detection, has high probability and that the b(1) has high probability. The detection of the b(1) lead me to believe that the ship more than likely (b) (1) (A), (b) (1) (B) and more probably a b(1) b(1) in the period of the gram which we have from the start of the gram at 1210. The (b) (1) (A) at that speed--

Q. The gram being Exhibit 52, is that right?

A. Yes. (b) (1) (A) . The slight turn pattern and the weakening of the signal at 1210 would indicate to me a change in course and then of course this means change in aspect to the array.

EXAMINATION BY THE COURT

Questions by a court member, Captain Osborn:

Q. Mr. Barnes, will you refer to Exhibit 52 and state your opinion at a period prior to 1411 Zulu, in what speed range do you think the THRESHER possibly would have been in.

A. Here, Captain Osborn, my estimate would be that THRESHER was at (b) (1) . Above that we should see b(1) on all aspects. This of course then generates the question, why b(1) at a lower speed, and the only assumption I would have there is that in a deep dive, the (b) (1) (B) o course give the captain a great deal of flexibility in arriving at a speed

Q. Previous to this time you detected the THRESHER at (b) (1) (A), (b) (1) (B) (b) (1) (A) in an area that was perhaps poor from a standpoint of reception. Would you say under those conditions that he was probably going slower than this speed?

A. I'd just like to comment on that, Captain, that during the previous detection, during the post shock acoustic trials, I would say that our conditions of detection were optimum as opposed to a poorer condition here.

Q. And what was your threshold during those trials?

A. During those trials we were at (b) (1) (A) and unfortunately because of the time aspect and the time allotted, we used in the post shock only the (b) (1) (A) from Eleuthera. At b(1) which is our closest speed to this, we detected b(1) The (b) (1) (A) however, was detected on a (b) . At b(1) b(1) which was the next increment we used, we detected b(1) (b) (1) (A) (b) (1) The other b(1) The cutoff point that the ship established with us during the pretrial conference for shifting to fast main circulating pumps and fast main coolant pumps was b(3) 10 USC 130

Q. What we are trying to establish, Mr. Barnes, is one involving our best estimate of speed or speed range. Would you, in terms of speed ranges, like to hazard a prediction that the speed range was in the zero to ten knot range; b(1)

A. Captain, I would say that it was most probably in the zero to ten, and quite frankly, b(1) and presuming that an emergency situation occurred, what I was immediately looking for in these grams was a b(1) to indicate that the ship was approaching a fast speed; that is, somewhere between b(1) , which I think would have shown under any conditions of aspect.

Questions by a court member, RADM DASPIT:

Q. Can you tell us how you determine the trace of the b(1)

A. Yes, sir. Admiral Daspit, the way we detect the b(1) is when I write the detection agenda, I write a portion of it in which the ship is in an all-stop hovering condition--and Captain Osborn pioneered this for us. At any rate, the ship will be in an all-stop hovering condition at 200 feet directly over an array, the establishment of the frequency is determined as the ship progressively lights off machinery where still at all-stop, or the ship is given lee way to keep enough speed for depth control. The ship then proceeds along, lighting off machinery at precise times, and we are turned in with WWV as the ship lights off certain equipment. For example, at 0025, b(1) , stays on for seven minutes, and is then secured. We can follow the lines as they come in. The ship is under very closely controlled conditions as to what they operate. We know the sequential operation. Here is a typical THRESHER gram and here is THERSHER operating at b(1) This is bow aspect, starboard beam, stern, port beam; she then b(1) During all of these conditions-- this is b(1) She was at essentially all-stop here and here is the period where she lit off her b(1) There was never a detection of b(1) That is b(1)

Q. Another relevant point, in an operating condition at sea conducting your data reference, it would be impractical to stop all coolant pumps. Therefore, in your data reference, you always have a signature with the main coolant pump at least in slow.

A. This is absolutely true, sir. We never, as I say, with the ship directly over the array, let's say in a four-knot condition with b(3) 10 USC 130 --we have never been able to detect b(1) situation. No history of b(1) I have said that three times, but in each case we have never detected them b(1) We do this quite definitely as you know. b(1)

COUNSEL FOR THE COURT: I don't want to interrupt your chain of thought, but we can introduce this in evidence and you can then provide us with a photograph of it.

WITNESS: Yes.

(THRESHER Gram was then received in evidence).

REPORTER: This will be Exhibit 55.

(U)

Unclassified

Questions by counsel for the court:

Q. Have you discussed your conclusions as regards the THRESHER data with Captain Leehey and Lieutenant (b)(6) who have already appeared before this court?
A. In the sense that we assembled as a team at Norfolk last Saturday-- I assembled my historical data on THRESHER at Annapolis and proceeded to Norfolk where we worked as a team to review this data and the data was common to all and we have reached what I would say are similar conclusions.

Q. There is no significant difference in the conclusions you have from those of Lieutenant (b)(6) and Captain Leehey?
A. No, sir.

Questions by the court president, VADM AUSTIN:

Q. Mr. Barnes, is there any explanation for the appearance on these grams of a b(1)
A. I am sure there is an explanation, Admiral. I do not have it. The difficulty we encounter is that when we are aboard the ship for a structure-borne noise trial, we are not able of course to get in the b(1) This is the one machinery group which we can't definitively analyze. There b(1) However we consider it inadequate for analysis purposes.

Q. With respect to the probability of Exhibit 52 being a gram of THRESHER rather than some other submarine or ship, is not any one of the parts of the signature there in the 90 per cent probable area?
A. Is there any one part?

Q. For example, b(1) part of the signature is 90 per cent certain, isn't it?
A. Yes, sir.

b(1)
Q. Then the part is 90 per cent certain, isn't it?
A. This, I would not assign as high a probability simply because, to be quite frank with you, our normal method of running a detection trial is to know the actual conditions. We are in the game to silence submarines and not hold a brief for the networks and therefore we know the conditions. This is extremely similar to a (b)(1) , exhibits a turn pattern similar to a (b)(1) Now I may be reversing myself here, but this very similarity with previous (b)(1) detection, knowing again that there was only one nuclear submarine in the area, would give it a very high probability.

Q. In other words if the b(1) and we had b(1) indication on this gram, there would still be a high probability just from the b(1) would there not?
A. It would be what we call a single line detection which is very difficult to assess a high degree of probability with. However, the condition you state with or without (b)(1) is very liable to occur with THRESHER at these ranges.

Unclassified

Q. Well my point is that where you have only one indication of say 90 per cent probability, then the overall probability, mathematically, is 90 per cent.
A. Yes, sir, I would agree with that.

Q. Where you have one that is 90 per cent and another that is, let us say, 80 per cent or 50 per cent, that increases rather than decreases the 90 per cent probability, doesn't it?
A. Yes, sir, particularly in lofargram analysis where one line probability is always enhanced if you can add an additional line.

Q. Add an additional one to it yes.
A. On something of this sort, going back into the method of doing this, normally when we are running against an unknown target you have to assess what you might call the intelligence data as to who is in the area, what their characteristics are and normally we go to the boat when it gets back in port and get the logs and then compare.

Q. Now this brings up my other point.
A. Yes, sir.

Q. And that is, with the hard intelligence which we have in this case, knowing beyond a shadow of a doubt that the THRESHER was submerged at approximately a specific location, which corresponds roughly with the bearings from the various stations, doesn't that enhance to a higher order the probability normally given to lofargrams based on less firm intelligence?
A. Yes, sir. I think to answer your question in another manner, if I had been at Shelburne for a detection trial of THRESHER, would have said we had THRESHER at the time of holding of the b(1)

Q. Yes.
A. In essence what I am saying is I would have been one hundred per cent certain that we had THRESHER at that time.

Q. I was just anxious to dispel from the minds of the court the more or less routine and categorized evaluations given to targets about which little or no intelligence is available.
A. Yes, sir.

Q. It is necessary that the system develop criteria and these criteria I am not questioning, but in a case where the intelligence is as hard and as certain as it is in this case, then I think we have to take the criteria of assessing probability from the system with a factor which is dependent upon the firmness of your intelligence with respect to the location of a particular target in that particular area at the particular time.
A. Yes, sir. I think we can add to this that my group and myself in particular are as familiar or more familiar with the nuclear submarine targets of the last three years than the operating personnel at most of the SOSUS networks.

(U)

Unclassified

Q. Now, Mr. Barnes, there is--I will have to come down and look at that. I show you Exhibit 54 and three lines in the higher part of the recorded spectrum which give a knee start in each case.
A. Yes, sir.

Q. Are those lines indications of the same sound source in your opinion?
A. In other words are these lines related?--Yes, sir. Quite definitely I feel they are harmonically related.

Q. If these are related, from your knowledge of the THRESHER's characteristics and signatures, would you be inclined to think that this indicated a noise emanating from THRESHER?
A. If I put myself in that same hypothetical situation where I was at Shelburne conducting a detection trial on what you might call a target of opportunity basis with THRESHER, I would say no.

