IN THE TRIAL COURTS FOR THE STATE OF ALASKA

THIRD JUDICIAL DISTRICT

AT ANCHORAGE

STATE OF ALASKA,

Plaintiff,

vs

JOSEPH HAZELWOOD,

Defendant.

No. 3AN 89-7217; 3AN 89-7218

TRIAL BY JURY
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BEFORE THE HONORABLE KARL JOHNSTONE
Superior Court Judge

Anchorage, Alaska
March 5, 1990
8:56 a.m.

APPEARANCES:

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TABLE OF CONTENTS

WITNESS INDEX

EXHIBIT INDEX

PROCEEDINGS

MARCH 5, 1989

(Tape: C-3650)

(592)

(Jury not present)

THE CLERK: ...the honorable Karl S. Johnstone presiding is now in session.

THE COURT: You may be seated.

You folks ready for the jury now.

MR. MADSON: Yes.

MR. COLE: Yes.

THE COURT: Mr. Cole, I can't control volcanoes. I can't control influenza, but there's no excuse for you to forget things, so please don't let that happen again. It's -- you've tied up a half an hour of valuable time.

Let's get the jury.

(Pause)

(Jury present)

(675)

THE COURT: Good morning, ladies and gentlemen, and thank you for being on time. I'm sorry we're getting a late start. We'll try not to let that occur again.

We'll resume with the testimony, and sir,

you're still under oath.

A Yes, sir.

WILLIAM MILWEE

recalled as a witness in behalf of the plaintiff, having previously been sworn upon oath, testified as follows:

CROSS EXAMINATION OF MR. MILWEE, CONTINUED

BY MR. CHALOS:

Q Good morning, Mr. Milwee.

A Good morning, Mr. Chalos.

Q You recall when we left off on Thursday we spoke a little bit about soundings that were taken around the vessel sometime either the next day or the day after that. Do you remember that?

A Yes.

Q And I asked you about the depth of water behind the vessel and you said immediately behind the vessel there was sufficient water. You recall that?

A Yes.

Q Now let me show you what's been marked into evidence as exhibit -- or introduced into evidence as Exhibit 95. And I'll show you what I have marked for identification as Exhibit AK, which is Exhibit 95 in its normal size...

A Uh-huh (affirmative).

Q Exhibit 95 appears to have been shrunk a little bit.

Now, taking a look at what I've marked as Exhibit AK and Exhibit 95 can you tell how far back these soundings were taken that indicate there was at least anywhere between 70 foot of water and 120 foot of water?

A Appear to be about 150 feet. Wait a minute. that's forward.

Q Yeah. Upside down.

A Well, just looking at the bow at the right that's the -- that's the only thing. There's a line indicates -- this first line of soundings is about 180 feet out. This one's about 150 feet out.

Q Okay. And you don't -- it doesn't appear to have any further soundings to -- to this...

A None further...

Q ...past that?

A ...than that.

Q Okay. But at least from what you can see here, to 180 feet out he's got anywhere between 70 foot of water and -- and a 112...

A That's right.

Q Okay.

MR. CHALOS: Your Honor, at this time I would like to offer Exhibit AK, which is 95, but in a -- a bigger form into evidence.

95's been shrunk down. It's difficult to read.

MR. COLE: No objection.

EXHIBIT AK ADMITTED

THE COURT: Admitted.

Q (Mr. Milwee by Mr. Chalos:) Mr. Milwee, have you looked at any charts to find out -- any detailed charts of soundings to find out where this vessel was at the time of the grounding and how much water she had behind her?

A No. No fine grades charts, no.

Q Now, you said on Thursday that one of the things that you believe Captain Hazelwood did wrong was not to take soundings after the grounding?

A That's correct.

Q Where do you get that information from, sir?

A I'm sorry? I don't understand what you're...

Q Well, you've read the testimony in this case, have you not?

A That's correct.

Q You've read Mr. Cousins, you've read Mr. Kunkel. I take it you read some of the other crew members?

A That's correct.

Q Do you recall seeing anywhere where any crew member said that no soundings were taken after the grounding?

A I don't recall anywhere where soundings were taken...

Q So, you're...

A ...and there's...

Q ...speculating...

A ...no record of soundings...

Q ...that no soundings were taken, right?

A ...soundings being taken.

Q You're speculating?

A Yes.

Q Now, you also said on Thursday that you believe that the Captain was trying to get this vessel off the reef by going ahead?

A Yes.

Q Is that right?

In your career as a salvage master and your navy career where you were involved with groundings, have you ever gotten a vessel off a

reef by going ahead?

A Yes. I have.

Q Straight ahead?

A No. The particular vessel, we took it all forward, but we took it off...

Q On a high tide?

A Of course on a high tide.

Q After you -- you took some cargo off?

A After we took a lot of cargo off.

Q And after you -- you -- you pumped water out of the vessel?

A No. We didn't have any -- that wasn't necessary.

Q But in any event you lightened the vessel before you went forward?

A Yes.

Q And in your career as a salvage master did you ever get a vessel off aground by going astern?

A Oh, yes.

Q And that's the prescribed method for getting it off, isn't it?

A It -- there is no prescribed method for getting a -- a ship off. It's a -- dependent on the particular conditions of the stranding.

Q Yeah. In -- in your career have you ever kept

a vessel on the strand, on the ground by going ahead until more favorable conditions came about?

A I have not, personally, no.

Q But you've seen it done?

A Yes.

Q Now you said also on Thursday in response to Mr. Cole that the captain used in your opinion too much force after the grounding, which you faulted him for?

A I don't think I phrased it quite like that. I said he -- it was indicative that he was trying to get the vessel off because he did use a lot of force.

Q All right. Let's talk about a lot of force.

Have you done any analysis of the power curves of this engine?

A No. I haven't. I've just done some very rough calculations on that.

Q Do you know what full power -- what kind of horsepower this engine had at full power?

A Yes. 31,600.

Q Do you know what kind of horsepower this engine had at 55 rpms?

A No, not specifically.

Q Well, if I told you that it had 8800

horsepower at 55 rpm, is -- does that in any way comport with your knowledge of slow speed diesel engines?

A That seems reasonable, but I haven't seen the curves for this particular engine.

Q Well, if -- I want you to assume for the moment that 8800 horsepower -- 9,000 horsepower at the most was all that Captain Hazelwood used.

If your scenario and your hypothesis is correct, would you think that at some point he'd press the button and let this engine go full ahead if he was trying to get it off that way?

A Not necessarily.

Q You don't think he would do that?

A Not necessarily.

Q Now, you know that the captain, according to what you testified ran his engine ahead for about an hour at various speeds, the highest being full maneuvering speed, or 55 rpms, do you recall that?

A That's correct.

Q You would -- wouldn't you agree that in doing so for an hour he realized that he wasn't moving at all forward?

A Could you ask that again please?

Q Yes.

You know that the captain used this engine for about an hour in the forward direction?

A Yes.

Q All right. And you also know that -- that the vessel didn't move at all on the basis of what -- what we know today?

A That's correct.

Q And the captain -- we can assume, can we not, that the captain also knew that at that time? He could see that his vessel wasn't moving?

A Yes and it's not at all unusual not to move for a period of time like that.

Q Okay. If, in fact, the captain was trying to get the engine off, isn't it logical -- I mean, the vessel off, isn't it logical that at some point he's either gonna use full power or he's gonna try and back up? Wouldn't you agree?

A No. I wouldn't. Not necessarily at all.

Q Because it doesn't fit your theory?

A No. It doesn't -- it's just not necessarily what would happen.

Q Sir, in those situations where you're trying to get a vessel off the strand, when you went forward and nothing happened did you back up?

A Not necessarily. It depends on the conditions of the stranding.

Q But you have done that, haven't you? You went a little forward, didn't go anywhere, you backed up a little bit trying to get it off?

A No.

Q Never in your career?

A No.

Q Even though you've written about that?

A That's true. It's...

Q Okay.

(Pause)

You said that if the captain was, in fact, trying to get the vessel off -- trying to keep the vessel on the reef, in your opinion he should have kept the engines running up until high tide and a little bit beyond it?

A Absolutely.

Q Did you do any calculations to find out what the difference of tide was between the moment he shut down his engine at 1:40 and 2 o'clock when high tide came in?

A Yes. I did.

Q What -- what was the difference?

A It was trivial.

Q It was an inch, wasn't it?

A I would have to look it up. I don't -- it was -- but it was a very small distance.

Q So, the fact that he shut his engine down at 1:40 when the tide had maybe another inch to go wouldn't have made any difference at all, would it?

A If it was necessary for him to keep the engines running to keep on the beach during the rise of the tide for the previous hour, it would also be necessary for him to run the engines to keep on the beach during the fall of the tide and during the stand of the tide at high water.

Q Mr. Milwee, you said you read Mr. Kunkel's testimony?

A Yes. I did.

Q Do you recall Mr. Kunkel saying that about 1:15, 1:21, 1:30 the vessel took a list to starboard, and then, settled down on the reef?

A I remember him saying it settled. I don't remember what time it was.

Q Well, it was about 1:30.

Do you remember that testimony?

A I remember him saying it settled.

Q Okay. And do you remember him saying to the

captain, we're not going anyplace and the captain says, that's right, we're not going any place? (1086)

MR. COLE: Objection, Your Honor.

Q You remember that testimony?

MR. COLE: I object to the form of the question. I don't believe that that is what his testimony was.

THE COURT: Objection...

MR. CHALOS: I'll withdraw the question.

Q (Mr. Milwee by Mr. Chalos:) You remember Mr. Kunkel saying that the captain ordered him at that point to be ready to ballast down sometime between 1:00 and 1:30?

A I remember him saying that he was told to look at his options and at the ability to ballast down.

Q That's right. That's correct. That's the testimony.

Now, is that consistent with somebody trying to get off the reef if he's try -- is looking at -- at an option to ballast down at that point?

A It's consistent with somebody looking at all their options.

Q So, you'll agree that the captain at that

point is looking at all of his options?

A He -- well, he was looking at his options, yes.

Q Now, you were asked to write a report by the State of Alaska?

A Yes. I was.

Q Specifically by the DA's Office?

A Yes. I was.

Q And you did write such a report on February 12th?

A Yes. I did.

Q Let me show you what I've marked as Defendant's Exhibit AD -- AM, rather, for identification.

Is that the report your wrote for the State?

A Yes. It is.

Q And this report was written in request to a request that had been made to you in early February by the DA's Office?

A That's correct.

Q Was this the first written opinion that you gave them?

A Yes. It is.

Q Had you given them any opinion prior to this?

A I don't recall specifically. I'm ver -- we

probably had talked on the phone about it.

Q Well, let me show you what I've marked for identification as Defendant's Exhibit AL, which is a letter dated February 2nd, 1990, from Mr. Adams, who you know as a Assistant District Attorney?

A Yes.

Q "Att: Bill Milwee." Do you remember receiving that letter?

A Yes. I do.

Q And was it in response to that letter that you wrote your report of February 12th?

A Yes. It was.

Q You see in the second paragraph of this letter of February 2nd...

A Yes. I see the 2nd paragraph.

Q Second paragraph? Are you with me?

A Yes.

Q Did you render an opinion that in certain circumstances it is appropriate to immediately remove a stranded vessel?

A Yes.

Q And did you also render an opinion that conversely in some circumstances it is imperative that the vessel remain firmly aground?

A Yes.

Q And did you also render an opinion that it may be necessary to run the vessel at slow ahead to ensure that it doesn't go anywhere?

A Yes.

Q Now, sir, 8800 horsepower when you have 31,000 available is akin to a slow ahead, isn't it?

A Not when you render a full ahead, no. Slow ahead is slow ahead.

Q Well, 55 rpms in terms of the power curve in a slow speed diesel engine is equivalent to a slow ahead, or just a little bit higher, isn't it?

A No. I'm not gonna agree with that.

Q In any event, you -- in any event you rendered an opinion here that under some circumstances it may be necessary to run the vessel slow ahead to keep it on the reef, didn't you?

A That's correct.

Q Okay. Now, in your -- opinion of February 12, you said -- you rendered this opinion, didn't you, "Stranded vessels usually refloat along the reciprocal of the course on which the grounded. They refloat much less frequently by passing over a reef or a shoal in deep water -- or into deep water."

Is that correct?

A That's true.

Q Now, what do you mean by stranded vessels usually refloat...

MR. COLE: Judge, I object and ask that under Rule 106 the whole thing be read. I think Mr. Chalos is taking this out of context and I'd ask that he have to read the next sentence.

MR. CHALOS: Well, I'll be happy to, Your Honor.

THE COURT: Go ahead.

Q (Mr. Milwee by Mr. Chalos:) Why don't you read your paragraph 4, you wrote it?

A I'll read the entire paragraph.

Q Go ahead.

(1284)

A "Stranded vessels usually refloat along the reciprocal of the course on which they grounded."

Q Uh-huh (affirmative).

A "They refloat much less frequently by passing over a reef or shoal into deep water. Under -- until the conditions of the stranding are known any refloating attempt is foolhardy. Before defining the way that a ship lies upon the ground and the amount of lost buoyancy a refloating

attempt with engines and tidal rise is a blind attempt."

Q Now, before we get into the whole paragraph, what do you mean by "stranded vessels usually refloat along the reciprocal course on which they grounded"?

A Well, it's much more frequent that a stranded ship will strand headed into shallow water and the logical way to remove her is to take her out the way that she went in, just...

Q By backing up?

A ...back her off in the direction in which she -- in the opposite direction of which she was going when she grounded.

Q In this case Captain Hazelwood never used the engine astern, right?

A It wasn't appropriate in this case.

Q Now, with respect to the -- the rest of your opinion there in paragraph 4, you wrote that because the state told you to write that...

A No, sir. I did not.

Q Is it not -- let's read something here.

Look at page 2 of Exhibit AL. Look at the third paragraph, starting, "After extensive review..." Would you please read that into the

record?

A "After extensive...

MR. COLE: Object. Hearsay.

MR. CHALOS: Your Honor, this is for impeachment purposes.

THE COURT: Objection overruled.

Q (Mr. Milwee by Mr. Chalos:) Go ahead. (1367)

A "After extensive review of the relevant evidence it is our view Sam Adams, Brent Cole, retired tanker Captain Bob Beevers, Mary Anne Henry and State Trooper Jim Stogsdill that from the time Hazelwood returned to the bridge after the grounding at approximately 12:10 p.m. until the...

Q A.m.

A "...a.m. until the engines were shut down at 11:41...

Q 1:41.

A "...Hazelwood..."

"...1:41 Hazelwood's actions were designed solely to remove the vessel from the reef...

Q Now, this is the attorney -- the District Attorney -- the Assistant District Attorney telling you?

A This was telling me what their opinions are.

Q Uh-huh (affirmative). Now, when was the last time Mr. Adams, Mr. Cole, Ms. Henry and Sgt. Stogsdill commanded a vessel that went aground?

MR. COLE: Objection. Relevance.

THE COURT: Sustained.

Q (Mr. Milwee by Mr. Chalos:) Did you ask -- did you ask Mr. Cole, Ms. Henry, Sgt. Stogsdill or Mr. Adams on what they based their opinion.

MR. COLE: Stogsdill.

MR. CHALOS: I beg your pardon. Sorry.

Q (Mr. Milwee by Mr. Chalos:) Did you ask 'em on what they base their opinion on?

A I did not and I did not give any value to this statement. I formed my opinion independently of that.

Q Would you read the rest of the paragraph?

A "Our conclusion is based on the absolute lack of any evidence that Hazelwood was trying to do anything else but remove the vessel from the rocks. From Hazelwood's statement to the Coast Guard to that effect, from Greg Cousins statement that Hazelwood gave a series of rudder commands designed to remove the vessel from the location of the vessel on the western edge of the reef,

from Hazelwood's statement to the Captain of the Port at approximately 1 p.m. about his attempts to free the vessel and from FBI statements and trooper interviews with Maureen Jones, Chief Mate Kunkel and also with Kagan."

Q Now, until you got this letter, Exhibit AL, you hadn't rendered any opinion, had you?

A No. I had not.

Q And you say this -- this didn't influence you in...

A Not in the slightest.

Q Yet when we look at your letter of February 12th, you write the exact same opinion that they suggested to you.

A I formed that opinion completely independently.

