

X. DELIVERABLE PRODUCTS

A. Digital Data

1. Field data will be recorded onto data sheets and keypunched onto computer cards using existing formats titled: Marine Fish Pathological Format (File Type 013) and Marine Invertebrate Pathology Format (File Type 063).

2. Digital Products - each format consists of five distinct record types: file header, station header, species catch, individual lesion, supplementary lesion. See also Data Products Schedule on p. 10.

B. Narrative Reports - will consist of journal articles and conference proceedings. Anticipated areas of subject emphasis in the narrative reports include:

1. Temporal and geographic distribution of diseased and non-diseased fishes and invertebrates.

2. Information on the epizootiology of pathological conditions, including evaluation of disease effects on individuals and populations.

DATA PRODUCTS SCHEDULE

Data Type (i.e. Intertidal, Benthic Organisms, etc.	Media (Cards, coding sheets, tapes, disks)	Estimated Volume (Volume of processing data)	OCSEAP Format (If known)	Processing and Formating done by PI (yes or No)	Collection Period Month/Year to Month/Year	Submission (Month/Year)
Marine Fish Pathology	Cards	10,000	013	Yes	Oct/77 to July/78	4 months after Collection
Marine Invertebrate Pathology	Cards	5,000	063	Yes	Oct/77 to July/78	4 months after Collection

3. Description of gross pathology and structural changes associated with disease conditions.

C. Visual Data - Primary types of visual data to be in reports will be:

1. Photographs of gross pathology

2. Micrographs of structure and ultrastructure of pathological conditions

3. Tables of disease frequencies for various species examined

4. Distribution maps of disease occurrence and frequency

5. Graphs of age, sex, and length composition comparing normal and diseased animals

D. Other Non-Digital Data - none.

E. Data Submission Schedule - Times of collection and submission of data will depend upon the timing of sample collections by resource assessment investigators.

XI. INFORMATION REQUIRED FROM OTHER INVESTIGATORS:

The biological characteristics (size, weight, age, and sex) of normal populations of marine species examined by us and found to have pathological conditions will be needed from RACE Division personnel who will be cooperating in these baseline investigations.

XII. QUALITY ASSURANCE PLANS:

Data quality will be assured by systematically applying methods previously described in quarterly and annual reports to OCSEAP for Research Unit #332 investigations during calendar years 1975-1977. The methodology used is designed to collect information on large numbers of individuals of each species, with the widest possible geographical representation. Sample sizes for many species are large enough that all but very low frequency, grossly identifiable disease will be detected. The PI's in charge of the field examinations are well-trained in disease research and are thoroughly experience in field operations. All sampling efforts will include one or more scientist(s) with previous field experience in examining fish and invertebrates for disease. In addition, excellent photographic records of diseases encountered in previous studies are available as guidelines. Methods of processing and analyzing specimens for histological, microbiological, and ultrastructural analyses have been perfected during the two previous years of similar OCSEAP studies. Methods of numerical data collection and analysis have also been applied and perfected previously. In addition, there is an excellent biometrics unit available at NWAFC to help solve data analysis problems, should they arise.

XIII. SPECIAL SAMPLE AND VOUCHER SPECIMEN ARCHIVAL PLANS: N/A

XIV. LOGISTIC REQUIREMENTS:

Under the proposed funding we anticipate a maximum of four field trips will be undertaken in FY 78. As in previous investigations we must interface our efforts with ongoing assessment programs. We would include one or two of our staff on each available sampling trip.

Regions proposed for inshore studies near Kodiak Island (Northern GOA) could be adequately investigated by two or perhaps three one-month-long cruises if they cover the same geographical areas. Preferable times would be early spring, midsummer, and late fall. We would expect to examine a total of 25,000-30,000 individual fish per cruise representing 15-20 different species. Small numbers of samples for microbiological, histological, and ultrastructural analyses would be collected from animals with overt pathological signs.

In addition we would, if possible, participate in one or two other near-shore surveys planned for other areas of the Northern GOA. For such studies we would have sampling requirements similar to those outlined above.

XV. MANAGEMENT PLAN

A. Management of Program

Bruce B. McCain, PhD, a Principal Investigator, will coordinate field and laboratory activities, perform and supervise pathological procedures with fish in the field and laboratory and will have responsibility for the preparation of progress reports and some journal manuscripts. Harold O. Hodgins, PhD, Principal Investigator, will be general supervisor over all phases of the research activities. Albert K. Sparks, PhD, Principal Investigator, will be responsible for the histopathological examination of invertebrate tissues, and will participate in field activities. William D. Gronlund will supervise and participate in field activities, supervise the recording of field data on computer cards and will perform preliminary analyses of field data. The yet-to-be-hired fish disease specialist will perform histopathological examinations of fish tissues and participate in field activities.

B. Activity/Milestone/Data Management Chart

Until the sampling schedules of the RACE Division's resource assessment study have been approved and space for our personnel aboard sampling vessels has been allotted, exact milestone dates with respect to data collection cannot be given. Other milestones are listed on the Milestone Chart, p. 16.

XVI. OUTLOOK

Because the health status of marine animals is an important aspect of marine resource assessment investigations, it is hoped that the pathological conditions of fish and invertebrates will be monitored as long as baseline studies of these animals are continued.

A. Final results and data products - the frequency, geographical distribution, and the pathological and biological properties of affected animals will be determined. Data products will be in the form of computer cards, distribution maps, figures, tables, photomicrographs, and journal articles.

B. Significant milestones - both field and laboratory activities and, therefore, milestones will depend on the sampling schedules of resource assessment investogators.

C. Cost by fiscal year - FY 79 - $50 K, FY 80 - $55 K

D. Additional major equipment - none

E. Location of future field efforts - Northern GOA

F. Logistics requirements - same as FY 78.

OCSEAP use only.
RU#
Discipline 13
Area of Operation

LOGISTICS REQUIREMENTS

Ple..se fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTUTUTION NMFS/NWAFC/NOAA PRINCIPAL INVESTIGATOR Bruce B. McCain

A. SHIP SUPPORT

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions.
Same as the resource assessment investigators

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. Captured marine fish and invertebrates will be examined for externally visible diseases, the biological properties of affected animals will be recorded, and appropriate specimens collected.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.)
As in Item 1.

4. How many sea days are required for each leg? (Assume vessel cruising speed of 14 knots for NOAA vessels. Do not include running time from port to beginning point and from end point to port and do not include a weather factor.)
As in Item 1.

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback?
We could piggyback.
Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling-time on station and sample processing time between stations.
Our requirements will cooincide with those of the resource assessment investigations.

6. What equipment and personnel would you expect the ship to provide?
Refrigerator, freezer, and microscope

7. What is the approximate weight and volume of equipment you will bring?
300 lb, 40 cu ft.

8. Will yourdata or equipment require special handling? NO If yes, please describe:

9. Will you require any gasses and/or chemicals? YES If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.
Should be on board prior to departure.

10. Do you have a ship preference, either NOAA or non-NOAA? If "yes" please name the vessel and give the reason for so specifying.
NO

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availability
N/A

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.
1 to 2

XVII. STANDARD STATEMENTS

1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labelled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when they are used, and sexes where these are morphologically distinguishable.

4. At the option of the Project Office the PI is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutally satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release for information and for forwarding to BLM. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following acknowledgment is standard.

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

MILESTONE CHART

RU #: 332 PI: Bruce B. McCain

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops, etc.

MAJOR MILESTONES	1977			1978														
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D			
Participate in field activities			Times not determined															
Submit data after each cruise (within 120 days)																		
Submit Quarterly Reports			X				X			X			X					
Submit Annual Report							X											
Do histopathology and microbiology on specimens collected in field																		

Publications: 22 recent relevant examples:

McCain and Wellings. 1974. A tumor-specific cell in flatfish (Heterosomata) papillomas with an abnormally low DNA content. Proc. Amer. Assoc. of Cancer Res. 15: 116.

Wellings, McCain, and Miller. 1976. Papillomas in pleuronectid fishes: the current state of knowledge, with particular reference to etiology. Prog. Exper. Tumor Res. 20: 55-74.

Wellings, Alpers, McCain, and Miller. 1976. Fin erosion disease in starry flounder and English sole in the Duwamish River, Seattle, Wash. J. Fish. Res. Board Can. 33: 2577-2586.

Alpers, McCain, Myers, and Wellings. 1977. Pathology of pharyngeal tumors of the Pacific Cod (*Gadus macrocephalis*) in the Bering Sea. J. Nat. Cancer Inst. (In press).

Wingert, R. C., B. B. McCain, K. V. Pierce, S. F. Borton, D. T. Griggs, and B. S. Miller. 1975. Ecological and disease studies of demersal fishes in the vicinity of sewage outfalls. 1975 Annual Report of the College of Fisheries, University of Washington, Seattle WA 98195. #444, pp. 29-30.

Sherwood, M. J. and B. B. McCain. 1976. A comparison of fin erosion disease in two regions. In the 1976 Annual Report of the So. Calif. Coastal Water Res. Proj. El Segundo, Calif.

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Miller, B. S., B. B. McCain, R. C. Wingert, K. V. Pierce, S. F. Borton, D. T. Griggs. 1976. Ecological and Disease Studies of Demersal Fishes in the Vicinity of Sewage Outfalls. Annual Report of the College of Fisheries, University of Washington, Seattle WA 98195, pp. 31-33.

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Published and in press: 54. Selected recent examples relevant to fish pathology and disease resistance.

Roubal, W. T., H. M. Etlinger, and H. O. Hodgins. 1974. Spin-label studies of a hepten combining site of rainbow trout antibody. J. Immunol. 113: 309-15.

Harrell, L. W., H. M. Etlinger, and H. O. Hodgins. 1975. Humoral factors important in resistance of salmonid fish to bacterial disease. 1. Serum antibody protection of rainbow trout (Salmo gairdneri). Aquaculture 6: 211-19.

Schiewe, M. H. and H. O. Hodgins. 1977. Specificity of protection induced in coho salmon (Orcorhynchus kisutch) by heat-treated components of two pathogenic vibrios. J. Fish. Res. Board Can. (In press).

Hodgins, H. O., M. H. Schiewe, A. J. Novotny, and L. W. Harrell. 1977. Pacific salmon diseases. In: Diagnosis and Control of Mariculture Diseases in the United States (C. J. Sindermann, ed.). Elsevier Publishing Co., Amsterdam (In press).

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65 Recent Relevant Examples

Sparks, Albert K. 1962. Metaplasia of the gut of the oyster Crassostrea gigas (Thumberg) caused by infection with the copepod Mytilicola orientalis Mori. J. Insect Pathol. 4(1): 57-62.

Mackin, J. G. and A. K. Sparks. 1962. A study of the effect on oysters of crude oil: loss from a wild well. Publications of the Institute of Marine Science, Texas, Vol. 7, 230-261.

Sparks, Albert K., Gilbert B. Pauley, Richard R. Bates, and Clyde S. Sayce. 1964. A mesenchymal tumor in a Pacific oyster, Crassostrea gigas (Thumberg). J. Insect Pathol. 6(4): 448-452.

Sparks, Albert K., Gilbert B. Pauley, Richard R. Bates, and Clyde S. Sayce. 1964. A tumorlike fecal impaction in a Pacific oyster, Crassostrea gigas (Thumbert). J. Insect Pathol. 6(4): 453-456.

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Sparks, Albert K. and Walter T. Pereyra. 1966. Benthic invertebrates of the southeastern Chukchi Sea. p. 817-838 (Chap. 29). In: Norman J. Wilimovsky and John N. Wolfe (eds.), Environment of the Cape Thompson Region, Alaska, U. S. Atomic Energy Comm., Div. of Tech. Infor. Ext., Oak Ridge, Tennessee.

Sparks, Albert K. and Kenneth K. Chew. 1966. Gross infestation of the littleneck clam, Venerupis staminea, with a larval cestode (Echeneibothrium sp.). J. Invertebr. Pathol 8(3): 413-416.

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Pauley, Gilbert B. and Albert K. Sparks. 1968. An unusual internal growth associated with multiple watery cysts in a Pacific oyster (Crassostrea gigas). J. Invertebr. Pathol. 11(3): 398-405.

Sparks, Albert K., Gilbert B. Pauley, and Kenneth K. Chew. 1969. A second mesenchymal tumor from a Pacific oyster (Crassostrea gigas). 1968 Proc. Natl. Shellfish Assoc. Vo. 59, pp. 35-39.

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Mix, Michael C. and Albert K. Sparks. 1970. Studies on the histopathological effects of ionizing radiation on the oyster Crassostrea gigas. I. The degenerative phase involving digestive diverticulae, stomach, and gut. J. Invertebr. Pathol. 16(1): 14-37.

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Mix, Michael D. and Albert K. Sparks. 1971. The histopathological effects of various doses of ionizing radiation on the gonad of the oyster, Crassostrea gigas. Proc. Natl. Shellfish. Assoc., Vol. 61 pp. 64-70.

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Sparks, Albert K. 1973. Host response in the white shrimp, Penaeus setiferus, to infection by the larval trypanorhyncid cestode, Prochristianella penaei. J. Invertebr. Pathol. 22: 213-19.

Sparks, Albert K. 1972. Invertebrate Pathology. Noncommunicable Diseases. 387 pp. Academic Press, New York/London.

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Patten, B. G., Thompson, R. B., and W. D. Gronlund. 1970. Distribution and abundance of fish in the Yakima River, Wash. April 1957 to May 1958. USFWS, SSR - Fisheries No. 603 31 p.

Gronlund, W. D. and H. O. Hodgins. 1970. Use of pituitary gland to determine maturity in salmon. INPFC Annual Report 1968: p. 101-03

Gronlund, W. D. 1969. Biological assay and partial characterization of the gonadotropic factors of the pituitary gland of Pacific salmon (Oncorhynchus). MS Thesis, University of Washington. 57 p.

Gronlund, W. D., Hodgins, H. O., and E. A. Blood. 1973. Pituitary gonadotropic activity and ovarian antigens for predicting age at maturity of high seas sockeye salmon. INPFC Annual Rpt. 1971 p. 101-07.

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Hibbits, J. H., K. L. Reed, B. J. Meeuse. 1967. Crassulacean acid metabolism in some members of the genus Stepelia (Asclepiadaceae). Kon. Ned. Akad. Weten. 526-534.

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McCain, B. B., S. R. Wellings, C. E. Alpers, M. S. Myers, and W. D. Gronlund.
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McCain, B. B., M. S. Myers, W. D. Gronlund, S. R. Wellings.
1977b. Baseline data on diseases of fishes from the Bering Sea for 1976. U. S. Natl. Mar. Fish. Serv., NWAFC, Seattle WA Submitted to Fisheries Bull.

Sparks, Albert K.
1972. Invertebrate Pathology. Noncommunicable Diseases. 387 pp. Academic Press, New York/London.

Turner, L. M.
1886. Results of investigations made chiefly in the Yukon District and the Aleutian Islands. In: Contritutions to the Natural History of Alaska, U. S. Army.

Wellings, S. R., B. B. McCain, and B. S. Miller.
1976. Epidermal papillomas in Pleuronectidae of Puget Sound, Wash. Review of the current status of the problem. Prog. in Experimental Tumor Res. 20: 55-74/

Research Unit #337

I. TITLE: Seasonal Distribution and Abundance of Pelagic Birds

II. PRINCIPAL INVESTIGATORS:

Calvin J. Lensink
Kenton D. Wohl
Patrick J. Gould
Craig S. Harrison

U.S. Fish and Wildlife Service
Office of Biological Services/
Coastal Ecosystems
800 A Street, Suite 110
Anchorage, Alaska 99501

III. GEOGRAPHICAL LOCATION AND INCLUSIVE DATES:

October 1, 1977 - September 30, 1978

Alaskan Sea Coast

The statements of work had not been received in finally approved form in time for publication.

Research Unit #341

I. TITLE: Population Dynamics and Trophic Relationships of Marine Birds in the Gulf of Alaska and Sothern Bering Sea

II. PRINCIPAL INVESTIGATORS: Calvin J. Lensink
Kenton D. Wohl
R. E. Gill, Jr.
G. A. Sanger
A. W. Sowls

U.S. Fish and Wildlife Service
Office of Biological Services/
Coastal Ecosystems
800 A Street - Street 110
Anchorage, Alaska 99501

III. GEOGRAPHICAL AREA AND INCLUSIVE DATES:

October 1, 1977 - September 30, 1978

Gulf of Alaska, Southern Bering Sea

The statements of work had not been received in finally approved form in time for publication.

OCS 77-16

RESEARCH PROPOSAL

to

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Outer Continental Shelf Environmental Assessment Program
Boulder, Colorado 80302

ALASKAN OCS PROGRAM COORDINATION
Research Unit 350

Total Cost $136,827

Sea Grant Program
University of Alaska
Fairbanks, Alaska 99701

June 1977

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June 15, 1977

TECHNICAL PROPOSAL

I. Title and Task Statement Number

Alaskan OCS Program Coordination
Research Unit 350

II. Principal Investigator

Mr. Donald H. Rosenberg
Director
Alaska Sea Grant Program
University of Alaska

III. Cost of Proposal

Total $136,827
N/A

IV. Background:

The large interdisciplinary research program being undertaken by the University of Alaska for NOAA requires internal coordination and special monitoring to insure the maximum efficiency of the scientific programs. Field logistics, equipment acquisition, personnel, contract reporting, data distribution, and information exchange, all required by the program, are beyond the normal scope of the University administration structure and require a central coordination to avoid duplication and confusion.

V. Objectives:

This project provides for the continuation of the OCS coordination office at the University of Alaska. This office has monitoring authority over all Task Orders under the University of Alaska's contracts with NOAA. This monitoring effort is limited to evaluation of the scientific effort being consistent with work statements, field data collection for consistence with Data Management Plans, establishment and maintenance of Data Management Schedules and the completion and submission of all required reports. The office also provides keypunch service for both the University and other OCS research units, as identified by the Juneau project office, in order to insure timely submission of all identified environmental data.

VI. General Strategy:

The management staff consists of the following personnel:

Donald H. Rosenberg	Coordinator
Raymond S. Hadley	Data Manager
Connie J. Bittorf	Keypunch Operator
T.B.N.	Fiscal Monitor
William Stringer	G.I. Liaison

In addition, the following personnel are provided by the University:

Brenda Melteff	Administrative Assistant
Helen Greschke	Typist

The responsibilities of these personnel are as follows:

Donald H. Rosenberg acts on behalf of the University of Alaska in any contract negotiations and in general supervision of the remaining staff in day-to-day work.

Raymond S. Hadley is responsible for the day-to-day management of the University's OCS contract, including all phases of Data Management, logistic coordination, and report submission; he also acts as a point of contact between the Project Offices and Principal Investigators. In the role of data manager, Mr. Hadley supervises the work of Ms. Bittorf, the keypunch operator.

A new person will be sought to fill the vacancy of the Fiscal Monitor position. The duties of this person are to maintain a day-to-day accounting of all monies for all task orders and prepare a quarterly report of expenditures for each task.

Dr. William Stringer has been added to the team to allow for closer coordination between this office and the Geophysical Institute projects. He will act as a partner with Mr. Hadley in performing the duties listed for Hadley relative to the Geophysical Task Orders.

VII. Sampling Methods:

Not applicable.

VIII. Analytical Methods:

Not applicable

IX. Anticipated Problems:

None.

X. Deliverable Products:

A. Digital Data

This project acts as a conduit for data gathered under other task orders. No data originates with this task.

B. Narrative Reports

Reports on the activities of this project will be submitted quarterly.

Cruise Reports and Data Submission Schedules are prepared by this office for all Task Orders under our jurisdiction.

XI. Information Required from Other Investigators:

Information necessary to create data and report submissions must come from other Principal Investigators. This information is readily obtained from the investigators under the contracts managed by this task. Any work done for investigators outside these contracts must be funneled through the appropriate Project Office, which takes responsibility for delivering all necessary information.

XII. Quality Assurance Plans:

This office receives data on copies of forms or computer printouts in whatever format used by the Principal Investigator. We do not accept the only copy of the data. The Data Manager determines whether all the information necessary for submission is available. If it is, the data goes to the keypunch operator. If it is not, the Data Manager finds out what is missing, then gives the data to the keypunch operator. The keypunch operator re-formats the data, as necessary, and does simple conversions when necessary, i.e., local to G.M.T., tenth of minutes to seconds of degrees, specified coding, etc. The data is key-punched, then verified after at least one day's delay. The verified cards are listed. The listing is spot checked by the Data Manager for format errors, or errors committed by the keypunch operator in coding or conversions. The corrected cards are given to the computer programmer with the label information and formating requirements. A tape is produced, which is returned to the Data Manager with a partial dump and the appropriate section of the D.D.F. filled out. The Data Manager completes the D.D.F. and forwards the tape and necessary documents to the project office by certified mail.

All along the line, if any questions develop concerning the data, either the Principal Investigator or the technician directly responsible for the data is contacted. The problems are cleared to the satisfaction of the Data Manager before work continues.

XIII. Special Sample and Voucher Specimen Archival Plans:

This office has agreed and continues to agree to negotiate a reasonable plan for collecting and maintaining Voucher Specimens for all appropriate tasks under our jurisdiction. As of this time, no such plan exists to our knowledge. We agree to review any plan proposed by NOAA/OCS, making comments and to reach an agreeable solution.

XIV. Logistics Requirements:

Funds are requested under this project to provide for travel, communication, xeroxing and computer service. Special travel is requested to allow for University Principal Investigators to travel to coordination and other NOAA meetings. Budgeted amounts are based upon this year's experience.

XV. Management Plan:

Technical management for the task orders supported by this office is provided by the Principal Investigators of those task orders. This task order provides logistics, data, and contractual and fiscal management as outlined below. The University of Alaska agrees that the Principal Investigator can travel to the Juneau Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator. Funds for travel are labeled "Administrative Travel" in the enclosed budget.

This office expects to undertake the following specific actions in partial fulfillment of the objectives of this work statement:

1. Environmental Data Management

   a. To code data and to provide keypunching and supervision of transfer to magnetic tape of data collected by the task orders listed in Other Data 7.

   b. To submit data management plans for those listed task orders, or new task orders, as necessary.

   c. To submit data, procedures, and documentation as specified in those data management plans.

   d. To establish and submit schedules for data submission in accordance with data management plans.

   e. To provide keypunching for up to 30,000 cards for task orders outside the contracts specifically covered by this office. This will be done at the discretion of and request from the Project Office providing the data to be keypunched is properly formated and in a readable form.

   f. To help incure the quality of environmental data submitted as part of this contract. This office will accept from the Project Data Manager, a set of printouts representing all data submitted under this contract. These printouts are to be in a manageabl format consisting of header information and data accompanied by appropriate printed headings. A statistical sample of these data will be compared to the raw data originally presented to this office for submission and any discrepencies noted and enumerated. Further, the printout will be reviewed by the Principal Investigator concerned to ascertain that the data contained are valid representations of the data he submitted.

2. Logistics

   a. To coordinate comments concerning the logistic project instructions received from the Project Offices. It must be emphasized that timely receipt of the preliminary instructions is required. In so responding, charts of cruise tracts and lists of personnel to be involved in the operation, including necessary information for security clearance will be provided when possible and where appropriate.

   b. Cruise reports will be formated and submitted, along with ROSCOP II forms, by this office as required by contract.

c. Copies of smooth plots and other cruise information are archived as received from the Project Offices by the Institute of Marine Science Data Processing Office. They are readily available to all Principal Investigators involved in the OCSEAP Program.

3. Reports

   a. To coordinate and aid in the preparation of all reports as required by the contract.

   b. To insure that all required reports are submitted in accordance with the contract.

4. Fiscal and Contract Management

   General contract management will be carried out by this office to insure that each aspect of the contract is carried out for the benefit of both the government and the University. Fiscal management will be maintained by this office over contract 03-5-022-56. Fiscal management of contract 03-5-022-55 will continue to be maintained by the Business Office of the Geophysical Institute.

5. Sorting Center Management

   It is proposed that this office coordinate sample flow and data flow and provide fiscal management for all OCS activities in the university's Marine Sorting Center. Procedures to be followed are provided in Other Data 8. Costs estimated for different types of samples are provided in Other Data 9.

XVI. Outlook:

The nature of this task precludes the necessity of answering this section in an independent manner. This task must be maintained for the duration of involvement by the University in OCSEAP and, therefore, is dependent on the level of effort for all tasks assigned to the University. The level of funding in the future is also dependent upon the number and nature of those tasks assigned to the University. Basically, level funding for the duration of the contract, adjusted to allow for inflation, will be necessary. Should the program expand, however, additional funds will be necessary.

XVI. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator. Funds for travel are labeled "Administrative Travel" in the enclosed budget.

5. Data will be provided in the form and format agreed to by the University and NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: ...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager by the Chief Scientist. If the Chief Scientist represents the contracts covered by this office, the form will be sent through this office.

8. This is in accordance with the base contract with which we shall comply.

9. Three copies of all publications or presentation abstracts or manuscripts pertaining to technical or scientific material developed under OCSEAP funding will be submitted to the COTR sixty days prior to publication or presentation. Copies of all news releases mentioning OCS or using information gathered by OCS funding will be sent to the COTR.

10. The following acknowledgment of sponsorship will be used:

> "This study was supported under contract 03-5-022-56 between the University of Alaska and NOAA, Department of Commerce through the Outer Continental Shelf Environmental Assessment Program to which funds were provided by the Bureau of Land Management, Department of Interior."

OTHER DATA 7

Task Orders and Research Units to be supported by the OCS Coordination Office University of Alaska FY '78

Contract 03-5-022-56

T/O	RU NO.	PRINCIPAL INVESTIGATOR
1	427	Alexander/Cooney
2	350	Rosenberg
3	290	Hoskin
5	275	Shaw
8	194	Fay
12	162	Burrell
15	5	Feder
19	289	Royer
23	351	Dieter
24	491	Hickok
27	441	Mickelson
33	529	Naidu
34	530	Cannon

Contract 03-5-022-55

GI 1	253	Osterkamp
GI 2	251	Pulpan
GI 3	271	Rogers
GI 5	258	Stringer
GI 6	265	Shapiro
GI 8	257	Stringer
GI 9	248	Burns
GI 10	483	Belon
GI 11	250	Shapiro/Harrison
GI 12	483	Biswas
GI 13	526	Matthews

OTHER DATA 8

SORTING CENTER PROCEDURES

1. An inventory of all samples to be sorted, giving a complete and accurate listing of sample identification information will be provided by the Principal Investigator to this office. This list will be batched according to the requested priority of sorting.

2. The samples will be delivered at the same time to the Marine Sorting Center, or if not available at that time, the expected date of delivery will be given this office.

3. Requested dates for return of data to the Principal Investigator should accompany each batch of samples and must be based on the attached table of estimated sample flow rates.

4. Priorities will be established by the University's OCS Coordination Office. In cases of conflict this office will coordinate with the Juneau project office.

5. Samples will be sorted only when funds are available. Estimates for costs per sample are provided in Other Data 9. It should be noted that these are estimated costs only and that actual costs will be charged the contract. In all cases, sorting will be done according to the agreed priorities up to the point funds allow.

6. The Juneau project office will be kept informed in each quarterly report under this task order of the status, costs, and data flow for samples in the Sorting Center.

SAMPLE FLOW RATE ESTIMATES

Intertidal Samples:

Once sorting commences at full rate, the following number of samples can be run:

Dominate Organisms Sorting

Five Samples/day/team, an amount of time equaling three days per team is needed each time a change of geographic area occurs for species identification verification.

Rough Microscopic Sorting

Two samples/day/team, six day period for identification verification is needed for each change in geographic area.

Detailed Microscopic Sorting

One sample/day/team, a nine day period for identification verification is needed for each change in geographic area.

Currently, the Sorting Center employs two teams capable of carrying out the above types of sorting.

Benthic Grab Samples:

Nominal Sorting

Two grabs/day/team, a six day period for identification verification is needed for each major change in geographic area.

Complete Sorting - Bering Sea

0.5 grab/day/team, a 12 day period for identification verification is needed.

Complete Sorting - Gulf of Alaska, Lower Cook Inlet

One grab/day/tem, a 12 day period for identification verification is needed.

The Sorting Center currently employs three teams capable of the above type of sorting.

Other Types of Sorting:

Flow rates for such items as stomach analysis, trawl species verification, etc., have not been determined for lack of data.

Phytoplankton and zooplankton sorting may be available through coordination with Dr. Alexander and Dr. Cooney, respectively, via this office.