Q. Could these lines have emanated from a patrol type craft with a diesel engine?
A. Yes, sir.

Q. You may or may not know that a patrol type craft was sighted in this general vicinity.
A. Yes, sir.

Q. At about this time.
A. I can also say that I know of the possibility that is accorded this in association with THRESHER, and I think it is important that I note from our past experience, we have never detected THRESHER's b(1)
However, and I would introduce this because it is pertinent, the David Taylor Model Basin personnel found during the radiated noise trial following THRESHER's shock trial that there was a significant increase in the radiated noise occurring when THRESHER operated b(1) The noise they detected fits this pattern. That introduces an element of doubt. There is another element which makes me shy away from this as THRESHER's b(1) despite her rise in radiated noise and that in my experience, unless THRESHER had been moving at a high rate of speed, at this time (indicating Exhibit 52) because this represents a shift in bearing.

Q. The knee?
A. Yes, sir.

Q. A shift in bearing rather than a shift in aspect?
A. Yes, sir.

Q. In other words your beaming is this way and THRESHER was appearing on this terminal beam. Normally when we have a ship close aboard a beam, and she moves across the beam, you can track her right across her bearing shifts. At this range THRESHER would have to be at a very high speed at a very short interval of time for us to have her b(1)
(indicating Exhibit 52) and then we pick up what we might say in the end at a later period-(indicating Exhibit 54).

Unclassified

Q. Let's turn this around. (turns Exhibit 54 around)
A. Your b(1) go out within say four minutes of the appearance of this signature (indicating on Exhibit 54). I don't believe the THRESHER could move fast enough at maximum speed to shift in bearing that quickly.

Q. Even at her maximum speed?
A. Yes, sir.

Q. In other words had this pattern (indicating on Exhibit 54) appeared here (indicating Exhibit 52) I still would be a little incredulous, but at the same time it would be a higher probability then of the b(1)

Questions by a court member, Captain Osborn:

Q. Mr. Barnes, do you think the fact that on Exhibit 54 we have no indication of b(1) followed by a knee rise in the higher frequency spectrum, while on Exhibit 52 we have b(1) do you think this makes any contribution, considering machinery signatures on the THRESHER itself and the geometry associated with the raise that they might not be the same noise source?
A. Yes, Captain, I believe that lessens the probability that the two, that this high frequency (indicating Exhibit 54) of harmonic signature on Exhibit 54 is related with THRESHER. It would indicate to me that we have a definite shift in bearing, the occurrence of which is highly unlikely.

Questions by court president VADM AUSTIN:

Q. Particularly due to the fact as you stated before that such a rate of change of bearing would hardly be made by THRESHER even at her maximum speed.
A. Yes, sir. For THRESHER to show this rate of change of bearing, she would have to be close aboard the array and traveling at a high rate of speed and we have a great deal of experience at Eleuthera in doing this very thing.

Questions by a court member, Captain NASH:

Q. Could this have been noise emanating from the diesel engine in the SKYLARK?
A. I can't answer that because I don't know the engine that SKYLARK carries. I know she carries a diesel engine. It would have to be studied. I can go further and say that Mr. Rule did check these characteristics and the data he had did not match SKYLARK. However, I have found that the SOSUS network data is not always up to date and we do find occasional bad information in there due to the fact that they aren't kept up to date on overhauls, re-engineering and so forth.

Questions by counsel for the court:

Q. With reference to the knee-up traces appearing on Exhibit 54, can you give us your fullest interpretation based upon reports available to you as to the probable source of those traces?

(U)

Unclassified

A. Yes, sir. When it became apparent that there was an extremely high coincidence factor between the appearance of the high frequency harmonics and the known signature of THRESHER's (b) the SOSUS headquarters at Norfolk went out with a message requesting information from the Shelburne Naval Facility regarding the correlation of the higher frequency harmonics detected in the area of 1416 to 17, and any previously known target. The reply came back in message form from Shelburne stating that they associated these frequencies with a target previously detected, that was evidently still in the area, or was still working somewhere in this area at the time, 1417. In other words, to go further, the SOSUS network was ascribing the higher frequency harmonics to another target.

Q. Now, do you know the nature of that target or their best interpretation of it?

A. No, sir. I do not recall it in the message, officially I don't recall that they in the message stated what it was. However, I know Mr. Rule has stated that Fox station was calling this a fishing vessel.

Questions by a court member, Captain Hushing:

Q. Mr. Barnes, on Exhibit 54 there is a knee effect.

A. Yes, sir.

Q. Will you expostulate the way a knee effect could have occurred from a vessel other than THRESHER?

A. A knee effect, sir, is common to machinery start up. We see it in b(1) when a nuclear submarine goes from a speed under ten knots say and accelerates say to a speed of--for an attack class boat--b(1) knots. It picks up the signature when you reach the acoustic threshold of the detecting network. It is typical of a rather fast change in rate of speed of an operating piece of machinery.

Questions by a court member, Captain Osborn:

Q. Could you say it would be akin to a diesel startup?

A. This is very much akin to a change in speed or diesel startup. We definitely see many diesel lines which are quite similar to this.

Questions by court president VADM Austin:

Q. The startup of an electric motor would not produce similar effects?

A. In my opinion it wouldn't, no, sir. Normally when we see machinery items which are associated with electric motors, what we see is the driven unit.

Q. Not the motor itself?

A. Not the electric motor itself, no, sir. Previously we saw a lot of b(1)

Questions by a court member, Captain Nash:

Unclassified

Q. Are these the same or related?

A. The target you refer to Captain (indicating in Exhibit 54) at 1300 is possibly related. I would like to defer her to the SOSUS network message which examines this in great detail. There is a possibility that it is the same target.

Neither counsel for the court, the court, nor the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness states as follows:

There is evidently additional SOSUS work previous to the time of the lofargrams that we have here. I assume that they will be looked at rather closely, primarily to possibly establish milestones or checkpoints in THRESHER's operations as she proceeded to her deep dive area.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

(U)

Unclassified

(b) (6) ; relieved Donald Lamont as reporter at this point.

The court then, at 1006 hours, 19 April 1963, recessed.

The court opened at 1016 hours, 19 April 1963.

All persons connected with the inquiry who were present when the inquiry recessed were again present in court, with the exception of RADM Palmer, who was absent from this session of the court at his own request. RADM Palmer's counsel was present.

(b) (6) was called as a witness for the court, was warned of his rights against self-incrimination, was duly sworn, informed of the subject matter of the inquiry, and examined as follows:

DIRECT EXAMINATION

Before testifying the witness was informed that the court was sitting with closed doors and classified information could be divulged. He was asked to state at the conclusion of his testimony the overall classification that should be placed on his testimony.

Questions by counsel for the court:

Q. State your name, address and present occupation.
A. (b) (6) , physicist, David Taylor Model Basin, Washington 7, D. C.

Q. What are your official duties as a physicist at the David Taylor Model Basin?
A. I am involved in taking radiated noise measurements at the David Taylor Model Basin.

Q. Will you describe in simple English, which can be understood easily by laymen unitiated in your field, the kind of work that you do?
A. Basically, what we do is take far field radiated noise measurements on all nuclear and conventional submarines, since I guess the CHOPPER and the AMBERJACK. The data is presented in the absence of propogation. It is an "effective signal source strength". We run various modes, various conditions, various depths and various speeds, and also we run various machinery items for identification and fixes during PSA.

Q. Post shakedown availability.
A. Yes, sir.

Q. Please don't use abbreviations in your testimony and if you come to a word recognized only by a technician in your field, please spell it for the reporter so that there will be no question about it.
A. Yes, sir.

Q. What is your background and experience which fits you for your present occupation?
A. I am a graduate physicist. I have been working in this field since 1956. I am now a section head and am in charge of taking all radiated noise measurements at the Model Basin.

Unclassified

(U)

Unclassified

Q. How long have you been employed by the Model Basin?
A. Since 1956.

Q. In pursuance to your duties, have you made an overall acoustic analysis of THRESHER's sounds?
A. Yes, sir, we had a complete analysis after building. We had another analysis prior to shock. We had another complete analysis during and after the shock trials.

Q. Now when you say a complete analysis, would that include, or do you mean it to include an analysis, not only of all the equipment inside THRESHER, but also the noise generated outside by her propeller, etc.?
A. Yes, sir.

Q. Since you have performed those analyses, have you also received data taken on THRESHER by the Portsmouth Naval Shipyard at their sound dock just prior to her post shakedown availability sea trials?
A. No, sir. The first time I saw that data was last week.

Q. Have you had an opportunity to study it at all?
A. Just briefly.

Q. Will your testimony today be of a vintage which could include the knowledge that you gained by studying it?
A. There is a gentlemen next, from the Portsmouth Naval Shipyard. I would like to defer the questioning to him with regards to the Shipyard data.