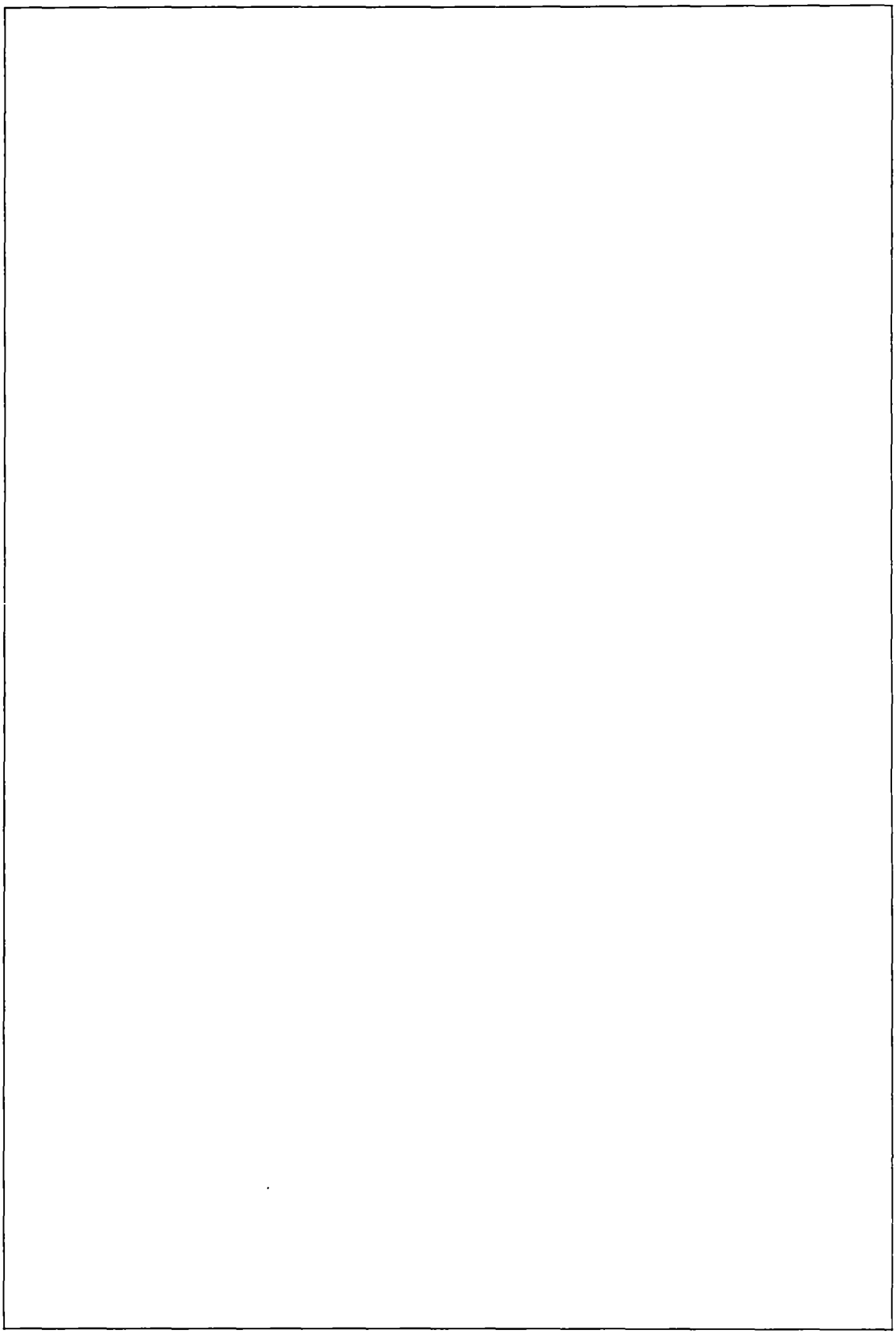
Q After you got the letter of February 2nd?

A Well, I got the let -- I believe before I got the letter.

Q But you didn't write to them anything about that? The first time you wrote was on February 12th, after you received a letter of February 2nd, is that right?

A That's right.

Q They also suggested to you, and you made that



part of your letter of February 12th, that you expressed an opinion that the vessel would capsize when she came off the reef. Isn't that true?

A (No audible response.)

Q Look at the last paragraph of page 2.

(Pause)

Read the first sentence to us.

A "In your report please address the following areas:..."

Q Go ahead.

A "...would a reasonable captain in the same situation recognize that actions such as Hazelwood's risk causing the vessel to come free from the reef and possibly capsizing or sinking."

Q And you wrote in paragraph 5(b) of your letter of February 12th, "Refloating the ship before defining the condition of the vessel could result in capsizing, sinking or catastrophic structural failure of the hull garter."

Right? Am I correct?

A That's correct.

Q Okay. And then you spoke about the vessel grinding into the rock. Do you remember that?

A That's correct.

Q Remember you had the model and you were showing the jury...

A Uh-huh (affirmative).

Q ...that the vessel would grind into the rocks? They told you to say that, too, didn't they?

A They didn't tell me to say anything, sir.

Q Well, continue on, then, please, in that paragraph, starting with the word "related".

A "Related to the immediately preceding question is a related question of whether a reasonable captain would recognize that grinding a vessel into a rocky reef could increase the possibility that the vessel would break up either at the time the rudder commands were being given or on a falling tide."

Q Then you wrote in paragraph 5(c) of your letter of February 12th, "Working the ship on a hard bottom is likely to cause additional damage and increase the possibility of catastrophic structural failure," didn't you?

A That's correct.

Q And it's true also, isn't it, Mr. Milwee, that they told you what evidence to read and what evidence to ignore, didn't they?

A They suggested. They did not tell me and I

didn't necessarily take their suggestions.

Q Do you think it's proper in your business as an expert to have the party you're workin' for tell you what evidence to read and what evidence not to read?

A It may or may not be proper, but it's certainly proper for me to ignore their suggestions.

Q Well, they told you looking at the first paragraph of page 3, "Also, you should not put much weight into second mate LeCain's NTSB testimony that the crew was standing by for quick action."

Remember that?

A I see that.

Q Did you ask 'em why shouldn't I pay attention to what LeCain said. He was there.

A No. I ignored it.

Q But you did give an opinion that the crew wasn't prepared to -- to deal with this casualty, didn't you?

A Yes, sir.

Q And that's contrary to what Mr. LeCain said at the NTSB.

A It's not contrary to what other people said,

though.

Q And your opinion is consistent with the State telling you to ignore his testimony?

A That's true, but I didn't give any credence to what the State suggested.

Q And yet your report of February 12th, 1990 goes right down the line as to what the State told you to say and you say...

(1622)

A The State did not tell me to say anything and I did not blindly do what the State suggested. I arrived at the opinions independently, sir.

Q The exact same opinions that the State suggested to you? You came to independently?

A I think if you bring out the whole thing you'll notice there are a couple of things that I did not address in my report.

Q Such as?

A The next to the last paragraph on the third page, "Lastly, would a reasonable captain drink even one alcoholic beverage just one hour before assuming command in violation of Coast Guard regulations."

Q And you said in paragraph 6(e) of your letter of February 12th, "I would expect the master of a

tank ship that is aground and is spilling oil to (e) do nothing to impair his ability to perform at his highest level of competence."

They didn't suggest that to you either, did they?

I have no further questions, Your Honor.

(1676)

REDIRECT EXAMINATION OF MR. MILWEE

BY MR. COLE:

Q Mr. Milwee, when did you get hired on this matter?

A In August of 1989.

Q And when did you receive the packet of information circa this matter?

A January 1990.

Q Why was that? Why did you not receive it until January 1990?

A I was given to understand that the evidence was not tainted in any way.

Q And that was a decision that was made by the State of Alaska?

A That's correct.

Q And were you given any instructions about how to proceed as far as whether you could review other newspaper articles, or watch TV or anything

else about how this -- the facts of this case when you were hired?

A None whatsoever.

Q What do you mean by that?

A I mean I was not restricted in any way with the information that I could review or look at, have access to.

Q Now, in the memorandum that was sent to you from Mr. Adams were you given suggestions as far as conclusions to reach, or were you asked to reach opinions on issues?

A I was asked to reach opinion on issues. They were put in the form of questions that I should answer.

Q Were there any opinions other than the ones set forth in the one in paragraph number -- page 2, paragraph 3?

A None that I recognized as such.

Q Well, let's talk about the opinions that are in that.

Did -- did you see any evidence whatsoever in anything that you read, heard, or saw that would indicate that Captain Hazelwood was trying to put this vessel on the reef?

A I didn't.

MR. CHALOS: Objection -- I'm objecting, Your Honor. He's leading the witness.

THE COURT: Overruled.

A I did not.

Q (Mr. Milwee by Mr. Cole:) In fact, what did Captain Hazelwood say to the Coast Guard?

A Captain Hazelwood told the Coast Guard he was...

MR. CHALOS: Objection, Your Honor.

A ...attempting to get the vessel off the reef.

THE COURT: Just a minute. What's your objection?

MR. CHALOS: He's leading the witness.

THE COURT: No he's not. Objection overruled.

Q (Mr. Milwee by Mr. Cole:) What did Captain Hazelwood tell the Coast Guard at 1:10 a.m.?

A That he was attempting to refloat the vessel.

Q How many times did he say that?

A Oh, several.

Q And did you read the trooper interview that Captain Hazelwood had with Trooper Fox?

A Yes. I did.

Q What did he tell Trooper Fox he was trying to do?

MR. CHALOS: That's hearsay. There's no

foundation that he's asking him did he base his opinion on what he read or what he heard. He's asking him to -- to submit it as the truth of the matter.

THE COURT: Objection overruled in support of his -- stand behind the podium, instead of wandering around, Mr. Cole.

Q (Mr. Milwee by Mr. Cole:) What did he tell the trooper?

A He told the trooper he was trying to refloat the vessel. And I believe he used the word extricate.

Q What does extricate mean to you?

A Remove the vessel, clearly.

Q Did you read anything in anything Captain Hazelwood said that would indicate he felt there was the possibility of that vessel coming off the reef, and that he took actions to stop it?

MR. CHALOS: I object to the form, Your Honor.

MR. COLE: I'll rephrase it.

Q (Mr. Milwee by Mr. Cole:) Anything that you saw, that you looked at, that would indicate that Captain Hazelwood was afraid of this vessel coming off the reef?

A There was nothing in anything that I saw that indicated there was any chance of the vessel

coming off the reef through the forces of nature, or anything of that -- accidentally, or anything of that nature.

Q So, Mr. Chalos asked you about the fact that this vessel didn't go astern.

Does the fact that this vessel did not go astern change your opinion on what Captain Hazelwood was trying to do?

A Not at all.

Q Why is that?

A Because the action was consistent -- totally consistent with attempting to refloat the vessel.

Q Why is that?

A Because he was using rudder. He was using the engines. It was like he was aground on mud and trying to slither off. That's -- the action that's just what you would do to refloat a vessel ahead like that. And it was an action that was consistent with a ship grounded on a reef where there was clear water out -- out ahead of it.

Q Okay. In your article you talk about reasons why you back off a reef when you get stuck. And you think -- when Mr. Chalos indicated that that would be the kind of situation where you would run into a shallow area from a deeper area. Is

that correct?

A That's correct.

Q What about the hypothetical of you've just run over a rock and you have shallow water behind you and you've got deep water in front of you? What would you expect a master's actions to be, then?

A That's the type of action when you take the vessel off in a forward direction. It's those -- the rare actions that I refer to in my report.

Q And Mr. Chalos indicated that -- asked you about whether or not this vessel was not put on sea speed. Does that indicate to you that he was not trying to get it -- use full power? Does the fact that this vessel was not put on load program up and put up to 78, or say, 80 rpms change your opinion about what Captain Hazelwood was trying to do?

A No. Not at all.

Q Why is that?

A Well, because there -- the engine's running under conditions for which it's not defined, and it's -- very likely, it's gonna overheat.

Q And did you see any evidence that the engine overheated at any point?

A I'm not certain that I remember specific

evidence to that effect now.

(Pause)

Q Now, Mr. Milwee, I'd like you to take a look at the times up there between 12:38 and 1:41. Now, do you see the time around 1:20? If 10 a.m. is 1 o'clock?

A Okay. Yeah. Yes.

Q Now, is there anywhere in there that you see action consistent with someone trying to keep a vessel on the reef?

A No.

MR. CHALOS: Your Honor, no foundation.

THE COURT: He can give his opinion. Overruled.

(2070)

Q (Mr. Milwee by Mr. Cole:) I'm sorry. I didn't hear you, Mr. Milwee?

A No. I see the heading being changed frequently, oh, 13 -- 14 degrees.

Q And would you describe this point at 1:20 right here? When this heading changes which way is the vessel turning then?

A Well, the vessel is turning -- let's see. He's turning to the port.

Q Turning to port? That's to the left, right?

A That's correct.
Q And he was grounded on his starboard side, is that correct?
A That's correct.
Q So, he was turning away from the reef?
A That's correct.
Q And would you describe the number of turns that he made after that?
A Oh, he -- he zigs back slightly to the right, turns to the left again, to the right again, a couple of degrees to the left, and then back to the right and stops his engine -- stops maneuvering.
Q Anything in that section of that course recorder that would indicate to you that Captain Hazelwood was trying to keep this vessel on the reef?
A No. There's not.
Q And if he was trying to keep it on the reef, and he was trying to use the minimum force necessary, what would that course recorder look like?
A There'd be considerable less swing than it -- than it shows there.
Q Would there be turns right and left?

A There would probably be an indication that he started -- the heading started to drift off in a response to it, but it wouldn't be a change of as drastic as is shown there in the recorder.

Q And if you...

A Certainly shouldn't be.

Q ...were gonna slide off a reef and you were hard on your starboard side, where would you be afraid of sliding off toward? Your port side, or your starboard side?

A I -- obviously the port. You know your port side is -- is probably not aground. If you know your starboard side is aground and you know your port side isn't, you're gonna slide off to port.

Q And if you wanted to keep yourself from sliding off when your port side was not aground and your starboard side was, would you turn to the port...

A No, you'd...

Q ...or would you turn to the starboard side?

A You'd probably carry a little cost to the right rudder.

Q To turn into...

A To turn into the grounded area. If you were grounded forward of your pivot point.

Q Now, I'd like to talk for a second about the IG system on this vessel. The -- would you explain to the jury why it would not have been a good idea to seal the IG system? What does it -- before we start, what does the IG system do? What's it's purpose?

MR. CHALOS: Your Honor, I think this goes beyond cross. I don't think I brought up the IG system at all with this witness.

MR. COLE: Your Honor, he talked about sealing...

THE COURT: I think you did. I think there was a inquiry about that.

MR. CHALOS: Well, I'll check my notes, it's been so long. But I don't remember bringing it up with this witness.

THE COURT: Well, I'll let Mr. Cole inquire, and you'll have a chance after his inquiry. I think you did bring it up to some -- you did bring some...

Q (Mr. Milwee by Mr. Chalos:) What does the IG system do on this vessel?

A The purpose of the IG, or inert gas system, is to put an inert gas -- a low oxygen content gas into the tanks -- the cargo tanks to reduce the danger of fire and explosion, to reduce the

amount of oxygen in the tanks so that the mixture of cargo fumes and atmosphere in the tanks is below the limits at which it will burn, or will possibly explode. It's been a great boon to tanker operations. It's reduced tanker explosions tremendously over the last 10, 15 years.

Q And Mr. Chalos talked to you about closing off the IG system in order to make this vessel, I guess not lose any more buoyancy? Do you remember him...

A That's correct.

Q ...talking about that?

What are the problems associated with taking an action like that?

A Well, the -- one problem is timeliness. That it's -- the loss of cargo is very rapid from damage in the bottom.

But, a more significant loss is that if you do that, disable the IG system, you're unable to put any more inert gas in the tank. And this is at a time when the cargo level in the tank has been dropping rapidly and the vacuum breaker system on the tank, which prevents a -- a vacuum from forming has began -- begun to function and air's

pouring into the tank.

You've got an atmosphere in the tank that is 8 percent oxygen. You begin to mix air with it at 21 percent oxygen and the percentage goes up, and the -- it becomes a danger of fire and explosion that didn't exist with the IG system functioning and the tank sealed.

Q On -- when -- we talked last week about soundings, how difficult is it to take these soundings -- would it have been to take these soundings on the Exxon Valdez at that time?

A It's -- it's difficult to quantify that. It wouldn't have been simply a matter of walking around and -- and making the measurements, but it would have been certainly within the possibility for an AB and a mate to take these soundings and to take them effectively.

Q And where would you have taken these soundings? Where, physically, on the boat -- on the ship?

A Oh, all around. Completely around the vessel at short intervals, short intervals being, oh, probably 25 feet first shot and then refine that later. And when you got -- that was an area that you found was aground you would certainly take

those at more frequent intervals.

Q I guess the last consideration -- the last thing I -- no. There's two other things.

Why -- why does the tanker captain have to take any throttle or rudder action at all after a grounding? What is the necessity, or is there any...

(2500)

MR. CHALOS: Your Honor, I object unless some foundation is laid. What -- what situation are we talking about? This one? Grounding in mud? Grounding on coral? Ahead, there's just not enough foundation?

THE COURT: Mr. Cole, you asked about three questions, there, too, and the form of each of them was objectionable. So, if you can rephrase it.