Selected Publications:

Rosenberg, Donald H., Ed. 1976. Proceedings of the conference on salmon aquaculture and the Alaskan fishing community. Sea Grant Report 76-2

Rosenberg, Donald H., Ed. 1975. Study plan for social and economic impact assessment of Alaskan outer continental shelf petroleum development. Sea Grant Report 75-15

Rosenberg, Donald H., Ed. 1975. Proceedings of conference to review draft study plan for social and economic impact assessment of Alaskan outer continental shelf petroleum development. Sea Grant Report 75-14

Rosenberg, D. H., Ed. 1974. Oceanographic data Collier Carbon and Chemical Corporation pier, Cook Inlet, Alaska., University of Alaska

Rosenberg, D. H. 1972. Oil and gas seeps of the northern Gulf of Alaska. *In* D. H. Rosenberg, Ed., A review of the oceanography and renewable resources of the northern Gulf of Alaska, University of Alaska.

Burrell, D. C., and R. S. Hadley. 1970. The liquid in solid partition of a trace transition metal across a freshwater marine interface. Trans. Amer. Geophys. Union 51:769 (abstract).

Burrell, D. C., and R. S. Hadley. 1971. Suspended sediment size fractionation within a fjord-estuary: Application of electronic counting techniques. Trans. Amer. Geophys. Union 52;853 (abstract).

Unpublished

Burrell, D. C., P. J. Kinney, M. E. Arhelger, and R. S. Hadley. 1970. Beaufort Sea environmental data Report R70-20, Inst. Marine Science. 276 pp.

OCS77-21

RESEARCH PROPOSAL

to

National Oceanic and Atmospheric Administration
Outer Continental Shelf Environmental Assessment Program
Boulder, Colorado 80302

R/V *ACONA* AND MARINE LOGISTICS SUPPORT

RU #351

Total Costs $285,827

Institute of Marine Science
University of Alaska
Fairbanks, Alaska 99701

B. R. Dieter
Marine Superintendent
SS 329-34-7569
(907) 224-5261

J. R. Moore, Director
Institute of Marine Science
University of Alaska
(907) 479-7531

A. B. Frol
Director of Administrative Services
(907) 479-7340

K. B. Mather
Vice-Chancellor for Research and Advanced Study
(907) 479-7282

June 15, 1977

I. Title

R/V Acona and Marine Logistics Support
Research Unit #351

II. Principal Investigator

Ms. Dolly Dieter
Marine Superintendent
Institute of Marine Science
University of Alaska

III. Cost of Proposal

A. Science $0
B. Logistics $285,827
C. Total $285,827
D. To be determined

IV, V, VI.

This project provides general logistics and sea-going technical support for all OCS related research at the University of Alaska. Two sea-going marine technical positions are requested. These individuals will support the scientific cruises proposed for FY '78. In addition to duties at sea, these technicians are responsible for all shorebase logistics and equipment maintenance associated with the various OCS projects.

Also proposed under this project is the funding of 60 days of the Research Vessel Acona. These sea-days have been scheduled by Principal Investigators in accordance with their projected needs. (See Table 1).

VII. Sampling Methods

Not applicable.

VIII. Analytical Methods

Not applicable.

IX. Anticipated Problems

If additional sea days aboard the R/V Acona are required by NOAA, their need should be transmitted to the University as soon as possible.

X. Deliverable Products

A. Not applicable.

B. Quarterly Reports on the activities funded by this workstatement will be submitted.

C. Not applicable.

D. Not applicable.

E. Not applicable.

XI. Information Required from Other Investigators

Complete project instructions for all cruises which involve either use of the R/V Acona or University of Alaska projects.

XII. Quality Assurance Plans

Funds are requested to provide for calibration of scientific sampling equipment aboard the Acona. This calibration is carried out at the Northwest Regional Calibration Center of NOAA in Seattle, Washington. Calibration is scheduled during the winter shipyard period.

XIII. Special Sample and Specimen Archival Plans

Not applicable.

XIV. Logistic Requirements

None.

XV. Management Plan

This project will be managed by the Marine Superintendent who is in charge of all vessels and general support technicians for the Institute of Marine Science. Marine technicians will augment the marine technicial support provided by the National Science Foundation. The National Science Foundation also provides for the support of the Principal Investigator.

XVI. Outlook

The work of this Research Unit is totally supportive of other tasks. The need to further extend this task beyond the current proposed period will be determined by the need of the vessel R/V Acona by OCSEAP to accomplish its purpose and the need of marine technicians in support of University of Alaska endeavors on behalf of OCSEAP. These needs are to be determined by others.

XVII. Contractual Statements:

1. A schedule for data submission for each task order has been, and will continue to be, submitted and updated each quarter.

2. This statement is in accordance with our base contract, and we will continue to comply.

3. See section XIII of this proposal. The University of Alaska will continue to negotiate a Voucher Specimen Policy with NOAA/OCS. We will comply with the then agreed to policy.

4. See section XV of this proposal. The University of Alaska agrees that the Principal Investigators can travel to the Project Office at least twice during the contract year, provided that such travel

is in accordance with University of Alaska travel policy and consistent with other University duties of the Principal Investigator.

5. Data will be provided in the form and format agreed to by the University of NOAA/OCS in the negotiating of the Data Management Plans for each of the tasks falling under the jurisdiction of this office.

6. As per Article 9 of the base contract, the University of Alaska agrees to the following: "...all archivable data is to be submitted by the contractor to the Contract Data Manager within 120 days after acquisition. Certain data sets such as plankton counts or volumes are not available until sorting of samples is complete. The data so obtained are archivable 120 days following the actual sorting or other laboratory procedure."

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10. The following acknowledgement of sponsorship will be used:

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TABLE 1

R/V Acona

OCS Cruise Support FY '78

Dates	Area	Principal Investigator
November 3 - 8	GOA - PWS	Royer
November 29 - Dec. 12	Cook Inlet	Shaw/Burrell
Feb. 14 - 19	GOA - PWS	Royer
March 7 - 16	Cook Inlet	Shaw/Burrell
April 26 - May 1	GOA - PWS	Royer
July 11 - 20	Cook Inlet	Shaw/Burrell
July 25 - 30	GOA - PWS	Royer

PROPOSAL

Title: Environmental Assessment of Selected Habitats in the Beaufort and Chukchi Sea Littoral System

Research Unit: 356

Principal Investigator: A. Carter Broad

Total Cost of Proposal: $~~149,498~~ 129,688 ACB

Institution: Western Washington State College*

Department: Biology

Date: June 30, 1977

Authorizing Signatures:

Principal Investigator: A. Carter Broad 6/30/77 modified 9/1/77 ACB

A. Carter Broad
Department of Biology
Western Washington State College
Bellingham, WA 98225
(206) 676-3632

Officer authorized to sign for the College: Sam P. Kelly 6/30/77

Sam P. Kelly, Dean for Graduate Affairs and Research
Western Washington State College
Bellingham, WA 98225
(206) 676-3170

Financial Officer Harriet Axlund 6/30/77

Harriet Axlund, Project Fiscal Officer
Grant Administration
Western Washington State College
Bellingham, WA 98225
(206) 676-3200

* The name of the Institution will become Western Washington University on September 30, 1977.

Technical Proposal

I. Title: Environmental Assessment of Selected Habitats in the Beaufort and Chukchi Sea Littoral System.

Research Unit Number: 356

Contract Number: 03-5-022-81

Proposed Dates of Contract: at least through 30 September 1979

II. Principal Investigator: A. Carter Broad

III. Cost of Proposal for Fiscal 1978

Total ~~149,498~~ 129,688 ACB

Distribution of Effort by Lease Area:

1. Beaufort Sea - $87,253 Science
2. Chukchi Sea - ~~$45,805 Science, $16,440 Logistics~~ $37,055 SCIENCE, $5,380 LOGISTICS ACB

IV. Background: This project began in 1975 as a survey of the littoral region of the Beaufort Sea. In 1976 the area of concern was enlarged to include the Chukchi littoral, and the project was identified as "reconnaisance characterization" of the littoral biota. We have concerned ourselves with the biota of a beach zone defined shoreward by the usual upper limit of wind-determined water levels (lunisolar tides are negligible by contrast) and seaward by the depth at which our work has interfaced with that of Carey (RU 6). Within this littoral/intertidal zone, we have been an arctic counterpart to Zimmerman's (RU 79) Gulf and Bering Sea intertidal work and in a sense, a littoral extension of Carey's Beaufort Sea benthos studies. By circumstance as much as by design we have inherited benthic sampling in the Beaufort Sea "lease zone."

Our methodology and reportage of digital data have been influenced by RU 79 (Zimmerman) with appropriate Arctic modifications. Our data reporting to NODC follows what began as Zimmerman's format. Our shallow water surveys have begun with aerial reconnaisance of the entire coastline from Cape Prince of Wales to Demarcation Point. The selection of sampling sites has been based on this survey but, necessarily, modified by logistic considerations. To date, we have established species lists of the marine invertebrate fauna and infrequently encountered macroalgae and of beach vegetation. These data are quantitative for selected gear and habitat related. We have data from Beaufort

Sea beaches in both 1975 and 1976 and consider the reconnaisance phase in shallow water complete for that sector. Our Chukchi data are from 1976 only but field teams have begun sampling in 1977 and will complete the Chukchi reconnaisance this season.

Our 1975 data, however, showed an increase in abundance of invertebrates in water deeper than two meters and, qualitative faunistic changes as well. This discontinuity in distribution/abundance may be related to the depth of the land-fast ice. We began more intensive sampling of the deeper water in 1976 from available platforms: small boats, inflatables, the RV Natchik and RV Alumiak. Again, our deeper water samples include species not found in shallow water and greater total biomass. The cruise of the RV Alumiak in 1975 was cut short because of mechanical problems and ice conditions but we sampled about half of the stations we had hoped to. On that cruise we worked cooperatively with Carey; we sampled from a depth of 5 meters shoreward, and he sampled from 10 meters seaward, but a data gap still exists between our quite shallow beach zone and his deeper benthic zone. Only the Alumiak samples of 1975, among contemporary data, exist to bridge the two, yet this region is the current Beaufort Sea "lease" area. Reconnaisance in this part of the Beaufort, therefore, has not been completed.

We began to sample the Chukchi littoral from smaller boats in 1976, but this effort was confined almost entirely to the Kotzebue Sound-Eschscholz Bay region. Our beach data indicate an Arctic affinity of fauna north of Cape Lisburne and a Bering influence south of Point Hope. Presumably, the same will obtain for the yet unsampled (by us) deeper water north of Point Hope.

Extant benthic data from the Chukchi Sea were obtained mainly with trawling gear, a toothed bottom dredge, and beach seines (see Alverson and Wilimovsky, Sparks and Pereyra; both in Wilimovsky and Wolfe, 1966. Environmental Studies of Cape Thompson). Except for the latter samples, all were made in offshore water. In each instance, controlling mesh size (either of nets or screening seives) was much larger than that used in current studies (Carey, Broad, Zimmerman). The fauna of the southern Chukchi is known to be far more diverse than that of the Beaufort. Available data show, as do our collections, a more diverse and abundant fauna south of Point Hope.

Thus although, with present and prior benthic work in the Beaufort and Chukchi Seas, the fauna is adequately documented for both quite shallow (<2M) and deeper (>20M) water, basic reconnaisance remains to be done in the area between. Our program for 1977 includes sampling on a Beaufort Sea cruise in RV Alumiak. Benthic sampling in water of less than 20M depth should be continued as long as platforms are available and extended into the Chukchi Sea.

Interest in ecological processes prompted a name change and change in emphasis in our program this year. Our data had failed to reveal a primary producer in the littoral region, but we were encountering abundant amphipods that seemed not to be carnivorous and unexpected numbers of annelid worms that possibly were detritus/deposit feeders. Most grab and dredge samples included a great deal of peat which, along with the lack of plants in the system suggested that one energy source might be terrestrial detritus from eroding tundra or from arctic salt marshes. Because ecological assessment ultimately would depend not only on an inventory of standing crop of marine biota but on growth in the littoral zone, ecological processes, food webs and energy pathways, the suggestion made in our proposal for 1977, to "design and conduct studies to describe the trophic communities of the Alaskan Arctic region" was accepted, and "reconnaisance characterization" became "environmental assessment." Similar interest in trophic relationships at lower levels had been expressed by other OCS investigators (Connors, RU 172; Divokey, RU 196; Burns and Lowry, RU 232; and others).

In order to assess the stability of community structure, reproductive activities and other seasonal and annual variables, selected sites for repeated sampling in 1977, 1978 and 1979 were selected in 1976. In addition, experimental work toward defining the possible function of peat as an energy source and identifying the food of common amphipod and annelid species was planned. Finally, an ecological study of production in Arctic salt marshes, a primary source of marine detritus, an important source of food for geese, and the sea-land interface most likely to be impacted by floating oil, was planned.

These studies, along with continuation of the reconnaisance phase on Chukchi beaches and in the Beaufort "lease zone" in RV Alumiak, comprise the work now underway in the 1977 field season. Our program for 1978 is, essentially, a continuation of this, but we will complete the reconnaisance of Chukchi beaches this year.

V. Objectives: The objectives of this project in a long-range sense have been alluded to above. We want to define the beach and shallow benthic biota communities and relate these to habitat types. We also want to assess energy flow in this region: primary production, food webs, growth and reproduction, and to estimate ambient hydrocarbon levels in the littoral environment. Finally, we hope to achieve some ability to predict the effects of environmental perturbations at the sea-land interface on the littoral marine system. The specific objectives of this proposal are:

1. Determine structure of biotic populations at selected sites in the Beaufort-Chukchi littoral system including benthos and epibenthos of the Beaufort Sea lease zone.
2. Determine stability and seasonal and yearly variability in these populations.
3. Assess population dynamics in the arctic littoral system: reproduction, growth, migrations.

4. Identify the main food of the principal species of amphipods and annelid worms. Plan subsequent work on feeding habits of other species.

5. Determine the importance of the littoral zone as a nursery area or seasonal feeding ground for animals from deeper water.

6. Assess the possible role of detritus of terrestrial origin (peat) as an energy source in the littoral system.

7. Assess evidence of chemical and physical perturbations on the littoral system.

8. Determine whether benzopyrene hydroxylase activity in fish tissues is a feasible method of monitoring ambient hydrocarbon levels.

9. Continue reconnaisance of the benthic community of the water deeper than 2 meters.

Specific objectives 1, 2, and 5, will provide data useful to decision makers who must consider both location of specific lease sites and times when activities are to be carried out. Objectives 2, 3, and 8, are most germane to monitoring programs but may provide data useful in planning intensity of development. Low production and slow growth probably are the general rule in the area. This hypothetical situation is incompatible with high intensity of development. Objective 4 is basic to our objective 3 and will provide data useful to OCS investigators interested in fish, birds and mammals. Objectives 6 and 7 will provide information important in management and protection once development and production in the OCS has begun. Our overall goal is to provide decision makers with information on where the principal food (of higher animals) is located, what it depends on, when it is most sensitive, and how it may be affected by at least some kinds of perturbations.

VI. General Strategy and Approach: For specific objectives 1, 2, 3, and 5, all of which are related to community structure and population dynamics at selected sites, teams of two investigators each will sample three times during the season at each of the following sites:

Nuvagapak Point (Arctic Wildlife Range) and Beaufort Lagoon
Point McIntyre (West of Prudhoe Bay)
Colville River Delta
Barrow and Elson Lagoon
~~Wainwright and Wainwright Inlet~~ AWB
~~Cape Thompson~~ AWB
~~Kivalina or Cape Krusenstern~~ AWB
~~Baldwin Peninsula south of Kotzebue~~ AWB
~~Cape Prince of Wales sea beach and Lopp Lagoon~~ AWB

These sites have been selected to encompass the widest geographic range and include the principal habitat types and have proved to be logistically feasible.

The sampling protocol will include:

1. Ekman grab samples
2. Plankton samples
3. small beam trawl samples
4. epibenthic dredge samples
5. miscellaneous other samples

Samples will be made at graded depths from the shoreline to a depth of 2.5 meters. Lagoon samples will be made along transects of lagoons. All samples will be analyzed in the laboratory in Bellingham for species composition and biomass, sex and condition (when appropriate or possible).

Specific objectives 4 and 6 will be approached through continuation of studies initiated at NARL, Barrow, in 1977. These include examination of stomach contents (smears examined microscopically), selected trapping experiments, selected feeding experiments in the lab and in holding chambers in the field, and other experiments designed in 1977. If the 1977 season provides answers to foods of amphipods and annelids, we will work on Mysiids, bivalves and euphausids in 1978.

A study of Marsh ecology begun in 1977 will be continued in 1978 to contribute to objectives 1, 2, 6, and 7. Studies underway include population structure, plant growth, production, and effects of natural (salt water inundation, silt deposition) and artificial (oil) perturbations.

Samples of fish gill and liver taken at various locations will be frozen and sent to Bellingham for benzopyrene hydroxylase activity determination (objective 8). This test will provide baseline data (see Payne and Penrose, 1976. Science, 191:945).

Participation in an RV Alumiak cruise in 1978 will contribute to objectives 1, and 9. The principal sampling tool will be a Smith-McIntyre grab. Our Alumiak-based work so far and Carey's benthic sampling have utilized this gear which, although the accepted standard of reliability in benthic work, has become increasingly difficult to secure. We now are using a borrowed grab. This request includes funds to enable us to construct a Smith-McIntyre for use in 1978 and 1979.

VII. Sampling methods: Methods are those used in 1975, 1976, and currently in 1977 and are covered in our 1977 proposal and work statement and on annual reports. We have suggested three sets of samples at each permanent station (early, mid-season, and late). Spatial sampling schemes are dealt with above. Both temporal and spatial sampling schemes from the RV Alumiak must be coordinated with whatever cruise plan obtains for the vessel. This is written with the expectation of a Beaufort Sea cruise, but a Chukchi cruise would also be acceptable from our point of view.

VIII. Analytical Methods: Analytical methods have been described in our 1977 proposal and work statement.

IX. Anticipated Problems: Except for the possiblity of adverse weather, and possible logistic problems that may result from the yearly increasing number of investigators and representatives of various interests in the arctic, we do not anticipate difficulty in doing the work outlined. The budget proposed is tight and may prove to be inadequate in PI provided logistics in the Chukchi Sea, but a larger estimate at this time is unfounded.

X. Deliverable products:

A. Digital data: Our digital data are those required by Intertidal data format 030 (NODC File Type 030). We have not reported atmospheric pressure.

B. Narrative Reports: In addition to required quarterly and annual reports, we plan narrative reports (published scientific papers) on ecology of arctic marshes and food preferences of arctic marine invertebrates. If the work on peat as an energy source indicates that this material is entering the food chain, we would hope to publish that as well. All of these results, however, will be included in the required OCSEAP reports.

C. Visual Data: Diagrammatic representations of littoral zone dynamics; maps, charts, and figures of seasonal density distribution and habitats (as in the Beaufort Sea Synthesis Report now in preparation), will be prepared and, unless required elsewhere, will accompany OCSEAP reports.

D. Other, non-digital data: not applicable.

E. Data submission schedule: Data from RU356 have been collected since July, 1975, and have been reported to NODC and the Project Office through required reports since September, 1975. When we agreed in 1976 to use the Intertidal data format (NODC file type 030), we accepted a format based on data reporting by cruises. Since our "cruises" are the entire field season, and because the format does not permit reporting data piecemeal, certain physical data cannot be reported until all biological samples have been analyzed. The controlling date for data "collection," therefore, is July 1.

For this specific proposal, samples will be made from late June through the first half of September, 1978. As dictated by our reporting format, this almost three-month field season constitutes a cruise. Since our field season comes annually at the end of the fiscal year, this specific request (fiscal 1978) includes laboratory and data analysis of samples collected in 1977. Samples collected in the summer of 1978 will be analyzed during the Fall, Winter and Spring of 1978-79 (fiscal 1979).

Data Products Schedule

ta Type e. Intertidal, nthic Organisms, c.)	Media (Cards, coding sheets, tapes, disks)	Estimated Volume (Volume of processed data)	OCSEAP Format (If known)	Processing and Formating done by P.I. (Yes or No)	Collection Period (Month/Year to Month/Year)	Submission (Month/Year)
tertidal	**tape**	**?**	**030**	**yes**	**6/78 to 9/78**	**6/79**

XI. Information required from other investigators: This proposal is not based on data, information, or samples collected by other investigators.

XII. Quality assurance plans: Our environmental monitoring instruments are all relatively simple and are calibrated in our own lab before each field season. Our identification of plants and animals is "standardized" with the Marine Sorting Center at the University of Alaska by visits and exchange of specimens. The benzopyrene hydroxylase assay used will be that reported in literature and will be useful only in comparing "in house" samples.

XIII. Special sample and voucher specimen archival plans: So far, all specimens collected are stored in our laboratory. We have been told that an OCSEAP archiving policy will be forthcoming but have yet to see it. To date and through the term of this specific request, the cost of storing the material is nominal and has been included in our budget for laboratory operation. It is currently impossible to predict long-range costs of archiving since we do not know whether the OCSEAP policy will require us to keep specimens or to send them elsewhere.

XIV. Logistics Requirements: see attached forms (pages 12-16)

XV. Management Plan: The Principal Investigator will be the project manager. He will be supported within the university by a Bureau for Faculty Research and Computer Center (see item B above). Dr. Schneider will be responsible to the PI for experimental and other work at NARL, Barrow, designed to provide data contributing to our specific objectives 4 and 6. Dr. Mason will be responsible to the PI for research in Arctic marshes addressed mainly to our objectives 1, 2, and 6 (in part) and 7. Mr. Koch will be responsible to the PI for laboratory operations in Bellingham (support of objectives 1, 2, 3, 5) except the benzopyrene hydroxylase assessment (objective 8) which will be done under the supervision of Dr. Williams. Technicians and research aides will assist the PI in obtaining field data required for our objectives 1, 2, 3, 5, 8, and 9. A computer programmer (part time) will be responsible to the PI for data management and liason with NODC.

An activity/milestone/data management chart is attached. (Page 17)

XVI. Outlook:

1. The nature of the final results and data products: The final products of this program have been dealt with briefly above (see item V). It is our intent to provide the following:

   a. Information in the form of charts and descriptions that characterizes the several habitats of the Beaufort and Chukchi littoral region in terms of physical attributes and biota. The latter description will be quantitative and will include, if sampling platforms are available, the bottom to a depth of 10 meters.

b. Descriptions and energy-flow diagrams of food webs within the Beaufort and Chukchi littoral region, including specific information on the nature of the food of principal species of invertebrates.

c. A narrative of energy flow and production in arctic salt marshes based on a study of two marshes (at Point McIntyre on the Beaufort Sea and at Arctic Circle Landing Strip on Kotzebue Sound in the Chukchi littoral region) with quantitative information on use of marshes by terrestrial species and input from marshes to the food webs of the littoral marine environment.

d. Information on growth, reproduction and migration of principal marine invertebrate species in the littoral benthos and epibenthos.

e. A reasonable estimate of the effect of salt water inundation and oil introduction to arctic marshes and the environmental effect of such perturbations; and background data on ambient hydrocarbon levels as indicated by benzopyrene hydroxylase activity in fish tissues.

f. Voucher and other specimens of arctic biota and physical environmental data for all sampling sites.

2. Significant milestones: The first approach to item "a" has already been made (Beaufort Sea Synthesis report). A better estimate will be forthcoming in the winter of 1978 (based on two years' samples), and a more or less definitive habitat/biota characterization will be made in the winter of 1979. Studies that will contribute to our other long-range objectives are beginning in the summer of 1977. We should produce estimates in each succeeding year with a final report after three years. We would like to be able to collect data and do experiments in the summers of 1977, 1978 and 1979. The 1979 samples will require analysis in fiscal 1980. Hopefully, final reports will be made near the end of fiscal 1980.

3. Cost by fiscal year: This proposal is perhaps even unrealistic in that it is based on current costs. I should like to have had around 150K for science and 20 for PI furnished logistics. To continue work already underway, which is all that we are proposing, I estimate the following:

Fiscal 1978 (this proposal)	124.3K ~~131K~~, science + 5.4K ~~17k~~, PI logistics
Fiscal 1979	145K, science + 18K, PI logistics
Fiscal 1980	70K, science

4. Additional major equipment: We have requested in this proposal funds for fabrication of a Smith-McIntyre grab. We shall require

some sort of epibenthic trawl nets in future years, but these are relatively inexpensive. Other equipment needs will be minor.

5. Location of future field efforts: Field stations in both Beaufort and Chukchi Seas have been established and will remain the same. We believe that we should extend our food-web work to the Kotzebue area in 1979, possibly by making arrangements to use laboratories in the high school. Sampling of deeper water (RV Alumiak or comparable platform) should extend into the Chukchi and Kotzebue Sound area in 1979 and, if possible, earlier.

6. Logistic requirements: Support in the Beaufort Sea area and at Barrow will remain constant or be slightly reduced. ~~We will need a permanent residence (apartment?) in Kotzebue in 1978 and 1979 and will need some laboratory space in both years. Ground and air transportation requirements can be met from private sources in Kotzebue, but a platform (vessel) for sampling deeper water does not exist there. Our suggestion for PI furnished logistics does include all of these items except the vessel~~.

XVII. 1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labelled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, juveniles, adults) when these are used, and sexes where these are morphologically distinguishable.

4. At the option of the Project Office the P.I. is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following standard acknowledgement is acceptable.

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

For OCSEAP use only.
RU # ______
Discipline ______
Area of Operation ______

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION Western Washington State College PRINCIPAL INVESTIGATOR A. Carter Broad

A. SHIP SUPPORT

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. Charted sampling track is not appropriate. We are interested in samples between the shoreline and the 10M isobath in the Beaufort (and, if possible, Chukchi Seas). Part of this will be done this summer.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. Replicate bottom grabs (probably Smith-McIntyre), replicate plankton tows, beam trawl tows, naturalist's dredge.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.)

   Any time during the ice-free season is acceptable.

4. How many sea days are required for each leg? (Assume vessel cruising speed of 14 knots for NOAA vessels. Do not include running time from port to beginning point and from end point to port and do not include a weather factor.) The cruise we have in mind could be done in roughly 2 weeks on RV Alumiak, but cannot be done from a NOAA vessel (because of deep draft).

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? We probably would be the principal operation in our area.

   Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling-time on station and sample processing time between stations. Including cruising time, our operation would require full ship's time for two weeks.

6. What equipment and personnel would you expect the ship to provide? Equipment: winch, cable, booms or outriggers, pumped salt water for washing samples.
   Personnel: winch operator (and all aspects of vessel operation).

7. What is the approximate weight and volume of equipment you will bring?
   400 pounds, 100 cubic feet

8. Will your data or equipment require special handling? NO If yes, please describe:

9. Will you require any gasses and/or chemicals? formaldehyde If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge. Can be loaded in Barrow

10. Do you have a ship preference, either NOAA or non-NOAA? If "yes" please name the vessel and give the reason for so specifying. Yes. RV Alumiak because of shallow draft.

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availability I believe $2,300. I have not verified availability.

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals. Minimum of two persons not yet selected.

B. AIRCRAFT SUPPORT REQUIREMENTS

1. Delineate proposed flight lines on a chart of the area. Indicate desired flight altitude on each line. (Note: If flights are for transportation only, chart submission is not necessary but origin and destination points should be listed)

Transportation only from Barrow to Deadhorse and Barter Island area three times during summer plus one supply flight.

2. Describe types of observations to be made.

none

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification)

not applicable

4. How many days of flight operations are required and how many flight hours per day?

Total flight hours? Estimated 12 to 15 hours

5. Do you consider your investigation to the principal one for the flight thus precluding other activities or requiring other activities to piggyback or could you piggyback? Piggyback is acceptable.

6. What types of special equipment are required for the aircraft (non carry-on)?

none

What are the weights, dimensions, power requirements, and installation problems unique to the specific equipment.

7. What are the weights, dimensions and power requirements of carry-on equipment?

not applicable

8. What type of aircraft is best suited for the purpose?

Any

9. Do you recommend a source for the aircraft?

If "yes" please name the source and the reason for your recommendation. NARL, Barrow plus private charters because of availability and cost.

10. What is the per hour charter cost of the aircraft?

Varies from $85 to $300.

11. How many people are required on board for each flight (exclusive of flight crew)?

2 to 3

12. Where do you recommend that flights be staged from?

various (see item 1)

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

(a) location	(b) calendar period	(c) no. personnel	(d) man/days
NARL BARROW	6/15 to 9/15/78	3 to 5	360*
KOTZEBUE	6/20 to 8/31/78	2 to 4	~~213*~~ 12
DEADHORSE	7/1 to 8/31/78	2 to 4	213*

*maximum estimates

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

NARL Barrow because of availability. No specific recommendation for Kotzebue (although Drift Inn apartment is very convenient to airport), ~~or Deadhorse.~~
RECOMMEND NANA OILFIELD SERVICES AT DEADHORSE.

3. What is your estimated per man day cost for this support at each location?

I have based by logistic request on $50 per day. I estimate that logistic support not provided by PI will be higher at Deadhorse ($100/day) and about the same at Barrow.

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp? This figure is based on experience.

E. SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

NONE

Sea allB

Field teams in the Beaufort ~~and Chukchi~~ shore stations will require inflatable boats (Zodiak or equivalent) but these are already on hand at Barrow (OCSEAP property)

MILESTONE CHART

RU #: 356 PI: A. Carter Broad

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1976			1977													
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D		
Reporting 1976 data to NODC			Δ														
Laboratory analysis of 1977 samples												Δ					
Reporting 1977 data to NODC															Δ		
1978 field season (data collection)												Δ					
Laboratory analysis of 1978 samples													⟷	⟷			

Beaufort Sea Plankton Studies

RU # 359

Rita A. Horner
Principal Investigator

Cost of Proposal: $50,000
Date: 20 June 1977

Rita A. Horner
20 June 1977
4211 NE 88th Street
Seattle, Washington 98115

(206) 523-2607 (home)
(206) 543-8599 (office)

Technical proposal

I. Title: Beaufort Sea Plankton Studies
Research Unit Number: RU # 359
Contract Number:
Proposed Dates of Contract: October 1977 to September 1978

II. Principal Investigator: Rita A. Horner

III. Cost of Proposal:
A. Science: $50,000
B. P.I. provided logistics: None
C. Total: $50,000
D. Distribution of effort by lease area: Beaufort Sea 95%
Chukchi Sea 5%

IV. Background:

One of the major gaps in our understanding of the Beaufort Sea ecosystem is basic knowledge of the food web. Preliminary data (Beaufort Sea Synthesis Report draft) indicate that amphipods, shrimps, euphausids, and Arctic and saffron cod are important food species for fishes, birds, and mammals, but there is little information on their distribution and abundance. General life history information is lacking for these food species and for some fishes. At the bottom of the food web, limited data are available concerning distribution and abundance of phytoplankton and rates of primary production.

Research Unit numbers 172, 196, 230, 232, and 233 are studying the abundance, distribution, and food habits of fishes, birds, and mammals in the Beaufort Sea, and have pointed out the need for information concerning the food species. RU # 359 will provide the information on distribution and abundance of the food species and on rates of primary production.

Previous studies, including RU # 359, Johnson (1956, 1958), and Cobb and McConnell (unpubl ms), have examined samples collected primarily with ring nets that were hauled vertically from some depth to the surface. Few specimens of amphipods, euphausids, and fish larvae were found in these samples because larger planktonic organisms can escape from this kind of net. Bongo nets that are towed obliquely were used by RU # 359 at stations where ice conditions permitted and larger numbers of amphipods, euphausids, and fish larvae were caught by these tows than would have been predicted from ring net hauls. With more favorable ice conditions predicted for summer 1977, it should be possible to use bongo nets at more stations.

V. Objectives:

The objectives of this proposal are to assess the density distribution and environmental requirements of zooplankton and ichthyoplankton in an array of samples of opportunity and, where possible, to measure phytoplankton activity.

Energy fixed by phytoplankton during photosynthesis is transferred through the ecosystem by primary and secondary consumers to fishes, birds, and mammals, including man. The trophic interactions within the Beaufort Sea ecosystem are essentially unknown. Disruption in the energy flow through the food web caused by pollutants would affect the populations of fishes, birds, and mammals. It is necessary, therefore, to know the basic structure of the food web in order to determine the movement of hydrocarbons and other pollutants through the ecosystem and to assess the impact of petroleum development on the system.

VI. General Strategy and Approach:

Zooplankton samples collected in the eastern Chukchi Sea and the Beaufort Sea during August and September 1977 will be analyzed for species present, abundance, and distribution. Species of major interest will include larval and juvenile stages of fishes, especially *Boreogadus saida* and *Eleginus gracilis*, euphausids, and pelagic amphipods because they have been reported to be important food species for marine birds and mammals. Other species will be added if they are shown by other investigators to be utilized by the birds and mammals.

Phytoplankton samples collected during August and September 1977 will be analyzed for species present, abundance, and distribution. In addition, chlorophyll *a*, phaeopigments, and primary productivity samples will be analyzed.

Environmental parameters measured during August and September 1977 will be analyzed. These will include temperature, salinity, light penetration, and, where possible, inorganic nutrient concentrations.

VII. Sampling Methods:

These sampling methods will have been used during the August-September 1977 cruise and will be used during a similar effort in 1978.

Zooplankton will be collected primarily with bongo nets using MARMAP procedures. Mesh size of the bongo nets will be 333 and 505 μm. In heavy ice concentrations where towing nets is not possible, vertical hauls will be made with 0.75 m ring nets having a mesh size of 308 μm. Acoustic surveys for layers of plankton will be made with a Ross 200A Fine Line echosounder system operating at a frequency of 105 kHz. A 10° transducer mounted in a 0.6 m V-fin depressor will be lowered over the side when the ship is on station or moving slowly in open water. Plankton layers, when found, will be sampled with a 1 m NIO net having a mesh size of 571 μm.

Phytoplankton for standing stock, chlorophyll, and primary productivity measurements will be sampled with 5 ℓ Niskin bottles. Salinity and nutrient concentrations will be determined on water collected in these bottles.

Temperature will be measured with reversing thermometers.

Light penetration will be measured with a Secchi disc and with a LI-COR quantum meter and underwater sensor.

VIII. Analytical Methods:

The zooplankton samples will be sorted first for fish eggs and larvae, euphausids, and pelagic amphipods. Other large or rare organisms will also be removed at this time. The remaining sample will then be split in a Folsom plankton splitter until a subsample containing approximately 100 specimens of the most abundant species is obtained. The organisms in the subsample will then be identified and counted using dissecting microscopes. References used to identify zooplankton are listed in Table 1.

Phytoplankton standing stock samples will be analyzed following the inverted microscope method of Utermöhl (1931). Rare and large organisms (> 50 μm) are counted at 10 X in 50 ml counting chambers, while small (< 50 μm), abundant organisms are counted at 25 X in 5 ml chambers. The portion of the chamber to be counted is determined for each sample depending on the number of cells in the chamber, but usually 1/5 of the chamber is counted. The principal references used to identify phytoplankton are Hustedt (1930, 1959) and Schiller (1933, 1937).

Primary productivity measurements will be made in 60 ml reagent bottles. Two light bottles and one dark bottle will be used for each depth. Two ml of $NaH^{14}CO_3$ solution will be added to each bottle, aluminum foil will be wrapped around the dark bottle, and the samples will be incubated in a sink in the laboratory. A bank of cool white fluorescent lights will be set up over the sink. Light levels will be measured at the beginning and end of the incubation period with a Gossen Super Pilot photographic light meter. Low temperature in the sink will be maintained by running seawater; temperature will be measured at the beginning and end of the incubation period. The incubation period will be 3 to 4 hr. The samples will be filtered onto 25 mm Millipore HA (0.45 μm) filters, rinsed with approximately 5 ml filtered seawater and 5 ml 0.01 N HCl, and placed in liquid scintillation vials. Radioactive uptake will be measured using a Packard Tri-Carb Liquid Scintillation Spectrometer with Aquasol (New England Nuclear) as the scintillation cocktail. Primary productivity will be calculated using the equation

$$Ps\ (\text{mg C m}^{-3} \cdot \text{hr}^{-1}) = \frac{(L-D) \times W \times 1.05}{R \times T}$$

Table 1. References used to identify zooplankton

Copepoda	**Polychaeta**
Brodskii, 1950	Pettibone, 1954
Heron and Damkaer, 1976	Yingst, 1972
Jaschnov, 1948	
Mori, 1937	**Appendicularia**
Sars, 1900	Leung, 1972a
Sars, 1903	
Vidal, 1971	
Euphausiacea	**Chaetognatha**
Leung, 1970a	Dawson, 1971
Ostracoda	**Hydrozoa**
Leung, 1972c	Naumov, 1960
Sars, 1928	Shirley and Leung, 1970
Mysidacea	**Ctenophora**
Leung, 1972b	Leung, 1970b
Decapoda	**Pteropoda**
Leung, Havens, and Rork, 1971	Leung, 1971
Makarov, 1967	
Amphipoda	**Pisces**
Sars, 1895	Blackburn, 1973
Tencati, 1970	Ehrenbaum, 1909
	Gorbunova, 1954
	Rass, 1949

where (L-D) is light minus dark bottle disintegrations per minute; W is carbonate carbon; 1.05 is a ^{14}C isotope factor; R is the activity of the ^{14}C used; and T is the incubation time.

Water for chlorophyll *a* and phaeopigment determinations will be filtered through 47 mm Millipore HA (0.45 µm) filters. A few drops of a saturated $MgCO_3$ solution will be added and the filter tower will be rinsed with filtered seawater. The filters will be folded into quarters, placed in labelled coin envelopes, and frozen. The samples will be analyzed using a Turner fluorometer (Strickland and Parsons 1968). Calculations will be done using the equations

$$\text{Chl } a = \frac{\dfrac{F_o/F_{a_{max}}}{F_o/F_{a_{max}-1}} (K_x)\ (F_o - F_a)}{\text{Vol filtered}}$$

$$\text{Phaeo} = \frac{\left(\dfrac{F_o/F_{a_{max}}}{F_o/F_{a_{max}-1}}\right) (K_x) \left[F_o(F_a/F_{o_{max}}) - F_a\right]}{\text{Vol filtered}}$$

where F_o is fluorometer reading before acidification; F_a is fluorometer reading after acidification; K is fluorometer door calibration factor; and Vol filtered is the volume of sample filtered.

Salinity will be determined using a Bissett Berman induction salinometer with "Copenhagen" seawater as a standard. The salinometer is standardized at the beginning and end of a batch of samples and after each 30 samples if a large number is run at one time.

Nutrients will be determined using autoanalyzer techniques described in Strickland and Parsons (1968).

Temperature, measured with reversing thermometers, will be corrected using thermometer calibration factors following the procedure in U.S. Naval Oceanographic Office Publ. 607 (1968).

IX. Anticipated Problems:

I do not anticipate any major problems associated with this research.

X. Deliverable Products:

A. Digital data
   1. Parameters to be recorded
      a. File type 024, Zooplankton
         1. Latitude and longitude
         2. Date

3. Time (GMT)
4. Depth to bottom
5. Sample interval, where applicable
6. Type of gear used
7. Mesh size of net
8. Duration of haul
9. Volume of water filtered
10. Species found (by taxonomic code number)
11. Life history stage
12. Size of subsample
13. Number in subsample
14. Concentration (number per m^3)

b. File type 028, Phytoplankton
1. Latitude and longitude
2. Date
3. Time (GMT)
4. Depth to bottom
5. Sample depth
6. Species found (by taxonomic code number)
7. Number of cells per liter
8. Per cent cells per liter

c. File type 029, Primary Productivity
1. Latitude and longitude
2. Date
3. Time (GMT)
4. Depth to bottom
5. Chlorophyll *a* (mg m^2)
6. Phaeophytin (mg m^2)
7. Carbon assimilation (mg m^2)
8. 1% light level
9. Secchi disc depth
10. Sample depth
11. Chlorophyll *a* (mg m^3)
12. Phaeophytin (mg m^3)
13. Carbon assimilation (mg m^3)
14. Incubation time
15. Inorganic nutrients (PO_4, NH_3, NO_3, NO_2, SiO_3 µg at ℓ)
16. Temperature
17. Salinity

2. Digital products (see p. 8)
a. Computer cards
b. Card listings
Processing and formatting will be done by the investigator.

B. Narrative reports

Special reports that might be required by OCSEAP for synthesis or other meetings will be prepared as requested. It is likely that papers for publication in scientific journals will be written.

C. Visual data

All visual data will be included in the required reports.

D. Other non-digital data
None

E. Data submission schedule
See attached sheet

XI. Information Required from Other Investigators:

Informal discussions during cruises and lists of species used as food by birds and mammals will be required. I have made the necessary contacts and arrangements.

XII. Quality Assurance Plans:

The Turner fluorometer is calibrated using a known quantity of a chlorophyll extract as a standard. Acetone blanks are run with each batch of samples.

The Packard Tri-Carb Liquid Scintillation Spectrometer is calibrated by factory representatives twice yearly.

Standard seawater ("Copenhagen" water) is used to calibrate the salinometer at the beginning and end of a batch of samples and after each group of 30 samples when more than 30 are run at one time.

The LI-COR quantum meter and sensor were calibrated at the factory in May 1977.

Flowmeters and bathykymographs are calibrated periodically in the Department of Oceanography, University of Washington.

XIII. Special Sample and Voucher Specimen Archival Plans:

Voucher specimens of zooplankton and ichthyoplankton species will be kept and processed according to OCSEAP guidelines. They will be identified, labelled, and deposited in the approved OCSEAP repository.

Voucher specimens of phytoplankton species will not be kept unless new species are described. If new species are described, TYPE specimens and/or photographs will be deposited in OCSEAP-approved repositories. Phytoplankton cells are small and delicate and it is exceedingly difficult and time-consuming to isolate and preserve individual cells of each species. This procedure would necessitate purchase of equipment not now available to us, and would at least triple the length of time needed to analyze the samples (already estimated to take 6 to 7 months).

XIV. Logistics Requirements:

See attached sheets

XV. Management Plan:

Analysis of samples will be started as soon as samples are received in Seattle following the end of the cruise, approximately 1 October 1977. Chlorophyll *a* and phaeophytin samples will be analyzed first, followed by the primary productivity samples. Zooplankton and phytoplankton samples will take the longest to analyze, but will be finished by June 1978. See Activity/Milestone/Data Management Chart, p. 10.

XVI. Outlook:

1. Nature of final results and data products

Assuming a field effort in August-September of FY78, additional funds will be necessary to analyze the samples in FY79. The final results will include a better understanding of the species present, and their abundance and distribution in the Beaufort Sea ecosystem. Emphasis will be placed on those organisms that provide food for higher trophic levels and the environmental conditions that affect them. Data products will include zooplankton and phytoplankton species, abundance, and distributions; primary productivity data, including chlorophyll *a* and phaeophytin; and environmental parameters including nutrient concentrations, temperature, and salinity.

2. Significant milestones

See attached chart (p. 11)

3. Cost by fiscal year

I estimate that sample analysis will cost approximately $50,000 for FY79.

4. No additional equipment will be required.

5. Location of future field efforts

Unless requested to undertake another field sampling program in FY79, none would be undertaken. If requested, the field program would be in the Chukchi-Beaufort seas.

6. Logistics requirements would not vary from FY78.

XVII. Standard statements:

1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labelled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (*e.g.*, larvae, juveniles, adults) when these are used, and sexes where these are morphologically distinguishable.

Data Products Schedule

Data Type (ie. Intertidal, Benthic Organisms, etc.)	Media (Cards, coding sheets, tapes, disks)	Estimated Volume (Volume of processed data)	OCSEAP Format (If known)	Processing and Formating done by P.I. (Yes or No)	Collection Period (Month/Year to Month/Year)	Submission (Month/Year)
Zooplankton	Cards	1000-1500	024	Yes	Aug 77 to Sep 77	Jul 78
Phytoplankton	Cards	1000-2000	028	Yes	Aug 77 to Sep 77	Jul 78
Primary Productivity	Cards	1000	029	Yes	Aug 77 to Sep 77	Feb 78

For OCSEAP use only.
RU # ______
Discipline
Area of Operation ______

LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION ______ PRINCIPAL INVESTIGATOR ______

A. SHIP SUPPORT

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions.
   See attached sheet

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible.
   See attached sheet

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.)
   August and September are the best months because of ice conditions.

4. How many sea days are required for each leg? (Assume vessel cruising speed of 14 knots for NOAA vessels. Do not include running time from port to beginning point and from end point to port and do not include a weather factor.)
   Approximately 30 days

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback?
   I can piggyback.

   Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling-time on station and sample processing time between stations. Approximately 2 (max 3), preferably in early morning (0500 to 0700). Processing time between stations is approximately 5 to 6 hr.

6. What equipment and personnel would you expect the ship to provide?
   Winches, winch operators, occasional help from marine technicians.

7. What is the approximate weight and volume of equipment you will bring?
   Approximately 1000 lb, 30 cu ft

8. Will your data or equipment require special handling? Yes If yes, please describe: Some must be kept dry; will need approximately 3 cu ft of accessible freezer space.

9. Will you require any gasses and/or chemicals? Yes If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge. Formaldehyde

10. Do you have a ship preference, either NOAA or non-NOAA? If "yes" please name the vessel and give the reason for so specifying. Yes. Icebreaker because of ice conditions in the Chukchi and Beaufort seas.

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availability OCSEAP has arranged for icebreaker time.

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals. See attached sheet.

1. The cruise track will run from approximately 162°W to 141°W between the 20 m depth contour and the edge of the ice. The exact tract and station locations will be determined during the cruise depending on ice conditions, concentrations of birds and mammals, and requirements of other investigators onboard.

2. At each station a transducer will be lowered by hand to approximately 1 m below the water surface and left in position during sampling. Light penetration will be measured with a photometer lowered by hand from the deck. A Secchi disc may also be lowered by hand. Niskin bottles equipped with reversing thermometers will be used to collect water samples for phytoplankton standing stock, chlorophyll, primary productivity, salinity, and nutrient determinations. Zooplankton samples will be collected with bongo nets. The net will be lowered at approximately 50 m/min to a depth approximately 10 m from the bottom, allowed to soak for 30 sec, and retrieved at approximately 20 m/min. Ship speed during the tow should be approximately 3 kt. If ice conditions are such that the bongo net cannot be towed, vertical hauls will be made with a ring net by lowering the net to a predetermined depth and hauling it to the surface. Several ring net hauls may be made at a station depending on water depth. If a plankton layer is found with the echosounder (transducer), it will be sampled with a 1 m NIO net which will be lowered closed to the layer, opened, towed for 5 to 10 min, closed, and retrieved.

12. 2 - participants unknown at this time although probably Rita A. Horner and Thomas R. Kaperak. Both are U.S. citizens.

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

   a) NARL, Barrow, Alaska
   b) Late July, early September 1978
   c) 2 people for approximately 4 to 5 days; total 8 or 10 man days

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

   Yes. NARL because this is the probably site for boarding the ship.

3. What is your estimated per man day cost for this support at each location?

   NARL daily rate

   How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

E. SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

I see no special logistics problems other than possible problems obtaining bongo nets. For the 77 *Glacier* cruise, they have been borrowed from the *Surveyor*.

4. At the option of the Project Office the P.I. is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and perdiem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following standard acknowledgement is acceptable.

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

MILESTONE CHART

RU #: 359 PI: ita A. Horner

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Reports: Quarterly	Δ			Δ						Δ					
Annual							Δ								
Final													Δ		
Sample Analysis: Chlorophyll	Δ														
Primary Productivity	Δ	Δ													
Zooplankton	Δ	Δ	Δ	Δ	Δ	Δ	Δ								
Phytoplankton	Δ	Δ	Δ	Δ	Δ	Δ	Δ								
Data Processing: Chlorophyll		Δ	Δ												
Primary Productivity			Δ	Δ											
Zooplankton								Δ	Δ						
Phytoplankton								Δ	Δ						
Data Submission: Primary Productivity, Chlorophyll					Δ										
Zooplankton										Δ					
Phytoplankton										Δ					
FY78 Field Effort											Δ	Δ			

MILESTONE CHART

RU #: 359 PI Rita A. Horner

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1978 O	N	D	1979 J	F	M	A	M	J	J	A	S	O	N	D		
Reports: Quarterly	Δ			Δ						Δ							
Annual							Δ										
Final													Δ				
Sample Analysis: Chlorophyll	Δ																
Primary Productivity	Δ	Δ															
Zooplankton	Δ	Δ	Δ	Δ	Δ	Δ	Δ										
Phytoplankton	Δ	Δ	Δ	Δ	Δ	Δ	Δ										
Data Processing: Chlorophyll		Δ	Δ														
Primary Productivity			Δ	Δ													
Zooplankton								Δ	Δ								
Phytoplankton								Δ	Δ								
Data Submission: Primary Productivity, Chlorophyll					Δ												
Zooplankton										Δ							
Phytoplankton										Δ							

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Title:	OCSEAP Data Base Management Support, RU 362
Principal Investigator:	John J. Audet, Jr.
Total Cost:	$450,000
Institution & Department:	NOAA, Environmental Data Service, National Oceanographic Data Center
Date of Proposal:	15 July, 1977
Signatures: Principal Investigator:	John J. Audet Jr
Date:	22 July, 1977
Address:	National Oceanographic Data Center (D781) 3300 Whitehaven Street, N.W. Washington, D. C. 20235
Telephone No.:	(202) 634-7441
Organizational Approval:	Robert V. Ochinero (DIRECTOR)
Date:	22 July, 1977
Address:	National Oceanographic Data Center (D7) 3300 Whitehaven Street, N.W. Washington, D. C. 20235
Telephone No.:	(202) 634-7232
Financial Officer:	Charles E. Cotton
Date:	22 July, 1977
Address:	National Oceanographic Data Center (D7x3) 3300 Whitehaven Street, N.W. Washington, D. C. 20235
Telephone No.:	(202) 634-7510

TECHNICAL PROPOSAL

I. Title: OCSEAP Data Base Management Support

Research Unit Number: 362

Proposed Dates: October 1, 1977 - September 30, 1978

II. Principal Investigator: John J. Audet

III. Cost of Proposal

C. Total: $450,000

D. Distribution of Effort: Management Support

IV. Background: The Environmental Data Service has, over the past two years, developed an operational data management support system containing six major elements.

(1) Format Development - Working closely with the OCSEAP Project Offices, EDS has developed formats approved by the Project Offices for the submission of digital data by OCSEAP investigators and has effected approved changes to existing formats when required.

(2) Inventories and Processing - EDS has developed an operational data inventory and processing system for data received at the data centers and entered these data into a versatile OCSEAP data base. The inventory includes analog records and data reports as well as digital data.

(3) Data Tracking System - A data tracking report system has been developed with OCSEAP Project and Program Offices' guidance which tracks the status of data through all stages from their collection through their entry into the data base. The system is updated continually and reported quarterly

or upon request. By-products of this system include a Principal Investigator Directory, Lease Area summaries, and OCSEAP File Type summaries.

(4) Catalog of OCSEAP Data - A catalog of Ocseap data has been developed and published which contains plots of OCSEAP data received by EDS prior to May 1, 1977. The Catalog presents data by file type (data type) and includes plots of the BLM lease areas.

(5) Data Products - Requests for data products from the data base have been generated in response to BLM, OCSEAP and OCSEAP Principal Investigators. They have ranged from relatively simple tape and micro-film reproductions to current rose plots and bird colony statistical plots.

(6) Taxonomic Code - A taxonomic coding system was devised and is being maintained by EDS for reporting Alaskan Biological data. The code has been distributed to all OCSEAP Project personnel and Principal Investigators involved in biological work.

V. Objectives: The objectives of this Research Unit include the continuation of the six task elements described above. Improvements in these areas constitute the main new objectives of the Research Unit.

(1) Format Development - EDS, through participation in discipline-oriented OCSEAP workshops and discussions with Project Office personnel hope to be able to not only respond to requests for changes to existing formats but also to assist the Project Office establish standard data set attributes and develop new formats where required. A minimum of ten (10) new formats, modifications to 12 existing formats, and changes to about 50 code tables are anticipated to be completed during the fiscal year.

(2) Inventories and Processing - Provide a pre-data processing check to include parameter ranges and a summary program to provide a complete description of each data set. The output from these programs will be forwarded to the Project Offices to review for completeness and quality assurance within ten working days after data receipt at EDS. Software will be developed to provide the Anchorage and Seattle sites with capabilities to perform similar data checking functions before submitting the data to NODC. Subsequent data processing will not begin until corrections or approval is received from the Project Office. Data Documentation deficiencies will also be reconciled by the Project Office before processing commences. It is estimated that about 500 data sets will be entered into the data base during the fiscal year.

(3) Data Tracking System - Instructions for direct remote access to data tracking system information and data inventories will be provided to the Juneau and Boulder OCSEAP offices and to the Anchorage and Seattle EDS offices.

(4) Catalog of OCSEAP Data - It is planned to update Part I of the catalog approximately every six months if new data acquisition warrants. Several minor format and cover changes are contemplated for the second edition of the catalog. Parts II, III and IV, which will provide information concerning sources of each data set, descriptions of available data parameters and data formats, and examples of data products derived from the OCSEAP data files are to be completed during the fiscal year.

(5) Data Products - The compendium of potential data products distributed by the Program Office is being reviewed. Those products that can be generated using existing software, those that will require new programs,

and those that cannot be generated by EDS will be identified. The results of this review will be forwarded to the Program and Project Office and, on their instruction and based on their priorities, EDS will provide the required products for selected data files and parameters in the data base considered adequate for data presentations.

(6) Taxonomic Codes - The taxonomic codes will continue to be updated and maintained. In addition, a list of taxonomic names of the organisms which occurred in each data set will be forwarded to the Project Office within ten working days of receipt.

VI. General Strategy and Approach: To improve the EDS support to the OCSEAP presently being provided EDS proposes to:

(1) work with the OCSEAP Project Office and discipline-oriented groups of PIs to better define the content of data fields, where possible, through workshops and other meetings.

(2) develop additional edit checks, and establish initial range limits for independent parameter values which may be supplemented by Project Office and Investigator inputs.

(3) develop software and instruction manuals to enable Anchorage and Seattle EDS Offices to perform some initial editing on local computers before data are shipped to the Project Office and EDS. This should result in many data problems being identified more expeditiously at the local rather than the Washington, D. C. facility.

(4) work with the OCSEAP Offices and the EDS Liaison Offices to provide direct access through telecommunications to inventory and tracking information in the EDS system. Methods and procedures to access the data in the data base from remote terminals will also be explained.

(5) offer multi-discipline products from related data files for OCSEAP and, if required, BLM syntheses studies. Extend the development of data products, especially biological, to meet the most immediate requirements of BLM and OCSEAP Offices requests.

(6) Detailed descriptions of the three basic tasks, processing, management, and products and their original cost estimates are included in this proposal as attachments A, B, C, and D.

VII. Sampling Methods - N/A

VIII. Analytical Methods - N/A

IX. Anticipated Problems

(A) It is anticipated that a considerable amount of new software will be required as we move into more highly developed edit routines for use on more than one computer system and increased emphasis on data products. It is difficult to anticipate how complex this programming effort might become. A detailed description of data products anticipated is being prepared and will be delivered in early August. It will be important for EDS to receive approval of those products on this list that will be required promptly to allow enough lead time to develop whatever software is necessary. Programs to provide new edit routines and conversion programs to run these on Anchorage and Seattle computers should be ready for testing early in FY78. This is not to say that EDS will not develop new software for products that will be needed but cannot be identified at this point, but only to point out that lead time must be anticipated depending on the complexity of the products.

(B) Managers of the three major elements of this proposal, processing, management and products independently arrived at labor costs and other expenditures that totaled over $600K. Therefore it is emphasized that this proposal, to meet the recommended guidance letter figure of $450,000, has reduced estimated actual costs and eliminated some items to meet this figure. Among these items are the following:

o salary for the NODC OCSEAP Data Coordinator is not included ($47K including indirect costs).

o updating and maintenance of taxonomic codes for OCSEAP data is not included ($20K including $2K for computer).

o only ½ m.y. has been allocated for format development, although it is anticipated that considerable format development may occur in FY78 based on NODC attendance and participation in more discipline workshops and format reviews (additional $21K).

o computer costs for this year are currently over $43K and expected to exceed $60K for the fiscal year. With an equal number of data sets expected for processing and an increased demand of the computer for data products, the figure of $39K for FY78 is unrealistic (additional $20K).

o the pre-checking and inventory file-generation task has been reduced by over one year of technician assistance although this task will directly involve OCSEAP data management (additional $18K).

o the new Seattle OCSEAP position is not included; it originally was considered as a separate item under data processing at a cost of approximately $20K including indirect costs.

o preparation of OCSEAP products based on the OCSEAP product compendium is an unknown quantity. Only $6K for the computer and less than one m.y. labor has been allocated to this task although a greater effort is anticipated.

o NGSDC computer costs of \$11.6K have been eliminated and are planned to be included in the OCSEAP computer costs for the Program Office in Boulder.

o the processing of 500 data sets for the fiscal year including prechecking, forwarding of check program results to the Project Office and possible corrections to the data was estimated to take 6½ m.y. of labor. This has been reduced to 5.4 m.y. to help meet the suggested budget (additional \$26K).

o the initial travel budget based on this year's travel and anticipated attendance by NODC personnel at workshops and synthesis meetings was \$28K. The submitted travel cost was reduced \$6K to help meet the suggested budget.

o NODC and NGSDC supply costs were reduced a total of \$1.2K to help meet the suggested budget.