Q. Would you now present to us the results of your analyses which you believe to be of use to the board in connection with its inquiry?
A. Based on the testimony that we had gathered with Captain Leehey prior to this previous meeting--

Q. Are you referring to Captain Leehey who testified before this court yesterday?
A. Yes.

Q. Proceed.
A. To my knowledge he has given all the information that I have. I have further information regarding various items of machinery, as far as level and as far as what we have detected during our trials in the tongue of the ocean.

Q. Will your information include your knowledge of the characteristics of b(1)
A. Yes, sir.

Q. And b(1)
A. Yes, sir.

Q. b(1) b(1)
A. Nothing on the sir. I do have information pertaining to the b(1) and to all the characteristics that were measured on THRESHER during the shock, prior to and after the shock trials last June and July.

Unclassified

In helping Captain Leehey with the analysis of the LOFARGRAMS we established b(1) From the data that we obtained. this particular speed -- I'm sorry. We measured it at (b) (1) (A) I believe that this b(1) is related to the b(1) doing something approximately b(1) During our tongue of the ocean trials at (b) (1) (A) knots we measured b(1) The amplitude of the b(1) in post shock trials were as high or higher than the fundamentals depending upon the aspect being presented. The b(1) line that were displayed on the LOFARGRAMS are attributed to the b(1)

We have seen this quite predominantly on all trials on THRESHER. The amplitude of this b(1) is equivalent to a b(1) During the post shock trials on THRESHER we ran an b(1) We ran two runs. In measuring the frequencies from this particular mode of propulsion, we measure b(1)

I think there are three on these LOFARGRAMS are approximately equal to the spacing that we obtained in our data in the tongue of the ocean. This basically is the identification that I helped conceive on this particular set of data.

Q. You worked as a team member, then, with Captain Leehey and Lieutenant (b) (6), and who else?
A. Mr. Barnes.

Q. You are familiar with the conclusions that they drew from the correlation of others?
A. Yes, sir.

Q. Do you take exceptions to their conclusions in any particulars?
A. No, sir.

Q. You fully concur with them?
A. Yes, sir.

Neither counsel for the court, the court, nor the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to made any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

I think I have covered everything I am knowledgeable enough to present.

The witness was cautioned and withdrew.

(b) (6) was called as witness for the court, was duly sworn, was warned of his rights against self-incrimination, informed of the subject matter of the inquiry, and examined as follows:

DIRECT EXAMINATION

Before testifying the witness was informed that the court was sitting with closed doors and classified information could be divulged. He was asked to state at the conclusion of his testimony the overall classification that should be placed on his testimony.

Questions by counsel for the court:

Q. State your name, address and present occupation.
A. (b) (6) 72 Taft Road, Portsmouth, New Hampshire; my present occupation is general engineer in the noise and vibration branch of the Portsmouth Naval Shipyard.

Q. In simple language, understandable by someone not in your line of effort, not engaged in your line of effort, what do you do in your job?
A. My specific duties are dockside acoustical surveys of both the conducting of and the analysis of the data obtained from these acoustical surveys.

Q. My understanding then, if it is correct, is that you take sound data from submarines tied up along side the sound dock at Portsmouth and that includes the recordation of data of sounds made through the operation of equipment inside the submarine?
A. That is correct.

Q. Does it also include data obtained from the operation of propellers and other external noises made by the submarines?
A. No, it does not.

Q. What is your training and your background which you consider fits you for this type of work?
A. My training was specifically as a mechanical engineer, and the background of this particular field has been gained through experience on the job.

Q. How long has your experience been on the job?
A. Approximately two years.

Q. Have you taken data on THRESHER noise characteristics?
A. Yes, we have, on four separate occasions.

Q. Please outline for us the occasions and the highlights of the data you obtained which you consider would be useful for the purpose of this inquiry.
A. The first occasion was, of course, the builder's original sound survey, immediately after the completion of the ship, and prior to commissioning in 1961. The second occasion was in August of 1961 when certain forms of corrective action found necessary as the result of the original survey had been made and we wished to evaluate the results of this corrective action. This information is now rather out of date for the purposes of this board. The third occasion was the pre-overhaul post shock acoustical survey made in July of 1962, which was immediately following the shock trials that were made down off the tongue of the ocean in the latter part of June, 1962. This data with regards to equipment not used, worked on by the Shipyard, from that time to this time is of pertinence. The

(U)

Unclassified

last survey is the one which we just completed, the 3rd of April of this year, which was immediately following the overhaul period through which THRESHER had just been. This data is, of course, the latest data and is pertinent to this particular investigation.

Q. Do you know Captain Leehey who testified before this court yesterday?
A. Yes, I do, sir.

Q. Were you engaged with him in a team effort that resulted in this testimony concerning THRESHER yesterday?
A. Yes, I have.

Q. You gave him, in the compilation of the results of that effort, you gave him all of the information you had except that obtained on the 3rd of April?
A. Including that obtained on the 3rd of April.

Q. So that the results of his studies include all the information that was available to you?
A. That is correct.

Q. Are you knowledgeable in the conclusions that he drew from those figures?
A. I am familiar with the conclusions.

Q. As the result of the knowledge that you have personally obtained from THRESHER do you differ with the conclusions of his study?
A. No, I do not.

Q. You fully concur?
A. Yes.

Neither counsel for the court, the court, nor the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

My only comment would be with regard to the acoustical levels of the b(1) which I believe Captain Leehey has a copy of the data which I had available. Now I would just in reiterating what he said as far as the discreet frequencies and the relative difference of the b(1)

The witness was cautioned and withdrew.

(b) (6) relieved by (b) (6) as reporter at this point.

Unclassified

Herbert E. Mc Carron relieved (b)(6) as reporter at this point.

PRESIDENT: Gentlemen, will the parties and counsel, the observers and recorders give us a cleared court so that we can discuss a matter of interest to the court at this time?

The court was cleared at 1055.

The court opened at 1115.

All the members, counsel for the court, the party, LCDR HECKER and his counsel, and counsel for the party RADM PALMER, and the reporter were present. The proceedings which follow were conducted behind closed doors.

No witnesses not otherwise connected with the inquiry were present.

Rear Admiral Palmer, a party, waived his right to be present during the testimony of the next witness; his counsel was present.

Samuel R. Heller, Jr., Captain, U. S. Navy, was called as a witness for the court, was duly sworn, informed of the subject matter of the inquiry, advised of his rights under Article 31, Uniform Code of Military Justice, and examined as follows:

COUNSEL FOR THE COURT: Captain Heller, this is a closed session of the court, and you can bring forth classified matter in your presentation and in your answers. At the end of your testimony, I will ask you to assign an appropriate classification of the sum total of all of the evidence which you have given.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, rank, organization, and present duty station.
A. Samuel R. Heller, Jr., (b)(6) '1400, Captain, U. S. Navy, Portsmouth Naval Shipyard. I am presently the Design Superintendent.

Q. Very briefly, if you will, will you state the duties of your present billet?
A. The Design Superintendent is charged with the preparation of work instructions in the form of drawings, test memoranda, design memoranda, liaison instructions, the specifications for the procurement of material, the preparation of allowance lists and technical publications for various projects assigned; the operation of acoustic radiation measuring basin; certain of the test facilities in the Shipyard; patent liaison, and the technical advice to the Shipyard Commander when requested.

Q. With reference to those duties, have you obtained a familiarity with the characteristics of the U.S.S. THRESHER?
A. Yes, sir.

Q. Her design characteristics and her operating characteristics?
A. Design characteristics primarily, those things which can be measured and for which we have test information.

Q. Please state briefly your professional background.

A. I received a Bachelor of Science in Engineering degree from the University of Michigan in Naval Architecture, Marine Engineering and Mathematics, in February of 1941. I received a Naval Engineering degree from the Massachusetts Institute of Technology in June of 1950, and a Doctor of Science degree in Naval Architecture in June of 1951 also from the Massachusetts Institute of Technology. Prior to entry in the U. S. Navy, I was employed at the New York Shipbuilding Corporation until the fall of 1942. I have served on continuous active duty in the Navy since November 13, 1942 in various duty stations and assignments.

Q. In connection with your statement as to your knowledge of THRESHER, is your knowledge up to date for the period at the close of her post shakedown availability?

A. Yes, sir.

Q. Have you prepared for the assistance of the court computer studies and analyses of various flooding casualties and the effect of counteractions by the use of air pumps, speed and ship controls?

A. Yes, sir.

Q. If you have, produce them.

A. Here they are. (The witness produced 8 charts.) I would like to state at the outset that the information which I am about to present was based on information that was available at approximately 2100 on Saturday, April 13th. This information was furnished to me by Captain Woodall from the operational side, and by Captain Kern from the technical side.