Q (Mr. Milwee by Mr. Cole:) Well, let's just talk generally. Why is it that a tanker needs to come off a reef -- why is it that immediate action has to be taken? Or is there a reason?

A It depends on the condition of the grounding. In -- in most cases -- in many cases absolutely not action is required. In all cases no action should be taken until the condition of the grounding is reasonable well defined.

It's particularly undesirable to take any

action when the ship is aground on rock.

Q And if you were told that you had damage in center cargo tanks 1 thru 5, port -- or starboard tanks 1, 3 and 5, and that you were taking on water in your ballast tanks on the starboard side 2 and 4, and that within 100 -- within a half an hour you'd lost 100 to 115,000 -- you could not account for 100 to 115,000 barrels, what would that tell you about your ship?

A That...

MR. CHALOS: Objection, Your Honor. This man hasn't been qualified as a master of a ship. He said he doesn't have any -- any experience as a master. His expertise is in salvage, not as a captain of a vessel.

MR. COLE: It's on damaged tankers all over the world, Your Honor. I think he should be able to evaluate what that -- that effect has on his assessment of the stability of that vessel.

THE COURT: Objection goes to the weight, Mr. Chalos, not to admissibility. Overruled.

A Would you repeat the question please?

Q (Mr. Milwee by Mr. Chalos:) If you were told that your center tanks 1 thru 5 were damaged, that your starboard cargo tanks 1, 3 and 5 were damaged, that your ballast tanks 2 and 4 on your

starboard side were taking in fluid and that you could not account for between 100 and 115,000 barrels of crude oil, and all this information was relayed to you within the first 20 to 30 minutes after the grounding, what would that tell you about your tanker?

A I would know that I had a very badly damaged tanker. I would be particularly concerned about the flooding into the ballast tanks and a loss of buoyancy that would come about from that -- from that flooding. I would realize that I should stay right were I was and -- and not attempt to move that ship because there was a danger -- because I'm losing buoyancy and because I have a very damaged -- very badly damaged ship, that if it did come afloat it would sink. And I would be much better off securing that ship in that position where it's obviously can't sink very far.

Q And in that situation what would have hurt -- what would have been lost by simply doing that? By simply securing this vessel and waiting?

A Nothing.

Q And by attempting to remove the vessel what was risked?

A The possibility that it might -- if it did come off, the vessel would be in a very -- a very dangerous situation.

I have -- in a similar -- in a situation where a tanker suffered damage to one of the tanks, it was -- one of its buoyancy tanks we put that thing aground immediately. We did just the opposite. We deliberately put it aground to prevent the ship from sinking in deep water.

Q And did you see any indication from anything that Captain Hazelwood was attempting to secure that vessel between 12:30 a.m. and 1:41?

A No. Other than looking at his options, or having the mate look at his options. There was no -- no positive action to secure the vessel.

Q And all the things that you saw were consistent with him attempting to get off?

A That's correct.

Q I have nothing further.

(2790)

RECROSS EXAMINATION OF MR. MILWEE

BY MR. CHALOS:

Q Mr. Milwee, when you're hired as a salvage expert and you come on board the ship you're always working under the supervision of somebody,

aren't you?

A I think we always -- always work under the supervision of somebody.

Q Except a captain of a ship who's just run aground, isn't that right? He's got to make the decisions himself.

A Now that doesn't mean he's not working under somebody's supervision.

Q Well, when you come on board you advise, right? You advise the captain, you advise the company representative. You advise whoever -- whoever's hired you?

A I'm sometimes in positions where I'm completely running the operation.

Q When you say you would have done this and you would have done that and some of the actions that are inconsistent with what you would have done, you've never been in that situation, isn't that right?

A In what situation?

Q Of a ship just run aground spewing oil? You've got to make a decision in the middle of the night. You've got the crew members to worry about. You've got your ship to worry about. You have the Coast Guard to worry about. You've got

stability, you've got...

A I've been in very similar situations many times where I had to make the decisions.

Q By the time you got there the ship had already run aground and it was fairly stable at that point, is that right?

A In a -- after the initial groundings, yes.

Q Now, you keep talking about the fact if the vessel would have come off. Well, we know that this vessel wasn't gonna come off. It was impossible for it to come off, don't we?

A We know that now, 11 months later.

Q Uh-huh (affirmative).

The fact of the matter was that whether we know it now or they knew it then, that vessel wasn't going anywhere?

A But Captain Hazelwood took no steps to determine that.

Q So, when you say he was reckless, what you're saying is he was reckless in not knowing his vessel couldn't move? Is that what you're talking about?

A No. That's -- let me think about the way you phrased that a little bit.

He was reckless in taking action without

determining the conditions that were extant at the time.

Q But that -- all those risks that you talk about, the capsize, the breaking up, the -- the what do you call it? The sinking. Those were all situations that weren't gonna happen no matter what action he took. It was impossible for him at that time to move the vessel, either by using the engine or by using the rudder, isn't that right?

A That's correct.

Q Now, Mr. Cole asked you about the evidence that you reviewed at the end of January, early February. Do you recall that?

A Yes.

Q What other evidence you reviewed, whatever testimony you reviewed, whatever reports you reviewed were reports, testimony, evidence that was given to you by the State, isn't that right?

A Yes. That's correct, except for items from my library.

Q Okay. So, the State controlled what you saw and what you based your opinion on, isn't that true?

A The State didn't restrict me in the seeking of

other evidence and other information whatsoever.

Q Did you on your own do any independent analysis? Any independent study? Gather any independent information with respect to the grounding, other than what the State gave you?

A Well, other than specific information about this grounding, and besides getting out charts and talking to the salvage master, no.

Q You -- you remember Mr. Kunkel's testimony where he said he came up 12:30 and told the captain that the vessel was stable at that point?

A Well, I don't remember it exactly like that. I...

Q Did you consider...

A ...remember him coming up and -- with a report of another analysis he had done using the Load Master computer.

Q That was later on. He said that was between 1:00 and 1:20.

A Well, there were two -- there were two reports.

Q Right.

A One which indicated there was a stability problem and the stress was all right. And the other indicated that there was a stress problem

and the stability was all right.

Q That's right. And the first one was that the stability was all right, but the stresses were below the acceptable level if they were gonna go beyond Cape Hinchinbrook, do you remember that?

A That's correct.

Q And the second report was that the stability was marginal. Do you remember that?

A That's correct.

Q Did you consider that in your -- in your opinion? Those...

A I certainly...

Q ...two reports?

A ...did.

Q Did you also consider the fact that when the Captain spoke to the Coast Guard he told them on several occasions we're ascertaining right now -- we're ascertaining our situation right now. Did you read that in those...

MR. COLE: Objection...

Q ...reports?

MR. COLE: ...Your Honor. I don't believe that that's what that says.

MR. CHALOS: It certainly does say that.

THE COURT: On several occasions he said that,

Mr. Chalos?

MR. CHALOS: At least...

THE COURT: I don't have the transcript.

MR. CHALOS: Well, let me rephrase it, Your Honor.

Q (Mr. Milwee by Mr. Chalos:) At least one occasion the captain told the Coast Guard when he was communicating with them that we're ascertaining our situation right now?

A That's correct.

Q Well, what does ascertaining mean to you?

A It means he was determining the situation.

Q Now, you spoke about situations where you've gotten vessels off the reef by going forward. You remember that?

A Yes.

Q And in those situations you said you always lighten the vessel by taking a lot of cargo off. Right?

A That's -- because that fit the circumstances of a particular grounding, yes.

Q Right. And if you did lighten the vessel, no matter how much -- in that situation that you're talking about -- no matter how much you drove it forward, she wasn't gonna go anyplace. Isn't

that right?

A Well, I wasn't using the engines. Engines are not my tool of choice for refloating vessels.

Q Well, that's because you -- you take out the cargo and you let it float up and you weight for a high tide and pull her off.

A Well, that's one way you do it. There are other ways, also, of laying anchors and purchases and hauling with -- with high powered vessels and the like.

Q Tell the jury what you mean by anchors and purchases in those situations.

(3186)

A One of the -- the basic tools of the salver is a high holding power anchor laid in the direction that the ship is to be refloated and taken to a multiple part -- purchase -- a series of pulleys and blocks, which multiplies the force that's applied to it. And you'd either haul it with a winch or a hydraulic puller to give a force and direction that'll pull the ship off.

Q And in that situation you're generating a lot of force, a lot of pull, aren't you?

A Well, you're generating a lot of pull, yes.

Q Now, one of the considerations of trying to go

forward when you haven't taken any cargo off -- aside from the fact that you were workin' the vessel in rock is that whatever you're ground on is gonna hit your propeller and your rudder, isn't it?

A Very likely.

Q Now, you heard testimony here about Captain Hazelwood being an experienced master, didn't you?

A That's correct.

Q Now, does it make sense to you that an experienced master like Captain Hazelwood would run his engine and his propeller and rudder over a reef? Does that make any sense to you?

A It's not the best action, but it's consistent with what was -- what was done here.

Q Well, you've said that the captain knew that his ballast tanks were damaged, didn't you?

A Yes. I did.

Q And you said that by -- by seeing that you have water -- he knew that he had water in his ballast tanks then?

A Yes.

Q And the effect of water in the ballast tanks is to make the vessel heavier, bring her down,

isn't it?

A Yes.

Q Now, an experienced captain like Captain Hazelwood would know that, wouldn't he?

A Yes. He would.

Q Now, you spoke sort of in an off handed manner about the loss of product being rapid from the damage to the bottom -- to the hull plate in the bottom, do you recall that?

A That's correct.

Q It's true, is it not, that it's not the size of the hole in the bottom that controls how much oil flows out, but the smallest opening at the top that -- that permits the air in that controls the flow of oil, doesn't it?

A That's correct.

Q So, you could have 100 foot hole in the bottom, but if you have a four inch valve that's on top, it's the four inch valve that's controlling the flow, not the 100 foot opening?

A That's correct.

Q You spoke about the danger of fire and explosion by using the IG system, or not using it.

You talking about the explosive range that one

goes -- that the system goes through at some point?

A Yes.

Q Tell the jury what the explosive range is, please?

A It's the mixture of oxygen and fuel vapor that's -- where an explosion is possible.

Q Did you do any calculations to find out what the explosive range in this situation was?

A No. I didn't.

Q Usually, it's...

A I didn't have the volume of the tanks, or the other information that would have been required...

Q So, when you...

A ...to do that.

Q ...say it would have been dangerous to use the IG system, or not use it, you don't know where they were in the explosive range, whether they had gone beyond it already, when it -- that happened, or what danger may have existed at that point?

A No. I don't. I know that the -- the inert gas would have been diluted. I know it would have -- the oxygen percentage would have been

increasing, and I know that the industry standard recommends keeping the inert gas system in operation.

Q You know, do you not that one goes in this type of situation where the inert gas system is open and you're losing cargo rapidly at that point, you know that the system goes through the explosive range very quickly, don't you?

A I would have to see figures on that before I would necessarily...

Q In any event, you didn't do the calculations?

A I did not do the calculations.

Q And then, it's also true, is it not, that once you go through the explosive range the danger of explosion or fire has dissipated?

A No. I think you've got a continuing danger that you could run in and out of that explosive range.

Q But it has nothing to do with using or not using the IG system at that point?

A It'd have a lot to do with not using it.

Q I have no further questions at this time, Your Honor.

THE COURT: Make it brief, Mr. Cole. We've had this witness on a long time and we've covered the

same ground several times. So, stay outside -- stay on new material only.

(3490)

REDIRECT EXAMINATION OF MR. MILWEE, CONTINUED

BY MR. COLE:

Q When Mr. Chalos asked you about whether or not an experienced captain like Captain Hazelwood would do such things, you assumed that he was not intoxicated at the time?

MR. CHALOS: Objection, Your Honor. No evidence to that.

THE COURT: Counsel approach the bench please.

(3540)

(Whispered bench conference as follows:)

Okay. There is evidence that he had been drinking beforehand. The jurors can make inferences on that if they want to.

But it's very argumentative. I'm gonna let you ask that one question and that's -- the answer's gonna be the end of that. And if you want to go into that, if you want to open the door wide, it's up to you.

MR. COLE: I don't, Your Honor. The reason I did that (indiscernible - whispering).

THE COURT: Well, I think there's an argument

to be made that the reason Captain Hazelwood did what he did is because he was -- didn't have his faculties about him because of alcohol. There's an inference he was (indiscernible - whispering).

UNIDENTIFIED SPEAKER: (Indiscernible - whispering.)

THE COURT: Okay.

(End of whispered bench conference.)

(3540)

Q (Mr. Milwee by Mr. Cole:) When Mr. Chalos asked you about what Captain Hazelwood, or what a reasonable captain would do in this circumstance, you assumed you had a reasonable captain that was not impaired?

A That's correct.

Q Nothing further.

(3600)

RECROSS EXAMINATION OF MR. MILWEE

BY MR. CHALOS:

Q Sir, you have no reason to believe that at the time of the grounding that Captain Hazelwood was impaired, do you?

A I have read -- read testimony that Captain Hazelwood was drinking earlier in the day. And I have read testimony that he was not showing any

signs of impairment.

Q That's your answer?

A That's correct.

Q Okay. I have no further questions.

(3657)

THE COURT: All right, sir, you're excused. Ready with your next witness, Mr. Cole?

MR. COLE: Yes.

THE COURT: You may call your next witness.

MR. COLE: The State would call Professor William Vorus.

THE COURT: I see you passing briefs around here. Do you have a copy for me?

MR. MADSON: I do, Your Honor. I didn't want to interrupt the Court.

THE COURT: That's okay. This is as good a time as any and file the originals downstairs if you would. Just give me copies. Thanks.

MR. MADSON: It is, Your Honor.

THE CLERK: Sir, can you raise your right hand, please?

(Oath administered)

A I do.

WILLIAM S. VORUS

called as a witness in behalf of the State, being first

duly sworn upon oath, testified as follows:

THE CLERK: Sir, would you please state your full name and then spell your last name?

A William S. Vorus, V-o-r-u-s.

THE CLERK: Current mailing address?

A 1360 North Lake Road, Gregory, Michigan.

THE CLERK: And, your current occupation?

A I'm a professor at the University of Michigan.

THE CLERK: Thank you.

THE COURT: We'll take a break about 10:15, Mr. Cole.

MR. COLE: Sure.

(3745)

DIRECT EXAMINATION OF MR. VORUS

BY MR. COLE:

Q Mr. Vorus, why have you been called to testify in this matter?

A To render opinions in the general area of naval architecture and specifically, with regard to my findings having to do with the freeing of the vessel from the reef.

Q Where do you teach, currently?

A Department of Naval Architecture and Marine Engineering at the University of Michigan.

Q Would you tell the jury what your educational

background is?

A I have a B.S. in mechanical engineering from Clemson University, 1963, a Master's from the University of Michigan in naval architecture in 1969, a PhD in naval architecture in 1971.

Q Would you explain a little bit of your employment background in the ship building industry?

A I was with Newport News shipbuilding for 10 years. Actually, three of those years were on educational leave. I went with the shipyard in 1963 after graduation from Clemson. Was there for five years, away for school for three and went back there for three years.

Q What were you doing there?

A Various positions in the engineering departments. The last one was the manager in charge of ship machinery in engineering.

Q Would you describe what you mean by "manager of ship machinery and engineering"? What were your responsibilities there?

A Well, our job was to verify designs produced by the design departments in the area of man propulsion machinery, deck machinery, steering gear, anchors, primarily, structural interface

with the hull associated with those components. The job was actually somewhat broader than that and that this group was analytically well equipped.

We handled all types of special problems. Vibrations problems, noise problems, special structural problems that arose. And, did it also include looking at damaged vessels?

A I can remember occasions where we worked with our ship repair department to do damage assessment in terms of strength degradation.

Q Now, after working for Newport News, what did you do?

A I went back, returned to the University of Michigan as a professor in '73.

Q What were you teaching there?

A My first assignment was a junior level course in structures, ship strength.

Q And, would you explain to the jury what is a naval architect?

A Naval architecture could be viewed, probably as a subfield of mechanical engineering and having to do with vehicle design. We are to marine vehicles what the aerospace engineer is to space vehicles.

Q What's a marine engineer?

A Well, the naval architect is more the hull envelope and outside the interface with the water. Strength issues having to do with the hull. A marine engineer; they could be viewed as two types. One would be the operating marine that are aboard the ship and then there is a design marine engineer who is associated primarily with man propulsion machinery.

Q Now, you've been teaching at the University of Michigan for how long?

A 16 years.

Q And, what kind of classes do you teach now?

A At this moment, I'm teaching a junior level course in ship dynamics, marine dynamics and a graduate course in marine structures.

Q And, have you taught about structures' designs in the past?

A Yeah, my first course at Michigan was a course in design of ship hulls. I've continued to teach that throughout the year.