The total for the above items not included is \$171K. The annual labor costs for those NODC individuals currently employed on OCSEAP tasks totals over \$300K. This excludes indirect costs, travel, computer, supplies and NGSDC's labor costs, which bring the total FY77 costs to almost \$600K. For FY78, there has been an attempt to place more emphasis on data products and management functions while maintaining an adequate working force to continue anticipated data processing. It is quite possible that additional funds may be required during the year to satisfactorily complete all tasks itemized in the guidance letter, even with the salary of the NODC OCSEAP Data Coordinator, taxonomic code efforts and the new Seattle position not charged to this proposal.

It should also be noted that OCSEAP is not charged for NODC system development costs that involve data handling, general applications software and other aspects of data processing and data products that do not relate directly to OCSEAP products although OCSEAP may benefit from many of these developments and improvements.

(C) The impact of the new NOAA computer on the OCSEAP data files and related software is not yet known. The contract for the new computer is now expected to be completed in November 1977 with delivery and installation completed within 6 months. There will be a 2-6 months overlap of computer usage with the present IBM 360/65 to reduce this impact. Some inventory systems will be converted to another system during the period before the new computer is delivered. Critical programs needed for OCSEAP will be identified in the next few months and assigned a high priority for conversion to the new computer system once it is known.

(D) The basic problem with establishing Project Office access to existing NODC inventory files is one of a satisfactory telecommunication line. Additional documentation must also be completed by NODC for remote access to 'DIP' and the OCSEAP data tracking system files.

(E) The division of funds between NODC and NGSDC is partially due to different indirect cost rates and partially to slightly different tasks within the data management proposal, although the basic elements of data processing, data management and data products are the same. Costs on the Cost Proposal Form are provided for both individual centers and combined for each category (labor, travel, etc.).

(F) The support of the new Seattle position is anticipated to include pre-checking activities, (once data are determined to be forwarded from the PI or Juneau Office to Seattle), contacts with investigators concerning data processing, format needs and possible OCSEAP and archival products to support the investigator's research activities. As mentioned above, no funds are allocated for this position in this proposal.

(G) Concerning planned taxonomic code activities, Dr. Collins will periodically issue news notes and respond to all requests for additional codes or other problems. Costs for this task also are not included in the proposal.

X. Deliverable Products

(A) Digital Data

No digital data will be generated by the research unit except data products derived from other investigators' data.

(B) Narrative Reports

In addition to quarterly and annual reports, periodic status reports based on the OCSEAP data tracking system and data inventory files will be delivered in partial fulfillment of this agreement. Reports related to check program results will be forwarded to the Project Offices with the computer results for individual or groups of data sets.

(C) Visual Data

Maps, graphs and special plots will be provided to OCSEAP and BLM personnel. These products will be dependent on the type and quality of digital data submitted by OCSEAP investigators to the Data Centers.

(D) Other Non-Digital Data

Copies of analog data received from OCSEAP investigators will be made available to OCSEAP and BLM personnel by EDS.

(E) Data Submission Schedule

Not applicable.

XI. Information Required from Other Investigators

For format development, complete definitions of required parameters for inclusion in new or modified OCSEAP data formats will be required.

For data processing, properly annotated data sets and documentation and compliance with OCSEAP data formats when computer-compatible media are delivered will be required.

For data products, complete descriptions of required products including scales, chart projections or other information will be required.

XII. Quality Assurance Plans

Not Applicable.

XIII. Special Sample and Voucher Specimen Archival Plans

Not Applicable

XIV. Logistics Requirements

Not Applicable.

XV. Managment Plan

This data base management project will be controlled by the Principal Investigator, the NODC OCSEAP Data Coordinator on a daily basis, working closely with the NGSDC representative who monitors the same data management functions for that Center. The Principal Investigator is under the direct supervision of the Chief, Project Monitoring Branch, NODC.

Data management tools include internal processing files and inventories, check programs for evaluating the quality of the data, the OCSEAP data tracking system and the OCSEAP file type summary. Status reports of data received and processed provide the necessary management overview to control the data processing activity. Copies of monthly reports submitted to the Director, Special Projects Division, will be available to OCSEAP management.

XVI. Outlook

1. Products and Results

a. Develop interactive access to OCSEAP management and inventory files and to selected OCSEAP data sets for the OCSEAP Project Offices and EDS offices in Seattle and Anchorage.

b. Improve the Seattle and Anchorage pre-checking capabilities to evaluate data submissions prior to receipt at NODC. Some steps of this function are to be established during FY77.

c. Improve the present edition of the OCSEAP Data Catalog, complete parts II, III and IV and provide updates to all parts of the Catalog.

d. Develop standard product packages for BLM and OCSEAP requirements.

2. Significant Milestones

Many data management functions are of a continuing nature with milestones evolving as the task develops through the year. Several of the more important milestones will involve attendance at workshops, improvements in telecommunications, new inventory schemes and more elaborate and useful data products.

3. Cost by Fiscal Year

Based on current funding for this task, continued processing of large amounts of digital data and expansion of products and product development, the following fiscal year costs for the next two years are estimated as follows:

FY79 $550K plus computer and travel costs

FY80 $575K plus computer and travel costs

4. Additional Major Equipment Required

None.

5. Location of Future Field Efforts

Not Applicable.

6. Logistics Requirements

Not Applicable.

XVII. 1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly Reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, Annual Reports by April 1.

3. At the option of the Project Office the PI is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

4. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release for information and for forwarding to BLM. The release of such material within a period of less than sixty (60) days shall

be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

5. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following acknowledgment is standard:

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

MILESTONE CHART

RU #: 362 PI: John J. Audet

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.

MAJOR MILESTONES	1977			1978											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Prepare users manual for access to DTS and DIP for OCSEAP offices and Anchorage and Seattle facilities	△														
Complete FORTRAN version of software for prechecking and inventory programs for Seattle and Anchorage			△												
Determine critical OCSEAP programs for conversion to new NOAA computer system			△												
Develop interactive access for Juneau Project Office for checking data set compliance													△		
Record keeping and status reports (continuous on a monthly basis to NODC and quarterly to Project Office)	△	→	→	→											
Attendance at workshops and data synthesis meetings (as scheduled)	△	→	→	→											

FY78 DATA PROCESSING PROPOSAL FOR RU 362

I. OBJECTIVES

To maintain the processing effort for the NODC data management support of OCSEAP/Alaska, the following objectives for FY78 are identified:

A. The processing of three hundred and fifty (350) anticipated data sets from accession through inclusion into the NODC project monitoring data base.

B. The processing of one hundred and fifty (150) anticipated data sets backlogged from FY77 from accession through inclusion into the same data base.

C. The creation of twenty (20) anticipated new data exchange formats through liaison with OCSEAP project trackers and discipline workshops.

D. Modifications to twelve (12) existing data formats and one hundred (100) code tables.

E. Development and implementation of a summary program that will provide a complete and descriptive assay of each data set received.

F. Continuation of the maintenance and expansion of the taxonomic codes.

G. Completion and documentation of software compatible with Anchorage and Seattle facilities for pre-checking data prior to submission to NODC.

H. Establish pre-processing capability at the NODC Seattle Liaison Office by hiring a new employee (GS-7/9) for checking OCSEAP data and working with investigators on format and data processing problems.

II. METHODS

A. Processing

Processing incoming OCSEAP data will be accomplished utilizing the multidisciplinary processing system outlined in Figure 1. This system is basically the same as that used the previous year. However, at the request of the Project Office, we will initiate a precheck with parameter ranges and a summary program to provide a complete description of each data set. The output from these programs will be forwarded to the Project Office for review for completeness and quality assurance within ten (10) working days after receipt of the data at NODC.

Initially, these programs will be run at NODC, but as programs are modified for use on other machines, some of this task will be transferred to the NODC offices in Seattle and Anchorage (RU 497) or to the University of Rhode Island (RU 527). It is anticipated that two (2) man-years will be required for this work as part of this Research Unit (RU 362) during FY78. It is expected that this amount could be reduced in future years, provided adequate resources are available as part of RUs 497 and 527 to allow a greater portion of the work to be done by these Research Units.

The NODC will not consider these data as accepted for processing until corrections or approval to continue processing is received from the Project Office. Data with Project approval will continue in the established processing cycle until complete. The DDF will be reviewed for completeness and accuracy by a data discipline specialist. Irregularities, errors, and deficiencies in the DDF will, whenever possible, be reconciled similarly with the project before further processing commences.

B. Formats

Development of data exchange formats is a requirement of OCSEAP and NODC. This development includes the definition of data set attributes such as: file types; record types; and data field width, location and definition. OCSEAP/Alaska data sets are file-oriented. Each file contains information relating to a specific study area (Benthic Organisms, Hydrocarbon Concentration, Trace Metals, etc.) and is composed of a series of record types. Generally, the record types include: File Header; Station/Observation Header; Environmental Information; and one or more Data Records. All project-oriented data files are required to contain certain minimal requirements (file type, file identifier, record type identifier, position, date-time, etc.). Beyond these required fields, information inclusion is at the discretion of the Program Office.

To maximize the amount of environmental baseline data transferred to NODC, to minimize resource expenditures necessary to process data by both originators and NODC, and to eliminate variability of exchange data formats, coordination and compromise between Project Office and NODC is imperative. This aspect of data management requires direct contact by NODC with Principal Investigators, Project trackers and Project managers via workshops and discipline-oriented discussions. NODC also must perform an education function, particularly for investigators not familiar with computer data processing and/or data base management, regarding data documentation. Outlining the importance of adequate reporting of scientific methodology and the concept of data exchange utilizing NODC as the intermediary are important factors in this area.

C. Taxonomic Codes

A list of the taxonomic names of the organisms which occurred in each data set will be provided to the Project Office for review within ten (10) days after receipt at NODC. This list is also being sent at the request of the Project Office and will accompany the summary listings mentioned in B.1.

As new species codes are required, they will be assigned and provided to the Project Office. The computerized tazonomic file will be maintained and updated as necessary.

FY78 DATA MANAGEMENT PROPOSAL FOR RU 362

I. INTRODUCTION

To maintain control, provide status reports and coordinate data requests, processing and product development, the following tasks are identified as part of data management:

A. Maintenance and updating of the OCSEAP data tracking system.

B. Preparation and distribution of data catalogs and inventories.

C. Monitoring of all OCSEAP digital and non-digital data sets received at NODC.

D. Digital data format coordination.

E. Coordination with OCSEAP Program and Project personnel including attendance at management meetings, workshops and data synthesis meetings.

II. METHODS

Details concerning the above tasks are as follows:

A. The data tracking system currently involves between 1000 and 1200 updates and changes per month. The update involves coding inputs received by Program and Project Offices and EDS data processing personnel, keypunching and verifying each update, entering the new information in the system and verifying all entries with an interim listing of the tracking system.

B. At least one update of the present data catalog is anticipated for FY78 and completion of Parts II, III and IV are planned during FY78. Part II will include identification of data sets by investigator and agency and indicate the number of stations for each data set. Different sorts will be made available to include types of data, agency and lease area. An Appendix is planned to provide cross references to data types and investigators. Part III of the catalog will include an expanded version of the format cover sheets with units defined where possible. Appendices will provide cross references of data parameters for all file types and copies of each format layout. Part IV will provide samples of output products for file types for which data have been received and processed and products defined by the Program Office.

C. Data monitoring involves recording the progress of each data set as it is received at the Data Center and following the data through the steps described under data processing. For NODC, this is accomplished by entering significant dates in logs maintained by the Special Projects Division. The most important steps include: (1) acceptance of data in terms of agreement with the DDF, (2) creation of copies of originator and user tapes, (3) creation of a temporary inventory file (QUADI), (4) correction of minor data errors, (5) completion of check program and inventory listings, (6) completion of processing and, (7) submission to archiver.

Under data monitoring, data reports and other non-digital information received by the Project Offices are logged in, assigned file IDs and entered in the data tracking system.

D. Format development efforts are described under the data processing methods. In addition to the development and modification of each format, a distribution list will be established based on data tracking information and other inputs from the Project Offices. After formats are completed, copies of formats are then forwarded by the NODC OCSEAP Data Coordinator in accordance with this distribution list. A total of 28 new or modified formats were distributed to 350 individuals during the past year.

E. OCSEAP coordination includes the following activities by the NODC OCSEAP Data Coordinator: (1) monitoring of data requests and processing problems for NODC; (2) daily or weekly contact with EDS processing and product personnel and representatives in Seattle and Anchorage; (3) verifying of data tracking system information and data catalog products; (4) distribution of data formats; (5) documented correspondence with the Project and Program Office, Seattle and Anchorage representatives and with OCSEAP investigators and data processors; (6) preparation of the quarterly and annual reports and timely status reports; (7) attendance at OCSEAP meetings and workshops.

Coastal Meteorology in the Gulf of Alaska
Research Unit: 367

Principal Investigator: R. Michael Reynolds

Cost: $135,000

Date: 15 June 1977

NOAA/Pacific Marine Environmental Laboratory
3711 15th Avenue N.E.
Seattle, Washington 98105

Required Signatures

Principal Investigator:

R. Michael Reynolds

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3711 15th Avenue N.E.
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Director, PMEL:

John R. Apel

J. R. Apel
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3711 15th Avenue N.E.
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Administrative Officer, PMEL:

R Cunningham (nt)

R. Cunningham
NOAA/PMEL
3711 15th Avenue N.E.
Seattle, Washington 98105

Technical Proposal Form
Research Unit 367

1 October 1977 - 30 September 1978

I. Coastal Meterology in the Gulf of Alaska

II. R. Michael Reynolds
NOAA/PMEL
3711 15th Avenue N.E.
Seattle, Washington 98105

III. A.	Science	$130,000
B.	Logistics (covered by this proposal)	$ 5,000
C.	Total	$135,000
D.	Copper River - Cape Hinchenbrook	$ 40,500
	Lower Cook Inlet	$ 54,000
	E. Kodiak Island	$ 40,000

IV. Background

For the past two years, various active meterological processes along the Icy Bay - Yakutat coastline have been considered, both for their local significance and understanding of their scales and importance, so other areas could be treated in a more experienced manner. Specifically we were concerned with the effectiveness of coastal processes in modifying winds along the continental shelf from what might be predicted by analysis of weather maps or large scale numerical models. Winds from several sources have been examined (see Fig. 1). The variation is significant as evidenced by Fig. 2. This figure shows scatter plots (an arrow drawn from the origin to a dot is one measurement of the wind vector) of March winds measured by data buoys EB-70 (55 km offshore), EB-43 (20 km offshore), and remote meteorological stations on the adjacent beach. Also shown are winds computed by the U.S. Navy Fleet Numerical Weather Central, (FNWC) and by geostrophic analysis of National Weather Service (NWS) weather maps. The plots show that winds near the coast are more directional than those offshore predominantly, N.E. Also, winds measured by EB-70 FNWC, and NWS show a considerable scatter. The importance of a knowledge of wind distributions in predictions of spilled oil trajectory or related environmental considerations is well accepted.

Measurements and model runs show a consistent pattern of wind. Fig. 3 is an example of one airplane flight in the area during a period of S.E. winds. Also shown in the figure are the data buoy measurements for the same time. The turning effect of the mountains is apparent. Fig. 4 is a model run for the case of S.E. winds. The model run was not set up to exactly duplicate the conditions of the 26 Feb. shown in Fig. 3, but rather to show typical conditions. Nevertheless, the consistency is encouraging.

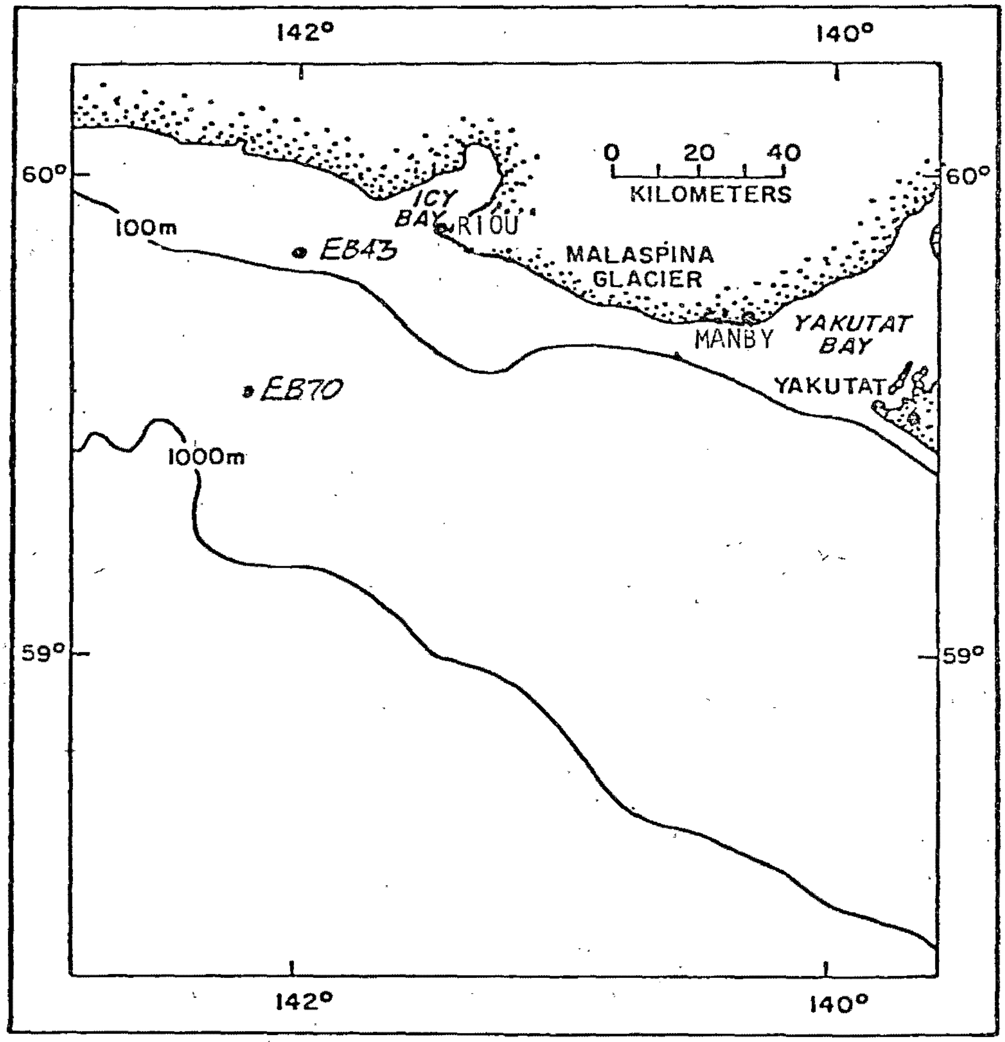


Figure 1 Sources of meteorological data: NWS Yakutat, environmental buoys 43 and 70, remote weather stations at Pt. Riou and Pt. Manby.

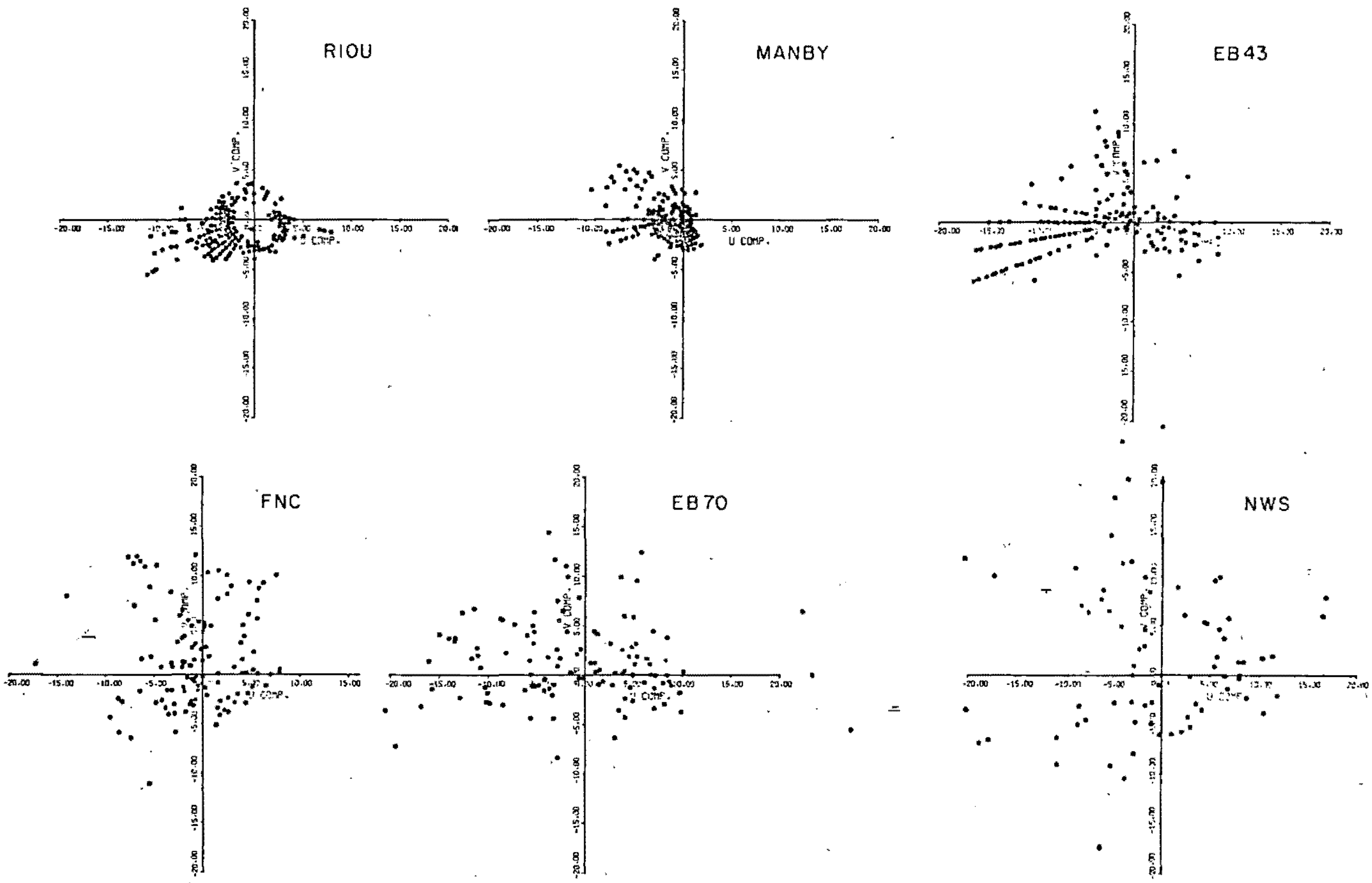


Figure 2 Scatter plots of March winds measured by EB 70, EB 43, remote weather stations at Pt. Riou and Pt. Manby; computed winds from FNWC and NWS.

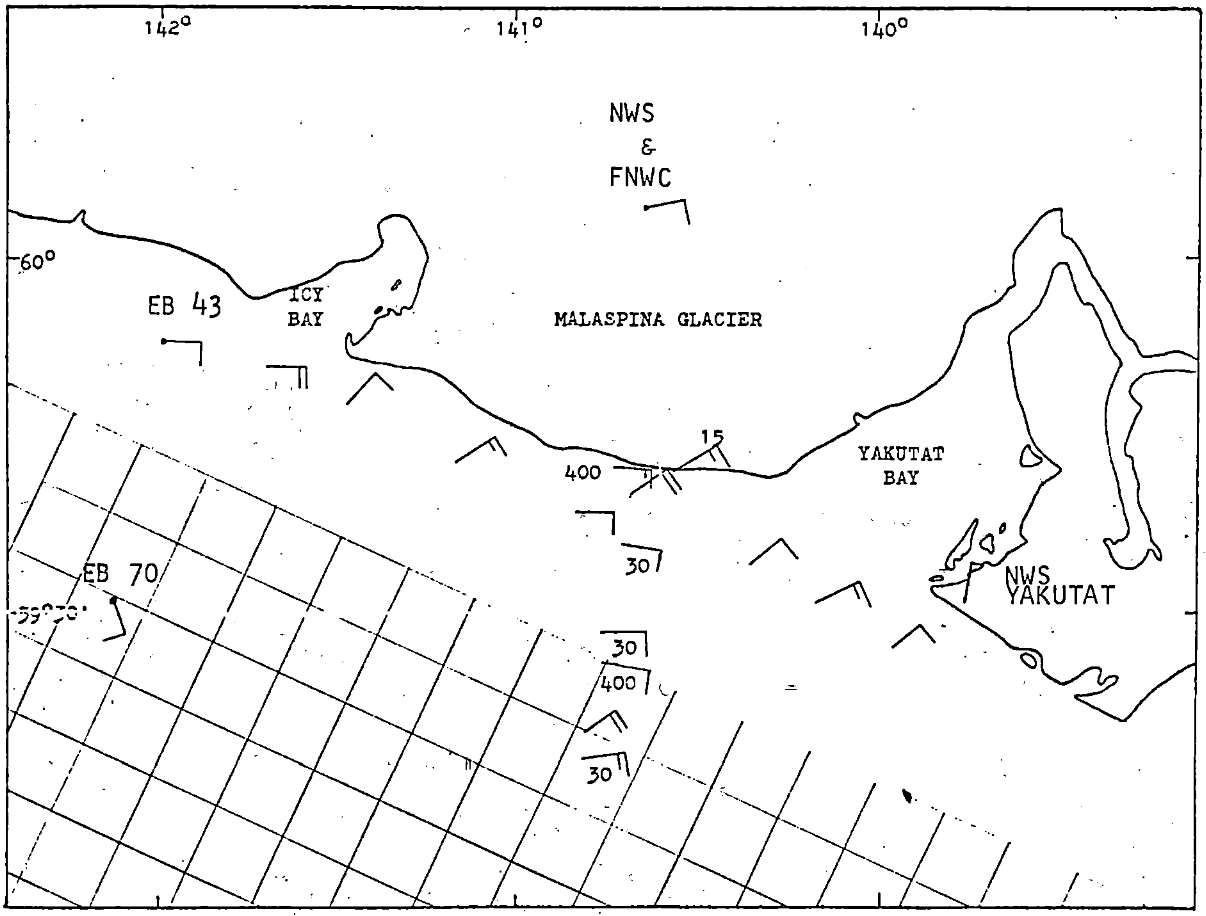


Figure 3 Winds measured by aricraft, NWS Yakutat, environmental buoys and computed by FNWC and NWS; 26 February, 1977. Aircraft measurements at 60 m unless otherwise indicated.

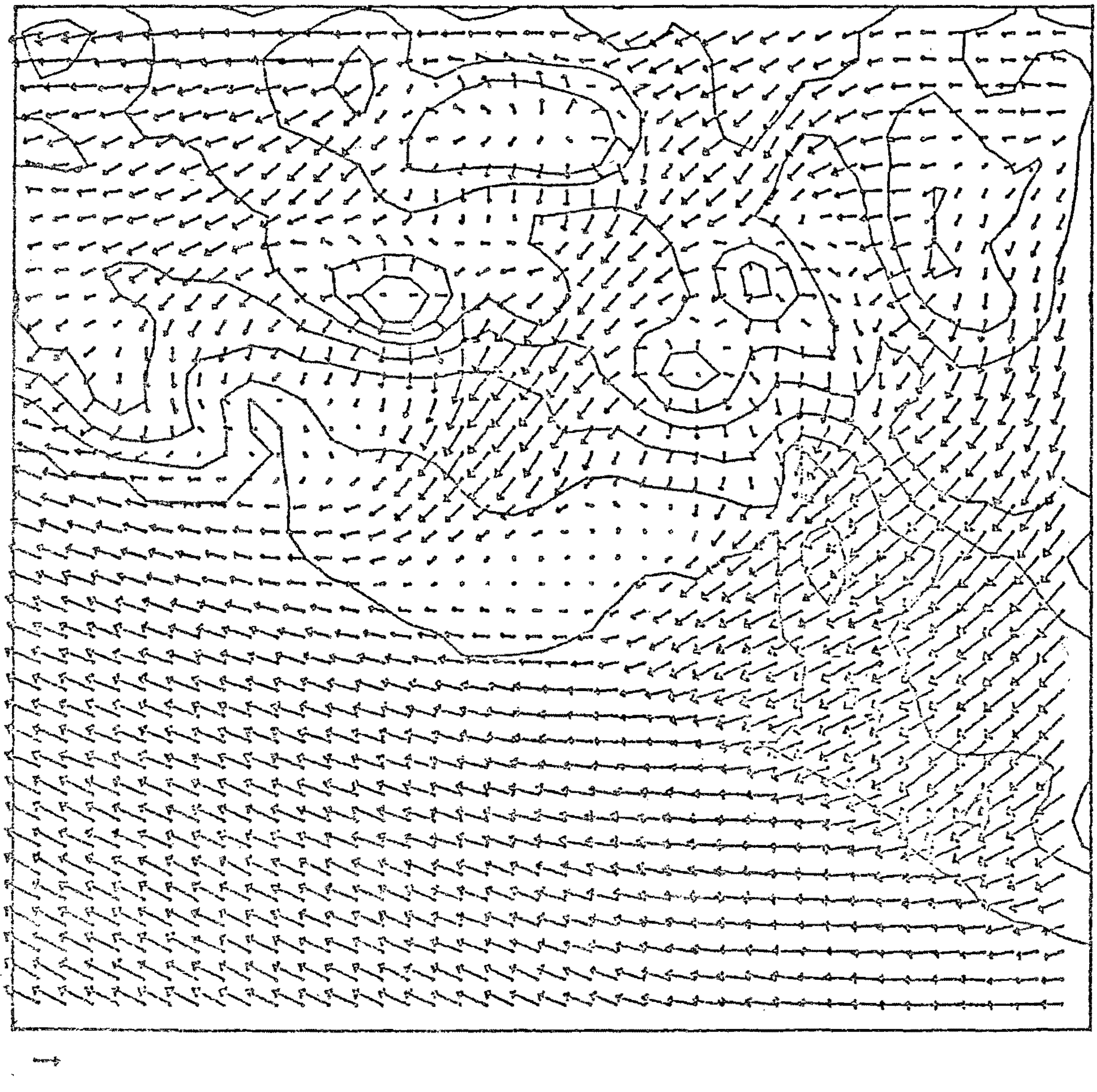


Figure 4 Meso-scale wind field predicted by numerical model in response to S.E. geostrophic wind initialization.