Q. Please give their full names.

A. Captain Reuben Woodall and Captain Donald Kern. (Witness indicating Card No. 1). The studies are based on certain assumptions, and I want to make certain that the court understands that these are assumptions. In the first case, we have assumed that the ship was at test depth at the start of the study and had neutral buoyancy at zero trim. It was proceeding at 6 knots. We have postulated that the flooding takes place in the engine room. We have also postulated that the expansion of the air, when used in blowing main ballasts, takes place adiabatically.

Q. What's that mean?

A. This means there is no heat transfer. This is the thermodynamic perfect cycle. We know for a fact, from the way the ship was constructed, that the capacity of the air banks are as follows: Number 1 air bank, the so-called Captain's air bank, contains 96.5 cubic feet. We know also that Banks 2, 3 and 4 normally contain 308.5 cubic feet. We have assumed that the pressure in the banks was at maximum rated effect, which is b(1) We have further assumed that the maximum speed attained by the ship is 8 knots, with hard rise on the stern planes, zero angle on the fair water planes, and that the ship remains at this speed throughout the duration of the computer study. There is an important statement to be made that is not on this card, and that is that there was never a loss of power, that there was possibly a momentary interruption of electrical power.

Q. By that you mean no loss of propulsion power?

A. Yes, sir.

Q. Let the record show that the witness referred to Card No. 2.

A. Now, the conditions that were examined in this study concerned the hole size. We performed individual studies for 2-inch, 3-inch and 4-inch diameter holes. The assumption made in this case was that the discharge coefficient at

water velocity was .61. which has been obtained at this Yard by measurements through a clean hole in a flat plate. Now we assumed also a number of conditions, to be studied separately of the way in which the main ballast tanks were blown. The first one was with the Captain's bank blowing the aft group only. The second was with the momentary loss of electrical power putting the Captain's bank on the header and Banks 2, 3 and 4 had their stop valves shut, caused by this momentary loss of electrical power. The next study made was with the three normally supplied banks blowing the after group only, and also with the three banks normally on the header blowing all tanks. Very recently we have added a study with no blow at all. The attempt was made, as I said at the outset, to fit information that was available Saturday evening, 13 April, and to do that we have used - and my charts will reflect - a zero time for computational problems when the ship reported by UQC, "Have minor difficulties. Positive up angle. Attempting to blow." Fifteen seconds prior to that, reflected mathematically as minus 15 seconds, the order was give, "Full ahead; hard rise on the stern planes; zero angle on the fair water planes." At 15 seconds after the UQC report, the blow was started and continued to the limit of the banks studied. At 240 seconds after the UQC report, collapse took place. These, I must repeat, are assumptions.

Now, pertinent to the mathematics of the situation is the maximum amount of salt water that can be blown from the main ballast tanks at test depths.

Q. Let the record show that the witness has turned to Card No. 3.

A. Now, with three air banks on service and assuming the adiabatic expansion, which we have used in our computation, 32.5 tons can be blown. In order to illustrate another thermodynamic possibility, we have computed that as expansion takes place isothermally - that is, at constant temperature - 59.5 tons can be blown. Similarly, for the Captain's tank alone, the expansion gives 9.2 tons adiabatically; at isothermal expansion it gives 18.6 tons. Pertinent also is a half life of the blow; that is, the point at which the flow rate has dropped to one-half its initial rate. Whenever an expansion takes place, it is a long, long time approaching, in the mathematical sense an infinite expansion, somewhat similar to the transient in an electrical circuit with the switch closed, and it is characteristic to use the half life for identification. This is also characteristic of radioactive decay. The Captain's air bank has a life of 20 seconds; the three air banks, 80 seconds.

Q. Let the record show that Card No. 4 was indicated.

A. The first study is Captain's air bank, blow aft only. Zero time is marked as 9:13, and plus 240 is 9:17. The blue line is for the 2-inch hole, and this indicates that the casualty occured at approximately 186 seconds prior to zero. The ship was at zero trim, and the trim increased gradually as indicated by the figures 8, 34, 36 and finally 42. The green line represents a 3-inch hole. In this case the casualty occurred at approximately 105 seconds prior to zero. The ship was at zero trim, and the trim increased gradually along 8, 34, 50 and finally 55. The red line is for a 4-inch hole. Casualty occurred at 40 seconds prior to the report. Trim at that time was zero, increasing to 8, 34, 49, and 60 at the end.

Q. (By a court member, CAPT Hushing) I think you should advise the court whether or not your scales are proportionate between zero test depth and collapse.

A. The scales are proportionate, sir. (Turning to Card No. 5.) For the Captain's air bank, blowing all air ballast tanks, the same color scheme has been used for the three different holes. The same time casualty occurs because, after all, the only effect of

blowing in one group rather than over all is the effect on trim. And this chart, blowing all main ballast tanks, shows a slight increase in trim angle - up angle, because the center of gravity of the entire main ballast tank capacity is forward of amidships.

Q. (By counsel for the court) And now turning to Chart No. 6.

A. This shows the trajectories obtained when three air banks are out and the aft main ballast tanks are blown. For the 2-inch hole the casualty occurs at approximately 254 seconds prior to the UQC report. The trim angle at that time is zero. It gradually changes to 11 at report. 34. increasing to 41, and 54 at the end of the problem. The green line, the three-inch diameter hole, shows that the flooding commenced at approximately 130 seconds prior to report. Trim at that time is at zero degrees. Again increasing to 47, and reaching 54, as was the case with the 2-inch. The red line is the 4-inch diameter. Flooding commences at 55 seconds prior to report. Trim is at that time zero. Then it increases to 40 at time of report, and progresses to 52 and then to 64 at the end of the problem.

Q. Turning now to Chart No. 7.

A. The next chart contains the same information, with the three air banks, blowing the entire main ballast tank group. The color scheme is the same. Times are the same. Trim angles increase, and the trim angle increases at the end to 66 degrees for the 4-inch hole, 60 degrees for the 3-inch and 59 degrees for the 2-inch.

Q. (By a court member, CAPT OSBORN) What is the angle involved on the 3-inch line at minus about 60 seconds?

A. This is 11, sir. Very nearly the same as for blowing -- well, it would be exactly the same, because the blow starts after the report came, and there would be no change to the left.

Q. (By counsel for the court) Would you confirm again for the court the assumption that the ship was building up to full power during the period of flooding?

A. Yes, sir, but I am sure also that the assumption used was that a maximum of 8 knots was attained because of the position of the stern planes.

Q. Referring to the next chart? (Chart No. 8)

A. The final chart is the condition of "No Blow." For the 2-inch hole, the casualty is calculated backwards to occur at 124 seconds prior to report. The trim is very slight, reaching 30 degrees at time of report, 35 degrees at about two-thirds, and finally 42 at the end. The green line, which is the 3-inch hole, shows that the casualty starts 44 seconds prior to report. Trim is then zero. It reaches 28 degrees at the time of report, and note that, because of the way the ship begins to rise above test depth, trim angle continues to grow; to 36 degrees at about one-third of the time interval, 44 degrees at about two-thirds of the time interval, and 50 degrees at the end. The red line is the 4-inch hole. The casualty occurs at about 15 seconds prior to reporting. The trim angle has become 20 degrees at the time of the reporting, and the trajectory shows a further rise from test depth over that for the 3-inch, but a more rapid decline; and note that on this casualty time runs out some 27 seconds before the common point on all previous charts. I would like to reiterate that these are mathematically obtained results using the characteristics of the ship that we know to be factual and based on assumptions that were provided on Saturday evening at approximately 2100, with the information then known. And lest there be

any misunderstanding, I would like to repeat that. The ship was at test depth at the start of the problem. It had neutral buoyancy and zero trim, proceeding at 6 knots. Flooding was assumed to take place in the engine room. Expansion of air, when blow was used, was assumed to be adiabatic. We know for a fact that the capacity of air banks is 96.5 for the Captain's bank, and 308.5 for the three banks normally in service. We have assumed that the pressure in the banks was maximum rated, b(1) We assume that full power was ordered, the maximum speed attained was 8 knots, with hard rise on the stern planes, zero angle on the fairwater planes, and that the ship remained at 8 knots throughout the life of the problem, and that, although no propulsion power was lost, there may have been a momentary interruption of electrical power.

EXAMINATION BY THE COURT

Questions by the president:

Q. Your various curves seems to all be on the same basis, except the last one, and that one had, "With hard rise on the stern planes." Am I to infer from that that the stern planes were on some other setting?

A. No, sir. In all studies conducted the stern planes were on hard rise; the fair water planes were at zero.

Q. I just wanted to make sure because the cards do differ.

A. Unfortunately, Admiral, they were made at different times.

Questions by a court member, RADM DASPIT:

Q. Captain, you've lost me, because your conditions are the same all the way up to minus 15 seconds. The ship should be doing exactly the same thing with each size hole, but it does entirely different things up to that minus 15 seconds.