Q Do you work with graduate students in this area also?

A Well, I've been the graduate program chairman. I'm not currently, but I was for a number of

years. I currently supervise seven PhD students.

Q And, that would be various projects with regards to marine naval architecture?

A I think two of the seven are structures. The two in hydrodynamics is one and propellers.

Q I would like to ask you a little bit about Vorus & Associates; what is that?

(Tape: C-3652)

(000)

A Well, it's a company that I formed in 1980. It's a corporation, a very small corporation, but I felt a need to stay a little closer to the front lines of activity in the field and that company allows me to do that.

Q What kind of work have you done with that company?

A We're specialists, but in a broad sense. We specialize in non-routine problems in the marine field. They could be structures that could be hydranomically oriented problems. The types of things that require a little extra effort in terms of careful diagnosis, analysis and resolution; the types of problems that the normal design office is not equipped to deal with.

Q Can you give the jury an idea of the types of

problems that you've been asked to handle with Vorus & Associates?

A Well, we're currently, for example, designing lines of high-tech cavitating propellers for recreational craft. The other extreme, recently, I was engaged by a container ship operator who had a problem on the class of 12 ships with main deck damage up in the forebody in heavy storm seas. Others had recommended that the forebodies of those ships be rebuilt. We looked at it very carefully and determined that it could be very simply solved by the addition of some simple panel stiffeners which was done and done successfully.

Q Have you authored any publications in the field of structural design?

A About a third of my publications are instructors, in general.

Q And, the work that you do with Vorus & Associates, who helps you with that?

A My associates are generally the staff and students of the Department of Naval Architecture and Marine Engineering there. I use them on an "as needed" basis when they're available.

Q And, how much of your work with Vorus &

Associates deals with structures?

A I would say about half.

Q Have you been asked to testify in cases before?

A Yes.

Q Approximately how many times have you had to testify in civil or arbitration cases?

A Well, not so many. I pick and chose these jobs real carefully, but I've been involved, I believe, in five arbitrations in the marine field and two civil cases.

Q When were you asked to provide the services that you've rendered in this case by the State of Alaska?

A August, September, 1989.

Q And, did you enter into a contract with the State of Alaska?

A Yes.

Q And, what was the amount of that contract?

A It was originally $25,000.00.

Q And, what was that for?

A It was to help the State with the case, to provide some analysis and conclusions with regard to certain aspects.

Q And, have you reached any conclusions in this

matter?

A Yes.

(170)

Q What conclusions have you reached about the stability of the Exxon Valdez on March 24th, 1989 in the early morning?

A In the grounded condition?

Q If it had gotten off the reef.

A If it had been extracted from the reef soon after the accident or during that period, our analysis shows that the vessel would have capsized and sunk.

MR. CHALOS: Your Honor, I move to strike any testimony on what would have happened if the vessel came off the reef, since we already have testimony that that was impossible. So, anything that Professor Vorus would say would be hypothetical. It would be speculative and really of no probative value because the vessel couldn't come off.

THE COURT: Let's take a recess now for the jury and we'll take this up outside their presence.

Remember not to discuss this matter among yourselves or with any other person. Don't speculate on what we do in your absence, please and do not form or express any opinions concerning the case. I'll call

you back when we can.

(Jury not present)

THE COURT: Mr. Chalos, we've had several witnesses testify as to what might have happened, the risks that were involved. I'm sure you're aware of the nature of the answer that was about to come and you waited to object until after the answer came in. So, I deem that you have waived the objection that you are making now, but as to future objections, I think we need to deal with the situation now.

I have your brief. I don't think Mr. Cole's had an opportunity to look at your brief. You've had an opportunity to look at his brief. This is somewhat in response to the Court's inquiry last Friday and apparently both counsel had understood this was going to be an issue because briefs had been prepared by the State already.

The issue boils down, I think, Mr. Cole, to whether or not factual impossibility of the vessel capsizing or any more damage occurring to it or any further pollution occurring as a result of Captain Hazelwood's actions, which we'll assume for the purposes of argument were to extract the vessel from the reef, can constitute the creation of a risk as the term was used in the statute defined in the offense. I

think you need to have time to look at this brief that's been filed by the defendant. We'll come back in in a few minutes and we'll resolve this.

There's been substantial evidence already submitted and we'll have to deal with this at some and we can start dealing now if necessary and we'll definitely be dealing with this question during jury instructions. We'll come back in in about 15 minutes. If you need more time, let me know. We stand in recess.

THE CLERK: Please rise. This court stands in recess subject to call.

(Off record - 10:13 a.m.)

(On record - 10:39 a.m.)

THE COURT: You may be seated. All right. Ready to argue this point?

MR. COLE: Yes.

THE COURT: Okay. I think you know what the objection is. We've got the brief on it. We got your brief on it, too. Let me start off with a questions for you. Maybe we can narrow this down. How can Captain Hazelwood be reckless when the definition of reckless requires to be aware of and disregard a substantial risk if there is there is no risk?

And, for example, the crime cited by the

defendant where a defendant was charged with arson and reckless endangerment. That case sounds like it might be on point. In that case, the defendant contracted with or made some agreement with an undercover agent to burn some place down and they charged with an attempt at arson and then they said they couldn't be charged with reckless endangerment because it was factually impossible. The undercover agent wasn't going to burn the structure down. So, it was factually impossible for the recklessness to have occurred. So, maybe you can use that as an analogy to this case.

MR. COLE: Sure. Judge, I think we need to go back to what the charging documents are in this matter.

THE COURT: Well, let's just deal with the charging document at this time of criminal mischief in the fourth.

MR. COLE: Right and the charging document at this time reads "Joseph Hazelwood, having no right to do so or any reasonable ground to believe he had such a right, recklessly created a risk of damage to property of others in the amount exceeding $100,000.00 by dangerous means to wit by the totality of his actions on March 23rd and 24th, he recklessly risked damaging the structural integrity of the oil tanker, Exxon Valdez, causing the spillage of crude oil."

THE COURT: Now, as I understand it, based on our earlier orders that have come out and the Bill of Particulars ordered by the State to be produced, the damage that the State is showing that exceeded $100,000.00, risk of damage, was to the shoreline, marine mammals, the birds, and the fish, correct?

MR. COLE: That's correct. But, we have to show that he risked, that by his actions that evening, the 23rd, that he risked, that he was aware of and consciously disregarded, this risk of causing damage to the structural integrity of the Exxon Valdez and our theory is when a tanker captain runs into a reef, he risks causing structural damage to the oil tanker and causing an oil spill, which causes this damage.

Now, we have to prove that. One of the ways that we've chosen to prove that is to put on a person who is going to explain what happened to this particular vessel on this particular occasion -- what would happen if it had gotten off the reef instantaneously or five minutes later or hourly? One of the element is that we have to prove that he was aware of and disregarded this risk of damaging the structural integrity by running into Bligh Reef.

Now, the way we've chosen to do that is put on someone who can tell the jury, whose done an analysis

of the damage sustained by this and can point out to the jury why these risks are there.

THE COURT: I understand all that. You're not addressing the issue here, Mr. Cole. The issue is the witness' testimony, had it gone it off the reef, had Captain Hazelwood been successful in getting this vessel off the reef with his efforts, it would have capsized, when, in fact, he could never have gotten it off the reef and I think that's undisputed, isn't it? Do we have any dispute about whether or not he could have gotten it off the reef?

MR. COLE: I don't think there's going to be any dispute on that. He could not with the engine horsepower.

THE COURT: What element of the offense of criminal mischief in the fourth degree does the testimony by this witness that it would have capsized had he gotten it off the reef, what element does that go to prove?

(479)

MR. COLE: It goes to prove that he risked damaging the structural integrity of the oil tanker causing an oil spill. I mean, you capsize, you've got to explain to him why his actions risk an oil spill causing the release of this $100,000.00 damage and our

theory is it risks it because when you run into rocks, you cause significant damage, which can cause the release of oil.

THE COURT: Well, we understand that. That's part of the elements. When he went aground, the oil came out and the testimony so far is that no other damage occurred after he went aground and it came to rest and there's no evidence that any more pollution took place. There was a risk, had he gotten it out, that more pollution would have taken place. There's a risk that it would have capsized and people's lives may have been lost, but once it came to a stop, the evidence seems to me to be pretty clear that it wasn't going anywhere and there was no further risk. Even though Captain Hazelwood may not have known that, in fact, there was no further risk.

Now, I think that's a fair, if I'm wrong, correct me. Is that a fair summary of the evidence so far?

MR. COLE: I have no problem with that. But, Judge, see, what we are going under and what I'm trying to get at is originally we brought this case as 2X: what he did before and what he did after. And, you consolidated it at their request, so I have to prove in my case that he risked the structural integrity my

running over a reef and that's what Professor Vorus does. He gives that to the jury.

We're not focussing on, as Mr. Chalos would like to say, what he risked by taking the actions that he did because you told me and you consolidated this whole thing. What we're talking about is what he risked by running his vessel over a reef, which Professor Vorus can testify about.

THE COURT: Well, let's get back to my original question. The elements of the crime of criminal mischief is that the defendant, having to right to do so, or any reasonable ground to believe he had such a right, recklessly created a risk of damage to the property of others in the amount exceeding $100,000.00 by widely dangerous means. Those are the elements.

After that, the "to wit" and the document that the State shows to file isn't an element of defense. The elements are -- I just read, so which of the essential elements of the crime charged, I just read to you, does this witness' testimony that had it gone off the reef, it would have capsized, prove?

MR. COLE: It created a risk of damage. When he was approaching the reef and he's 10 feet away or he's 100 yards away, we have to prove that there is a

risk, that he creates a risk of the damage, and one of them is Professor Vorus saying when this vessel hits rocks, this is what happens to the undercarriage.

THE COURT: Maybe we're not communicating. My question is what does the evidence of what he did after it went aground and came to a stop and the damage was done, the pollution took place, the damage was done, what further evidence that if it had gotten off the reef, which is factually impossible, it would have capsized prove? What element does that prove? The chance of getting off the reef that was impossible, what does that go to prove after the grounding?

MR. COLE: If you want to focus on that, Judge, I think it's a mistake of fact. Mr. Madson has not addressed that at all in his brief. All he says is it's an impossibility. Contrary, really, the law review article that we pointed out and the cases in line say that this is a mistake of fact, not impossibility. A mistake of fact in the State of Alaska is not a defense in this particular case. If you want me to focus on that, what does the actions of coming off the reef -- our response is this is not impossibility. It's a mistake of fact and AS 11.81.620 sets out the defenses for when a person commits -- you know, when mistake of fact.

The mistake of fact here is that Captain Hazelwood thought he could get this thing off the reef, when in fact, he couldn't and that is not a defense in this case. So, we believe that if you look at it as well, how does the actions of taking the vessel off the reef or attempting to take it off the reef relate to the State's case in chief? If that's the question you're asking me, my response is that it's a mistake of fact.

THE COURT: Maybe I misread the briefing and maybe I was unaware of the point, but it seems to me that's what the briefing addressed. The events by Captain Hazelwood, him attempting to get it off...

MR. COLE: Right.

THE COURT: ...and the risk here that you're trying to introduce is that had he got off the reef, there would have been additional damage. There would have been more pollution and there would have been risk of life.

MR. COLE: That's correct.

THE COURT: Okay, now, that's what I thought Mr. Madson's brief addressed. Am I incorrect, Mr. Madson, about that?

MR. MADSON: I think you're correct, Your Honor. It's what it addressed.

(694)

THE COURT: So, my question becomes again, if it was factually impossible to do any more damage or create any more pollution, what essential element of the charge does the opinion that it would have capsized had it gotten off by Captain Hazelwood's efforts, go to prove?

MR. COLE: Well, Judge, if you tell me that you're ruling that it's a factual possibility, then you're right. It doesn't.

THE COURT: Well, wait a second, now. I just asked you if it was a fair summation of the testimony that in fact, it could not have been removed by Captain Hazelwood. In fact, no more damage occurred and in fact, there was no chance of additional pollution. If that was a fair summary of the State's evidence so far, and I thought you said that is correct, am I wrong about that?

MR. COLE: Well, there was more damage done by what he did. I mean, you just don't put a tanker on a rock and grind it back and forth for an hour and a half and not be additional damage and that's what everybody's testified to, that there was additional damage that was done.

THE COURT: What witnesses have testified that

there is additional damage...

MR. COLE: Captain Beevers and Mr. Milwee both testified that additional damage was done by going back and forth on that reef.

THE COURT: Has there been any evidence of additional pollution as a result of that?

MR. COLE: Well, I don't think that our expert will say that the additional pollution is caused not by the damage inside, but my understanding it's based on the apertures on top of the deck.

THE COURT: Is there any evidence whatsoever that Captain Hazelwood's efforts, for purposes of this argument, were assuming his efforts were to remove it from the grounding, that those efforts created additional pollution?

MR. COLE: Yes, I believe some evidence...

THE COURT: What is the evidence?

MR. COLE: The evidence is going to be -- or, that has been is that he created additional damage by damaging the longitudinal beams on the keel of this vessel.

THE COURT: What is the evidence that he created additional pollution? Just bring it to my attention.

MR. COLE: The additional pollution is caused

by the risk that he creates by disrupting the longitudinal beams going forward and aft and that is -- and the problem that arises there is that 8:30 in the morning, we've got a low tide coming in and that at that time, there's the greatest chance of this vessel breaking in half and that is what he risked. I mean, Professor Vorus is going to say that, too. The most critical time of this vessel was at 8:30 in the morning at the low tide.

THE COURT: Had he succeeded in getting it off the rock, is that what you're saying?

MR. COLE: No. Just by going back and forth, he risked damaging the bottom of this vessel, which it goes to the stress and stability of the vessel, but the greatest stress that this vessel was going to see was at 8:30 that morning.

THE COURT: Okay, now, Mr. Cole, the elements say that he has to recklessly create a risk of damage to the property of others. Now, what is the property of the others that he risked damage to in this case?

MR. COLE: It's further oil pollution if this vessel breaks up in the morning.

THE COURT: And, your witness is going to testify that by his actions in trying to get this vessel off, that there was a substantial risk that he

could have broken the vessel up even though it couldn't have moved?

MR. COLE: No, he's not going to say that.

THE COURT: Okay, you've answered some of my questions. I'll let you go ahead with your argument, Mr. Cole.

MR. COLE: Well, in addition to that, Judge,...

THE COURT: Now, we're just dealing with the criminal mischief. We're going to get into other charges against Hazelwood in a minute, but right now we're just dealing with criminal mischief.

MR. COLE: As I said before, I think that when you look at Count 1 of the information amending indictment, Professor Vorus should be allowed to testify as to what the risks are of a vessel going over a reef and he has a scenario in this case where the Exxon Valdez sustained the same damage, but came off immediately or within five minutes after the grounding and I believe that that's one of the elements that we have to prove. That the risk is that when a tanker captain runs over a reef, this is the type of damage that can be sustained and this is the type of risk that's involved with operating a tanker.

Second, as I stated earlier before, we believe

that in addition to the impossibility, there's also a mistake of fact here. Captain Hazelwood certainly believed he could take that vessel off the reef and it wasn't for a lack of trying either.

Finally, there is two other things. The defendants have waived this by failing to object earlier than this. Professor Vorus gave his opinion. The time to object was prior to that. He should be allowed to explain his answer. And, finally, what Hazelwood did afterward and what he risked -- Captain Hazelwood did after and what he risked goes to the element of bad judgment, Your Honor. That's one of the things that we have to prove in this case, that he was acting in an impaired state and he was acting not in a conformity of a person because of the impairment of alcohol and one of the ways that we can prove that is to show what he risked by doing this and that's our argument.

THE COURT: All right. Thank you.

(938)

MR. MADSON: Your Honor, at the risk of over-simplifying this, I think the Court has really zeroed right in and targeted the issue squarely on the head, but there's a couple comments I would like to just make with regard to what we're talking about and hopefully

it will put it in perspective. If I, or anybody else here -- let's assume there are 10 weapons on Mr. Cole's table over here. One of them is loaded and I have reason to believe one of them is loaded. If I picked up any one of the 10 and pointed it at somebody and pulled the trigger, there is a substantial risked that result. It was a substantial one considering even though maybe one out of 10 or one out of 100 because of the result that would follow.

But, let's take another example. Let's suppose none of the weapons are loaded, but I don't know that. I have reason to believe that there may be one there. The fact that I grab an unloaded weapon, point it at somebody, no matter what my intent is, does not create this risk of whether it be damage to property, injury or death because it is a non-existent risk and that is exactly what we have here.

The evidence shows, and I think the State's main expert on this, Mr. Milne clearly showed, and he said it last Friday, and he said it here again today, it was impossible to move this vessel off the reef no matter what he did because he had insufficient power to do it. No matter what he intended and how many times apparently in discussions with the State, Mr. Milne had a misconception of what his role was and his opinion

because he kept saying "But, Captain Hazelwood didn't know that." And, of course, we agree with that. It has nothing to do with what he knew or did not know.