However, testing of the model under a variety of conditions has shown certain weak points in the model, especially as regards the boundaries. At present it seems necessary to propose a two grid model with a coarse grid expanded area run first to establish realistic boundary conditions, then finalized with a fine grid model in the region of interest.

The areas which will be considered in this proposal are Kodiak, Lower Cook Inlet, and Hinchenbrook Entrance. Data buoys located in each location will monitor surface meterological conditions. The three areas are shown in Fig. 5. The dashed areas are anticipated to be the outer model coverage, with the solid lines shown as the fine grid area. The circles show where meteorological time series will be collected. The letters represent:

B - Data buoy location

S - Reporting surface weather station

W - NWS weather station with upper air data

M - Remote weather stations (installed by PMEL).

Examination of satellite photographs and conversations with local weather persons suggest the mountain ranges which surround both Prince William Sound and Cook Inlet have a profound influence on regional weather. For example, a mountain gap at the head of Kamishak Bay appears to funnel westerly winds through Kennedy Entrance. It appears that while that area receives strong winds, the Albatross Banks, in the shadow of Kodiak Island, remains relatively calm. When Augustine Island in Lower Cook Inlet became active during the winter of 1976, several meteorological studies were made. Instrumented aircraft from the University of Washington and the National Center for Atmospheric Research (NCAR) spent several weeks flying in the vicinity. A study of these data should go a long way toward understanding the regional meteorology.

V. Objectives

The most important objectives of this research project are

1. To relate observed over-water winds and surface currents to winds computed by the meteorological model adapted from Lavoie under R.U. 140.
2. To characterize the regional wind field by operating the mesoscale surface wind model for the three aforementioned regions, and correlate over-water wind measurements with measurements obtained from available land-based meteorological stations.

These objectives relate to the environmental assessment of the Alaskan Continental Shelf by providing for more accurate prediction of surface winds. Certain areas such as Kamishak Bay or Valdez which

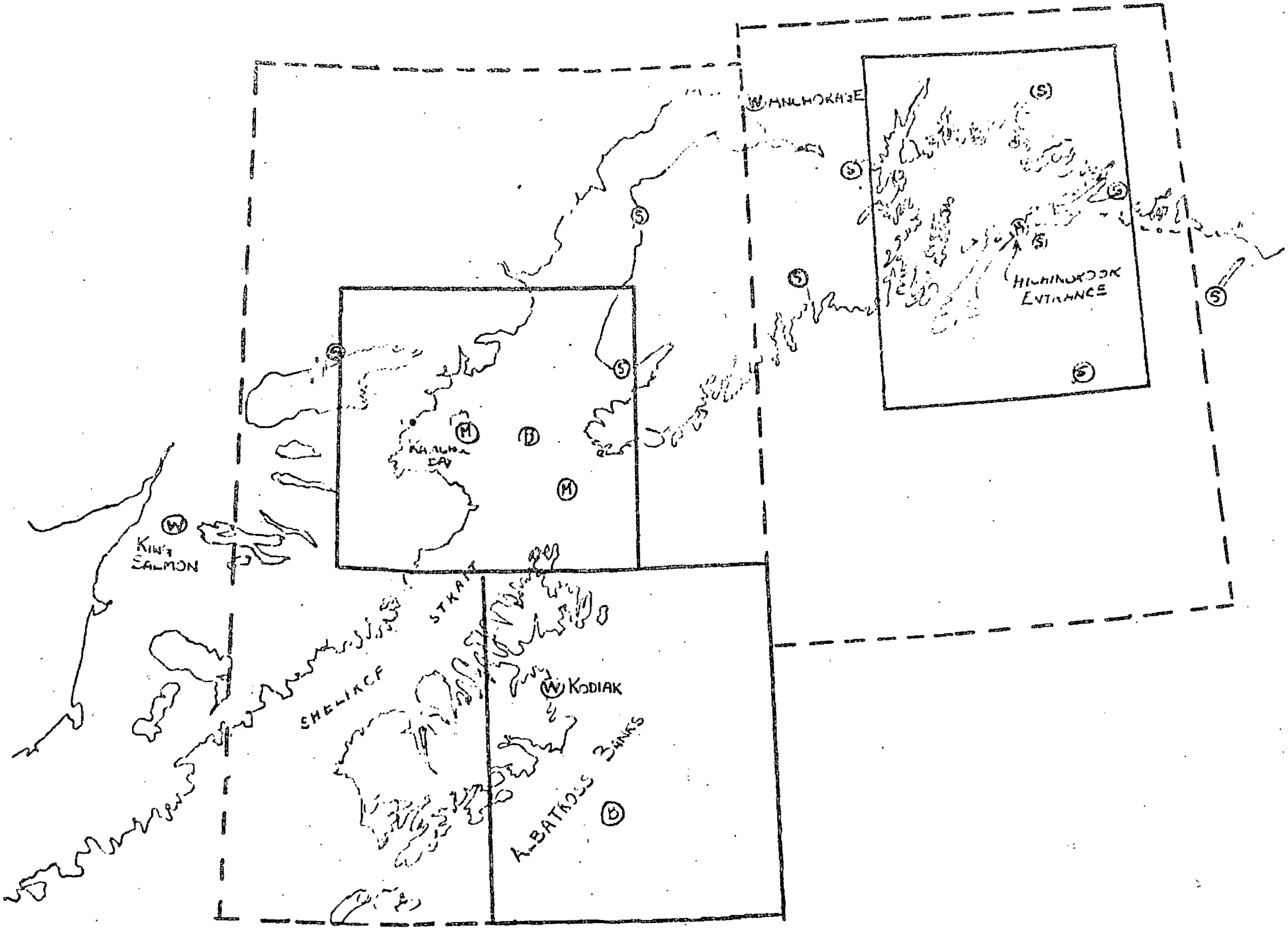


Figure 5 Three research areas for FY 78. ---- model coarse grid; ——— model fine grid; (B) data buoy; (S) reporting surface weather station; (W) NWS station with upper air data; (M) remote weather station.

receive strong winds from preferred directions will be classified. Accurate wind distributions are critical to accurate oil trajectory analysis.

VI. General Strategy and Approach

With the above information in mind, the strategy of the proposed studies is to better define the processes which affect the synoptic scale flow field and cause its modification on the meso-scale in the three proposed areas. An initial historical study encompassing climatological and synoptic records and previously published meteorological research will identify typical weather patterns in each of the operating areas. The approach to be used in studying coastal winds will be two fold - operational and analytical. In the latter case an existing meso-scale numerical model will be applied to each of the three study areas employing typical synoptic situations as boundary conditions. The resulting meso-scale wind field will be analyzed in terms of the forcing functions being modelled. In order to obtain data in the near-shore region against which to verify the model output, and to provide additional insight into the problem of offshore and along-shore wind variations, operational data will be collected from both synoptic scale and meso-scale instruments. Existing National Weather Service, National Data Buoy Office, and aviation stations will be employed where possible. In addition, several remote weather stations will be installed. An automated meteorological boom will be fitted to a NOAA vessel engaged in Lower Cook Inlet - NEGOA research for opportunistic data collection. A meso-scale pressure network is to be established in Lower Cook Inlet in order to better define the surface wind and pressure fields. This approach will provide a long-term, high resolution data set showing the behavior of the meso-scale wind and pressure fields in the near-coastal area during various synoptic situations.

In addition, it is intended to make aircraft observations of the three meso-scale regions in late February and late August, 1978, using NOAA's P3 Orion from the Research Flight Facility. Such flight observations offer an excellent opportunity to clearly define the surface wind variations from both a spatial and temporal sense and to relate these variations to observed dynamics of the atmospheric boundary layer. In the event that these flights cannot be scheduled, two week concentrated field experiments will be substituted using NOAA vessels as working platforms. During these cruises both time series and trackline probes of the lower atmosphere will be conducted. This approach will provide a seasonal summary of meso-scale meteorological processes in each area. Relevant wind forcing parameters will be identified and seasonal analysis of off-shore/on-shore and along-shore wind variations will be correlated with 5 - 10 model test runs in each area.

VII. Sampling Methods

In order to properly identify synoptic scale-mesoscale relationships it is important to collect a long time series of key predictive meteorological paremeters such as winds, barometric pressure and air temperature from a network of observation sites. The synoptic scale is well-defined from the pre-existing National Weather Service net in the south region of Alaska. These data are collected twice daily and are readily available from the National Climatic Center. Additional coverage will be provided by remote weather station installations such as currently in use in the Yakutat Bay - Icy Bay area and environmental data buoys. A meteorological bow boom and data logger will be installed on a NOAA vessel operating chiefly in the Lower Cook Inlet - NEGOA waters. A meso-scale pressure net is to be established in Lower Cook Inlet using pre-existing surface observations and remote installations. Careful calibration of pressure sensors is to be maintained by frequent intercomparison with a laboratory standard. Intensive short-term surveys will be carried out by instrumented aircraft and by ships of opportunity if necessary.

VIII. Analytical Methods

N.A.

IX. Anticipated Problems

Substantial effort will be made to provide back-up systems and replacement equipment where possible.

In the event that the Research Flight Center cannot lend their aircraft support to this study, it is anticipated to conduct intensive field efforts in a piggy-back mode from a ship of opportunity.

X. Deliverable Products

A. Digital products

Digital data will be collected from the following systems:

1. Ship Meteorological Boom - wind speed, wind direction wet bulb temperature, air temperature, pressure.

2. Remote Weather Stations - wind speed, wind direction, air temperature, pressure.

3. Aircraft - to be designated.

4. Ship (Radiosonde) - pressure, temperature, humidity

All data will be submitted in OCSEAP Wind format except aircraft data which is in GATE format. Please see "Data Products Schedule" for further information.

Data Products Schedule

Data Type (ie. Intertidal, Benthic Organisms, etc.)	Media (Cards, coding sheets, tapes, disks)	Estimated Volume (Volume of processed data)	OCSEAP Format (If known)	Processing and Formating done by PI (Yes or No)	Collection Period (Month/Year to Month/Year)	Submission (Month/Year)
SHIP MET. BOOM	TAPE	UNKNOWN	WIND	YES	2/78-8/78	12/78
REMOTE WEATHER STATIONS	TAPE	4-8 TAPES	WIND	YES	2/78-8/78	12/78
AIRCRAFT METEOROLOGY	TAPE	6-12 TAPES	GATE FORMAT	NO	2/78 and 8/78	3 mo. following receipt from RFC
SHIP RADIOSONDE	TAPE	2 TAPES	WIND	YES	2/78 and 8/78	5/78 and 11/78

B. Narrative Reports

A descriptive summary of seasonal meteorology for each of the three areas (as determined from historical study) will be issued.

C. Visual Data

No visual data submission other than that included in reports is anticipated.

D. Non-Digital Data

No non-digital data will be submitted

E. Data Submission Schedule

See attached "Data Products Schedule"

XI. Information Required from other Investigators

Arrangements have been made to collect satellite photographs of the South Alaskan region for historical and ongoing studies.

Digitization of Alaskan topography required for the numerical model is being made available from scientific personnel operating under R.U. 140.

Lower Cook Inlet studies are being coordinated with investigations under R.U. 138.

XII. Quality Assurance Plans

The meteorological station net, proposed for Lower Cook Inlet, will be regularly visited throughout the year to insure accurate readings, especially of pressure. A kit of calibrated pressure sensors will be hand carried to each sight for intercomparison of all the pressure sensors. This circuit will be made at least four times during the year. The data buoys, remote wind stations, and ship will be compared during airplane overflights. The airplane winds will be self checked with overlapping legs, standard techniques with such measurements. Remote met stations will be pre-and post-deployment calibrated with the U of W wind tunnel.

XIII. Special Sample and Voucher Specimen Archival Plans

N.A.

For OCSEAP use only.
RU #
Discipline
Area of Operation

XIV. LOGISTICS REQUIREMENTS

Please fill in all spaces or indicate not applicable (N/A). Use additional sheets as necessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

INSTITUTION PMEL/NOAA PRINCIPAL INVESTIGATOR R. Michael Reynolds

A. SHIP SUPPORT

1. Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions.
   Ships of opportunity in Gulf of Alaska and Bering Sea.

2. Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible.
   Boom measurements of surface meteorological data. Unit will be self-contained requiring occasional maintenance and a bridge log.

3. What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.)
   N.A.

4. How many sea days are required for each leg? (Assume vessel cruising speed of 14 knots for NOAA vessels. Do not include running time from port to beginning point and from end point to port and do not include a weather factor.)
   N.A.

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback?
   Piggyback
   Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling-time on station and sample processing time between stations.
   Consistent with CTD stations.

6. What equipment and personnel would you expect the ship to provide?
   Maintenance and occasional calibration by Survey Dept. Bridge log maintained by Quartermaster or Survey Dept.

7. What is the approximate weight and volume of equipment you will bring?
   1000#

8. Will your data or equipment require special handling? ______ If yes, please describe:
   Boom davit must be installed in Seattle or Kodiak with dockside boom.

9. Will you require any gasses and/or chemicals? NO If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If "yes" please name the vessel and give the reason for so specifying.
    DISCOVERER of SURVEYOR - These have davit collar installed.

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availability
    N.A.

12. How many people must you have on board for each leg? Include a list of participants, specifically identifying any who are foreign nationals.
    Possibly one person on occasional legs to check operation.

B. AIRCRAFT SUPPORT - FIXED WING

1. Delineate proposed flight lines on a chart of the area. Indicate desired flight altitude on each line. (Note: If flights are for transportation only, chart submission is not necessary but origin and destination points should be listed)

See Attached RFC propasal

2. Describe types of observations to be made.

Above

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification)

Above

4. How many days of flight operations are required and how many flight hours per day?

Above

Total flight hours?

5. Do you consider your investigation to the principal one for the flight thus precluding other activities or requiring other activities to piggyback or could you piggyback?

Principal Experiment. We encourage campatible piggyback investigations.

6. What types of special equipment are required for the aircraft (non carry-on)?

See propasal

What are the weights, dimensions, power requirements, and installation problems unique to the specific equipment.

7. What are the weights, dimensions and power requirements of carry-on equipment?

N.A.

8. What type of aircraft is best suited for the purpose?

WP-3D

9. Do you recommend a source for the aircraft?
If "yes" please name the source and the reason for your recommendation.

NOAA Research Flight Facility (RFC)

10. What is the per hour charter cost of the aircraft?

Base funded if approved

11. How many people are required on board for each flight (exclusive of flight crew)?

2 for principal experiment, up to 6 possible.

12. Where do you recommend that flights be staged from?

Anchorage

C. AIRCRAFT SUPPORT - HELICOPTER

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed)

   See Figure 5 - stations marked Ⓜ are remote weather stations on exposed islands.

2. Describe types of observations to be made.

   Install and service remote weather stations.

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

   Feb., April, June one flight each time to service installations.

4. How many days of helicopter operations are required and how many flight hours per day? 3 - 6 days 5 hours/day

   Total flight hours? 30 hours

5. How many people are required on board for each flight (exclusive of the pilot)?

   2 Scientists

6. What are the weights and dimensions of equipment or supplies to be transported?

   300# Equipment includes a data logger (2 ea., 3' x 2' x 1') instruments, and tower (2 ea., 6' long)

7. What type of helicopter do you recommend for your operations and why?

   no preferences

8. Do you recommend a particular source for the helicopter? If "yes" please name the source and the reason for your recommendation.

   1. Totem Helocopter in Homer 907-235-8966 - They are near and handy

   2. Kodiak Coastguard - possibly free

9. What is the per hour charter cost of the helicopter?
   Totem Helocopter is $295/hr.

10. Where do you recommend that flights be staged from?

    Homer or Kodiak

11. Will special navigation and communications be required?
    NO

XVI. Outlook

1. Nature of final results and data products.

Preliminary work suggests the two-level mesoscale model is adequate to describe the surface wind field along the Alaskan coast, especially during cases of on-shore winds. Specification of inflow boundaries in mountainous regions remains a nagging problem. The FY-78 research will investigate these boundary problems in detail, hopefully the inclusion of a larger coarse-grid area surrounding the area of interest will result in adequate boundary specification.

The major results of FY-77 research will be a set of seven model verification cases in which a model run is compared to aircraft and surface measurements. In addition, a set of hypothetical model runs aimed at emphasizing certain aspects of the numerical solution will be produced. The FY-78 research will continue this study into three additional areas.

Final data products for each region will be *i*) a summary report of the model verification study and hypothetical cases. *ii*) a summary of the regional meteorology of each region.

2. Significant milestones are *i*) results from each aircraft flight which, when correlated with a numerical solution will provide insight into regional meteorology, *ii*) adequate ability to measure the correct set of parameters in a region so that accurate model predictions can be made. Definition of the correct set of parameters, which may include a precision pressure grid, rawinsondes, or wind measurements, is one of the goals of this research.

3. Cost is best quantized by region. To prepare the model to run in a region, the costs are approximately $10K for digitization, set up, and perlininary runs. To fully develop the model and run it for a variety of test and weather conditions, will run an additional $20K. A field verification study can run from $10K to $50K depending on the complexity of the area or the detail needed. Thus, a figure of $60K for a regional study can be considered a typical cost, with savings incurred by conjoining nearby areas.

4. Little major equipment is foreseen. Use of available instrumented aircraft are sufficient for our needs.

5. Aside from specific application at other lease areas, the edge of the ice pack is of considerable interest. The dynamics of ice/ocean transition coupled with the thermodynamics involved in heat transfer and ice formation are not understood, and must be better known before accurate interpretation of observed oceanographic phenomena are possible.

6. Future logistic requirements are not expected to be much different than FY-78.

XVII. Standard Statements

1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labelled, held, and shipped to an officail OCSEAP-designated repository in coformity with OCSEAP voucher specimen policy. Vouchering will include life history stages (e.g., larvae, ju eniles, adults) when these are used, and sexes where these are morphologically distinguishable.

4. At the option of the Project Office the PI is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection preiod, unless a written waiver has been received from the Project Office. This does not apply to report requirements (see par. 2).

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending dispostion at contract termination.

9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release for information and for forwarding to BLM. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office

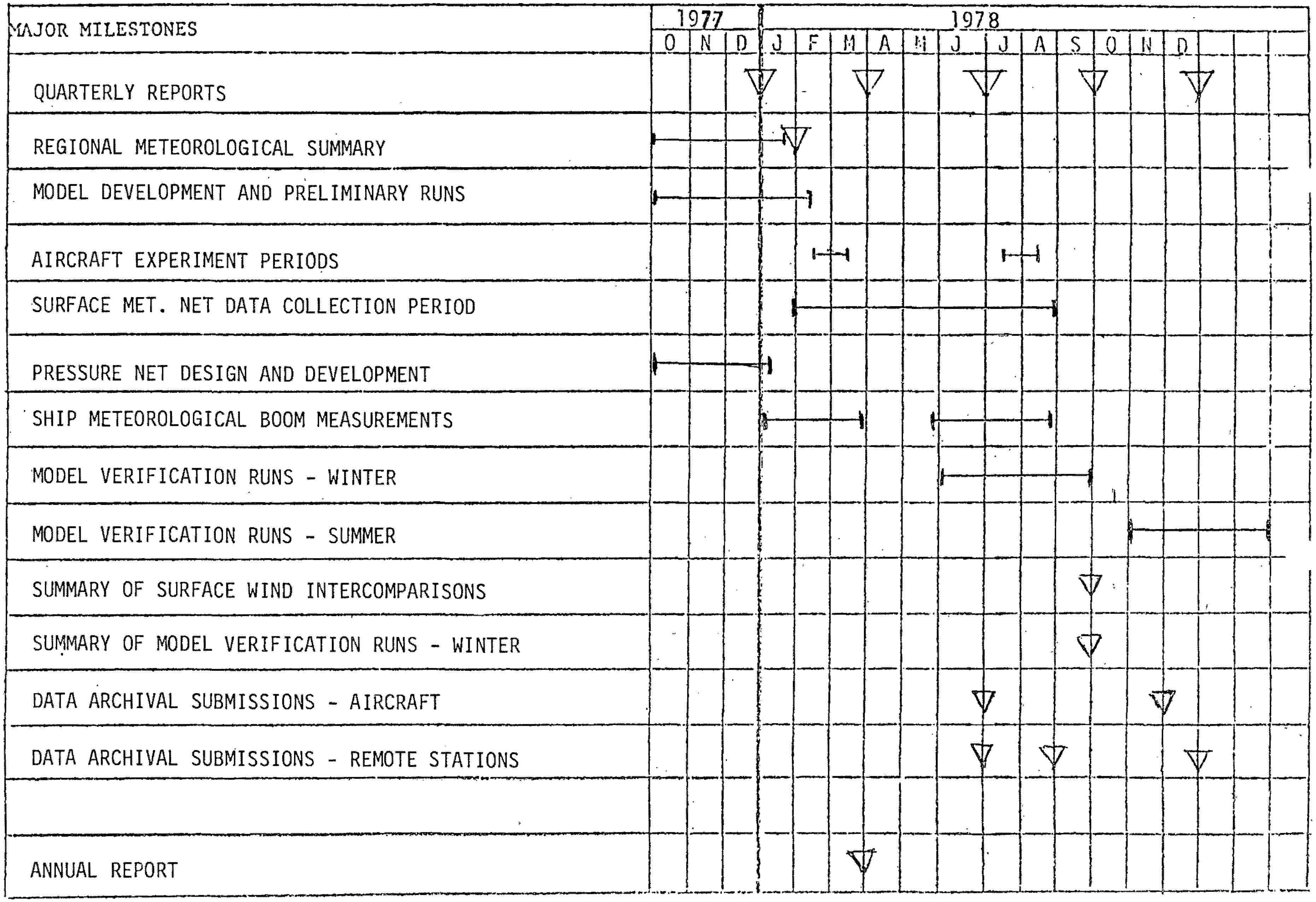
10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following acknowledgement is standard.

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

MILESTONE CHART

RU #: 367 PI: R. Michael Reynolds

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.



NOAA FORM 85-501
(10-75)

U. S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ENVIRONMENTAL RESEARCH LABORATORIES

RESEARCH FACILITIES CENTER

P.O. Box 480197

Miami, FL 33148

FOR RFC USE ONLY		FOR RFC USE ONLY
DATE RECEIVED	REQUEST FOR RFC SUPPORT	PROGRAM NUMBER

PART I (TO BE COMPLETED BY INVESTIGATOR)

INVESTIGATION TITLE

Alaskan Coastal Winds

ABSTRACT OF PROPOSAL

A mesoscale numerical model, a modified version of the two layer model of Lavoie (1972), will be applied to three areas in the Gulf of Alaska: Kodiak Island, Cook Inlet, and Prince William Sound. The ability of the model to accurately predict winds in such mountainous regions must be verified, especially when the flow is NW to NE. Aircraft support is needed to produce a series of trial cases against which to compare the model. Additional scientific goals include the study of the atmospheric dynamics along the ice edge, turbulent structure under stratocumulus, and if possible, the off-shore modification of katabatic flows. AXBT measurements will supplement concurrent ship measurements.

FIELD SITES AND REQUESTED FLIGHT DATES (SUMMARY)

Anchorage

Winter Experiment: 15 Feb. - 1 Mar. 1978 (Approximate)

Summer Experiment: 20 July - 3 Aug. 1978 (Approximate)

NUMBER OF AIRCRAFT REQUIRED	TOTAL NUMBER OF FLIGHT—HOURS REQUESTED
1	100

PRINCIPAL INVESTIGATOR NAME, ADDRESS, PHONE NO.	CO—PRINCIPAL INVESTIGATOR NAME, ADDRESS, PHONE NO.	SPONSOR POINT—OF—CONTACT NAME, ADDRESS, PHONE NO.
R. Michael Reynolds NOAA/PMEL 3711 - 15th Ave NE Seattle, WA 98112 (FTS) 339-1960		OCSEA Program-RX4 % Roy Overstreet NOAA/ERL Boulder, CO 80302 323-6531
SIGNATURE	SIGNATURE	SIGNATURE
DATE	DATE	DATE

APPROACH AND TECHNIQUES (This uld treat hardwa.e, experimental design, and ana techniques. Identify any areas that are beyond the state of the art, borderline, or for which development work is required.)

Two types of flights are anticipated:

1. Surface wind distribution - Under the assumption of a well mixed planetary boundary layer, the three study areas will be sampled at two levels, 60 m and 2000 m above ground. Up to 5 dropsondes will be dropped in each area.

2. Boundary Layer Structure - Under favorable conditions, several levels will be flown along a specific track line in order to define boundary layer development over a 200 km adjustment scale. This will be especially important at the Bering Sea ice edge during winter.

The aircraft must be able to make 3 D turbulence measurements as will as liquid water and total water content. Desired measurements are checked on the attached Table 1.

REQUESTED RFC SUPPORT (Aircraft, ground support, engineering, installation, data management, etc.)

WP 3 D Aircraft instrumented as above.

Ground Support.

Instrument calibration; pre & post experiment.

Data preparation to standard GATE format (see Data Package section)

Dropsondes and AXBT's - up to 150 each.

SENSOR REQUIREMENTS AND RATIONALE (Why are these particular measurements needed? Are there any alternatives available?)

No extraordinary requirements for either sensor accuracy or resolution are required above standard turbulence measurement needs. In the event the dropsonde system is not functional, slant profiles can be substituted. Occasionally, slant profiles will be taken as a check on dropsonde accuracy.

WEIGHTS, DIMENSIONS, POWER REQUIREMENTS (User/investigator's equipment, including drawings if available.)

No user equipment necessary.

OPERATIONS (Time, place, environment ıracteristics, and outline of field operations. These i should be as precise as possible.)

Times: 15 Feb. - 1 March 1978 Approx.
20 July - 3 August 1978 Approx.

Figure 1 shows the Alaskan Gulf Coast and three areas of interest. Frequently strong offshore winds are observed in winter whereas summer conditions are milder. A typical flight plan suitable for NW winds is shown in figure 1. The airplane based at Anchorage would cruise at 2000 m at 325 knots or 60 m at about 200 knots. Dropsondes will be deployed where indicated. Several checkpoints for the INS are available. The 2000 m tracks would be adjusted to remain upwind of the study areas for other wind directions. The track shown is about 2000 nautical miles long requiring about 3½ - 4 hours at each level for a total of 7 - 8 hours flying time.

When conditions are favorable, some flights will be made over the Bering Sea for studies of thermodynamic modification of the Arctic continental air by both the ice and open sea. The ferry to the ice edge would be about 600 nautical miles each way. Upon arrival at the study area, a 200 km run would be made over open sea and dropsondes deployed as shown in figure 2. The airplane would return to the ice edge at 60 m and then execute a series of rectangular box patterns, all at about 200 knots. The boxes typically would be at 30, 60, 150, 300, 600, and 1000 - 1500 m. The last level consists of slow ascending and descending legs in order to measure structure above the mixed layer. This flight is also about 2000 nautical miles requiring about 8 hours of flying time.

DATA PACKAGE (What output data are required, in what formats, in what quantities, when will they be required, and to whom are they to be delivered?)

In addition to the variables listed in Table 1, output from the INS and gust probe giving position, attitude angles and incidence angles should be recorded on tape compatible with CDC computer systems. The preferred format is that used for chival of GATE aircraft data in which each logical record contains one or more seconds of data stored at a sample rate of 1/sec and gust probe data at 20/sec. Data storage in a packed-binary format is particularly efficient. Any graphics or tabulation of time series used during quality control analyses are desirable.

The data are to be delivered to R.M. Reynolds as soon as is reasonable, allowing a few months for processing and quality control by RFC.