A. Well, may I explain, sir. We performed the computations in all cases that we could to make collapse take place at 9:17 plus 240 seconds from zero time in the computation, and that is the reason for the differences which are apparent to the left, or the time before reporting. The one case where we could not make collapse take place at 9:17 was for "No Blow" with the 4-inch diameter hole, and here we could not have the flooding take place after the time that it was reported they were having minor difficulties, not in time test.

Questions by the president:

Q. Captain, does that fact which you have just pointed out with respect to your studies indicate to you that there is very probably an upper limit to the size of the opening through which flooding took place?

A. Yes, sir.

Q. Would you give to the court your interpretation of this particular facet of the problem?

A. I can only hazard a guess. I would have to have access to better information and run additional studies to be able to come up with a refined guess. And if I may digress for just a moment before answering your question: Some of these studies are under way now as better information has been made available, and I anticipate that there will be further studies with further refinements. But to return to your question, it appears to me that it would be a hole less than 3 inches. probably on the order of two 2-inch holes. I must say "probably". I am only hazarding a guess.

Q. Did you say two 2-inch holes?
A. Yes, sir. Now that is slightly less in area than one 3-inch hole.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. Except for the report which you have graphed as "zero," have you ever heard the expression, "Positive up angle" before?
A. No. It is a redundant expression.

Q. Now, the trim angle at the time of that report as indicated varied as much as 60 degrees and more. Is that--
A. I don't believe it was quite that much. If you will allow me to refer back, I will check that.

Q. I think it was your last chart.
A. The largest angle indicated is 40 degrees up, and this is for the case of the longest time casualty, when three air banks were used to blow.

Q. From your knowledge of submarine parlance, the fact that the Commanding Officer used the phrase, "Positive up angle," without stating he had a radical up angle would eliminate any of those, from just his own choice of words?
A. I am unable to answer the question intelligently, sir.

Q. On the last chart, can you explain why, with no blow, or no provision for positive buoyancy, the situation seemed to improve after zero time?
A. Yes, sir. Now, mind you, one of the conditions which the mathematician worked with in this case, forcing collapse to take place at a predetermined time and forcing an up angle at zero, or 9:43 clock time; and now knowing that the trajectory must pass through this point, or as close as mathematically possible from the case of not blowing, the casualty occurs very, very shortly before the zero time of report. The power that is applied with the up angle gives the rise and the impression that recovery is taking place. Of course, as the trim angle increases--and it would increase, not only from the stern plane condition but from the flooding assumed in the engine room--it would have a greater velocity component upward and would give this early indication of rise, but then if the trim angle increases, the drag coefficient begins to lessen, and the sinking rate increases and the ship has a tendency to plunge.

Q. Then, the drag coefficient is greatest from the ship at zero trim?
A. The drag coefficient for sinking is greatest. The situation is analagous to the condition of zero trim at underway in a common trajectory. May I finish my recapitulation of the assumptions, because I do not want the impression conveyed that this is anything more than a mathematical representation of ship characteristics and certain operational assumptions?

COUNSEL FOR THE COURT: If you are going to add new assumptions, yes; but we have already heard your assumptions.

PRESIDENT: Captain, I believe the court is fully aware of the "iffy" nature of your testimony, and I don't think it is really necessary to reiterate the assumptions.

REEXAMINATION BY THE COURT

Questions by a court member, CAPT. HUSHING:

Q. Captain Heller, you stated your opinion a few moments ago, in answer to a question posed by the court relative to hole size in the ship which caused this casualty to occur. I believe you stated that it was slightly less than three inches, is that correct?
A. Yes, sir.

Q. Were you speaking at that time of a normal hole size in the hull with an infinite reservoir outside?
A. Yes, sir.

Q. You were not, then, speaking of a pipe size internal to the engine room?
A. No, sir. I must base that on the information that I have already obtained from these assumptions - based on an infinite reservoir and a clear hole through a flat plate.

Q. In a piping system such as the auxiliary salt water system, where there are valves and various take-offs, is there appreciable friction generated during water flow?
A. Yes, sir.

Q. Does this result in the flow of less water through an aperture inboard of the hull in such a piping system than there would be in the hull itself?
A. The velocity of this would increase with the pressure loss, and this would indicate a high velocity, and consequently, a high flooding rate.

Q. Inboard?
A. Right. I would have to be a little more careful, I'm sure, than I have been, but the datum is the same.

Q. Let me ask you another question: If we have a straight section of pipe and we have pressure 1, at the beginning of that pipe, and pressure downstream, pressure 2, and there is flow in the pipe, will pressure 1 be greater than pressure 2?
A. Yes, sir.

Q. If this pipe is ruptured at point 2, would you expect less flow of volume than if the pipe were ruptured at point 1?
A. May I recapitulate? This is an intact piping system at the outset between 1 and 2, with a normal flow, depending on the service required?

Q. Yes.
A. The flow is such that there is some change toward 2 with a higher pressure at 1 than at 2, naturally, and rupture takes place closer to point 2?

Q. At point 2, yes.
A. The flow would be less if ruptured at 2 than at 1, because the friction loss of the pipe would be greater, and at point 1, of course, there would be only the friction loss through the system upstream of that point.

Q. Do you know of any shock phenomena which have been measured in piping systems used for salt water service?
A. Yes, sir. On THRESHER's second sea trials in the spring of 1961, there

was a pipe line - and I am relying on memory now - of about 2 inches in diameter that carried away at time of cycling the hull valve which was a requirement for the sea trials, and it was hypothesized at that time that this line broke because of the water hammer phenomenon due to the sudden in-rush of water by the rapid opening of the valve. The ship was drydocked upon return from second sea trials, and the Shipyard proceeded to conduct a series of these water hammer type tests, using a fairly large reservoir under pressure and the normal opening of the valves. During the course of these tests, the valve opening time was progressively slowed down to relieve this tendency to hammer, and prior to third sea trials the valve operating times were all decreased. That's the extent of my knowledge of a shock-type test.

Q. Do you happen to know what system this casualty occurred in?
A. I'm not certain, but recollection says that it was the priming line for the trim pump.

Q. Do you happen to know at what depth it occurred?
A. That is very hazy, but it was within the range of test depth minus 300.

Q. Now your answer to my earlier question was very interesting, but I want to pursue a little bit hydraulic theory and flow-in pipes, and this question is related to that. Is there a phenomenon known as "shock wave" created in piping systems under high pressure or high velocity where there is a bend or a discontinuity in the pipe?
A. Yes, sir.

Q. Does this phenomenon tend to reduce the flow through the pipe?
A. I do not know, sir. If the shock wave heads back down the pipe in the direction from which flow was coming, it would tend to reduce it. It would be the interference that is characteristic of a train of waves in water or in an elastic medium. I cannot answer your question from my own knowledge on flow.

Q. Is there a tendency for shock wave probability in fittings to increase with velocity of the fluid going through a fitting?
A. Yes, sir.

Questions by a court member, CAPT. OSBORN:

Q. Captain Heller, I am interested in determining the status of the THRESHER with respect to knowledge of the particular curves that you have prepared here and her status of ability to analyze those and take the proper action with respect to the casualty. On the basis of the trim line failure test at fairly deep depths were curves and analyses similar to the ones you have presented to us published with respect to official publications, published with respect to operational procedures, and incorporated in the ship and a matter of detailed knowledge to the crew?
A. Not to my knowledge, sir.

Q. The individual analyses that had to be conducted in ship design obviously were made for a particular system; is that correct?
A. Would you repeat the question, please?

The reporter read the last question.

THE WITNESS: Now, in answer to your question, in many cases, yes; in equally many cases, no.

Ralph S. Jacobson relieved (b)(6) as reporter at this point.

Questions by a member, CAPT Osborn.

Q. All right, you can answer that question.
A. There are many requirements on the design level that are covered by the contract plans and specifications over which he has no control. For instance, the contract plans and specifications for building THRESHER say, "Thou shalt have four banks of air with a maximum capacity of 405 cubic feet." and that this shall be dispersed in the following fashion: so much in No. 1, so much in No. 2, so much in No. 3, and so much in No. 4. Now the designer doing the detail planning work has no choice in the matter. He is faced with fulfilling the specifications.

Q. Then I take it, from your knowledge, that curves in published form of the type presented here this morning were not on board THRESHER when she made her last sea trials?
A. To the best of my knowledge there were none on board because there were none prepared in the yard prior to last Saturday evening when we commenced this study.

Questions by a member, RADM Daspit:

Q. Captain, do these curves indicate to your mind what a submarine with these size leaks would actually do, or do they indicate what a submarine of this size would do if the conditions started at the time which you assume they started?
A. These curves that I have presented, sir, are entirely fictitious curves that have been fabricated to suit certain conditions. Now they are true if the conditions on which they are based are true.