Now, if he were charged with intentionally trying to get the vessel off the reef, we wouldn't be here arguing that. Intent crimes are completely different and when you intend to do something that is factually impossible to do it, that doesn't relive you of criminal responsibility or liability. What it does is simply say "Well, because of the result, the crime couldn't occur". Therefore you have attempted to commit the crime, even though it would be impossible to do it. And, that's what the statute Mr. Cole refers to really addresses.

The statute on impossibility or mistake of fact or mistake of law really addressed the defendant's mental state. It does not address the other part of the recklessness statute which is the substantial risk factor. In other words, like, just common sense says that no matter what you do, every time you drive a car, no matter what, it can be argued that you create a certain risk. Recklessness doesn't come into play until that risk raises to that level where it becomes a substantial and unjustifiable one.

Now, if we look at this case in the context of

it was originally three counts as the State originally had it. I don't think there would be any question, but at this stage, or certainly by the end of at the end of the State's evidence, that count would have to be dismissed because there was simply no evidence of a substantial risk which is an element the State must prove.

Now, they're coming in here and saying "Well, it's other things. It goes to the whole total, the whole package." Well, we can remove it from the package and that's what I asked the Court to do in the brief is simply say it cannot be considered in the total circumstances of Captain Hazelwood's judgment in the context of recklessness.

Now, there may be others, but I am just saying with regard to that, it's simply muddies the waters. It allows the jury -- if it would go to the jury and they came back with a decision after the testimony they've heard and nothing else, it would be, I think, serious error because we wouldn't know if the jury based their decision on actions taken after the grounding or not and if they did, they would be totally wrong. So, we have to put it in the context of one count now, but we can still remove that and whatever happened prior to the grounding, the State is still

free to argue. We're not going that far. We're just obviously saying from the State's own evidence here, it was impossible to create the risk after the grounding.

Other than that, I don't know what more we can add, Your Honor. I think the highest Court in the state of New York -- it's certainly not a little magistrate's court somewhere, it's taking exactly the same statute we have word for word and basically saying that in essence, you can't have a substantial risk if it was impossible. Thank you.

MR. COLE: Judge, I just want to add one last thing. There was another risk of what Captain Hazelwood did and that has been shown on this thing.

THE COURT: Risk of damage to the property of others?

MR. COLE: Damage to the vessel, yes.

THE COURT: You were given specific instructions to give us a bill of particulars to set forth what damage it was that you were claiming was damage to the others and specifically, you said it wasn't to the vessel as I understand it. Am I correct about that?

MR. COLE: I'm saying that, but I'm saying that there is a risk and that risk is -- let me just show it to you and this has been testified to. The

vessel was sitting on this rock right here. Captain Hazelwood does not know anything all the way around this vessel and he goes backward and forward. The whole time, the expert, Mr. Milwee sat here and told you that he risked puncturing another hole in that vessel. He risked the engine being damaged; he risked that -- I understand the Bill of Particulars, but he also risked running into a rock here, running into one here, here, here, here and he didn't take soundings and I think that supports more oil lost.

(1220)

THE COURT: At this stage of the proceeding, since there's been so much evidence produced already showing what might have happened had Captain Hazelwood been successful, it would seem to me it would be inappropriate to instruct the jury at this point -- I haven't made up my mind completely, however, I do see the relevance of this evidence to prove the element of under the influence for driving a water craft while under the influence.

The argument could be, and I'm not saying that this is what the facts are, but it's relevant to show under the influence. Mr. Cole might legitimately argue that not taking soundings, trying to move the vessel off the rock is evidence that Captain Hazelwood was

impaired and that he should have known or was under duty to know that by doing this, he did take a chance, had he been successful in capsizing the vessel and that goes to his judgment at the time.

So, I think that goes to prove an element of the misdemeanor operating a water craft under the influence. It may not go to prove that Captain Hazelwood recklessly created a risk of damage to the property of others. I don't know the answer that yet, however I can cure any kind of ambiguity that may be given to the jury with the jury instruction at the completion of the case. I'm going to let the answers come in as proposed. If you have other objection to testimony as it comes in, please make it timely so we can make a timely ruling on it.

But, at this time, I'm going to over rule the defendant's objection and I'm going to deny your motion to strike and any other objection that comes in for that very question or one very similar to it would probably be overruled as well.

Although, Mr. Cole, please be on notice that there is a likelihood that you will not get an instruction that suggests that what could have happened goes to prove an element of criminal mischief. My inclination now, but I'm going to give it more thought,

and I hope that maybe you can give me a little better briefing on this than you have already, is that factual impossibility, physical impossibility, or creating any additional damage, is not evidence in any of the essential elements of the crime of criminal mischief in the fourth degree and I would using the New York cases and law clerk is doing some work on Alaska cases, but I've been unable to find any Alaska cases on point so far.

Let's call the jury back in.

MR. MADSON: Your Honor, I might mention I've tried to find Alaska cases, too, and that's the only case that we could find on this subject.

(Jury present)

THE COURT: How long do you expect the rest of your direct will take?

MR. COLE: Probably an hour.

THE COURT: All right.

(Pause)

Q (Mr. Vorus by Mr. Cole:) Professor Vorus, in coming to the conclusions that you did, what evidence did you rely on?

A Piece by piece?

Q Yeah. Just generally.

A NTSB testimony, salvage plan, various ship

design documents, the longitudinal strength report, "Trim and Stability" booklet. The ship general arrangement, the body plan, the Caleb Brett documents giving the loading and departure, the output of the load master computer program run at the departure condition. There may have been a few others. That's essentially it.

Q Did you have any conversations with Mr. Kunkel?

A Yes.

Q And, how about with Mr. Leitz (ph)?

A Yes. I also saw the vessel in dry dock in San Diego.

Q Well, let's talk about that. When did you visit the Exxon Valdez in San Diego?

A In September, 1989.

Q And, who were you with then?

A You, Mr. Adams, Mr. Milwee, Mr. Greiner.

Q And, had you received any of the evidence at that time, the documents from the State?

A Yes, I had -- perhaps a very limited amount.

Q Now, would you describe for the jury the damage that you observed? Let me...

(Side conversation)

Q Now, Plaintiff's Exhibit 159, is that diagram

that you made?

A Yes, this is a schematic or drawing of -- this shows the plan view of the main deck of the vessel with the compartmentation indicated. It's basically the same drawing you see on the aisle, but without the frame notation.

A These two are just simple views viewing the ship from the bow from the front and what I prepared this for was to sketch on here the damage that I observed in the dry dock in San Diego and the scenario that I expect as to how that was created.

Q Can you show the damage, then, on the top of the diagram there?

A Well, I would like to draw one on the sketch to accompany this. The Exxon Salvage report has attached with it soundings of the area that were taken on March 24th. In addition we have a number of course recreations that show the ship on a 180° heading toward Bligh Reef. It was on a 180° heading.

The Exxon salvage report, this sketch is lifted out of that documentation. It shows a reef line that comes roughly across the path of the ship. This represents a line of shallow

water, representing a ridge in this rock field associated with the territory right off the northern end of Bligh Island.

The ship executed a turn and at a heading of about 250° is where the course recorder shows the deviation in path. I suspect that that's where it first encountered this reef ridge line. It's momentum carried it across that line and in viewing the damage in San Diego, what I saw was the ship encountered that water and that depth there, the vessel is running at a draft at this point of about 56 1/2 feet and if you project that -- now, this was from a view of the damage and of some knowledge of what the water depth was in way of the reef ridge.

It looks like that projecting the profile of the reef on this view, what you saw was some contact at the corner, water opened below much of the starboard side and then a rock coming up under close to the center the line on the starboard side. The damage that that did, was, I believe, it looks like, some scraping, it's hard to tell here because the later encounter was with shallower water, produced more extensive damage, but back in this region, there was some scraping

associated that and mild holing here of the number 4 ballast tank.

In addition to that, you can follow the damage line of this rock. This looked like it was down at a depth of, say, 54 feet, about a two foot interference between the bottom of the ship and the top of rocks. So, say this is 54, and these are rough numbers, what that did was cut a tunnel.

You could see the upset -- could view the ship from the bow -- look down the tunnel. The ship was in the starboard turn. It was turning to the starboard and that rock seem to cut a tunnel, just to upset the plate over most of the length of the ship. You could follow it down the length and it made a trajectory on the bottom that started at the fore peak tank and went down the entire length of the vessel with a trajectory at starboard. It took out number 1 center tank. It took out number 2 center tank and I say "took it out"; it was like taking a pair of scissors and just snipping the bottom plating.

This upset region, the plate was upset and it was opened at the top. This was a width of about six to eight feet, but it was holes through the

tanks. This trajectory followed a course generally toward the starboard side as the ship went into the turn. It took out 2-C, it took out 3-C, it took out 4-C. It took out both 5-C and 5-S and it took out the double bottom, the 10 foot, 11 foot double bottom under the starboard slot tank.

So, I think that first encounter, which is very likely the crew didn't even hear or didn't even feel it, just thundered right over it, took out one, two, three, four, five, six, seven, eight, including the, I think, nine of the 12 tanks.

(1900)

All right, then it progressed into the turn and came on around the heading of something like 305°. This was 180° -- 305°. It later settled back to about 280°. This was a most intense region of that reef from the simple soundings and sketches that Exxon produced.

At that point, the interference was large enough, again projecting on this view, and interference that looks more like that, where now we're set up here on the starboard side perhaps to a 50 to 52 feet, somewhere in that range,

where there is a much more intense interference. And, that interference was such to dissipate the momentum of the vessel and stop it and in doing so, it took out much of the turn here into the bottom.

It did extensive damage in the fore peak and to a one starboard to two starboard -- one starboard, two starboard. This is a ballast tank number 2. It got three starboard and came to rest somewhere in this region on that shallow part of the reef. Here we come across, all right, for the first one, for the second one, the ship stopped in an attitude something like that. It stopped at about 305° and then swung back to something about 280°.

Q Now, would you use the diagram that you've just drawn to explain a little bit about the longitudinal beams that run along the bottom of the vessel?

A All right, we really need to get into strength to deal with that concisely.

Q Well, just explain the layout before you get into that. What is the layout on the bottom?

A You can see the layout better from the drawing on the other aisle. The pink lines here, these

are the bulk heads, the major transverse lines that I have on that sketch. The intermediate transverse lines are frames. They're big frames about as high -- higher than as high as this ceiling, but are open, generally open and these occur at roughly the spacing indicated here and then there's the next level of structure, closely spaced longitudinal with flanges on top that are probably about this high that run longitudinally and passed through all the frames and all the bulk heads.

Q Now, when you were in San Diego, did you notice any damage that would be consistent with tide ballooning, going up and down on the tide?

A Yes, the vessel came to rest locally. This ridge seemed to be rather steep, so it came to rest right in the region here of bulk head 23 and then with the outgoing tide, the ends of the ship, then, tend to droop over. It's like you've got a bar with a fulcrum somewhere in the center and the tendency is for the ends, because of the weight, to droop over and it creates a very stressful situation.

Fortunately this ship, rather than knuckling, breaking, at that point, it crushed, the local

structure crushed, so that the region here where it settled on the grounding was -- you could walk down the length of the bottom and the dry dock, the docking blocks was set at four feet and usually it's very hard to even get underneath. In this case, you could stroll down between longitudinales on either side of your head all the way through this region and then in reaching the region of settlement, this became like a cathedral almost.

It was set up about eight feet. The longitudinales were spread and they were heavily bowed and that represented the settling of the ship on the reef with the first low tide. Did you see any indication of damage where twisting of the heading of the vessel?

(2174)

MR. CHALOS: Objection, Your Honor. Your Honor, I object. Misleading the witness.

MR. COLE: It's a foundational question, Your Honor.

THE COURT: Maybe you can be a little more specific. The form of the question is ambiguous. When you say "twisting", what are you referring to?

Q Did you seen any evidence of damage due to the

vessel changing course through twisting motions?

A If, again, we draw that similar picture, this time working upward from the bottom, the vessel was fairly crushed and distorted in this region where it is settled on the starboard side about 365 feet back. There were to me -- there were signs of rotation due to some cause and that you could generally walk out in any direction from roughly the center of this cathedral and see marks that were perpendicular to radial lines out of that area, just walk out a radial line and much of the plating was missing, but where plating was intact, you could see, I could see scratch marks that were roughly perpendicular to my direction indicating a rotation roughly about at some center in this area.

Q Now, can you determine the cause of that twisting just from the marks, itself?

A No. I should add that there was also -- the longitudinales are, by design, absolutely straight. Nothing is absolutely straight, but that's where they provide their maximum strength as members of the hull structure. They're absolutely straight. When these members become bowed in any direction. They lose their

stiffness and essentially discontinue to provide strength to the hull.

There was an indication of the longitudinal splaying. It was certainly vertical. It was unquestionably vertical where the ship has settled on the reef, but there was also splaying laterally, which could have come from the ship rotating -- a rotation about some fulcrum at this point. It would move the ship's center line, transversely and then in the presence of rocks, a rough bottom contour is catching on these longitudinales and bending them sideways.

Q And, you saw evidence of longitudinales that had been bent in this way?

A Yeah, I think the pictures that had been introduced as evidence confirm that they exist.

Q When was -- well, we can get to that in just a second. You talked about the conclusion that you reached in this matter. Are there any factors that the jury or theories that the jury needs to understand before you explain why the Exxon Valdez would not have floated had it come off that reef?

A Well, buoyancy is they key. If you can understand buoyancy, I think most of this becomes

rather simple. An understanding of simple buoyancy leads to understanding what we did here in terms of strength, stability, and even the spill itself, the flow of flue is into and out of the tanks.

Q Have you made some exhibits to demonstrate this?

A Yes.

MR. COLE: I'm going to move for the admission of what's been marked as Plaintiff's Exhibit 159.

MR. CHALOS: No objection.

THE COURT: It's admitted.

EXHIBIT 159 ADMITTED

(Side conversation)

Q Let's talk about stability. What do we mean by "stability in a vessel"?

A You mean "buoyancy"?

Q Buoyancy.

A Well, I would like to illustrate this with a very simple example. This may be unnecessary and I don't want to insult you with this, but I think if you'll bear with me for just a moment, I think this is the key to understanding the things that I'm going to show you a little later.

(2519)

MR. CHALOS: Your Honor, I don't mean to interrupt, but I think the witness has to be responsive to the question rather than give us a lesson as you would students in class. I think there has to be questions and answers rather than a lecture.

THE COURT: I think our rules, Mr. Chalos, allow an expert o give somewhat of a dissertation a subject, particularly preliminary to -- and I think I'm going to let him do it. Objection overruled.

A I'm going to start with the idea that you have two balls. One is a tennis ball made out of fabric and the other, say, is a cannon ball, muzzle loading cannon ball. They're both the same size, roughly three inches in diameter. And, let's say that we have water and you take the two balls, same size and hold them beneath the surface.

Now, obviously if you let go, one floats and one sinks, but just say for now that you're holding them below the surface. You know that the tennis ball is going to rise. The cannon ball is going to fall, and I mean that's the proof, but there's another way to prove that and that's by the concept of displaced volume. Say these are both the same size, three inches and

they both have the same volume and the volume of a three inch ball is essentially about one cup. It's about eight ounces.

So, the volume -- and when we say "displaced volume", it's the water which occupies the same space as this material, so it's the volume of a three inch spear.

All right, the volume here in both cases is about eight ounces, volume ounces and the weight of eight ounces of water is about a half a pound. So, the weight of that volume is about one half pound. Now, the fact is, if this weight is greater than the weight of the ball, it's greater than the weight of the ball, then the object floats, rises to the surface. If this weight is less than the weight of the object, the object sinks.

Now, I think it's obvious that a fabric tennis ball full of air weighs less than a half a pound. So, the tennis ball rises and the cannon ball sinks once you release the two. The half a pound is the buoyancy. That's the buoyancy of a submerged ball. It's the weight of the volume displaced by the objects.

Now, let's forget the cannon ball. We're

interested in bodies that float and go to the surface with the tennis ball. The tennis ball goes to the surface and it floats there. It's got to have the new displaced volume in this configuration. The displaced volume, now, the volume, the water displaced by this object is the volume of this little cup. It's not just a cup of water -- all right, and the weight of that cup of water, which is the volume of the ball below the surface, that's it's displaced volume, the weight of that cup of water is its buoyancy and it is exactly equal to the weight of the ball.

The weight of the ball, if the ball is heavy or displaces more water, the weight of that water is heavier equal to the heavier weight of the ball. If the ball is lighter, it displaces less volume. A lighter weight equal to the lighter weight of the ball.

Q So, your little half circle there, if that was filled up with water, the half circle there,...

A Yeah.