ANALYSIS PLAN (How will the data be yzed? When and to whom will they be available?)

Wind Field Flights: Each of these flights will be used to produce a map of measured surface winds and a comparison of aircraft winds with both model results and surface measurements. A fine grid pressure net will be used to generate pressure fields r further comparison.

Boundary Layer Structure: Inversion height, inversion strength, temperature, and humidity will be compared to theoretical models. Of special interest is the interaction of dynamics and thermodynamics in the developing air mass.

The data will be archived as part of the OCSEA Program which is funded by the Bureau of Land Management and administered by NOAA. They will be available through the OCSEAP Project Office as soon as possible after the experiment.

COMPLETION DATE (When will the scientific objectives — analysis and/or final report — be achieved?)

The experiment final report will be made on 1 October 1978.

August experiment final report will be made on 1 April 1979.

PROGRAM SIGNIFICANCE (Give an argument for the importance of the investigation with respect to one or more of the following: (1) National societal needs/impact; (2) National economic needs/impact; (3) Major flaws or gaps in environmental science.)

This study is part of a comprehensive environmental survey of the Alaskan continental shelf, OCSEAP, one of the largest such undertakings in history. The data taken by aircraft will be used to verify wind field models which are an integral part of oil spill trajectory and surface current prediction schemes. The oil development program in the Alaskan shelf region will not proceed without assurances of environmental safety, which are possible only with accurate field measurements. Further, the transfer of heat from ocean to atmosphere plays a big role in ice development, ocean stratification, and climate. The use of an aircraft in this region where many supporting measurements are being made will create an important step toward understanding that transfer process.

RELATIONSHIP TO OTHER INVESTIGATIONS (If the i[...]lgation is part of a broader program, describe that p[...]m and indicate the interrelationship with this investigation. If a similar investigation or flight program has been done previously, describe the methodology used, results, and reasons for any failures in the program.)

During the experimental periods, a wide variety of concurrent measurements will be ..nerway. At lease one NOAA ship will be in the area and will take surface meteorological and oceanographic measurements. Several data buoys and remote meteorological stations which will be active are shown in the attached figure. In the vicinity of Lower Cook Inlet, a calibrated pressure net will be operational, and will be used for precision geostrophic calculations.

During the February dates, NOAA oceanographic ship operations will be underway in the Bering Sea, and a combination of ship and aircraft measurements will be possible.

PREVIOUS AIRBORNE EXPERIENCE (Describe any previous airborne research experience of the proposed investigator(s).

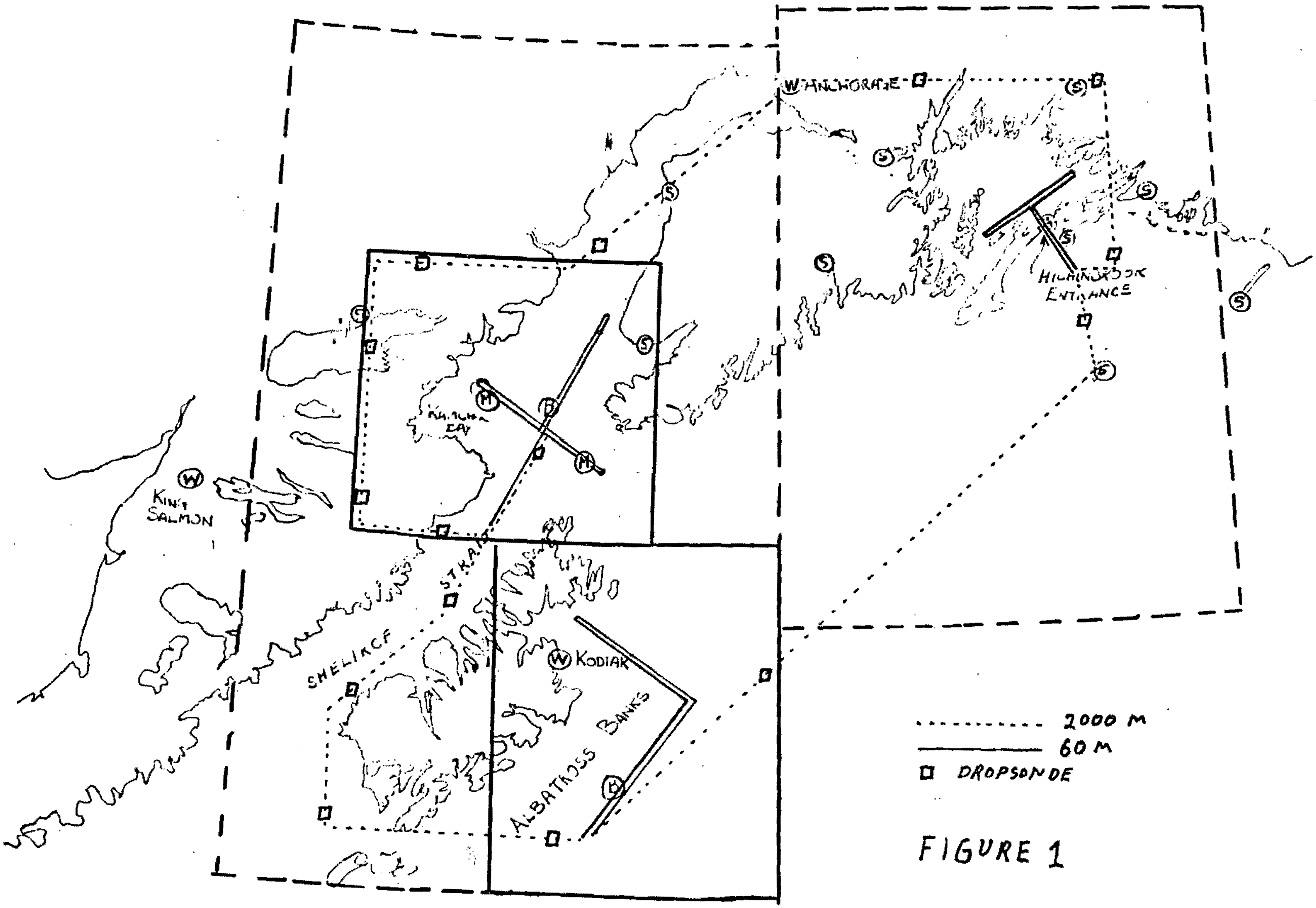
During Feb. - Mar. 1977 a similar study was made in the Icy Bay - Yakutat area by the NCAR QUEEN AIR 304 D. That data is now being examined and compared to a mesoscale model for the area. Data analysis thus far agrees generally with model results, and indicates mountain induced effects far out to sea (> 50 km).

Data analysis is led by Mr. T Hiester who recently finished his M.Sc. in Atmospheric Science at University of Washington. His research was a comprehensive summary of aircraft turbulence data taken by several programs including GATE, BOMEX, AMTEX, and ~eat Lakes.

COMMENTS (Any comments that requester feels are relevant.)

Table 1. NOAA P-3D (43RF) (Plane A, Low Level) Instrumentation

I.	METEOROLOGICAL SENSORS	
	Temperature	(Rosemount total temp)
	Pressure	(Static-dynamic, Garrett)
	Dewpoint	(General Eastern)
	Sideslip	
	Winds	(Omega-INS TAS computed)
	Vertical wind system	(High resolution angle of attack, pitch angle, vertical acceleration)
II.	CLOUD PHYSICS	
	Cloud droplet spectrum	(PMS Knollenberg 2-D probe)
	Hydrometeor size spectrum	(PMS Knollenberg 2-D probe)
	Hydrometeor size spectrum	(Foil impactor - MRI)
	Cloud liquid water	(Johnson-Williams hot wire)
	Total water content	(Lyman-alpha probe)
	Total liquid water content	(Merceret-Schricker nimbiometer)
	Ice-water discriminator	(Mee Industries)
	Cloud condensation nuclei CTR	(Mee Industries)
	Bulk water sampling system	
	Nuclei	(General Electric E-1)
	Total dust	(General Electric)
	Ice	(NCAR-Acoustic or MEE)
	Condensation	(Diffusion, 1% super sat)
	Millipore filter system	
III.	RADIATION	
	Sea surface temperature	(Barnes PRT 5)
	CO_2 air temperature	(Barnes PRT 5)
IV.	RADAR (Digitized and video recorded)	
	C-band PPI belly 360° scan (horizontal) fan beam radar	
	X-band RHI tail 360° scan (vertical) radar	
	C-band PPI nose 240° scan conical	
V.	MISCELLANEOUS	
	Gust probe	
	Hot-film anemometer	
	Airborne expendable bathythermograph launch mechanism — 150 units	
	Flare seeding system (internal)	
	Photography (nose, side, vertical)	
	Laser altimeter	
	Dropsonde — 150 units	



ANCHORAGE
HINCHINBROOK ENTRANCE
KING SALMON
KODIAK
SHELIKOF STRAIT
ALBATROSS BANKS
2000 M
60 M
DROPSONDE

FIGURE 1

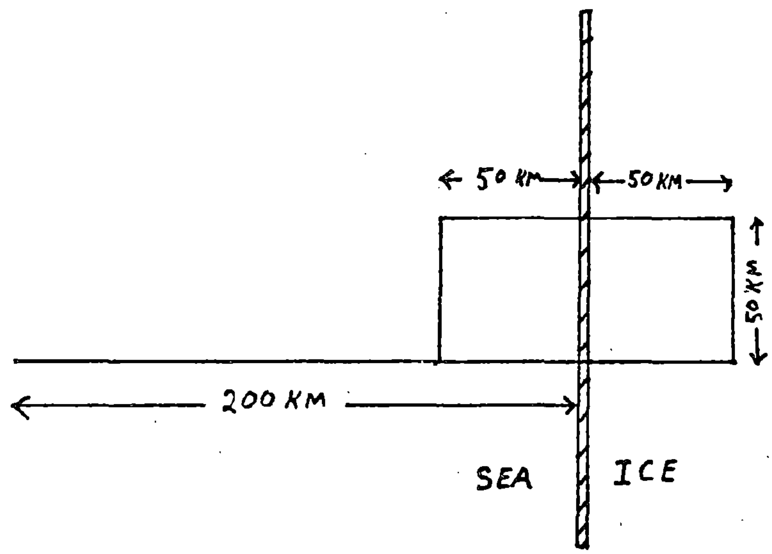


FIGURE 2

Outer Continental Shelf Environmental
Assessment Program
Bering Sea-Gulf of Alaska Project Office
P. O. Box 1808
Juneau, Alaska 99802
PH: 907-586-7432

RFx41-367-678

AUG 1 9 1977

R. Michael Reynolds
PMEL
3711 15th Avenue N.E.
Seattle, Washington 98105

Reference: Research Unit #367

Dear Mr. Reynolds:

Your FY 78 renewal proposal, entitled, "Coastal Meteorology in the Gulf of Alaska," has been reviewed by the Juneau Project Office and judged acceptable in its present form at your requested funding level of $135,000. We will instruct our Contracting Office to initiate contracting procedures based on this proposal.

I regret that the added funding for instrumental aircraft cannot be provided.

The final funding commitment and level are contingent on the approval of the FY 78 OCSEAP budget by the Bureau of Land Management.

I look forward to your continued involvement in our program.

Sincerely,

Herbert E. Bruce, Ph.D.
Bering Sea - Gulf of Alaska Project Manager

cc: Program Office

U.S. DEPARTMENT OF . MMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL RESEARCH LABORATORIES

PACIFIC MARINE ENVIRONMENTAL LABORATORY
3711 - 15th Avenue Northeast
Seattle, Washington 98105

Date: August 15, 1977

To: Herbert E. Bruce, OCSEAP Project Manager, Juneau

From: R. Michael Reynolds, Oceanographer, PMEL, Seattle
Michael Reynolds

Subject: Research Unit 367 request for revision, 28 July 1977

This memo is a response to your request for revisions to our FY 78 renewal proposal entitled "Coastal Meteorology in the Gulf of Alaska."

1. As regards the possible unavailability of the RFC aircraft, once more I would like to stress the importance of that operation. A winter study would require as little as 50 research hours costing $70 K at estimated incremental costs This winter study would provide excellent coverage of all three proposed study regions as well as several passes over the ice edge. As we work up the data set obtained by the NCAR aircraft in Yakutat we are impressed by its quality. Reverse legs in the flight pattern as a check on the data show a high degree of consistency and repeatability. This consistency reduces the need for extrapolation or interpretation to a minimum, tremendously enhancing the whole verification process. In addition we are able to delineate several mesoscale processes which cannot be treated by the present models; e. g. small coastal fronts which generate wind reversals offshore have been detected. The importance of these phenomena in prediction of surface wind is presently under consideration.

   If the RFC aircraft cannot be obtained, we will participate in the PMEL cruises in Cook Inlet during the March and May cruises. Cook Inlet has a great deal of coverage from several sources. During the cruises we will use tethered balloons, radiosondes, and surface measurements to complement these sources. We will be making detailed pressure measurements so we can relate the local pressure field on the mesoscale to the synoptic NWS maps. Also during the cruises we will maintain an expanded array of weather and pressure stations along the coastal periphery. It is crucial that good shore measurements are made concurrently with shipboard measurements and the characteristics of Cook Inlet lend themselves to that goal.

   As we mentioned in our proposal, two instrumented aircraft studies were made in the Lower Cook Inlet area during Feb-Mar 1976. We will be examining this data to assess its applicability to our needs. Without a tailored aircraft study of our own, we will probably delve more deeply into utilizing some of the data.

2. As part of our FY 78 work we intend to archive all pertinent data in Format 101. This includes remote weather station data, radiosondes, and meteorological data sets taken by ships or aircraft. Radiosonde and weather station data is presently translated onto our HP9830A computer/calculator where it is checked for quality and easily edited. The data is then sent, via terminal interface, to the UW CDC center where the BCD archival tape is written. A playback of portions of the archival tape is made to insure no problems were encountered by transmission. All editing and check printouts are filed at our lab.

3. A revised milestone chart which includes titles to narrative reports is included with this letter. The model development report entitled "Application of the PMEL Mesoscale Meteorological Model to Three Areas in the Gulf of Alaska - Preliminary Report" follows closely a regional meteorological summary for the three areas and will draw from that information. In our case, a discussion of model development will be a simple comparison of preliminary model results to the information available for the areas. Important or sensitive areas will be delineated at that time.

4. Visual data products will be included in all narrative reports. These will be selected to be as descriptive of the main objectives as possible in order to provide information to decision makers and to show progress of our work.

5., 6. A revised Cost Proposal Form is included with this letter. We have met with Dr. Galt and have defined the demarcation between model development and model verification. The revised CPF reflects this definition. We do not intend to either develop the modelling techniques or make model runs. Instead, we aim to verify model performance in two main areas. Firstly we will produce a variety of test cases, tests which are designed to exercise the basid physics of the model. Use of the model either in new locations, or with no direct verification, will rely on an understanding that the model contains good physical insight. Secondly, we will produce a set of field cases, cases of actual conditions in the model areas. These cases will contain a surface winds summary along with all available supportive data.

If the model is to be effective, it should be able to produce realistic results with a minimum of input data; typically this might include a NWS upper air sounding and synoptic weather map, possibly even a data buoy measurement. RU 140 will produce model runs based on the above parameterization which will be compared to expected or measured wind fields. Parameter sensitivity and physical shortcomings will be worked out jointly between RU 367 and RU 140 in hopes of improving the model performance. Model performance will be appraised in the Quarterly and Annual reports from RU 367.

The above demarcation is the same as we originally designed the modelling/verification program. The title "Modelling Support" has been altered to "Data Analyst" which better reflects the nature of that task. Also "Computer costs" in CPF-5 is renamed "Data processing analysis costs", again to reflect overall spending. This money will include processing aircraft data (historical and/or future), translating data-buoy tapes, and procurement of historical and climatological data.

7. We will provide a written specification for non-routine shipboard procedures to the OCSEAP office no later than 30 days before utilization of the ships. This will include any special considerations for control of quality and accuracy. The specification is scheduled on our revised milestone chart.

8. Data will be submitted to the Project Office within 120 days of the completion of a cruise or 3 month data collection period, unless a written waiver has been received from the Project Office. This does not apply to report requirements.

Personnel involved with this RU are as follows:

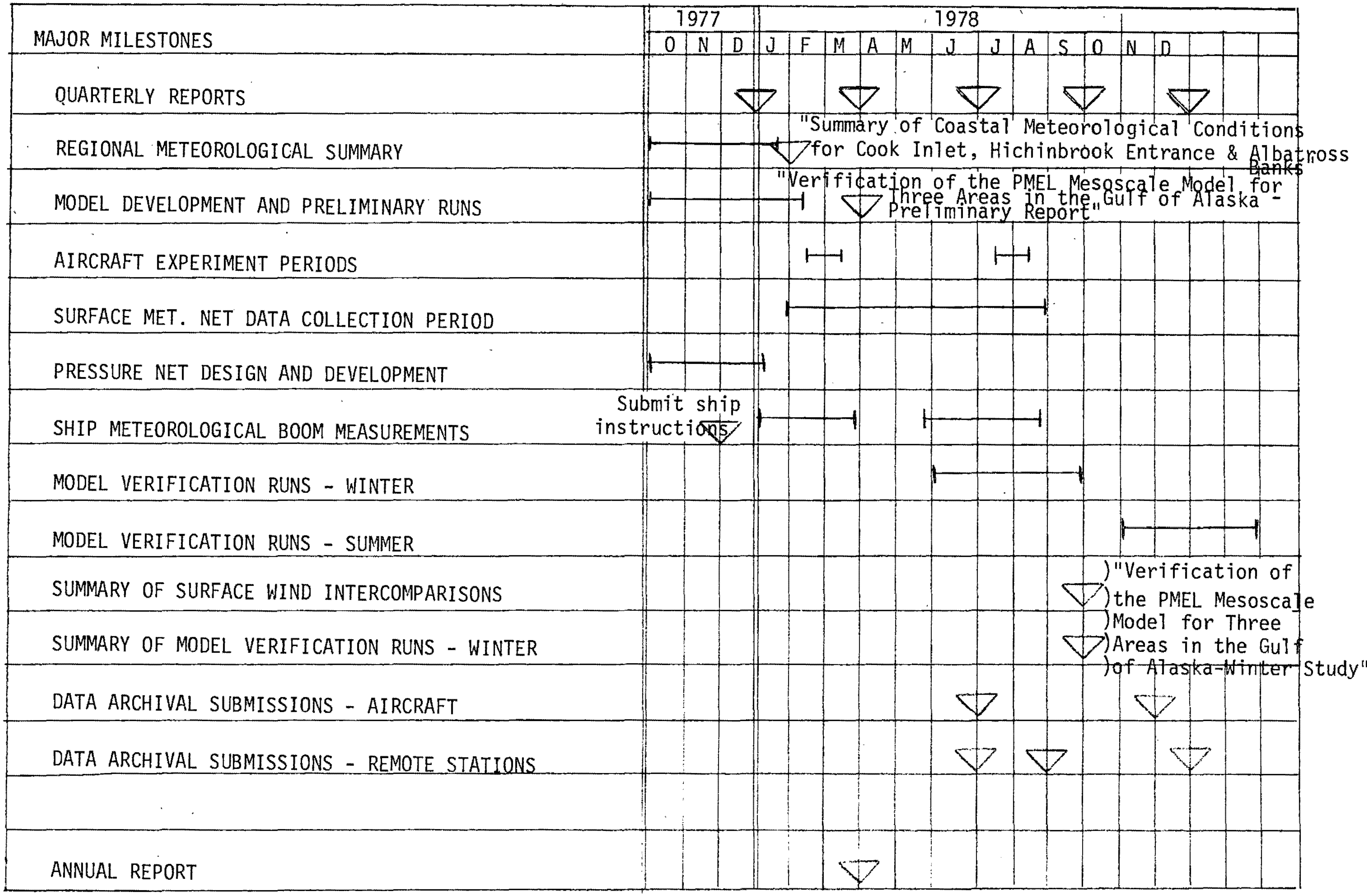
1a.	R. Michael Reynolds	Scientific design, analysis, program administration	6 months
1b.	Bernard Walter	Scientific design, data analysis, historical summaries	6 months
2.	S. A. Macklin	Field operations, logistics, data archival, preliminary analysis	12 months
3.	Data Analyst	Aircraft data analysis, Case study preparation, Scientific programming and graphics	12 months

cc: R. Overstreet
R. Charnell
J. Galt
J. Apel
A. Macklin

XV. MILESTONE CHART

RU #: 367 PI: R. Michael Reynolds

Major Milestones: Reporting, data management and other significant contractual requirements; periods of field work; workshops; etc.



OCS 77-24
OCS 78-7

RESEARCH PROPOSAL

TO:	OCSEAP/NOAA Rx4 325 Broadway Boulder, Colorado 80302
TITLE:	Administrative and Technical Support for The OCSEAP Data Processing Center and the NODC/OCSEAP Representative - RU 370
PROPOSAL NO:	AEIDC 77-06 Modification #2
PRINCIPAL INVESTIGATOR:	David M. Hickok
TOTAL COST:	$100,000
INSTITUTION:	Arctic Environmental Information & Data Center University of Alaska 707 A Street Anchorage, Alaska 99501
DATE:	September 9, 1977
PERIOD:	October 1, 1977 - September 30, 1978

David M. Hickok
Principal Investigator
AEIDC, University of Alaska
Anchorage, Alaska 99501
(907) 279-4523

Mr. A. B. Frol
Director of Administrative Services
University of Alaska
Fairbanks, Alaska 99701
(907) 479-7551

K.B. Mather
Dr. K. Mather
Vice Chancellor for Research
and Advanced Study
University of Alaska
Fairbanks, Alaska 99701
(907) 479-7551

Modification #2 date: September 9, 1977

ADMINISTRATIVE & TECHNICAL SUPPORT FOR THE
OCSEAP DATA PROCESSING CENTER AND
THE NODC/OCSEAP REPRESENTATIVE

October 1, 1977 - September 30, 1978
Contract #03-5-022-56
Task Order #24
Research Unit 370

			Technical	Admin.
CPF-1	Salaries/Benefits/Overhead			
	1 Data Control Clerk I	2080 M/hrs @6.56[1]	13,645	
	1 Data Control Clerk II	2080 M/hrs @7.00[1]	14,560	
	1 Personal Secretary	1664 M/hrs @6.78[1]	5,641	5,641
	1 Work Study Student*(Fr. 7)	832 M/hrs @20% of 5.21[1]	867	
	10% Salary Increments[2]		3,471	564
	Sub-Total Salaries & Wages		38,184	6,205
	Staff Benefits: 20% of Salaries and Wages		7,637	1,241
	Overhead: 50% of Salaries and Wages[3]		19,092	3,103
	Total Salaries/Benefits/Overhead		64,913	10,549
CPF-2	Travel and Per Diem		-0-	-0-
CPF-3	Equipment			

	Monthly	Total
Lease IBM 3741 -4 mo.	418	$1,672
Lease Intelligent Entry Data Hardware Discette Based System - 10 mo.	840	8,400
Lease Graphics Terminal -12 mo.	100	1,200

		Technical	Admin.
	Total Equipment Lease	11,272	-0-
CPF-4	Logistics Support Costs	-0-	-0-
CPF-5	Estimated Cost of Providing Data, etc.	-0-	-0-

CPF-6 Other Direct Costs

Supplies		1,500	1,396
Commercial Data Processing		1,475	-0-
Telecommunications		811	-0-
Xerox & Duplication			2,000
Rent - Office/storage space 352 sq. ft. @1.25	$5,280		
Office Equipment	504		
Phone System	300	-0-	6,084
Total Other Direct Costs		3,786	9,480
TOTAL		$79,971	$20,029

1 Time shown under each person indicated the estimated number of actual hours they will work on the project. Time for annual, sick and holiday is included.

2 The proposed staff increment for FY78 is 10%.

3 The following overhead rate is proposed:

Period	Type	%of Salaries & Wages
October 1, 1977 - September 30, 1978	Fixed	50.0

* A program is available through the University of Alaska whereby students can obtain jobs up to a certain amount per semester (determined by their eligibility regarding student hours taken and/or their own financial situation), sponsored by the College Work-Study Program. The federal government pays the student 80% through the Program and the work provider 20% of the wages.

INTERAGENCY AGREEMENT
between NOAA/OCSEAP and NIDR, NIH

(revised September 26, 1977)

Research Unit 371

I. PERIOD OF AGREEMENT: Remainder of Federal FY 1977

II. NATURE OF SERVICES: The NIDR shall provide the necessary personnel, equipment, and expendable supplies to maintain files, respond to requests, and provide products relative to existing OCSEAP microbiological data in accordance with the statement of work outlined in the proposal submitted by Dr. Micah I. Krichevsky, Chief, Microbial Systematics Unit, NIDR, dated January 25, 1977.

III. ESTIMATED COSTS: The transfer of funds to support this agreement will not exceed $5,000 for the period in Fiscal Year 1977 defined in I. above.

IV. METHOD OF PAYMENT AND ACCOUNTING: An advance payment at the beginning of the period defined in I. above in the amount estimated for that year shall be made upon receipt of Standard Form 1081 by NOAA.

V. REPORTING REQUIREMENTS: The NIDR Project Officer will forward at the end of FY 1977 a summary report on the program activity under this agreement to the NOAA Liaison Officer named herein. Included in this year-end report will be a discussion of the resources utilized by the Micorbial Systematics Unit in performing the tasks outlined in the statement of work. An encumbrance for FY 1977 will be established against Purchase Order Number 01-7-022-13243 upon initiation of this agreement.

VI. PROJECT AND LIAISON OFFICERS: Mr. James J. Audet is designated as NOAA Project Officer and in that capacity will serve as liaison officer for NOAA in contacts with NIDR relative to this agreement. Dr. Micah I. Krichevsky is designated as NIDR liaison officer for administrative affairs with NOAA relative to this agreement.

VII. This agreement may be amended by mutual writtten consent of both parties.

Wayne J Fischer

Concur: Wayne Fischer
EDS Data Management Representative

Approved:

Rudolf J Engelmann

Dr. David B. Scott, D. D. S.
Director
National Institute of Dental Research

Dr. Rudolf J. Engelmann
Director, OCSEAP
Environmental Research Laboratories

cc: J. J. Audet, NOAA
Executive Officer, NIDR
Dr. Micah I. Krichevsky, NIDR, NIH
Director, NIDR
Wayne Fischer, OCSEAP
Mauri Pelto, OCSEAP
Wanda Power, OCSEAP

RETURN TO

Project Control Office, DCRT
Building 12A, Room 3013
National Institutes of Health
Bethesda, Maryland 20014

INTERAGENCY AGREEMENT FOR ANNUAL RENEWAL OF DCRT OUTSIDE ACCOUNT AUTHORIZATION

OFFICIAL NAME OF REQUESTING AGENCY AND COMPONENT

DCRT ACCOUNT: W L H 1

PERIOD COVERED BY RENEWAL — FROM 1 OCTOBER 1977 TO 30 SEPTEMBER 1977

CONDITIONS OF USE

By renewing the existing agreement for DCRT services, requester agrees to the following:

1. All use will be in accordance with DCRT Standard Operating Procedures as expressed in the User's Guide and other technical publications. Use will be on a time available basis subject to NIH's production requirements. Since the sponsor or his designee will submit computer runs directly to DCRT'S computer, the requesting agency assumes responsibility for all charges incurred.

2. This agreement is of the nature of an interagency agreement in accord with the U.S. Code 31-686.

3. If estimated maximum costs, amounts obligated, fiscal year limitations, etc., are required by internal procedures of requesting agency, the requester assumes full responsibility for assuring that these are not exceeded and for reimbursing NIH for services actually used even if any such internal limitations are exceeded. Payment will be made by the requesting agency upon receipt of periodic billings initiated by the Office of Financial Management, NIH, based on actual services used at standard rates of the NIH Service and Supply Fund.

4. When the use requested is to be terminated, requester will so inform DCRT and will initiate steps to: release all tapes, disks, equipment and online storage space being used; request deactivation of the account number and all user initials assigned to it; and notify the Technical Information Office to suspend all mailing of technical literature. *In the event the requester fails to do this, DCRT upon discovering that use has discontinued will do so with the actual costs of doing so charged to the requester.*

FINANCIAL OFFICER RESPONSIBLE FOR RECEIVING AND PAYING BILLS

NAME *(Print or type)*: DR. RUDOLF J. ENGELMANN

PHONE: FTS: 323-6562

TITLE: DIRECTOR, OCSEA PROGRAM OFFICE

APPROPRIATION NO.

ADDRESS: NOAA/ERL/OCSEAP (RX4) SUSSEX I - SUITE 430, 1790 - 30th STREET
BOULDER, COLORADO 80302

METHOD OF PAYMENT (If known): BILL IN LIEU OF

Services to be billed on ☐ SF-1080 or ☒ SF-1081

Internal Agency Reference (Agreement No., Purchase Order No., etc.)