Q. But could you assume from these curves, in case of such a casualty, it's better not to blow your tanks?
A. If you have power available, Admiral, this is the way out, in my opinion. Now if you blow alone without an increase in power, you know from the characteristics which preceded the presentation of these curves how much water can be expelled at test depth. Obviously, if you can do both there is an optimum solution for a particular casualty, but this indication in the not blowing condition is an indication that if speed is maintained and trim angle is controlled that you have an escape route. Now it's much too early for me to continue.

Q. It appears to me, Captain, that there is a possibility that flooding occurred but that it may have been controlled and shut off by the crew too late to save the ship. Do you intend, if your studies indicate that it would be fruitful, to explore that possibility also?
A. As I indicated earlier in the testimony, Admiral, we are continuing with studies and I anticipate that I will be requested by this court to make further studies with better information to try and pinpoint the actual case of THRESHER. In response to your implied question, for the safety of this class of ship in general, it goes without saying that these studies are being continued at this time to find this combination of speed and control surface angle, and time and duration of blow, to reach an optimum situation for sustaining the casualty and recovery.

Questions by a member, CAPT Hushing:

Q. Captain Heller, turning your attention to the size of a hole at the point of the hull with the infinite ocean outside, I want to ask you a series

of questions and elicit your opinion on ship survival. Within the framework of the assumptions made here, at 9:13 and 9:17, if the hole were twenty inches in diameter, could it have been fitted into this time plan?

A. Only if the--

Q. No control of flooding.

A. Only if the casualty occurred much later than 9:13, the zero time.

Q. I postulated 9:13 as the zero time and 9:17 as the collapse time.

A. No, sir. And may I show in this chart that even with a four inch hole occurring prior to 9:13 we were, with the zero blow, unable to extend it to 9:17; and with a hole five times the diameter there would be no chance.

Q. Then let's ask the same question relative to a ten inch hole; is your answer the same?

A. Yes, sir.

Q. Let us go to an eight inch hole; is your answer the same?

A. Yes, sir.

Q. Let us go to a six inch hole; is your answer the same?

A. Under the assumptions on which this chart--

Q. 9:13, 9:17, and the other assumptions that we have on these charts.

A. On these charts? I apologize, sir, I was speaking to this chart with zero blow, and I would have to back up and take another look.

Q. All right, leave it on this chart then, with zero blow; let's take the six inch size and answer that question?

A. It could not extend to 9:17, sir.

Q. So then, in your opinion, we have excluded a hole size greater than six inch with no blow?

A. That is correct, sir.

Q. Now let us take the case of your previous chart. Put one up there--there are three banks-

A. Blow all?

Q. Blow all main ballast tanks. Let us ask the question of a twenty inch hole. Could that have been fitted into this time frame of reference?

A. I do not believe so.

Q. A ten inch hole?

A. I do not believe so.

Q. Eight inch hole?

A. Marginal.

Q. Six inch hole?

A. More than likely.

Q. Removing these postulations then, do you have in your mind an upper limit of hole size at the hull with the condition of three air banks and blowing all

main ballast tanks?

A. I believe the four inch hole picture, sir, is the maximum that could have happened. The difference is in the assumptions of speed and availability of propulsion power, the availability of electrical power, and so on, would enter into it. But this appears to be a reasonable set of assumptions and a reasonable trajectory based on what I have been fed as operational information.

Questions by a member, CAPT OSBORN:

Q. To the best of your knowledge, with respect to the catastrophic failure, has there been promulgated a set of standard operating procedures primarily based upon safety considerations?

A. I would have to ask for an explanation of a catastrophic--

Q. Say, three to four inch?

CAPT OSBORN: I'll withdraw the question.

Questions by the president, VADM AUSTIN:

Q. For the record, Captain, will you repeat your answer to the question concerning the responsibility of the building yard for providing operating forces with information regarding the ships built?

A. Yes, sir. The building yard is required to furnish ships with a full set of technical publications, which includes ships information books; technical manuals describing the construction and operation and maintenance of components of some complexity; and to conduct a crew training lecture series which covers the concept of the various systems and complicated components, their capabilities, their means of operation and methods of maintenance; and the building yard is available throughout the time that the fitting-out detail for the ship is in its environs to assist in any way requested. The building yard is not, to my knowledge, either required or requested to furnish standard operating procedures.

Q. Captain, all of these studies would lead a layman to the conclusion that water comes in very fast at the depths that we are talking about. Would you give us a feel for this rapidity of intake of negative buoyancy for a three inch hole, if you could do it? Just approximate.

A. I do not have the accurate data, the velocity that corresponds to the test depth of the ship. Making the same assumptions that I did in the preparation of this, that is, the discharge co-efficient of six-tenths, is in the order of about (b)(1)(A) . See this is the square root of--

Q. This is what velocity?

A. The intake velocity through the hole.

Q. Well, I'll tell you, what I'm concerned--

A. You want the damage water?

Q. I want tons of water. For example, the maximum positive buoyancy that you could get if you could have a perfect isothermal expansion of three air

~~vents~~ is roughly (b) (1) (A) ?

A. Yes, sir.

Q. How long would it take sixty tons to come in through a three inch hole?

A. At test depth?

The witness started figuring with paper and pencil.

Q. Captain, all I wanted was a rough approximation.

A. I don't have the numbers available, Admiral. These are performed on an electrical analog and I frankly have not cranked the detailed numbers through. The flow velocity, which is, of course, not the answer to your question, is 3 [illegible] per second. The area of the hole is of the order of seven square inches which is approximately one-twentieth of a square foot. This gives me 5 (b) (1) (A) cubic feet [illegible]. And salt water goes at 35 cubic feet per ton, which is about a [illegible] (b) (1).

Q. If you would just check that particular little point for us before you come in with your more refined curves we might just like that; there's a nice little measuring stick, sort of a layman's yardstick on this thing.

A. Be happy to, sir.

Q. Now the ability of the ~~stems of the~~ planes to hold up negative weight naturally varies with speed, but could you give us a rough feel for the amount in tons of negative buoyancy, assuming it is not at the extreme ends of the ship but near the middle of the length of the ship, at ten knots?

A. I do not have the information available, Admiral. I can retrieve it for you, sir.

Q. I would appreciate that, and not only for amidships, but for the forward compartment of the ship; and, of course, we've been dealing with the after compartment here.

A. That is available; I did not bring it with me.

PRESIDENT: That sort of information is valuable to us in roughly approximating and estimating the testimony of less sophisticated and technical witnesses.

Eight charts referred to by the witness in his testimony were submitted to the court and offered in evidence by counsel for the court.

There being no objection, they were received in evidence.

REPORTER: These will be Exhibit 56.

Question by counsel for the court:

Q. What is the highest classification of all the information taken together that you have given us?

A. ~~Confidential~~. UNCLASSIFIED

CROSS-EXAMINATION

Questions by a party, LCDR Hecker:

Q. Captain, how long have you been Design Superintendant at this Shipyard?
A. Since 25 May 1962.

Q. In the presentation of these data before this court of inquiry, I would like to ask if they were arrived at through the use of computers?
A. Yes, sir.

Q. Were you present during the times that the information was fed to the computers and the results were obtained therefrom?
A. Not at all times, sir. At the initiation of the study and periodically during its conduct.

Q. You found it a little difficult to answer the Admiral's question as to how many tons of water would come in at test depth; yet when Captain Hushing asked you certain questions regarding the chart, for example, a twenty-inch hole and a ten inch hole under the no blow condition, you were quite clear in answering that you could exclude the twenty, the ten, the eight and the six. How is it that you could answer that so quickly and clearly? Did you actually feed that type of information to the computer and exclude those?
A. No, sir, because it is very obvious that if a four-inch hole could not have a casualty life to start prior to the zero time of reporting and extend to the imposed condition of 9:17, that no hole larger than that could do it either.

Q. That's under no blow conditions?
A. That's correct.

Q. May we look at that chart again. All right, now your four inch hole on that chart commenced when; when would you start, Captain; we are relating ourselves to 9:13 as I recall?
A. Fifteen seconds prior to that. No blow. Collapse is reached at 9:16 with 33 seconds.

Q. Now a six inch hole, what do you postulate the six inch hole curve would look like on there?
A. It would be of this nature, (the witness demonstrated on the chart), a sharper rise and an equally sharper fall and a much shorter time.

Q. Isn't it conceivable then that a six inch hole could be included in your chart there?
A. It could be added, yes, sir.

Q. But definitely a ten inch hole and a twenty inch hole would not fall within the period 9:13 to 9:17?
A. The six inch hole would not fall within that period either. Collapse will be reached at a time less than 9:16, sir.

Q. Captain, from whom do you receive the specifications and characteristics for the building of ships?
A. From the contracting activity, the Bureau of Ships.