Q That would then be equal to -- the weight of that half a cup of water would be equal to the weight of your tennis balls.

A That's right. All right,...

Q Go ahead. I was going to ask you what about the center of gravity?

A Okay, that's the next thing. You've got to go from buoyancy now to talk about where the buoyancy acts. It will be centered. We need the concept of the center of gravity which I think most people are familiar with. Low center of gravity, high center of gravity. It's just a center of your weight.

So, center of gravity for the tennis ball, since this absolutely symmetric, would be in the center of the ball. All right, so draw the center of gravity. This represents "G" and I'll refer to this as "G". All right, acting through "G" is the way of the ball at the "W". Now, center of buoyancy; center of buoyancy is nothing more than the center of gravity of the displaced volume.

All right, this is the displaced volume. That displaced volume has a center which is somewhere on the axis because it's symmetrical, but somewhere below the surface. Just a geometric center of that space. That's known as "B".

Q What's "B"?

A "B" is represents center of buoyancy. It's

center of buoyancy and center of gravity. Center of buoyancy being the center of gravity of the displaced volume. All right, now the weight, you see, also then -- since buoyancy, the magnitude of buoyancy is equal to the weight, you see, also then -- since the magnitude of buoyancy is equal to the weight, then you've got the weight of the object acting down through the center of gravity and you also have the weight of the object acting up through the center of buoyancy because the buoyancy is equal to the weight.

All right. That represents the condition where the ball is stable and it's the condition for -- and we'll define stability, but the center of buoyancy must lie directly above the center of gravity for any object in order for the object to be stationary. If a center of gravity is not directly above the center of buoyancy on the same line, this will rotate.

Q When you say rotate, it will start to twist, is that right?

A It'll turn. If you had a configuration, for example, where the center of gravity was over here and the center of buoyancy was here, you've got the weight acting through both, but this is

coming down and that's going up, so it tends to twist it and it will seek an equilibrium state. The state where these two always line up one on top of the other.

Q What forces are there that push this ball up again? What is happening?

A Well, it's the pressure of the water which holds it up, but that's represented in this buoyant volume.

Q Now, what happens now when they become disaligned?

A All right, for this case, for a sphere, you can put it in any position you want. I can take the ball and say rotate it. Rotate it and as I rotate -- I can -- it will rotate, but as it rotates, the center of gravity is rotating about the center of gravity. About the center of the ball, which is the center of gravity, that stays in the same place, but as it rotates, the center of buoyancy rotates with it, so the center of buoyancy always stays onto the center of gravity and I can put the ball, turn it into any position that I want and it will stay there.

Now, that's not generally true. I mean, this is a very special case because of the symmetry of

the ball and that's generally not the case with the ship.

Q Why is the ship different?

A The ship is different in two respects. One the center of gravity is not at the axis of rotation. This shows a ship which has been inclined and remember the center of buoyancy, "B", both of these arrows represent the magnitude of the weight of the ship, but the center of buoyancy is the center on this displace volume and you can see that that center is shifted to one side.

All right, the center of gravity is along the axis. Now, the ship has been rotated over, but you can see that in this configuration with the center of gravity below the axis of rotation -- the axis of rotation is where the vertical line through the center of buoyancy intersects the axis of the ship. If the center of gravity is below that axis of rotation, the ship will rotate back to upright because you would expect it to.

Q When you say "rotate back", in other words, it will right itself?

A The action of these two forces is to rotate it back toward upright and that's what you would

expect it to do. You know, you rock your boat. When it stops rocking, it's sitting upright again. All right, but that doesn't have to be the case as indicated here on the lower picture.

Imagine moving the center of gravity. The center of gravity, now, will be symmetric. It will be on the axis with the ship because we're assuming that the weight's the same on both sides at this point. That's not necessarily true if one side floods for example.

But, for the symmetric case, as a center of gravity, you stack more weight on the deck, for example. The center of gravity moves up this line. If it ever crosses the versicle line through the center of buoyancy, in other words, if it gets above the axis of rotation of the ship, then these two forces act to rotate it in the direction of the angle.

Q So, instead of righting itself back up, it continues to roll?

A It capsizes and turns over. That's stability. Let me give you another example of that.

Q Go ahead.

(3199)

A I think one that maybe you can relate to -- a

log roller or a lumberjack. Think of the ball, now. This ball that we drew is now a log. The log is cylindrical, so instead of looking at a sphere, you're looking in the end of a cylinder. A ship is more or less cylindrical. If the log roller is not a board, then this looks very much like the sphere. It floats at some depth. The center of gravity is in the middle, is in the center and the center of gravity -- or the center of buoyancy is some place below and you've got the action of buoyancy and weight lined up together on the same versicle line is stable.

But, now let the log roller climb aboard and the center of gravity goes way up. If you put the log roller on, the center of gravity of the system now goes up, say, to somewhere here and if his balance is not precise, and he leans one way, then that log tends to rotate. It tends to rotate, so that now the log roller, the center of buoyancy is still in the same place, but the center of gravity is now off to one side and the weight is down and I think you can clearly see that now because the weight and the buoyancy are not in the same vertical line, that the log is going to tend to roll over, capsize.

The center of gravity is above the axis of rotation. So, in order to correct that, the log roller has to start running. You have to do something to get his center of gravity back above the center of buoyancy to stabilize the system.

So, if he starts running to try to gain his center of gravity back up, up over the center of buoyancy, so that the log will stop rolling, in this case, he's gone too far and it will be rolling back the other way. But, if he can't run fast enough, or respond quickly enough to this, he gets thrown in the water.

Q Now, in the examples that you've given, does it make a difference when you have a liquid cargo like in the tankers here?

A Yes, that is a case of center of gravity movement. Let me say first of all that, you know, the idea of low center of gravity, everybody skiing for example, you get your stoop back and get the center of gravity low. High centers of gravity are bad.

One other demonstration here, this thing caught my eye and it looks like a good candidate for capsizing. The axis of rotation is fixed here at this fulcrum.

A The center of gravity, you can look at it, and it would appear to be below the axis of rotation and this is stable rocked back and forth and aside from friction that exists in the mechanism here, it tends to right itself. I would turn it upside down so that the center of gravity demonstrations often don't work. The center of gravity is above the axis of rotation and let it go to give it a start.

Well, that's friction that's keeping it upright. It tends to turn over and turn back into the stable position, which, if this was up, if this was the attitude that you were trying to maintain, this device would be unstable in that condition and would capsize.

Q Now, we were talking about what happens when a vessel, a ship, has a liquid cargo. Does that further complicate stability questions?

A We talked so far about the center of gravity rising above the axis of rotation. I think it's really best to think of the two versicle lines and where they lie relative to one another. If you've got a vertical line through the center of buoyancy, a vertical line through the center of gravity, and for the vessel to be stable, those

lines have to be the same. They have to be coincident, or again, the stable configuration.

Now, this is stable because the vertical lines through the center of buoyancy lies outside of that though the center of gravity, which tends to make it rotate back into the condition where the two lines are the same. All right, the condition here, the vertical line through the center of gravity lies outside of the line through the center of buoyancy and that tends to make it rotate so the lines are displaced further and further apart and it has to turn upside down in order to get the lines to aline.

All right, now, you can see that anything that moves the center of gravity further outside the center of buoyancy in this case tends toward greater instability. Anything that moves the center of buoyancy toward the center of gravity means greater stability.

(3610)

Now, you can see a tanker has an advantage with it's very boxy section in regard to the movement of the center of buoyancy. In other words, if this was circular, you don't get much movement of the center of buoyancy, but with

these very sharp corners, the center of this displaced volume tends to move to the outside which is good. It's like a sumo wrestler spreading his legs apart.

On the other hand, liquid cargos, for example, if this is carrying liquid, when the vessel rolls to one side, the liquid will pile up on that side, which tends to move the center of gravity in the wrong way outside the center of buoyancy. So, free surfaces, liquid cargos present a problem with tankers. And, of course, you can see that if you carry more weight, if the vessel is holed, and you're taking on water on one side, then that further shifts the center of gravity outside of the center of buoyancy, not only perhaps raising the "CG", leading to a more unstable situation that can lead to capsizing.

Q So, we've talked a little bit about stability, what is the next concept that we need to understand?

A It's really the same mechanics except we've got to not only talk about the -- we talked about buoyancy where buoyancy and gravity act and now you need to recognize that that really distributes it. They don't really act at points.

That they're distributed over some dimension. What I'm doing now is looking at the ship rather than from the end, from the side and what this represents, this is just a simple schematic, these curves represent the distributions of weight and buoyancy. I mean, the fact that the ship has length, the weight is not at a point that distributed over the entire length from stern to bow.

Q You mean it's heavier in some spots than it is in others?

A Yeah. This vertical distance represents the weight at any point and you can see the ship trims down to essentially no weight at the ends and then as it broadens, carrying more weight in this case in the center, the weight goes up and there would be an engine room here, which takes some weight out. So, but the area, the sum of all these weights represents "W", what we've been calling "W" and in fact, the area of that curve is the weight, the total weight if you take that area.

Q All right, now, the other curve that's superimposed here is the buoyancy distribution. The buoyancy, similarly is distributed over the

length. It will be smaller where the displaced volume is smaller, which will be at the ends and it will be largest where the vessel displaces more volume near the center.

All right, and likewise, the total area under the buoyancy curve is the total buoyancy and the total weight and the total buoyancy have to be the same so the areas under these two curves have to be the same.

Q What happens then when they're not, certain areas of the vessel?

A Then, we have stress. If they were exactly the same, point for point, there would be not stress of the type that we're primarily concerned about. The stress occurs because these two curves are not the same point for point. The fact, you can see here that in the middle for this particular case, it says that buoyancy is larger than weight in the middle, which tends to lift the vessel up locally in the middle.

However, the weight is greater than the buoyancy on the ends, so it tends to sag off on the ends which tends to bend it. I mean, the weights in the middle, it's, you know, pushing down on the ends. It's tending to bend this as a

beam. That's called a "hogging". That's a hogging moment where it hogs up in the middle.

A tanker can be that. It's typically more the other situation where it sags in the middle, where it's more weight over buoyancy in the middle and buoyancy over weight on the ends. It can be either. But, it's the difference in weight and buoyancy distributions that produce the stress of primary concern. The stress that essentially knuckles or breaks the ship.

Q How do waves affect this?

A It's just, again, a simple extension of the same argument. You can view the wave as just a change in the buoyancy, but this represents a waive and it's freezing the picture in time. At some other time, the wave will be somewhere else. But, here there's been a waive placed here, so that we've taken buoyancy out of the middle with the wave. So, here, we tend to get buoyancy over weight on the end and it sags down in the middle trying to fill the space created by the trough of the wave.

A half or quarter wave length, half a wave length later, this trough is now reversed. It's in the middle, tending to make it hog. Lifted in

the middle and it falls off on the ends supporting what we have here just in still water without waves, so that the ship as it traverses waves is continuously going like that.

Q These are these tankers. Even though they're made out of steel, they're bending up and down?

A Well, any ship, but particularly these tankers. It was thought that these ships could never be built in these sizes because the big waves and storm seas are about 1,000 feet long, which is typically the lengths of these ships and this represents a wave which has the length of the ship. If the waves are longer than that or much shorter, they don't stress it as severely.

The way this was accomplished was to move the superstructure back to the stern and get a long continuous parallel mid-section with all this longitudinal material. The ships had to be reconfigured, these ships in order to handle stresses associated with this with practical construction methods.

Q What is the ultimate consequence if a ship gets over stressed in a hogging or sagging motion?

A Well, it can fracture. The buckling of either

the deck or the bottom probably occurs first, depending on whether it's hogging or sagging and then knocking. It just takes, you know, from that set, and possibly fracture beyond that.

Q You indicated that the longitudinales were designed to help. How do the longitudinal beams running down the length of the vessel help prevent this?

(Tape: C-3653)

(000)

A Say, that we have a hogging situation, I think that was the one that was most critical with regard to this case. Where the bending of the vessel is up in the middle, down on the ends, what that tends to do is stretch the deck. You're stretching -- this is being stretched out. In other words, because this is bending on an arc, this has to become longer and is being stretched. By the same token, the bottom is being compressed, all right, so there is compression on the bottom.

So, these longitudinales that we talk about, if this is a web and this is a web, these are the transverse members that we showed on this sketch. The transverse webs that run between the bulk

heads and this is a longitudinal. This might be 20 feet. These are, you know, 10, 12 feet high.

This member from here is being pushed. It's being pushed and all of them are being pushed together by the action of the this hogging. If this member is absolutely straight, it's stiff in compression, but if it has some initial bow to it, if it's already bowed, then to press on it in a bowed or distorted condition, it has no stiffness. It doesn't really contribute to resisting the stress associated with this hog.

In other words, if this is bowed up, initially, when you bring the compression on, it bows up some more. It just has very little rigidity. So, these members become ineffective in resisting stress once they're subjected to these out of plan deformations.

Q Isn't that what happens when a vessel hits rocks and tears out the bottom of it's...

A Some of it is bound to occur.

Q Now, we've talked about two things. What is the final concept that the jury needs to understand to understand how this vessel reacts if afloat?

A All right, it's to take the same concept of

buoyancy and stability and apply it to the tanks themselves, the tanks with holes in the bottoms.

I would like to consider this just as a tank. It's not necessarily at this point a tank and a ship, but it's just a tank that -- oops, that's the wrong one. It's an open tank with no top and you take this tank, it has a depth, "D", and this is what we've been calling draft. It's the distance from the waterline to the bottom of the vessel, but this is the tank and you put water in it up to the level of the surface, exactly equal to the level of the surface. So, that the displaced volume -- the displaced volume now is volume of this vessel below the waterline. That is exactly equal to the weight of the water in the tank, by definition.

Now, take the bottom away and what happens?

Q When you say "take the bottom away", you mean...

A Remove the bottom. These dotted lines mean that the bottom has been taken out. Nothing happens all right because the water inside -- this just becomes an open cylinder, a rectangle and the water is stable. The water stays at that level if I take the bottom away.

All right. Now, I go to the next picture and let's say that I want to put a weight of oil in the tank equal to that original weight of water. Now, oil weighs less than water, so it would take a bigger volume of oil to get the same weight. In other words, my displacement is the same so in the concept of displacement, it takes a bigger volume of oil to equal the same weight.

So, I take the water out and put the oil in and it rises up above the level of the surface outside because it's a bigger volume for the same weight. Now, take the bottom away and what happens? Nothing.

See, the concept, -- people are under the misconception that an oil spill is like the bottom falling out of the bucket, that the bottom gets a hole in it and the oil gushes out. That doesn't happen. It doesn't empty. It will go down to level for which the water displaced is equal to the weight of the oil in the tank and it stays there. Now, there may be some seepage and some washing back and forth in this case, but basically the level is established.

Q Well, what happens then if you have more oil -- the weight of the oil in your tank is greater

than the weight of the water displaced?

A Well, I take "O" here -- "O" represents -- this is "O" oil. This is zero. Take zero, zero level is this equilibrium level. The amount of oil for which I can take the bottom away an nothing happens. So, I put my oil in that and take the bottom away, and the oil runs out -- will go out the bottom until it reaches the level "O" for which the system is an equilibrium and then it stops.

Q Well, what happens then if oil is below?

A All right, you put less in than "O", which is equilibrium, take the bottom away. Water comes in the tank. Water will come in under the oil and float the oil up to a level so that the total weight of the water plus the oil is again equal to the weight of the displaced volume of water. So, in this case, the oil won't go quite back up to level "O".

Q Now, does it make a difference that in your hypothetical that it's an open atmosphere? What would happen if you had it closed? Oh, you've got another couple there. What are these?

A It demonstrates the same thing. Again, level "O" is the level for which there is no bottom.

Oil is above the level of the water in an equilibrium. Now imagine the tide falling. If the tide falls a certain amount, the level of the water, the level outside, drops and oil runs out. But, oil runs out only until it reaches a new level above the new waterline and then it stops. On the other hand, the ship is sinking, so that the waterline is rising relative to the tank. The waterline has come up. This is the equilibrium level and no bottom.

If the waterline rises, which could either be a rising tide or a sinking ship, then again, water would come back underneath the oil and float the system up until we reached a new equilibrium level of oil above the original one and above the new waterline.

Q Now, what happens when we put a top on?

A All right, now if you go to the equilibrium case, and the bottom is in overfill, "O" is equilibrium so that if I take the bottom out, it stays put; nothing happens. Put the bottom back on, put some more oil in, but put a top on, and assume that the top is airtight, then take the bottom away. Now, before when we took the bottom away with no top, the oil ran out, but the top is

airtight. What happens? Nothing.

There may be a little bit of movement because of just the compressibility of air, but generally in order for oil to flow out of the bottom, it has to be replaced by an equal volume of air in the top and that if air can't get into the top, there's no way oil can run out of the bottom. The system is locked, it's got a vent lock. It tends to draw a vacuum. The weight of this oil is hanging on the air and it's creating a vacuum in the air.