AUTHORIZATION TO COMMIT FUNDS OF REQUESTING AGENCY

NAME — SIGNATURE: Wanda Power

TYPE OR PRINT: WANDA W. POWER

DATE: 9-15-77

TITLE: ADMINISTRATIVE OFFICER, OCSEA PROGRAM OFFICE

PHONE: FTS: 323-6562

ORGANIZATION: NOAA/ERL/OCSEA - BOULDER, COLORADO

DCRT/NIH ACCEPTANCE

NAME — SIGNATURE

DATE

TITLE: Assistant Director, DCRT, NIH

PHONE: 301-496-2282

NIH 1767-4
3-74

☆ U.S. GOVERNMENT PRINTING OFFICE: 1977-241-175/19

SEPTEMBER 1, 1977

TO: KRICHEVSKY, M.

FROM: PROJECT CONTROL OFFICER, DCRT

SUBJECT: DCRT ACCOUNT NUMBER WLH1

IN ORDER TO ASSURE UNINTERRUPTED USE OF THE NIH COMPUTER SERVICES FOR FISCAL YEAR 1978, IT IS MANDATORY THAT THE ATTACHED INTERAGENCY AGREEMENT RENEWAL FORM, NIH 1767-4, BE FILLED OUT AND THE INFORMATION LISTED BELOW BE UPDATED. TWO COPIES OF FORM NIH 1767-4 AND ONE CORRECTED COPY OF THIS MEMO MUST BE RETURNED TO THE PROJECT CONTROL OFFICE, DCRT, BG. 12A, RM. 3013, NATIONAL INSTITUTES OF HEALTH, BETHESDA, MARYLAND, 20014 BY SEPTEMBER 30, 1977.

FAILURE TO COMPLY WILL RESULT IN CANCELLATION OF YOUR NIH COMPUTER CENTER ACCOUNTS. BEFORE A USER CAN BE DELETED FROM AN ACCOUNT, ALL DATA SETS STORED WITH HIS INITITALS MUST BE REMOVED AND ALL TAPES MUST BE RELEASED. ALL DATA SETS AND TAPES MUST BE CLEARED FROM AN ACCOUNT BEFORE IT IS CANCELLED. DATA SETS AND TAPES FOR ACCOUNTS WHICH ARE NOT RENEWED WILL BE SCRATCHED WITH THE COSTS OF SO DOING CHARGED TO THE ACCOUNT.

PLEASE ATTACH A SHORT STATEMENT DESCRIBING THE PROGRAM AND MISSION OF THE OFFICE WHICH THE ACCOUNT IS SUPPORTING AND THE TYPE OF COMPUTATION OR PROCESSING FOR WHICH YOU USE NIH'S COMPUTER CENTER. HOW THE USE OF NIH FACILITIES CONTRIBUTES TO MISSION ACCOMPLISHMENTS SHOULD BE INCLUDED. LAST YEAR'S STATEMENT STILL OBTAIN. MK

THE PROJECT CONTROL OFFICE, PHONE 496-6146, WILL BE GLAD TO ANSWER ANY QUESTIONS YOU MAY HAVE.

TITLE OF ACCOUNT: ATLAS-OCS ANALYSIS NOAA

SPONSOR OF ACCOUNT: KRICHEVSKY, M. LOCATION: ~~30 132~~ 31 3B04

AUTHORIZED USERS: (DCRT PROGRAMMERS NOT INCLUDED.)

NAME	BOX	PHONE NO.	LOCATION
ATLAS, RONALD M.	545	502-636-4429	UN.OF LOUISVILLE, L
KRICHEVSKY, ELAINE J.	545	63652	31 3B06
KRICHEVSKY, MICAH	545	63652	31 3B06

SUBMITTED BY

NAME: Micah KRICHEVSKY

TITLE: Chief, MSU, NIDR

PHONE: 6-3652

INTERAGENCY AGREEMENT
between NOAA/OCSEAP and NIDR, NIH

I. PERIOD OF AGREEMENT: Federal FY 1978

II. NATURE OF SERVICES: The NIDR shall provide the necessary personnel, equipment, and expendable supplies to maintain files, respond to requests, and provide products relative to existing OCSEAP microbiological data in accordance with the statement of work outlined in the proposal submitted by Dr. Micah I. Krichevsky, Chief, Microbial Systematics Unit, NIDR, dated January 25, 1978.

III. ESTIMATED COSTS: The transfer of funds to support this agreement will not exceed $6,000 for the period in Fiscal Year 1978 defined in I. above.

IV. METHOD OF PAYMENT AND ACCOUNTING: An advance payment at the beginning of the period defined in I. above in the amount estimated for that year shall be made upon receipt of Standard Form 1081 by NOAA.

V. REPORTING REQUIREMENTS: The NIDR Project Officer will forward at the end of FY 1978 a summary report on the program activity under this agreement to the NOAA Liaison Officer named herein. Included in this year-end report will be a discussion of the resources utilized by the Micorbial Systematics Unit in performing the tasks outlined in the statement of work. An encumbrance for FY 1978 will be established against Purchase Order Number 01-7-022-13243 upon initiation of this agreement.

VI. PROJECT AND LIAISON OFFICERS: Mr. James J. Audet is designated as NOAA Project Officer and in that capacity will serve as liaison officer for NOAA in contacts with NIDR relative to this agreement. Dr. Micah I. Krichevsky is designated as NIDR liaison officer for administrative affairs with NOAA relative to this agreement.

VII. This agreement may be amended by mutual writttten consent of both parties.

Wayne J. Fischer

Concur: Wayne Fischer
EDS Data Management Representative

Approved:

Rudolf J. Engelmann

Dr. David B. Scott, D. D. S.
Director
National Institute of Dental Research

Dr. Rudolf J. Engelmann
Director, OCSEAP
Environmental Research Laboratories

cc: J. J. Audet, NOAA
Executive Officer, NIDR
Dr. Micah I. Krichevsky, NIDR, NIH
Director, NIDR
Wayne Fischer, OCSEAP
Mauri Pelto, OCSEAP
Wanda Power, OCSEAP

Transport, Retention, and Effects of Toxic Petroleum Hydrocarbons in Experimental Food Chains

Research Unit No. 389

Principal Investigator: Dr. Jeannette Whipple

NOAA/National Marine Fisheries Service
Southwest Fisheries Center
Tiburon Laboratory
Tiburon, California

A small amount of supplementary funds was granted to continue the research of this unit into FY 78 with a completion date of May 31, 1978.

A. COVER PAGE

ECOLOGICAL STUDIES OF
INTERTIDAL AND SHALLOW SUBTIDAL HABITATS IN
LOWER COOK INLET AND
THE NEGOA REGION

OCSEAP Research Unit #417
AN Proposal #34633/071177

Principal-in-Charge: Richard C. Miller

Principal Investigator: Dennis C. Lees

Total Project Cost: $131,300.00

Organization: Dames & Moore - Anchorage, Alaska

Date: 20 July 1977

Organizational Approval:

RHW

Robert H. Winn, Managing Partner-Anchorage, 20 July 1977
510 "L" Stree, Suite 500, Anchorage, Alaska 99501
(907) 279-0673

Richard C. Miller

Richard C. Miller, Principal-in-Charge, 20 July 1977
510 "L" Street, Suite 500, Anchorage, Alaska 99501
(907) 279-0673

Dennis C. Lees

Dennis C. Lees, Principal Investigator, 20 July 1977
SRA Box 110, Homer, Alaska 99603
(907) 235-8316

Financial Officer:

Jon Benoist

Jon Benoist, Administrative Manager, 20 July 1977
510 "L" Street, Suite 500, Anchorage, Alaska 99501
(907) 279-0673

C. TECHNICAL PROPOSAL

I. ECOLOGICAL STUDIES OF INTERTIDAL AND SHALLOW SUBTIDAL HABITATS IN LOWER COOK INLET

Research Unit #417
Contract No. 03-6-022-352532
1 October 1977 to 30 September 1978

II. PRINCIPAL INVESTIGATOR

Dennis C. Lees

III. PROGRAM COST

Total - $131,300
Distribution of effort
Lower Cook Inlet - 81%
NEGOA - 19%

IV. BACKGROUND

The intertidal and shallow subtidal regions of lower Cook Inlet and the NEGOA region are extremely important components of those systems, and are crucial to the well-being of their biological assemblages. The macrophytes in these regions produce a large proportion of the plant materials utilized by detritivores in deep and shallow water throughout the lower inlet. Several species of commercial importance (e.g., shrimp and clams) depend directly upon such materials for food. Many other commercial species (e.g., salmonids, halibut, several crab species) feed heavily on various detritivores such as hermit crabs, worms, snails, small shrimps and clams, which also depend largely on algal debris. In the past few years, information linking the macrophyte producers to commercial fisheries has begun to emerge but the full importance of this linkage has yet to be recognized. Additionally, many important marine birds and mammals feed heavily on organisms which live in the inshore areas and depend upon plant material produced by macrophytes. Furthermore, the littoral zone is quite important to many commercial species for spawning and rearing during their early life stages.

In this study, strong emphasis will be placed on acquiring data on primary production of the major seaweeds from the high intertidal zone to a depth of -60 feet. These data will assist in assessing relative importance of the three major basic food sources (macrophytes, phytoplankton and plant debris from land) for the biological assemblages in lower Cook Inlet and the NEGOA region. Additionally, data on trophic structure within the littoral zone will be collected to examine patterns of energy transfer.

These types of information are important in assessing the potential impacts of technological and resource development on commercial and non-commercial stocks of organisms. Furthermore, they increase the understanding of the biological assemblages supporting commercial fisheries and will eventually permit more enlightened management of fisheries stocks. The data produced will be of particular importance to investigators examining inshore fish and bird populations and offshore benthic assemblages, all of which interact heavily with the littoral assemblages.

Basically, this work is a continuation of a line of research that commenced in 1974 and 1975 to assess the general attributes of the intertidal and nearshore assemblages in lower Cook Inlet and outline important relationships and pathways. We are now attempting to answer some of the more fundamental questions posed by those studies. These studies are especially relevant to the OCS decision-making process because they provide information showing the importance of the near-shore and intertidal habitats to the biological systems and fisheries of Cook Inlet, NEGOA and Prince William Sound. Knowledge of the role of these habitats is important because they have the greatest probability of sustaining effects from OCS development, but also appear to be very important to other faunal assemblages in lower Cook Inlet as food resources and nursery areas. It appears that the contribution of plant material by the major kelps may be very important to several other faunal assemblages in lower Cook Inlet, because of both the quantity produced and the chronology. Detailed information is crucial to evaluate the role of macrophytes, a large preponderance of which are located near potential areas of development.

V. OBJECTIVES

1. To assess seasonal changes in composition and define trophic relationships among dominant intertidal and subtidal organisms in representative habitats in lower Cook Inlet and in the NEGOA region.

2. To compare FY75 and FY78 data in order to define long term changes in composition and distribution within the areas.

3. To collect information on primary production, growth and standing crop for major macrophyte species, and growth and standing crop for selected invertebrate species..

VI. GENERAL STRATEGY AND APPROACH

The general strategy is to develop an understanding of the species composition, major energy pathways and seasonal fluctuations in energy transfer in three major intertidal or nearshore habitats in lower Cook Inlet and the NEGOA region. At this point in time, the approach remains rather broad; many of the details of the proposed research will be developed during the OCSEAP planning meetings. Although the studies are of a quantitative nature, the small number of sites being examined provides only a preliminary perspective of community dynamics in the Inlet and the NEGOA region.

Site specific studies were begun during FY76 in the NEGOA region and during FY77 in lower Cook Inlet. Three major habitat types examined included rocky intertidal and subtidal, sandy intertidal and muddy intertidal. The general strategy and approach in the proposed continuation work will remain essentially unchanged. Sites have been occupied on a seasonal basis. Research has been directed at obtaining information on seasonal changes in composition and distribution of the dominant intertidal and subtidal organisms, and defining their trophic relationships. Data on density, relative coverage and biomass of characteristic species are being obtained by direct observation from replicate quantitative samples. Additionally, data are being collected in lower Cook Inlet to permit estimation of primary production by the major intertidal and subtidal macrophytes on rock substrates. A major intent of the proposed continuation is to collect additional information on temporal growth patterns and biomass distribution for the major algal species.

Two main changes in the general strategy are proposed for FY78. First, these studies will be expanded into the NEGOA region (Latouche Point and the Port Etches-Constantine Harbor complex) on a limited scale. Second, because of apparently high temporal homogeneity in faunal composition and distribution in the sandy and muddy habitats, sampling frequency will be reduced to two periods during the year (early spring and late summer). Otherwise, the approach will remain the same. Studies in these areas will be coordinated closely with those of Dr. Howard Feder (R.U. #5), Dr. Jerry Larrance (R.U. #425) and Mr. Peter Jackson (R.U. #512). We will provide direct support to those investigations by conducting detailed SCUBA studies in specific inshore areas. Findings will be compared and closely integrated in a timely fashion so as to make the best use of field efforts. Where possible, field work will be conducted concurrently so as to make efficient use of logistical support. Additional coordinations will be made with Dr. Paul Arneson (R.U. #3), Dr. Tom English (R.U. #424) and Carl Lensink (R.U. #341) with whom there may be limited involvement. Additionally, we will conduct reconnaissance studies in Chiniak and Marmot Bays on Kodiak and Afognak Islands, and in other areas of opportunity.

VII. SAMPLING METHODS

On rocky substrates in lower Cook Inlet, stations will be occupied five times during the year, allowing greater sensitivity to the large seasonal changes in the development of algal assemblages. The NEGOA sites will be sampled only three times a year. Information will be collected from three distinct zones, namely (1) rockweed-littorine, (2) mussel, and (3) laminarian zones. The latter zone is quite broad, extending from low intertidal down to below -60 feet; it will be examined at one intertidal and three subtidal levels. Densities, relative cover, biomass and size structures of organisms will be determined from replicate quadrats of various types (0.01 to 25 m^2); quadrat size will depend upon the size and relative abundance of the respective species. Coverage will be determined by visual estimation from within the quadrants.

Growth rates and conservative estimates for primary production for the major laminarian kelps will be measured by several methods. In all cases, a number of plants will be individually tagged. Major blade growth in laminarian kelps occurs in the meristem area, at the distal end of the stipe along the base of the blade (frond). The rate of blade growth for many kelp species can be determined by marking the blade at a certain distance above the meristem and then observing the rate of migration of the mark from the meristem to the tip of the blade. Changes in the overall length of the blade give a highly inaccurate picture of growth because the end of the blade is continually eroding away as a consequence of wave action and tidal currents, and the rate of erosion changes continually in response to sea and plant conditions. Different methods of marking the blades are necessary for different plant types. With Laminaria and Nereocystis, it is feasible to punch small holes in the blade and follow it through time. For Alaria spp. and Agarum it is necessary to implant a stainless steel staple in the midrif of the blade and monitor its changes in position through time.

Using individually tagged plants, these methods provide size specific rates of tissue production. By integrating size specific rates to size structure and density data for the respective species, it is possible to develop a very conservative estimate of net primary production for each species studied. Additional components of total net primary production not examined by this method include mucus, a significant metabolic product for Laminaria groenlandica, and sporophyll production for Maria spp., and spore production for all species examined.

Length-weight regressions will be developed, and variations in stipe length/weight relationships at various times of the year. These data will be used to develop biomass estimates from size data, to indicate plant conditions, and possibly to establish the age structure of the plant populations.

Soft sediments will be sampled two times during the year. The density and size structure of animals in soft substrates will be examined in samples obtained with large (10 cm diameter) core tubes. Core samples will be screened through 1.0 mm sieves to eliminate the sediment fraction. The remaining fraction will be preserved with formalin.

Trophic structure will be determined from observations of feeding activities and stomach analysis of organisms in the study area. This aspect of the studies will be qualitative, i.e., the relative importance of observed feeding relationships will not be determined.

Replicated samples on both rock and soft substrates will be positioned in a stratified random manner. The degree of replication will vary according to limitations in field time but the desire is to reduce variance to the lowest practical level.

VIII. ANALYTICAL METHODS

The following types of analysis will be employed:

Biological:

Density and relative coverage data will be collected in the field using quadrats or various sizes (from 1/16 m^2 to 50 m^2, depending upon the density of the organism measured).

Size measurements, including linear and wet weight measurements, will be for selected species or algae and invertebrates.

Analysis of gut contents will be made for selected species of fish, starfish, crab and snail. Data will be obtained by opening stomachs to examine for prey species. The abundance and size of each prey item will be recorded where applicable.

Statistical:

Population parameters will be described where applicable, using a method developed from the Brody-Bertalanffy growth equations (Ebert, T.A., 1973, Oecologia 11:281-298), which generates estimates for growth and mortality rates, age-specific size, and longevity.

Standard descriptive ecological statistics (diversity indices, classification techniques, etc.) will be used to assist in describing the assemblages examined, particularly from soft substrates. Analysis of variance techniques will be utilized to compare among sampling sites and levels, and among seasons.

IX. ANTICIPATED PROBLEMS

The main problems anticipated are logistical and will be discussed in Section XIV.

X. DELIVERABLE PRODUCTS

A. Digital Data

1. Listing of types to be provided by research - those items noted with an 'x' will be provided. Additional digital data to

be provided include size-frequency summaries, algal growth rates, and feeding data (on File Type 023 format). The 1977 NODC taxonomic code will be used for digital data fields requiring species identifications.

B. Narrative Reports - No special reports at this time.

Administrative reports will be submitted quarterly, using the format prescribed by the OCSEAP office for quarterly reports; they will report on the progress of the studies.

An annual report will be submitted in April 1978 summarizing the data collected during the study to date and discussing the findings as they relate to the lower Cook Inlet systems and the findings of other investigators.

C. Visual Data

Location maps
Zonation diagrams for major species and assemblages
Food web diagrams
Temporal abundance charts for seaweeds
Size/weight regressions for selected species

D. Other Non-digital Data - none anticipated

E. Data Submission Schedule

1. Lower Cook Inlet

Date of first data collection - 10/77 (Algal growth rate studies in Kachemak Bay will continue)
Completion date for data collection - 9/78
Data will be submitted by quarter
If processing load permits, data will be submitted in January, April, August and December 1978

FILE TYPE 030 - INTERTIDAL DATA

Common to all records
- xFile Type - 3 bytes wide
- xFile Identifier - 6
- xRecord Type - 1
- xStation Number (Record Types 2,3, &4) - 5
- xSequence Number (Record Types 2,3, &4) - 4

Record Type '1' - File Header
- xVessel Name/Cruise Number - 11
- xCruise Dates - 6
- xSenior Scientist/Investigator/Institution - 19

Record Type '2' - Station Header
- xGeographic Position - 15
- xDate/Time - 10
- Surface Water and Air Temperatures
- Salinity
- Secchi Depth
- Weather (codes)
- Wind/Sea State (codes)
- Beach Exposure Direction
- xSubstrata Type (code) - 3
- xHabitat Description (codes) - 4

Record Type '3' - Site Header
- Catalog/Photograph Numbers
- xGear Type (code) - 1
- xTransect Number/Direction - 2
- xMeter Number - 4
- xSample/Zone/Arrow Number - 3
- xQuadrat Size/Elevation/Slope - 5
- xSubstrata and Surface Topography Types (codes) - 6
- xCollection Time - 4
- xSieve Size - 4
- Dilution Volume
- xSediment Volume - 7
- Grain Size
- xGrab Number - 2
- Patch Grid Size
- Total Work Area
- Number of Grids Occupied
- Distance of Net Tow
- xWater Depth - 5

Record Type '4' - Sample Data
- xNODC Taxonomic Code/Subspecies (code) - 10
- Sex (code)
- xSample Condition (code)-3
- xPercent Coverage - 3
- xCount of Species - 5
- xWet and Dry Weights - 7
- xMinimum/Maximum/Mean Lengths -6
- Minimum/Maximum/Mean Widths
- Minimum/Maximum/Mean Age
- Number of Grids Occupied
- Displacement Volume
- Dilution Volume
- xPlant Height - 2

Record Type '5' - Individual Sample Data
- xNODC Taxonomic Code/Subspecies (code) - 10
- Sex (code)
- xSample Condition (codes) - 3
- Age
- xWet/Dry Weights - 7
- xLength/Width of Sample - 6
- Displacement Volume

Record Type '6' - Profile Data
- Oxygen
- pH and pH Scale (code)
- Temperature and Salinity
- Permafrost Depth
- Secchi Depth
- Grain Size (Phi unit levels)

Record Type '7' - Text
- xText/Comments

DATA PRODUCTS SCHEDULE

Data Type (i.e. Intertidal, Benthic Organisms etc.)	Media (Cards, Coading Sheets, Tapes, Disks)	Estimated Volume (Volume of processed cessed data)	OCSEAP Format (if known)	Processing and Formating done by PI (Yes/No)	Collection Period (Month/ Year to Month/ Year)	Submission (Month/Year)
Rocky Intertidal Subtidal-lower Cook Inlet	Disks	10,000 records	030 & 023	Yes	10/77 to 7/78	12/78
Sandy and muddy intertidal-lower Cook Inlet	Disks	5,000 records	030 & 023	Yes	10/77 to 7/78	12/78
Rocky intertidal and subtidal-NEGOA region	Disks	10,000 records	030 &	Yes	10/77 to 7/78	12/78

FILE TYPE 023 - FISH CATCH DATA

Record Type '1' - Same ranges as for File Type 030

Record Type '2' - Not used

Record Type '3'
- xFile Type - 3 bytes wide
- xFile Identifier - 6
- xRecord Type - 1
- xAgency Code - 2
- xVessel Code - 2
- xCruise Number - 2
- Haul Number
- Sample Number
- xTaxonomic Code - Predator - 10
- xTaxonomic Code - Prey - 10
- xNumber of Prey Individuals - 5
- xVolume of Prey Individuals - 5
- Organ Code
- Stomach Fullness

2. NEGOA Region

Date of first data collection - 7/78, if conducted
Completion date for collection - 9/78
Data will be submitted by quarter
Data will be submitted in December 1978

XI. INFORMATION REQUIRED FROM OTHER INVESTIGATIONS

Arrangements are being made to acquire the following information:

A. Data from intertidal clam surveys in Cook Inlet (ADF&G)

B. Descriptions of intertidal and nearshore assemblages for Outer Kenai Peninsula and lower Cook Inlet (Dames & Moore)

C. NEGOA OCS reports (Dr. Steve Zimmerman)

D. Benthic reports from Cook Inlet (Dr. Howard Feder)

E. Bird feeding data from lower Cook Inlet (Dr. Paul Arneson & Gerald Sanger)

F. Inshore fish data from lower Cook Inlet (Mr. Pete Jackson, ADF&G)

XII. QUALITY ASSURANCE PLANS

Consistency in species identification is assured by frequent intercomparison of species identifications organisms among the field investigators and referral of questionable organisms to taxonomic specialists.

Size measurement techniques will be standardized among investigators. Estimation of coverage will be compared frequently among investigators to calibrate results. Adequacy of the sampling program is provided by examination of the variances for dominant species.

XIII. SPECIAL SAMPLE AND VOUCHER SPECIMEN ARCHIVAL PLANS

Voucher specimen collection will be retained in the Dames & Moore office in Homer during the study and transferred to the Institute of Marine Science, University of Alaska, at the termination of the program.

XIV LOGISTICS REQUIREMENTS

A. Lower Cook Inlet

For OCSEAP use only.
RU #
Discipline
Area of Operation

LOGISTICS REQUIREMENTS

P ease fill in all spaces or indicate not applicable (N/A). Use additional sheets as n cessary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

I STITUTION Dames & Moore PRINCIPAL INVESTIGATOR Dennis C. Lees

A SHIP SUPPORT

Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. See attached Figure 1 for lower Cook Inlet

Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. Vessel will be used as a diving platform and for transportation in lower Cook Inlet.

3 What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.) Vessel must be scheduled during low tide series in November 77, February, May, June and August 78, as well as between the low tide series in each sampling period.

4. How many sea days are required for each leg? (Assume vessel cruising speed of 14 knots for NOAA vessels. Do not include running time from port to beginning point and from end point to port and do not include a weather factor.) 18 days per survey for five surveys.

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? This should be principal activity on diving operations. We could piggyback on intertidal surveys. Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling-time on station and sample processing time between stations. 10 to 12 hrs/day; daylight except in October, November and March.

What equipment and personnel would you expect the ship to provide? Work and storage space, a suitable skiff and motor for diving and intertidal work; a boat operator.

What is the approximate weight and volume of equipment you will bring? 750 lbs., 50 ft.^{3}

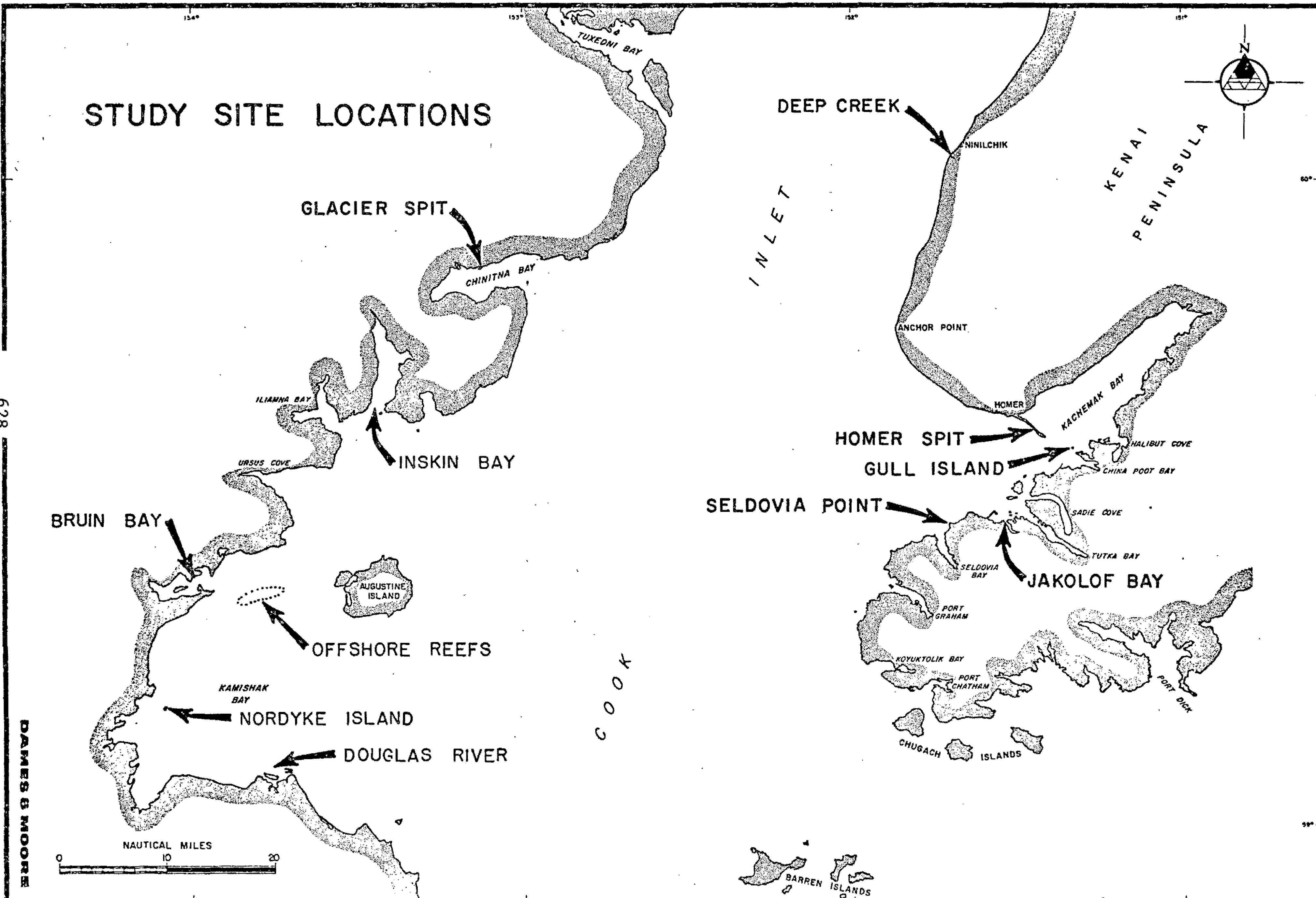
8. Will your data or equipment require special handling? Yes If yes, please describe: Compressed air tanks.

9. Will you require any gasses and/or chemicals? No If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

10. Do you have a ship preference, either NOAA or non-NOAA? If "yes" please name the vessel and give the reason for so specifying. Yes. M/V Humdinger. Local knowledge, operational convenience, availability.

11. If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availability? M/V Hundinger, $500/day, available.

12. How many people must you have on board for each leg? Include a list of participants, s ecifically identifying any who are foreign nationals. 4-6 persons; myself, R.J. Rosenthal, William Driskell, Deborah Boettcher, Jon Houghton.