Q. In such specifications and characteristics is there ever a requirement included that curves of any type be prepared indicating the amount of flooding which might be expected from orifices of various sizes at various depths?

A. Not to my knowledge.

Q. No such requirement is required in the specifications and characteristics?

A. Not to my knowledge.

Q. Do you know whether or not in the conduct of crew training at the Shipyard that this particular subject was covered in the instructions to the crew?

A. No, sir, I do not. At the time crew training for THRESHER was being conducted, between roughly the first of July of 1960 and first sea trials in latter April in 1961, my duties did not include the Design Division's responsibilities. I was then in the Planning and Estimating Division which has a totally different set of responsibilities.

Q. Do you know whether or not any other shipyard engaged in the building of this class of submarine has prepared such curves?

A. In what time frame, sir?

Q. From the time they commenced building this type of submarine until the present time?

A. To the best of my knowledge, nothing of this type has been done by any design or building yard before. There is a relatively recent set of studies authorized for ships now under construction by the several building activities. For example, here at Portsmouth, for the AGSS-555 DOLPHIN, such a set of studies has been under way for approximately two months.

Q. Has anyone authorized the preparation of curves of any type indicating the amount of flooding which could be expected from orifices of various sizes at various depths for the THRESHER class submarine?

A. I can only speak from personal knowledge, that it has not been authorized at Portsmouth or directed, except as a result of this court's deliberations.

Neither the counsel for the court, the court, nor any of the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything relating to the subject matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

WITNESS: May I withhold such a statement until the time that further studies have been conducted and the results reported to this court.

PRESIDENT: The court agrees to your doing so, mindful of the fact that your comments, or views, or opinions will be more meaningful after you have had an opportunity to study the problem further.

The witness was duly cautioned concerning his testimony.

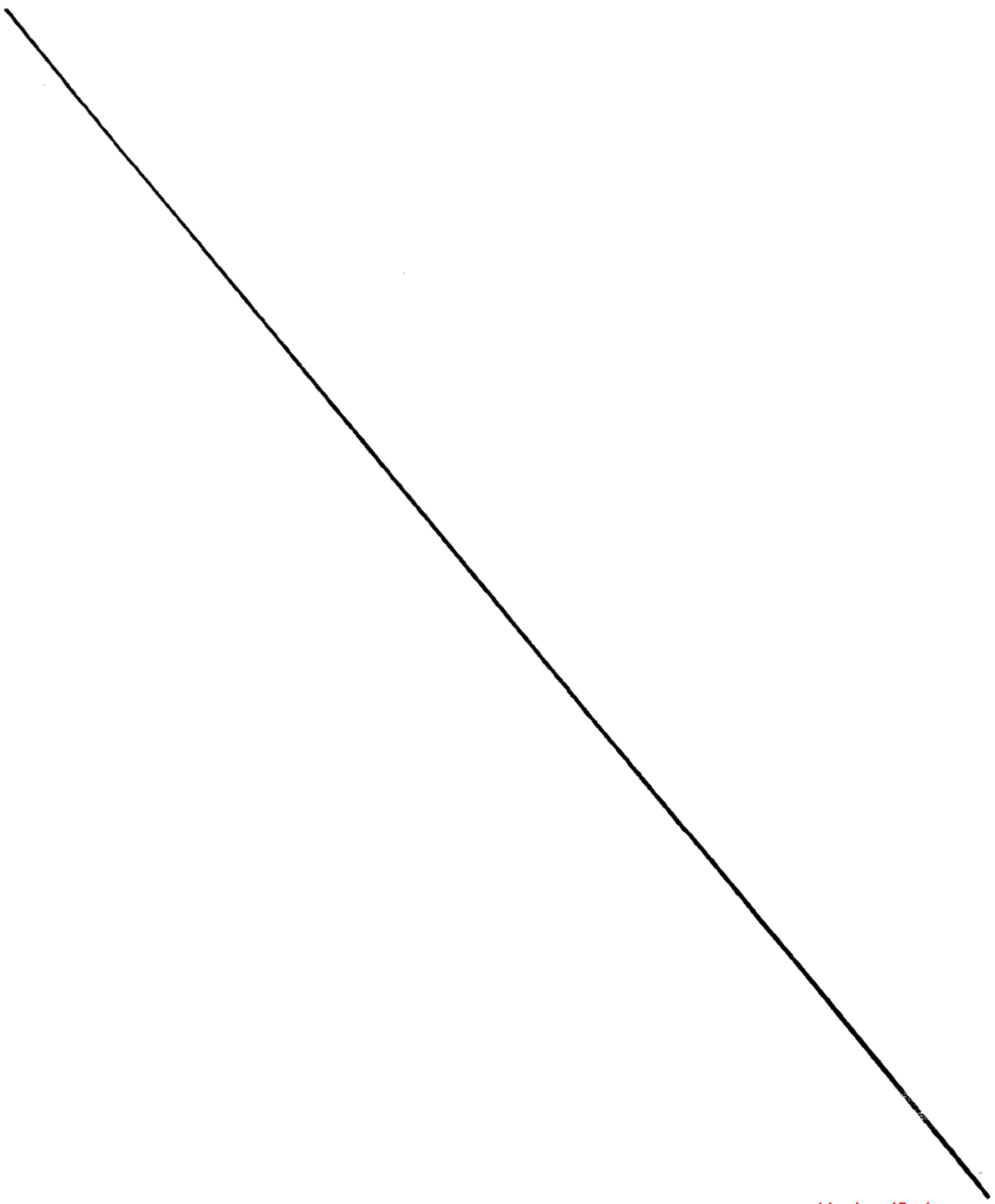
RADM DASPIT: Captain, may I suggest that in preparing additional charts they use a tape that has dots and dashes so that it will reproduce in black and white, because I don't think those color prints will be printed.

COUNSEL FOR THE COURT: I have requested him to indicate RED, GREEN, and BLUE, because his testimony was related to that, sir.

The witness withdrew from the courtroom.

PRESIDENT: I think we should have a closed court here a little bit for deliberating processes.

The court closed at 1245 hours, 19 April 1963.



The court opened at 1415 hours, Friday, 19 April 1963.

All persons connected with the court who were present when the court recessed were again present with the exception of Ralph S. Jacobson who was relieved as court reporter by Donald E. Lamont; also absent were Lieutenant Commander Hecker and his counsel who expressly waived their presence.

No witnesses not otherwise connected with the inquiry were present.

Lieutenant Raymond A. McCoole, U. S. Navy, was recalled as a witness for the court, and reminded that his previous oath was still binding. The witness indicated his awareness of his rights under Article 31 of the Uniform Code of Military Justice, as well as the subject matter of the inquiry, and was examined as follows:

The witness was informed that the court was sitting with closed doors and classified information could be divulged. At the end of his testimony the witness could state the highest classification of the testimony he had given.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Mr. McCoole, can you tell us the normal policy of the ship during a deep dive as regards the running of the main coolant pumps? Would they be at fast or at slow speed?

A. There would be two pumps in each loop operating at fast speed

Q. Was that an invariable practice to your knowledge?

A. I believe the policy was any time that there was a possibility of power requirements greater b(3) 10 USC 130 the pumps would be placed in "fast."

Q. So that if you had gone on her sea trials and were in a deep dive you would be surprised for an order to run the coolant pumps at other than fast speed, is that right?

A. Yes, sir.

Q. From your experience on board THRESHER, in the hot reactor plant operation, could you tell us the time required to recover from a loss of power in THRESHER?

A. From experience, b(3) 10 USC 130 from the time of SCRAM until we were capable of answering bells, b(3) 10 USC 130 If a more experienced engineering officer of the watch were there, I would say b(3) 10 USC 130

Q. You made that scram recovery during some drill to qualify you in that process, did you not?

A. Yes, sir.

Q. We have to presume that you knew the cause of the scram. There was no time loss in looking for it, is that correct?
A. That is correct, sir.

Q. At that time, do you recall whether the officer who was marking you for your performance of this drill made any comment as to whether your time was fast or slow?
A. He gave me a mark of excellent, though he passed the word to the rest of the engineering operators that the time was slow.

Q. Excellent for a new man but slow for an old?
A. Yes.

Q. As a matter of practice, when you shifted to the emergency propulsion from main propulsion, b(3) 10 USC 130

A. No, sir.

Q. It was not done on THRESHER as a matter of practice?
A. Not to my knowledge.

Q. Had you heard of any, or was it common knowledge in the ship, that a casualty had been experienced in a ship and was attributed to failure to
b(3) 10 USC 130
A. I heard about this within the last few days. I did not know about it.