(430)

It's what we started calling the "soda straw system for oil spill controls". Just vent lock the tops of the tanks, and oil can't go out the bottoms. You know, a soda straw, you fill a soda straw with liquid and put your thumb over the top and it doesn't go anywhere. Well, that's what this is.

On the other hand, if you cut a small hole in the top, and overfill it with oil above "O", take the bottom away, now you let air come into the top of the tank so that oil can go out the bottom, but slowly. At this point, we haven't considered how fast any of these things occur,

but it takes time for this to happen and the smaller this hole, the longer it takes for the oil to leak out and reach the level "O". It will ultimately get there. The smaller the hole, the longer the time will be required for the level to drop, the oil to leak out the bottom and to achieve the level of equilibrium state.

Last point, go to the same case, but now instead of removing the bottom entirely, only take part of the bottom out, but such that the area removed in the bottom is still much greater than the area of the little hole in the top. If that's the case, these two situations are essentially the same. That the rate, in terms of rate, they're certainly the same -- they're both going to reach the same level, but the rate at which it reaches the equilibrium level is controlled by the small hole.

In this particular case, as we'll see, this is what I wanted I to do to go on to explain the analysis that we've done of the Valdez, that that's the case. That we've got holes both in the tops and in the bottoms of the tanks, but the holes in the tops are much smaller than the holes in the bottoms and in fact, the spill is

controlled from above and not from below.

Q So, what you're saying is it's not the size of the damage that's done to the bottom that controls the oil loss or water gain, but rather the size of the openings up above?

A It's the vents in the top. It's important the tanks have to be holed, but the sizes of the holes in the bottom almost no matter how big they are, in this particular case, are a lot bigger than the vents in the tops.

Q Did you develop a computer program to demonstrate this?

A Yes.

Q How did you do that?

A Well, we used something called the Darcy Equation. It's like pressure in a pipe. You've got pressures at two ends of a pipe and if they're different, there's a flow that occurs through the pipe. Well, this whole thing could viewed simplistically as a big pipe all the way from the ends of these vents, the inert gas system and the vents and the ballast tanks from where they're exposed to atmosphere, to the bottoms of the tanks where they're exposed to the water pressure due to surface elevation. It can

be looked at as one big pipe and you just calculate -- can predict the flow rates through that system.

Q Do you have a way of predicting the loss of the oil that would have occurred on this vessel when it was on the reef?

A That was the first part of the program -- was a flow model to fix the attitude of the ship and fix the contents in terms of oil and water at some initial state and then start time and predict the flow rates out of an into the oil tanks and the flow of water into the ballast tanks with time.

Q And, have you done a graph to show that?

MR. CHALOS: Your Honor, can we take a break at some point? We're coming up to about quarter after 12:00.

THE COURT: Yeah, I think that's a good idea. We'll take our break, too, ladies and gentlemen. Don't discuss the matter among yourselves or form or express any opinions. We'll take about 10 or 15 minutes.

THE CLERK: Please rise. This court stands in recess subject to call.

(631)

(Off record - 12:11 p.m.)

(On record - 12:36 p.m.)

THE CLERK: This court now resumes its session.

THE CLERK: Resume now, Mr. Cole.

Q (Mr. Vorus by Mr. Cole:) Professor Vorus, when we took our break, we were talking about the computer program that you used to predict the oil loss. The Exhibit that's right there, Plaintiff's Exhibit 166, is that a graph that you designed to help explain the oil loss and rate of loss?

A It's a graph of the output of the computer program that was written to predict the oil loss, water gain versus time. This was a program that was developed -- you have to specify the attitude of the vessel. Here, that was specified as a departure condition. The departure draft...

Q Which was about 56 point...

A 56.3 feet. Essentially zero list or heel, which is the rotation and I think a slight trim by the stern and this is a plot versus time. This lower scale here is the time in minutes after grounding. "T" equals zero is the time that the tanks are opened up. The ship is now fixed on the reef and one of these curves is the

rate of oil loss predicted by that program and barrels per hour.

Now, you need to multiply -- if you want to use this as the loss rate barrels per hour, you have to multiply this number by one million. So, it starts off at the initial time losing oil at a rate -- this is the total tanks, losing oil at a rate of about 1/2 million barrels per hour. A barrel being 42 gallons.

The second curve is the cumulative oil loss. This is the oil loss versus time after the holes are open with the vessel fixed in position as if it were on the reef, as existed approximately at the time. The numbers here is predicting about one and a half -- here, for the cumulative oil loss, this scale has to be multiplied by 100,000, so it indicates two things. One, that the spill is over, at least initially, in about 18 to 20 minutes. That those tanks are all or about 80 feet -- 75 to 80 feet of oil. It was 85% loaded and they're equilibrium position, the point zero that I talked about is about 10% above the draft of the vessel. So, 62 feet.

So, the tanks come down from 75 to 80 feet, depending on the tank, down to around to 62 feet

and then they stop and that takes about less than 20 minutes according to this calculation. The prediction is at that time, that we've lost about 160,000 barrels. Now, Mr. Kunkel's testimony cited numbers like 140,000 losing 10 to 15 feet of oil. This maybe is a little higher, but certainly in the same range.

At this time, we've lost about 12% of the cargo and no doubt the rest of it, the 25% totally, the other half, most of that occurred when the tide went out. The tide went out, you drop another 12 feet, the goes down, the oil runs out and that constitutes the bulk of the spill. After the first low tide, no doubt there was seepage back and forth, but not major change in oil.

Q So, any bubbling that people would have seen as they came up, would have been like, say, 3:30, 4:00, 5:00 in the morning, that would have been as a consequence of the low tide and the water level going down and at the same time, the oil level correspondingly going down and the vessel losing more oil?

A Yeah, following with the tide.

Q Well, what happens next, then? Well, you've

lost oil, what else is happening at the same time?

A All right, this is the graph after 30 minutes. This one is to 18 minutes. This is the same, essentially the same graph in that this is the cumulative oil loss as on the preceding graph and now instead of barrels, we're in tons. This is thousands of tons of oil lost versus time after 30 minutes. You can again see that the oil loss is stabilized at about, you know, 16 to 17 minutes.

The other curve is the rate of water gained. We've got the fore peak tank, which was initially empty. The two ballast tanks on the starboard side were initially empty. So, this represents essentially water, the net water coming into those tanks versus time. Again, after 30 minutes, the oil is stabilized, but the water is continuing to increase and the reason the rates are different is because of the size of the small hole on the tops of the tanks.

Q Well, now what you've been referring to is Plaintiff's Exhibit 165, is that correct?

A Yes.

Q Now, do you have a diagram there that will

help explain the difference between the oil loss and the water gain?

A All right, this is Exhibit 168. What you are looking at here is again the same plan view of the main deck that we've had up here on several occasions for different reason. "BT" represents ballast tank vent system. Now the ballast tanks on this ship are the fore peak tank. It's the tank right in the front just forward of the forward bulk head. Then, number 2 starboard is a ballast tank that was initially empty and number 4 starboard is a ballast tank that was initially empty.

All right, now all three of these tanks were holed during the accident. You'll notice the vents here. The fore peak tank has to 10 inch vents and one 2 1/2 and that's a good bit of area. As a result of that, the fore peak tank stays up pretty well with the waterline. There is some lag. In other words, there is some time required for the changes to occur as controlled by these vents, but the fore peak tank is relatively open. In other words, the openings in the top are relatively large. So, things occur more quickly there.

Q Wait a minute, when you say "things occur", does that mean water is coming in from...

A Water fill occurs more rapidly in the fore peak tank than it does in these two ballast tanks because the vents in the top are larger. They can pass more air more rapidly.

Q Which way is the air going, in or out?

A The air is coming out of the vents as water comes in the bottom. This is really the reverse situation from the one I demonstrated. Oil will go out. This is the system down here that controls the oil loss. Oil goes out, air has to come in through this system here. As water comes in, air has to come out. It's pushed out through these vents.

Q So, would it be fair to say that the water gained in the fore peak is relatively quick?

A The fore peak gains water fasts. Relatively fast compared to tanks 2 and 4. These have only one six inch and one four inch vent in each tank. It's the same with both of them. All right and these -- the four and the six vents in these tanks are much more constricted, in fact, then the vents associated with the cargo tanks.

Q Now, before you get into that, you're assuming

now that each one of these tanks is like a separate little container, is that correct?

A Yes.

Q Well, like, when you were talking about how the water and the oil comes in in your previous example, where instead of having one tank, we're talking about 15 or 16 tanks?

A That's right. They're all gaining water or losing oil at the same time depending on the constriction on the top, which allows the flow to occur and then the curves I've just shown, with cumulative amounts of oil and water are lost or gained with time.

Q Now, would you explain to the jury why it is that oil is lost faster -- what type of vents do we have on the cargo holding tanks?

A All right, this is the inert gas system that you've heard about that keeps the inert atmosphere on the tanks to avoid explosion.

There's a 24 inch diameter of main that comes out of the engine room. This is flue gas. The exhaust gas out of the boiler that's washed and it's pushed through this 24 inch diameter pipe.

On that 24 inch diameter line are pressure

vacuum relief valves that they lift if the pressure exceeds about 3 psi to relieve the gas. And they open the vacuum if the gauge pressure, the pressure below atmosphere, is about 1 pound per square inch.

All right. In addition, there's what's called the liquor breaker, which is basically a "U" pipe with liquid in it, that allows for a high volume of flow of air or gas. This is protection of the system and protection of the tanks.

The liquid can be either blown out or sucked out. And, when it is, by vacuum or by over pressure, at essentially those same settings, when that occurs, the system is open to the atmosphere.

The mechanical pressure vacuum relief valves will reseat. The pressure drops within those limits of minus 1 to plus 2 3/4, they will reseat. But the liquid breaker won't. It has to be recharged with a water-glycol solution in order to secure the system.

All right. Then, off the 24 inch main, we have these branch pipes of the 12 inch lines going to each of the cargo tanks.

At each of the tank access openings, there's

an additional pressure vacuum valve, mechanically actuated on a 4 inch line.

All right. The valves in this system, there are valves here at just up stream in the branches at the cargo access hatches. But the venting for this system then is the mechanical pressure vacuum relief valves, this is the cargo tanks, to let air in on 4 inch lines at the tank accesses. That's the first level.

Then we've got the pressure vacuum relief valves on the 24 inch main, as well as the liquid breaker. And onto the vacuums created by that bottom opening, all of these valves will open very quickly after the spill; after the opening occurred.

Q When the opening occurred and the oil started to leave the vessel, how fast is this air coming in to these tanks?

A Well, up here, because of the high constriction in the vents on the ballast tanks, it's a choke flow. I mean, it's sonic velocity in the throats or on the balls. No matter what the pressure difference across these vents is initially, it's a sonic flow; speed of sound of the air...

Q And would it be making noise?

A ...through those vents. I'm sure it would be making a screaming.

Q Based on this, you were able to reach the diagram of the flow rates of water in and out, is that correct?

A That's right. These really control the rate at which oil goes out these two systems. It really doesn't matter what's happened to the bottom.

I mean, the holes, they are so much larger than, you know, the equivalence of 4 and 6 inch pipes in the constrictions of this system, that these two control, absolutely control, the rate at which water comes in and oil goes out almost independently of the size of the holes in the bottom.

Q And your program was designed to take that into consideration, is that correct?

A That's right. These systems are both modeled in that program.

Q You had a second part of your computer program.

A All right, this...

Q Go ahead.

A This program was then coupled, what you see to this point is that the ship's attitude is fixed. The tanks are opened and the flows are allowed to occur. And we predict what happens in time.

We then took that program and coupled it to a ship hydrostatics program. In that program, for a given loading of the tanks, will predict its attitude. This program predicts the loading in the tanks at any time.

The other program predicts the change and attitude of the ship with the change in loading.

All right. So this previous program changes the loading. That goes into the hydrostatics program, which changes the attitude of the ship. The attitude of the ship then comes back to this program and that predicts new flow rates and changes in loading.

That goes back to the hydrostatics program to predict the new attitude of the ship and those two are flip-flopped, sequentially followed in time together, to predict what would have happened had the ship then come free of the reef after some starting time.

Q Now, let's take an example. Did you run one when the vessel had come off ten minutes after it

initially hit the reef?

And, before I ask you that, it could have been, it just refloated off by its own. Is that correct?

A We ran, once we got these programs written and working, we ran a number of different scenarios. As to when it comes off is important because that becomes the initial condition for which a ship attitude starts changing, which in turn changes the rates at which water comes on and oil goes off.

But we did one for which the ship is holed, but never stopped. And then we did it for different starting times on the reef. In other words, used the preceding curves and went to a particular time on those. This is ten minutes. And that became the initial condition then at which the ship is refloated at that time.

And then the flow and the vessel attitude change is allowed to progress in time out to either a new equilibrium condition or...

Q An equilibrium condition, meaning what?

A Equilibrium condition meaning that the ship remains floating and up-rights. Or the consequence, the alternative, is capsizing or

sinking or both.

Q And, if the vessel refloats after ten minutes after the grounding, what would have happened?

MR. CHALOS: Objection, Your Honor. Speculation. It's not probative. Irrelevant.

THE COURT: Well, consistent with my earlier ruling, I'm going to overrule the objection. We'll take this matter up at a later time. You may answer the question.

A Well, this assumes the vessel came off the reef. It was allowed to lose oil and gain water for ten minutes, according to the preceding curves. And at ten minutes it was kicked off or set adrift, and coupled with the other program, allowing for attitude changes, this is the oil loss continuing out to 75 minutes.

Now, at this point, as it comes off, and I think it may be appropriate at this point to put up the other...

Q Now, you're referring to plaintiff's Exhibit 169.

A What this is, this is a profile view of the ship showing the transverse bulkheads which separate the tanks. This is the bow fore peak. This is along the center line.

This view is right down the center of the ship. So, all you're seeing, you're seeing the fore peak tank then all the center oil tanks.

See, oil is red. The water's blue.

Then the figures down below are sections. This section goes with this tank. In other words, looking in from the end, so that this level is the level right in the middle. And then this is a port tank, which is full. And then this is a starboard tank corresponding to number 5.

(1509)

All right. This section, likewise, is 4. This is a section through 3. The section through 2. The section 1. The section through the fore peak.

All right. With red being oil at this particular time and blue being water, now, this time is ten minutes. In other words, it's been sitting on the reef for ten minutes, and this is the configuration that it's reached.

You'll note that there's water indicated under number 4 center tank. Now, that's because that tank was loaded to about 60 feet initially at departure at the terminal.

The equilibrium of point zero for the tank is about 62 feet. So this predicts that, when that tank was open, rather than oil going out, water came in in a small amount.

Now, I should say that the precise position of the ship on the reef is somewhat indeterminate. I assumed that it was fixed on the reef at the departure draft. It could have raised slightly on the starboard side. I don't think it makes significant difference to the outcome of this exercise.

All right. So this is after ten minutes; showing the levels of oil in the tanks. It's been freed and the first movement is a slight -- here it changes draft. It comes up. It rises up slightly because it's lost weight, net, and it heels, rotates slightly to port. You can see it's rotated in this direction, opposite to the direction of the ground as it came off.

Q Why did it heel to port?

A Because it had lost more weight on the starboard side than it gained.

Q The weight of the oil that it had lost had not been replaced...

A That exceeded the water that had been lost.

Q Okay.

A All right. That's this point. And you can see that, as it went over to port, it dropped a little more oil. The oil rate went back up and then stabilized again in less than 30 minutes.

At that point it's lost 17% of the cargo. Now, the total spill we know is 25. About 12% was lost during the going out tide as it stay on the reef.

This says that, had it come free, we would have come free, the oil would have restabilized at 17% cargo loss.

Now, some people have -- I've heard rumor that some have claimed that the best thing that could have been done here was to free the ship. Float the ship and to minimize the spill, because then it doesn't have to face that going out tide on the reef. And that's true. Seventeen percent versus 25% had it stayed afloat.

But the prediction here is that, after 75 minutes, it capsizes. Turns over. And the displacement at that time is up around 260,000 tons.

Q Now, do you have the next time period?

A The remainder of these charts are the attitude

of the ship every 15 minutes from the ten minute start out to capsize.

Q What's the next one?

A All right. This is...

Q And that has been identified as 170.

A This is at 15 minutes. The times here are different. This is 15 minutes from ten. So this is at 25. This picture corresponds to 25 minutes.

The oil has restabilized. There's no more oil spilling.

About all that's happened to the attitude of the ship during this time is a rotation to starboard. There's very little change in draft. There's very little trim change.

(1730)

But in that first 15 minutes after freedom, our program predicts that we get a roll back over to starboard. Went to port first and then back to starboard. It's at three and a half degrees.