STUDY SITE LOCATIONS
TUXEDNI BAY
GLACIER SPIT
CHINITNA BAY
ILIAMNA BAY
INSKIN BAY
URSUS COVE
BRUIN BAY
AUGUSTINE ISLAND
OFFSHORE REEFS
KAMISHAK BAY
NORDYKE ISLAND
DOUGLAS RIVER
NAUTICAL MILES
0
10
20
COOK
INLET
DEEP CREEK
NINILCHIK
KENAI
PENINSULA
ANCHOR POINT
HOMER
KACHEMAK BAY
HOMER SPIT
GULL ISLAND
HALIBUT COVE
CHINA POOT BAY
SELDOVIA POINT
SADIE COVE
TUTKA BAY
JAKOLOF BAY
SELDOVIA BAY
PORT GRAHAM
KOYUKTOLIK BAY
PORT CHATHAM
PORT DICK
CHUGACH ISLANDS
BARREN ISLANDS
N
DAMES & MOORE

B. AIRCRAFT SUPPORT - FIXED WING

1. Delineate proposed flight lines on a chart of the area. Indicate desired flight altitude on each line. (Note: If flights are for transportation only, chart submission is not necessary but origin and destination points should be listed)
Transportation originating in Homer, flying to Chinitna Bay, April & August 1978.

2. Describe types of observations to be made.

N/A

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification)

Optimum time is dictated by low tide series.

4. How many days of flight operations are required and how many flight hours per day?
4 days, 4 hrs/day
Total flight hours? 16 hrs

5. Do you consider your investigation to the principal one for the flight thus precluding other activities or requiring other activities to piggyback or could you piggyback? Yes

6. What types of special equipment are required for the aircraft (non carry-on)?
N/A
What are the weights, dimensions, power requirements, and installation problems unique to the specific equipment.

N/A

7. What are the weights, dimensions and power requirements of carry-on equipment?

1,000 lbs., 50 ft.^{3}

8. What type of aircraft is best suited for the purpose?
Dehavilland Beaver or Cessna Skywagon on floats or wheels.

9. Do you recommend a source for the aircraft? Yes
If "yes" please name the source and the reason for your recommendation.
Kachemak Air Service)
Cook Inlet Air Service) Local knowledge, reliability, convenience

10. What is the per hour charter cost of the aircraft?
$100-$125/hr

11. How many people are required on board for each flight (exclusive of flight crew)?

Three

12. Where do you recommend that flights be staged from?

Homer

C. AIRCRAFT SUPPORT - HELICOPTER

1. Delineate proposed transects and/or station scheme on a chart of the area. (Note: If flights are for transport of personnel or equipment only from base camps to field camps and visa versa, chart submission is not necessary but origin and destination points should be listed)

   Support required in Kamishak Bay for all winter operations

2. Describe types of observations to be made.

   N/A

3. What is the optimum time chronology of observations on a seasonal basis and what is the maximum allowable departure from these optimum times?

4. How many days of helicopter operations are required and how many flight hours per day?

   7 days for 3 periods in winter - 3hrs/day
   Total flight hours? 65 hours

5. How many people are required on board for each flight (exclusive of the pilot)?

   Four persons

6. What are the weights and dimensions of equipment or supplies to be transported?

   200 lbs.; about 25 $ft.^3$

7. What type of helicopter do you recommend for your operations and why?

   Hiller

8. Do you recommend a particular source for the helicopter? If "yes" please name the source and the reason for your recommendation.

   Yes. Totem Helicopter in Homer - Local knowledge, convenience, ease of support

9. What is the per hour charter cost of the helicopter?

   $295/hour

10. Where do you recommend that flights be staged from?

   Iniskin Bay

11. Will special navigation and communications be required?

   No

-9. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

Kachemak Bay - all survey periods
1 person/day - 7 man days per period

Chinitna Bay - two survey periods
3 persons/day - 6 man days per period

Kamishak Bay - five survey periods
5 persons/day - 50 man days per period

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

No

3. What is your estimated per man day cost for this support at each location?
Kachemak Bay - $50/man day
Chinitna Bay - $20/man day
Kamishak Bay - $30/man day
How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

For Kachemak Bay, 60% is quarters, based on commercial rates.
For Chinitna Bay, 100% is food and costs of establishing a field camp.
For Kamishak Bay, 100% is food, based on the availability of a base camp at Iniskin Bay.

E. SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

I request that NOAA pay boat charter costs for fall and winter work in Kachemak Bay. I propose to handle arrangements for scheduling and chartering the vessel required. Projected costs (20 days @ $500/day) - $10,000.

B. NEGOA Region

For OCSEAP use only.
RU # ______
Discipline ______
Area of Operation ______

LOGISTICS REQUIREMENTS

Pl se fill in all spaces or indicate not applicable (N/A). Use additional sheets as ne ssary. Budget line items concerning logistics should be keyed to the relevant item described on these forms.

IN ITUTION Dames & Moore PRINCIPAL INVESTIGATOR Dennis C. Lees

A. SHIP SUPPORT

1 Delineate proposed tracks and/or sampling grids, by leg, on a chart of the area. Include a list of proposed station geographic positions. See attached Figure 2 for NEGOA area.

2 Describe types of observations to be made on tracks and/or at each grid station. Include a description of shipboard sampling operations. Be as specific and comprehensive as possible. Vessel will be used as a diving platform, for transportation and for lodging in the NEGOA area.

3 What is the optimum time chronology of observations on a leg and seasonal basis and what is the maximum allowable departure from these optimum times? (Key to chart prepared under Item 1 when necessary for clarification.) Vessel use must be scheduled between low tide series, and sampling period should be in late March, June and August.

4. How many sea days are required for each leg? (Assume vessel cruising speed of 14 knots for NOAA vessels. Do not include running time from port to beginning point and from end point to port and do not include a weather factor.) 9 days per survey.

5. Do you consider your investigation to be the principal one for the operation thus requiring other activities to piggyback or could you piggyback? This survey could piggyback if the vessel remains nearby during diving and intertidal activities. Approximately how many vessel hours per day will be required for your observations and must these hours be during daylight? Include an estimate of sampling-time on station and sample processing time between stations.

12-16 hrs/day; daylight except in March.

6 What equipment and personnel would you expect the ship to provide? Work and storage space, a suitable skiff and motor for diving and intertidal work; a boat operator.

7 What is the approximate weight and volume of equipment you will bring? 1,500 lbs. 100 $ft.^3$

8 Will your data or equipment require special handling? Yes If yes, please describe: Compressed air tanks, formalin.

9 Will you require any gasses and/or chemicals? No If yes, they should be on board the ship prior to departure from Seattle or time allowed for shipment by barge.

0 Do you have a ship preference, either NOAA or non-NOAA? If "yes" please name the vessel and give the reason for so specifying. Yes. M/V Humdinger or R/V Acona - Local knowledge, operational convenience, availability.

1 If you recommend the use of a non-NOAA vessel, what is the per sea day charter cost and have you verified its availability? Yes. M/V Humdinger, $500/day, available. R/V Acona, $ 00/day, limited availability.

2 How many people must you have on board for each leg? Include a list of participants, s ecifically identifying any who are foreign nationals. 4 persons; myself, R.J. Rosenthal, William Driskell, and Michael Jackson.

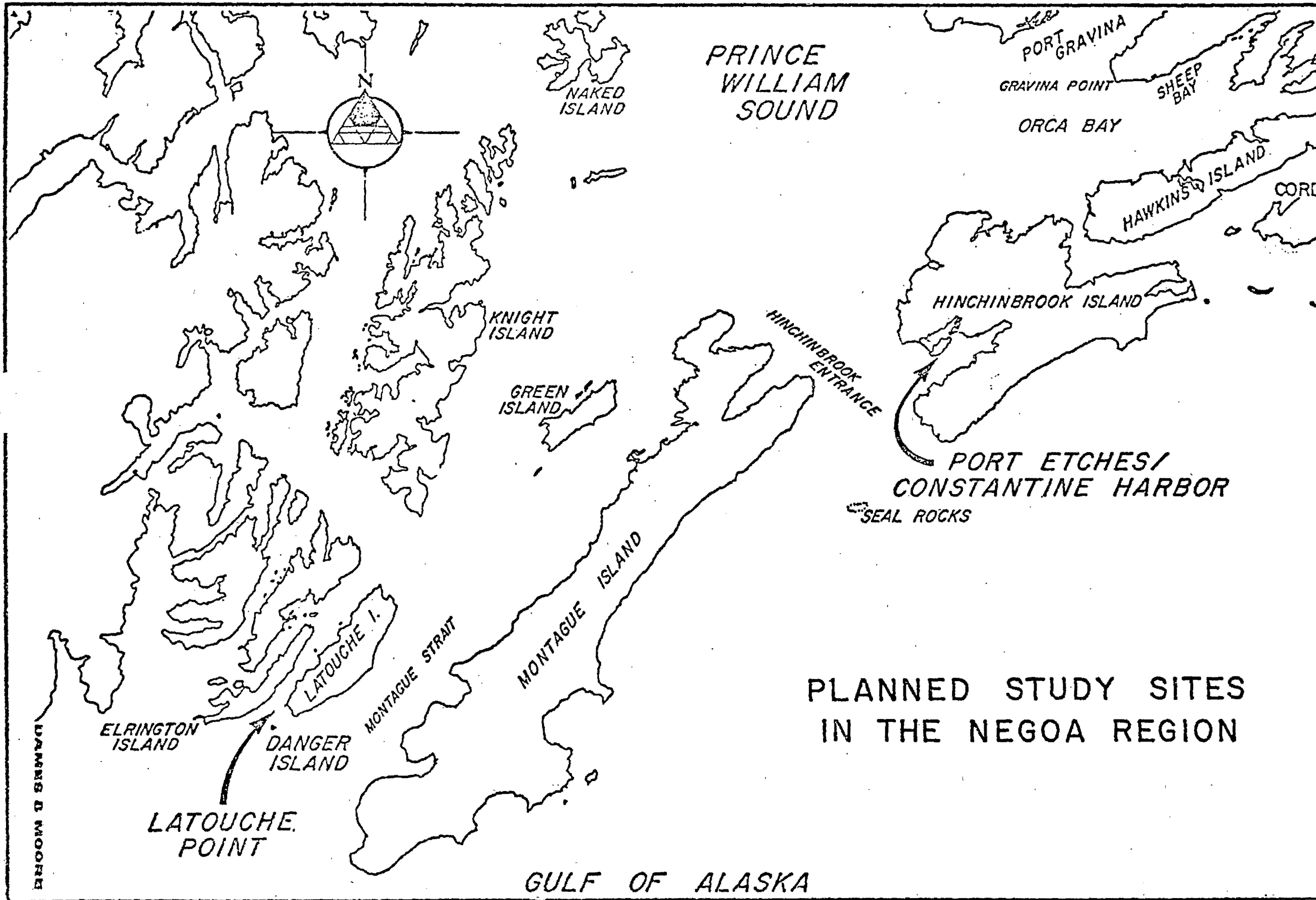

PRINCE WILLIAM SOUND
N
NAKED ISLAND
PORT GRAVINA
GRAVINA POINT
SHEEP BAY
ORCA BAY
HAWKINS ISLAND
CORD
KNIGHT ISLAND
GREEN ISLAND
HINCHINBROOK ISLAND
HINCHINBROOK ENTRANCE
PORT ETCHES/
CONSTANTINE HARBOR
SEAL ROCKS
MONTAGUE ISLAND
MONTAGUE STRAIT
LATOUCHE I.
ELRINGTON ISLAND
DANGER ISLAND
LATOUCHE POINT
GULF OF ALASKA
PLANNED STUDY SITES
IN THE NEGOA REGION
DAMES & MOORE

FIGURE 2

D. QUARTERS AND SUBSISTENCE SUPPORT

1. What are your requirements for quarters and subsistence in the field area? (These requirements should be broken down by (a) location, (b) calendar period, (c) number of personnel per day and total man days per period)

NEGOA region - two survey periods (August and March).
Four persons/day - 40 man days/period.

2. Do you recommend a particular source for this support? If "yes" please name the source and the reason for your recommendation.

Yes.
M/V Humdinger or R/V Acona. Previous performance, convenience, local knowledge.

3. What is your estimated per man day cost for this support at each location?

$20/man day for food.

How did you derive this figure, i.e., what portion represents quarters and what portion represents subsistence and is the figure based on established commercial rates at the location or on estimated costs to establish and maintain a field camp?

E. SPECIAL LOGISTICS PROBLEMS

1. What special logistics problems do you anticipate under your proposal and how do you propose that the problems be solved? (Provide cost estimates and indicate whether you propose handling the problems yourself or whether you must depend on NOAA to solve them for you?

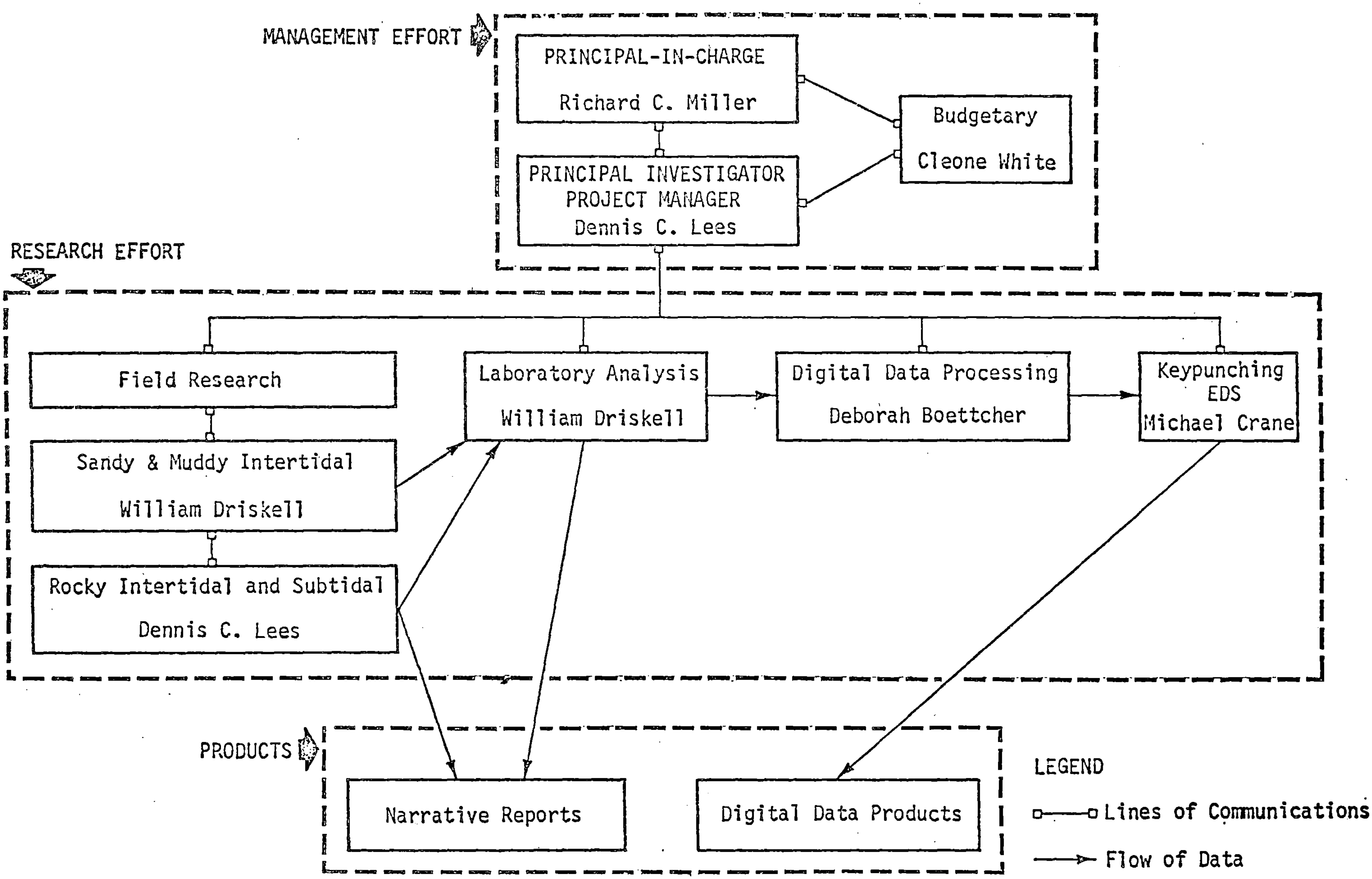
The budget is very limited and I must rely on NOAA provided logistical support. The sampling design requires that we remain at each site, with close boat support, for about 4 days. Boat requirements are fairly specific. It must be set up for convenient diving, have full electronics, a diving skiff, and the skipper must have local knowledge and allow the boat to work into as shallow as three fathoms. Additionally, there must be adequate space for work, gear storage and a suitable location for an air compressor and filling tanks.

I propose to handle arrangements for scheduling and chartering the vessels required, but request that NOAA pay for the charters.

Projected costs (20 days), assuming 100% use

M/V Humdinger ($500/day) - $10,000 or
R/V Acona ($ 00/day)

XV. MANAGEMENT PLAN



XVI. OUTLOOK

A. Nature of Final Results and Data Products

1. Final results

   a. Description of seasonal variations in abundance, production, standing crop, and composition of some intertidal and shallow subtidal habitats in lower Cook Inlet and the NEGOA region.

   b. Distribution of major macrophytes and areas of significant production in lower Cook Inlet.

   c. Basic trophic structure of selected intertidal and shallow subtidal regions in lower Cook Inlet and the NEGOA region.

   d. Effects of ice abrasion and other winter conditions on rocky intertidal and shallow subtidal assemblages in Kamishak Bay.

2. Data products

   a. Digital data records - magnetic disk (floppy).

   b. Narrative reports describing various biotic assemblages, and relationships among major organisms and assemblages.

B. Significant Milestones

1. Determination of growth rates for the major macrophytes;

2. Description of macrophytes distributions in lower Cook Inlet;

3. Description of seasonal patterns in plant production and biomass, and their relationships to high levels of secondary production in nearshore and offshore assemblages; and

4. Description of major energy pathways in the intertidal and shallow subtidal assemblages.

C. Cost, by Fiscal Year, for Plans Described Herein

FY79 - $350,000
FY80 - $300,000

D. Additional Major Equipment Required - none

E. Location of Future Field Efforts

1. Lower Cook Inlet

a. Kachemak Bay
b. Kennedy Entrance
c. Kamishak Bay - general
d. Iniskin Bay
e. Chinitna Bay
f. Deep Creek

2. NEGOA

a. Latouche Point
b. Port Etches/Constantine Harbor

F. Logistics Requirements

1. Work planned for FY79 and FY80 on the west side of lower Cook Inlet would benefit greatly from the installation of a semi-permanent base camp at Iniskin Bay. Field work could be conducted from this site in most of Kamishak Bay by utilizing support from boats, float or wheeled planes and helicopters.

2. Helicopter support for ice-related winter surveys in Kamishak Bay.

XVII.

1. Updated Activity/Milestone/Data Management Charts will be submitted quarterly.

2. Quarterly reports will be submitted in sufficient time during the contract year to be in OCSEAP hands by the first day of January, July, and October, and annual reports by April 1. The Final Report will be submitted within 90 days of the termination of the contract.

3. Where biota are concerned, all species and higher categories will be represented by the voucher specimens that will be preserved, labelled, held, and shipped to an official OCSEAP-designated repository in conformity with OCSEAP voucher specimens policy. Vouchering will include life history stages (e.g., larvae, juvenile, adults) when these are used, and sexes where these are morphologically distinguishable.

4. At the option of the Project Office the PI is prepared to travel to the Project Office at least twice during the contract year to review project status and progress. Such reviews will be scheduled on dates mutually satisfactory to both parties. It is understood that costs of the travel and per diem for these trips will be borne by the Project Office.

5. Data will be provided in the form and format specified by OCSEAP, accompanied by a data documentation form (NOAA 24-13).

6. Data will be submitted within 120 days of the completion of a cruise or 3 month data collection period, unless a written waive has been received from the Project Office. This does not apply to report requirements (see para.2).

7. Within 10 days of the completion of a cruise or data gathering effort, a ROSCOP data collection inventory form (NOAA 24-23) will be submitted to the Project Data Manager.

8. Title for all property purchased with OCSEAP funds remains with the U.S. Government pending disposition at contract termination.

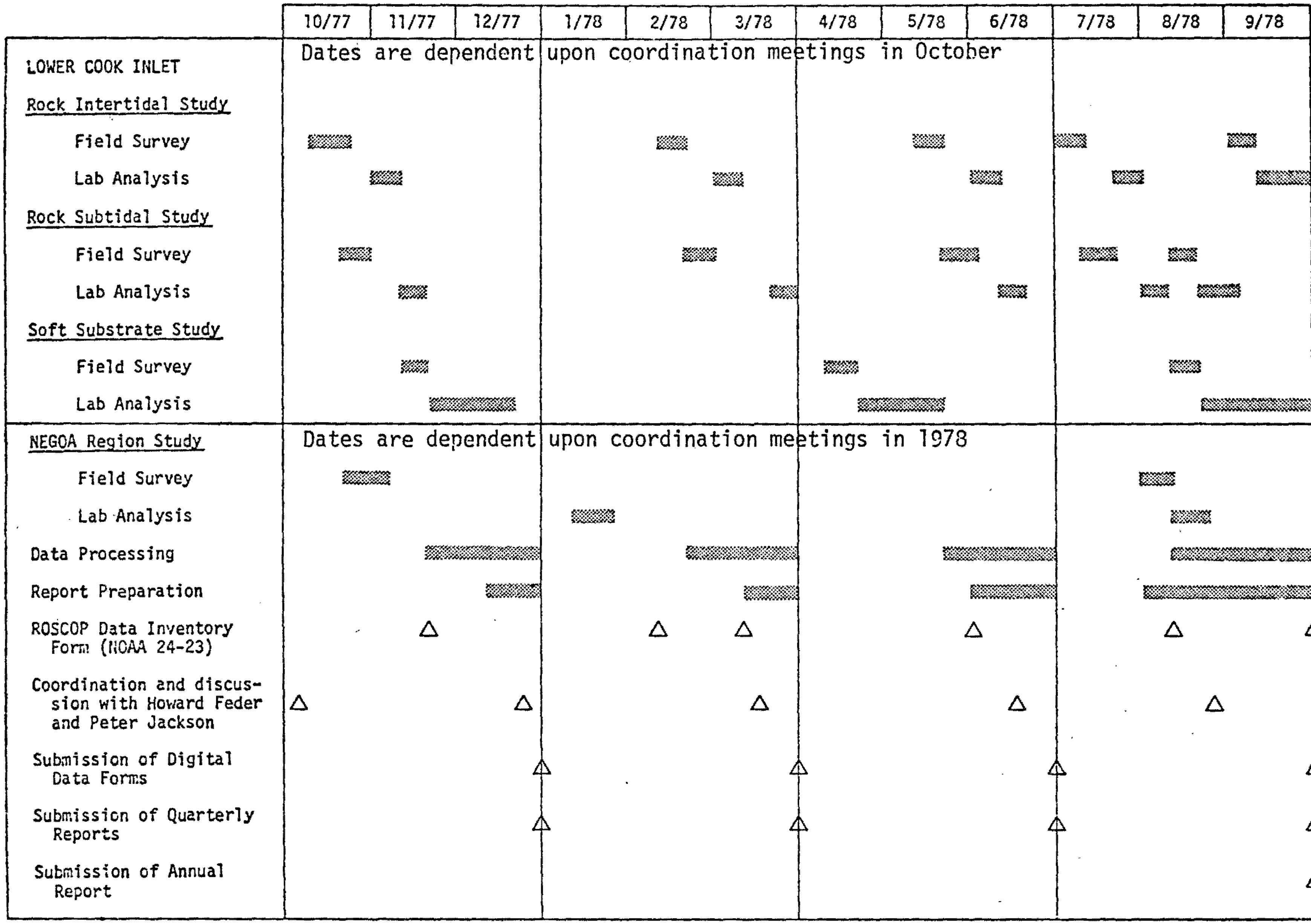
9. Three (3) copies of all publication or presentation manuscripts pertaining to technical or scientific material developed under OCSEAP funds will be submitted to the appropriate Project Office at least sixty (60) days prior to release for information and for forwarding to BLM. The release of such material within a period of less than sixty (60) days shall be made only with prior written consent of the Project Office. News releases will first be cleared with the appropriate Project Office.

10. All publications and presentations of material developed under OCSEAP funds will acknowledge BLM/OCSEAP sponsorship. The following acknowledgment is standard.

> "This study was supported by the Bureau of Land Management through interagency agreement with the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaska Continental Shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office."

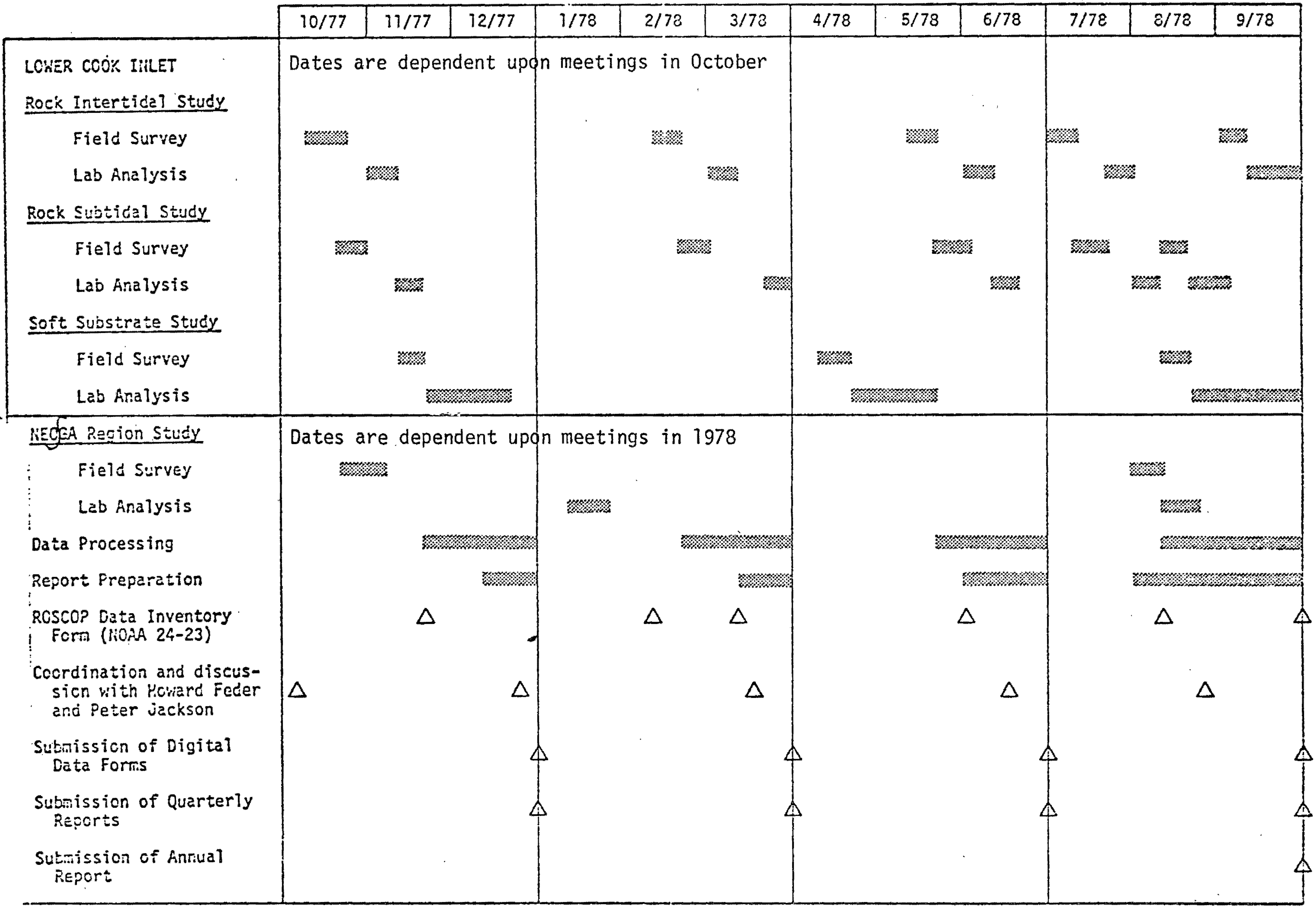
ACTIVITY/MILESTONE/DATA MANAGEMENT CHART

PI: Dennis C. Lees
R.U. # 47



ACTIVITY/MILESTONE/DATA MANAGEMENT CHART

PI: Dennis C. Lees
R.U. # 47



*U.S. Government Printing Office: 1978-777-067/1252 Region 8