Q Why does it go to starboard?

A It goes to starboard now because the oil has stopped and we're now picking up water in the ballast tanks. We've ceased losing oil on the starboard side. We're taking on water in the

starboard side ballast tanks and she begins to go over toward the starboard side.

You can see the fore peak tank is staying pretty much with the attitude of the vessel. It's full.

The ballast tanks are lagging way behind because of the constrictions in the vents on the deck. In other words, they would tend to come up to water line because that's water. But because of a lag in the system associated with the constriction of the vents, the ballast tanks stay somewhat behind the motion.

Q Now, 30 minutes after. Do you have one for that?

A At 30 minutes the heel line goes up to 11 degrees. It's now going down by the stern. It's down by the bow. The bow is dropping down. It's at almost one degree. The draft has increased to 60 feet. It's taken a very noticeable heel angle to starboard. Water is now coming back under all the oil tanks.

You see, as the vessel drops, both to starboard and down by the bow, that creates a higher draft. You know? The ship is sinking. So that makes oil come back -- water come back

under the oil and add more weight. And more weight makes it sink further. And the deeper draft makes more water come aboard. And it's happening throughout, now, the ruptured tanks.

But the effect is to make the bow go down and the ship list to starboard.

Q How does that affect the ship's stability as you get the greater weight on the starboard side?

A Well, if you remember the lesson; the center of gravity now is moving further and further outside of the versicle line to the center of buoyancy, which is tending toward a capsizing situation. And instability.

Q That was Exhibit 171?

A Yeah. That's 30 minutes, which is actually 40 minutes on this graph.

Q And then at, is it, 45?

A This is at 50 minutes.

Q Fifty minutes. This is plaintiff's Exhibit 172.

A The aforedeck is now awash.

Q When you say awash, what...

A Well, there's water over the deck edge.

The trim is one and a half degrees bow down. The heel is now almost 20 degrees. You couldn't

walk on the decks in this condition.

You can see the ballast tanks on the starboard side are filling up, as well as all the oil tanks, with a combination of oil and water. These will ultimately fill completely up with the tank volume being oil on top floating on water on the bottom. The draft is up to almost sixty-six and a half feet.

And then the ultimate event here, which occurs at 65 minutes relative to start, 75 relative to grounding, shows that, you know, you got water half way across the deck.

If the water-tight doors in the engine room are not shut, the engine room's taking on water.

She, at this position, has become unstable. Heavy water on board. And the process from this point would be a slow roll on to her back. Then flooding in the engine room area and no doubt sinking, if the water was deep enough.

(1917)

Q And this is plaintiff's Exhibit 173. Is that correct?

A Yes.

Q Now, did you run any of the scenarios like you just did if this vessel had never been grounded

and it just suffered the damage and stayed afloat?

A Yes.

Q Would you explain to the jury what happened then?

A We started running at different times. The plan was to go on out and start it at successively greater and greater times. But it became obvious very quickly that, the longer it stayed on the reef, the more quickly it sank after it came off.

And that's because there's more space. The longer it stays on the reef, the more oil is lost. The more space you had for water. And water is what sinks the ship. Not the oil. It capsizes the ship. Not the oil.

So, we're looking at a conservative situation here by starting freeing the vessel quickly from the reef.

Q What about when you assumed that it came off without being grounded at all? What would happen?

A The time of the sinking was about 10 minutes longer than after 10 minutes.

(2040)

Q And did you run any scenarios at all that this vessel would have reached equilibrium?

A There's been some testimony about slider valves, I believe. They're the valves on the inert gas system which are at the hatch openings. You'll remember the...

Q I think it's right up on the -- I'll get it.

(2080)

A The valves here on the branch lines on the inert gas system are butterfly valves which could be shut. Now, if those valves are shut, then the pressure relief, the vacuum relief provided by the PV and liquid breakers on the main, is eliminated. So, the only vacuum relief then, if these valves are shut, are through the pressure vacuum breakers on the 4 inch lines right at the cargo access hatches.

All right. So, if those valves are shut, that provides a greater constriction to air flow into the tanks on the cargo tanks and slows down the rate of oil loss.

All right. So, that, when it comes off the reef, then there's not as much space aboard for water because the oil loss has been slowed down.

And we ran it starting at zero. Assuming the tanks were holed and it passed over the reef and free floated. And, in fact, with the slider valve shut, in that case, it does not capsize by this prediction. It comes back to equilibrium. It's at a high heel angle and at a high trim, but it continues floating.

That's also the case at five minutes.

(2135)

At ten minutes, however, which was the case run here with the slider shut, enough oil has still been lost then so that capsizing is predicted.

And then for any later time it would predict capsizing whether the valves were shut or not.

Q When you were asked to do this, you were asked to assume the damage that was done to this particular vessel, the Exxon Valdez, as you saw it. Is that right?

A Yes.

Q And the scenario then, just to go over one more thing, if the vessel had not grounded whatsoever and the slider valves had not been closed, what was your prediction as to when the vessel would have capsized?

A Well, I don't have the numbers right in front of me. But I think it was -- this was 75 minutes after -- after 10 minutes on the reef, I think it added about another 10 minutes to that time, as I recall.

Q And any time after that it just speeded it up?

A That's right.

Q And when was the most critical time period for this vessel in terms of the danger that was posed to it by the tides?

(2230)

A Well, I think it had to be on the going out tide.

The vessel was pivoted. The fulcrum there between cargo tanks two and three -- and as the tide went out, that became a hard support near the center of the vessel -- a hogging configuration with the ends of the ship hanging over tending to bend the vessel about that point. So as the tide drops, more and more of the support of vessel is from the rock, and less and less from buoyancy of the ship, producing a situation where it's propped up in the middle.

And I think if you do that stress calculation, you'll find that unless the structure relieves

that point support, that the vessel is overstressed. The thing I think that saved it was that the structure did crush -- it crushed and relieved the magnitude of that concentrated load at the rock and let more of the load be taken by buoyancy distributed over its length.

Q Now there was no damage done to the port side in the initial grounding, is that correct?

(2320)

A That's correct.

Q If the port side had been one of the, let's say cargo tank number 5, were hold for some reason, what would happen then.

MR. CHALOS: Objection, Your honor. Sheer speculation, again.

THE COURT: Objection overruled.

Q With the amount of -- let's say, for instance...

MR. CHALOS: There is no question pending. And the witness said, I'm not -- I'm...

THE COURT: Let him ask the question, Mr. Cole. You'll have to be satisfied with the question and the answer. Can you answer the question?

A Cargo tank number 5 would have lost oil at a rate similar to what we've shown here for the

other tanks, and ultimately water would have begun to come back in to the ruptured port side tank.

Q And, would it have been under the same theory that it depends on the assumption that the hole is greater -- that's caused by the rock, would be greater than the aperture above the tank.

MR. CHALOS: Objection, Your Honor. Now we're really speculating.

THE COURT: Mr. Cole, you're going pretty far off track. I'm going to sustain that objection, you'll have to get back on track.

MR. COLE: I have nothing further.

(2380)

CROSS EXAMINATION OF MR. VORUS

BY MR. CHALOS:

Q Good afternoon, Dr. Vorus -- Professor Vorus, I'm sorry.

You say your initial contract was for $25,000.00?

A Yes. That's my company, now, that's not -- I had to hire three people to do this job. But, yes, it was for twenty-five thousand.

Q Are you, is there a contract now that's greater than twenty-five thousand?

A There's been an amendment to the contract to allow for the extra time that I've spent here in Alaska.

Q How much is your contract presently?

A Forty thousand.

Q How much have you billed the state so far?

A About twelve thousand.

Q And how much do you anticipate billing them before it's over?

A Well forty thousand is conservative; that's certainly adequate.

Q It could be greater?

A No, be no greater than that.

Q How much is this $40,000.00, that's what you've billed, how much does that represent of Vorus and Associates' annual income?

A Not a large amount -- I have a contract with a propeller manufacturer that pays Vorus and Associates $4,000.00 month.

I have a contract with BP Oil on one of their Alaska trade tankers, which is forty thousand dollars. It's not the only thing we're doing.

Q I understand that, but, based on the numbers you just gave us, it's about a third of your annual salary?

A Well, I don't have enough. I mean that's the backlog at the moment. I mean there's work coming and going all the time.

Q I take it that you don't hold any Coast Guard issued licenses?

A No.

Q You're not a Master?

A No.

Q Chief Mate?

A No.

Q Chief Engineer?

A I own a fifty-two foot yacht that...

Q Have you ever been aground?

A No.

Q You've never sailed as a crew member on a merchant ship, have you?

A No, but I've spent many hours on merchant ships.

Q In your work at Newport News?

A Yes, and since.

Q Now, you've never sailed as a crew member on a tanker, have you?

A No.

Q Let's talk a little bit about your background and your experience. You spent some time down in

Newport News, I think you said twelve years?

(2520)

A Ten, total; seven in residence; three on educational leave.

Q And you've written a number papers over the years?

A Yes.

Q Is it fair to say that your expertise lies in main propulsion rather than construction of vessels?

A You mean construction of main propulsion plants, rather than construction of vessels?

Q Yes.

A You'll have to clarify that.

Q As I read your resume, it seemed to me, and you can let me know if I'm wrong, that your experience lies in the construction of main propulsion equipment, and the effects on vessels with main propulsion equipment.

A That was my job at Newport News by definition. I was a manager of machinery engineering. We got involved in many aspects of vessel design that involved interfaces with the machinery and many that didn't.

Q But your area was the main propulsion. The

interfacing you're talking about is putting a propeller or shaft or an engine into a vessel that's been constructed?

A By definition of the job, it was machinery.

Q Could you tell the jury what we mean by machinery main propulsion equipment?

(2640)

A The main propulsion machinery is -- Newport News never produced diesel ships, so at that time it was everything from boilers, turbines, condenser, main shaft, and propellers.

It included auxiliaries, a diesel, diesel generators, stain drilling generators. It included steering gear, rudders, deck machinery, which would be windlasses. On military ships, it was weapons elevators. Simply the machinery aboard the ship.

Q And you would consider that to be your primary area of expertise?

A No, I don't. That was the job that I had at Newport News between the years of 1963 and 1973.

Q As I read your resume since 1973, you've been at the University of Michigan?

A Yes.

Q So your practical experience, your field

experience, if you will, ended at that point?

A It did not. I've had a great deal of field experience since being at Michigan.

Q In what way?

A Activities such as this, involved with, not so much trials, but with shipping companies, with shipyards, problem identification, diagnosis, rectification, that's what Vorus and Associates does. Vorus and Associates is not a research company. I do my research through the University of Michigan. Vorus and Associates is an engineering company, and the engineering it does is by and large on ships -- ship problems.

Q Do you go out there yourself, or do you send your associates?

A I go.

Q Yourself?

A Yes.

Q I take it that you, yourself, have never been aground? You said you haven't been aground on your boat, but I take it you've never been aground on another ship?

(2724)

A Oh, I've been aground on my boat.

Q You have?

A Yes.

Q I thought you said you haven't?

A I'm sorry, I misunderstood your question.

Q How often would you say you've run aground in your boat?

A Well, it's a fifty-two foot boat. I don't want to be defensive. I run aground several times.

Q This is a sailboat?

A Yes.

Q Have a motor on it?

A Yes.

Q How'd you get it off?

A Well, there's only one way to get a sailboat over an obstacle.

Q How's that?

A That's to back up.

Q When you ran aground with your little sailboat, I take it you didn't have your computer with you?

(2770)

A No.

Q You didn't sit there and say, my center of buoyancy, my center of gravity, my KG, my -- this, that is x,y,z, I've got to figure out how

I'm going to get out of here?

A I'm sure those concepts have to go through ones head, if you're familiar with them.

Q But you didn't do calculations in your head?

A No.

Q You've never been aground on a tanker, have you?

A No.

Q And I take it, you've never had the experience of seeing a crew that's just run aground try and figure out what the best course of action is?

A No.

Q You mentioned that you've testified before in some arbitrations and some court cases?

A Yes.

Q None of those cases involved groundings, did they?

A No.

Q And none of them involved the type of structural problems that we're talking about here?

A Well, yes, in some level. I mean, structure is structure, and it behaves the same in different circumstances. I mean, the considerations are the same.

Q Well, what I'm really talking about is the cases that you were involved with, did not involve a ship capsizing, or possibly capsizing and sinking?

A No, none of the arbitrations I was involved with had to do with capsizing and sinking.

Q Now, I take it that your main expertise, or the expertise that you had on propulsion, dealt with steam engines?

A Yes.

Q Have you had any experience with slow speed diesel engines?

A Some, since then.

Q Since you left Newport News?

A Yes.

Q You familiar with the power curves of the slow speed diesel engine?

A Yes.

Q Do you know what the maximum horsepower of this vessel was?

A It's about 30,000, I think I've heard the number 31,600.

Q Do you know what the horsepower was at 55 rpms?

A Well, it's a constant torque machine The

power should vary roughly with the cube of the rpm.

Q Have you done any calculations to figure out what the horsepower was at 55 rpm?

A No.

Q You don't feel it necessary for your purposes?

A I wasn't asked to do that.

Q Did you discuss it with any of the other experts in this case? Discuss the available horsepower at 55 rpms?

A Initially as the contract was defined, I was to look into some of those issues, but in view of the time frame, we had to pick the things that I thought were most important, most relevant.

Q Did someone tell you not to bother with figuring up what the power curves for this vessel were?

A No, that was part of the original scope of work, but there simply wasn't time to do it.

Q Is it very, very difficult to figure out the power curves for this vessel?

A No, all you've got to have is the propeller open water curve, and the power curve for the engine is extremely simple, it's a straight line.

Q That's easy enough to get, if you wanted to

find out what kind of power this vessel would generate at 55 rpms?

A Well you would have to have the propeller open water curve, including the effect of the duct, because you're certainly -- you're not going to develop full 86 rpm at (indiscernible - unclear), but let's assume that you could develop 55.

Q Well, the point I'm trying to make here, is if you wanted that information, it was easy enough to get?

A I suppose -- I suppose it was.

Q Now, talking about what the state ask you to do, you mention the state provided you with certain information, is that correct?

A Yes.

Q And, on the basis of the information they provided you, you came to certain conclusions. You did some studies on certain conclusions.

A Well, it was a typical way I operate with all my clients. I have to have the input information to do anything. My client at this time was the state of Alaska.

Q Did you do any independent analysis yourself? In other words, did you try and gather

information from other sources besides the state of Alaska?

A Well, I have my own sources.

Q Such as?

A Well, my experience, my knowledge that's been gained through 27 years of experience; my library.

I did seek some information on IG system operation, which I provided independently of the state.

Q But other than what you just mentioned, everything else came to you from the state?

A The state and my own observations of the ship.

Q So, if the state didn't want you to know something, they could have withheld it from you for all you know?

(3100)

A I'm confident that they didn't. I had the complete information that I needed in order to do what was defined.

Q Did anyone write to you from the state, from the DA's office telling you what kind of conclusions they wanted to reach in this case.

A No, they did not.

Q Did they write you a letter telling you what

they wanted you to do?

A No. The only definition on paper is what is written in the contract that I have with the state.

Q The one that was originally for twenty-five thousand?

A It's the same contract. The wording is the same, there's been an extension which ups the maximum.

THE COURT: It's 1:30, Mr. Chalos.

MR. CHALOS: I can finish him up tomorrow, Your Honor, in about a half hour to forty-five minutes.

((3168)

THE COURT: Ladies and gentlemen, we will recess for the day, and I'll see you back at 8:15 A.M. tomorrow morning. I think we'll get a prompt start at 8:30 tomorrow morning. I'm going to do my best. Don't discuss the case among yourselves, with anybody else, don't form or express any opinions and avoid the media sources regarding this case. I'll see you back tomorrow. You may step down.

(3240)

(Jury not present)

THE COURT: Mr. Cole, when this witness is finished, how many do you have left in the state's

case.

MR. COLE: Two.

THE COURT: And do you anticipate about a day for both of them?

MR. COLE: No.

THE COURT: You anticipated an hour for this witness, and I'm going to multiply it by a factor of two or three, whatever you say, so..

MR. COLE: I think that one witness, I think we'll be done tomorrow.

THE COURT: Okay, I dug up the court's sua sponte order, and the state's response to the court's sua sponte order. If you folks don't have a copy of that -- Mr. Cole, you indicated the phrase "property of another" as used for the purpose of the indictment. It includes the fisheries, wildlife, vegetation, shoreline, and other aspects of Prince William Sound. It does not include the Exxon Valdez itself.

So, I've been going on the assumption, we're dealing with that as damage to another. Is there anything else we can do today before recess? Let's have counsel in court tomorrow at 8:15, and we'll get a prompt start.

THE CLERK: Please rise. This court stands

recessed.

(Off record - 1:31 p.m.)

CONTINUED