Q. You did not know about it in THRESHER?
A. No, sir.

Q. Do you know of any sea systems where hoses or piping work was performed during the post shakedown availability without a subsequent hydrostatic test being performed on it?
A. No, sir--I'm sorry. The sensing line for the PUFFS system was not adequately hydro'd up to the Friday before we got underway. Now, that system could have been hydro'd in drydock--I don't know.

Q. You say it was not adequately hydro'd. Had there been a hydrostatic test performed on it, to your knowledge?
A. Yes, sir.

Q. When?
A. While alongside, or at Berth 11C, a diver was sent over the side and flanged the diesel 'circ' water system and we attempted to hydro the system with flanges on the sea suction. The maximum pressure we could get on the system was a hundred and fifty pounds. Then it would leak past the flange.

Q. In THRESHER, the pump sensing line you are describing was unisolable, wasn't it?
A. There were no sea valves. There was no sea valve in the system as such.

Q. It comes off before the sea suction?
A. Yes, sir.

Q. Do you know of any other sea systems where hoses or piping work was done without a subsequent satisfactory hydrostatic test during the period of post shakedown availability?
A. No, sir.

Q. I believe you mentioned in your unclassified testimony before this court that there was considerable trouble with both the high and low pressure air reducers in the ship over a considerable period of time, is that true?
A. Yes, sir.

Q. During the fast cruise, do you remember what length of time the tanks were blown?
A. They were blown for very short durations, just a shot of air into the tank.

Q. Have you a pretty good estimate of the length of time for each shot?
A. Perhaps two seconds maximum.

Q. That is the outside maximum, two seconds?
A. Yes, sir.

Q. Now, how many times were such shots executed?
A. I would say at least four times. It was probably more than that but I can't remember.

Q. Now I would like to repeat the same question with regard to the second fast cruise.
A. During the second fast cruise we were still experiencing difficulty with the high pressure air. We again conducted b(3) 10 USC 130 and also (b)

Q. No, I beg your pardon. I meant my question to relate solely to air lines and air pressure.
A. The eight hours that I was in the maneuvering room, I believe it was probably about six times that I heard the air.

Q. And again, describe what you heard.
A. Air blowing into the tanks for a very short duration.

Q. Were the durations any longer than the previous description you have given?
A. No, sir, about the same.

Q. As the electrical officer, could you describe the air bank selection circuits.
A. No, sir.

Q. Can you tell us what happens if the air bank stops because of interruption of vital electrical power?
A. No, sir. I understand that the vital air bank would automatically come on service, if the air bank that was on service was shut off. I don't remember this from print. I hadn't gotten into that system at all.

Q. What is your basis for that conclusion?
A. I first heard about it recently and dug into it a little bit in the ship.

Q. With a mechanically frozen trim pump brine pump, do you envisage that the drain pump priming pump would ever be used for both the trim and drain system?
A. Yes, sir.

EXAMINATION BY THE COURT

Questions by a court member, Captain Nash:

Q. Do you happen to remember where the UQC hydrophone was located?
A. No, I don't.

Questions by a court member, Captain Hushing:

Q. You mentioned that there was an equalizing line connection with Puffs for which there were no stop valves, I believe, did you not?
A. I don't believe it was an equalizing line; it was a sensing line.

Q. Excuse me. What size was that line, do you know?
A. Quarter-inch, I believe. It appeared to be.

Questions by a court member, Captain Osborn:

Q. What was your ordinary procedure for an ASW casualty in the engineroom?
A. If it could be determined b(3) 10 USC 130 that the casualty was in, that b(3) 10 would be isolated. If it was a major casualty, the system would be isolated from sea. The one procedure--I mean the one casualty drill that we conducted was, I believe, to isolate b(3) 10 USC 130 The drill was that we had a leak in the b(3) 10 USC 130 and we had to isolate it. I can't remember where the leak was.

Q. Say you had a leak in the b(3) 10 USC 130 and you couldn't determine where the leak was, what procedures as engineering officer of the watch would you order executed?
A. We would execute flooding in the engine room casualty procedure. All sea valves would then be shut.

Q. All sea valves in the engine room?
A. Yes, sir.

Q. Would it be necessary to shut any other valves?
A. In the machinery space also, to isolate the complete system.

Q. Did you frequently practice coordination of the order with the auxiliary machinery space?
A. Orders were normally given to the auxiliary machinery space over the two MC systems. This was a normal method of communicating with that space.

Q. Where are the outlets for the two MC circuits in the auxiliary machinery space?
A. They are on the port side midway in the compartment. I'm speaking of the lower machinery space. In the upper machinery space they are in the passageway just aft of the nuclear instrumentation.

Q. What's their relative location with respect to the isolation valve?
A. The hydraulic manifold in the upper level machinery space on the starboard side, I would say they are about five steps from the MC system.

Q. I want to briefly review again your electrical setup for my own information for record purposes. Would you explain what pieces of equipment you have operating with respect to the MG--Motor Generator sets--and SSTG--Turbo generator sets--under the conditions that you expect this casualty to occur?

A. On rig for deep submergence, b(3) 10 USC 130 I would expect to be running; the electrical buses b(3) 10 USC 130

Q. Do you have any idea how much air is normally used in surfacing the THRESHER from periscope depth?

A. No, I do not.

Questions by a court member, RADM Daspit:

Q. There has been testimony that there was considerable initial trouble with the high pressure air system, that the stainers clogged and there was reducer trouble?

A. Yes, sir.

Q. Was the reducer trouble such that the air would continue to go into the tanks and you could blow the tanks even if the reducer failed, or was it such that your reducer shut the air off?

A. The failures that we experienced were that the reducers were bleeding air into the compartment. This is the (b)(1) reducers. They were reducing properly. There were some failures very early in the availability where they were not reducing properly. However, the troubles that we had during fast cruise were just that the reducers were bleeding air into the compartment. The poppet valves were not seating.

Q. And it would not have prevented your blowing air out of the main ballast tanks?

A. No, sir.

Q. There is a calendar on the wall for your use. I am trying to make a firm schedule of what this ship did. My notes indicate that the reactor went critical on the 29th of March. Was this the first time it had gone critical?

A. No, sir.

Q. And that the fast cruise--the first one--began on Saturday about 2200 and continued through until--no, I am incorrect. The reactor went critical on the 22nd of March.

A. That is correct, sir.

Q. Now, was that the first time it had gone critical?

A. No, sir.

Q. Your first fast cruise began then on 2200 on Saturday, went through Sunday and Monday until Tuesday morning, sometime after midnight?

A. That's correct, sir.

Q. Do you remember what was done the rest of that week on Wednesday and Thursday and Friday?--Did the ship stay right at the dock?

A. Yes, sir. We considered that to be a weep correction period where the deficiencies uncovered during that first fast cruise were corrected.

Q. Then my notes indicate that the reactor was made critical again on Friday, the 29th and the second fast cruise began on Saturday.

A. That's correct, sir.

Q. Do you remember what time Saturday that was-- or did it perhaps occur the next day on Sunday?
A. I couldn't swear it was Saturday or Sunday.

Q. Do you recall whether it was necessary to recall people from liberty to start the fast cruise?
A. Yes, sir, it was, and the fast cruise was on Sunday.

Q. Does this refresh your memory enough to know what time?
A. Yes, sir, eight o'clock in the morning.

Q. This cruise ended on Monday about ten o'clock according to some testimony which I have noted.
A. Yes, sir, that is correct.

Q. Do you recall then when the ship went to the sound mooring?
A. Let me back up, if I may. The fast cruise, the second fast cruise started at ten o'clock. We had called men back from New London. We didn't want them leaving too early in the morning so we started the fast cruise at ten o'clock and it went for 24 hours. I believe it was Tuesday morning, the 26th that we were brought over--

Q. Tuesday the second of April perhaps?
A. --the 2nd we were brought over to the sound pier. I believe that was on the flood tide--I believe about 1100.

Q. And from that pier you moved right into drydock on what day?
A. Well we did not go directly to the sound pier. We tied up at, I believe, it is Pier 6 or Berth 6 for a short period of time and a decision was made whether we should go into drydock then or go to sound trials and then into drydock. We went to the sound pier for our sound trials and then were brought into drydock.

Q. Do you remember what day you docked?
A. Tuesday on the second we went over to the sound pier. We stayed--(pause)

Q. Its not important; the yard records will indicate it. I just wanted to take this opportunity to check.
A. I believe it was on Thursday, sir, the fourth, though I feel that I don't have enough time here at the sound pier--I believe it was at least three days.

Questions by the court president, VADM AUSTIN:

Q. Lieutenant Mc Coole, were you given instructions on THRESHER regarding the greater dangers of flooding at deep depths?
A. I was given no specific instruction.

Q. Do you, from what instruction you had, have a feel for the length of time that you could lose a hundred tons of buoyancy at such depths?
A. This would be determined of course by the size of the leak but it wouldn't be any time at all.

Q. That is right, it wouldn't be any time at all.
A. No, sir, for any size line.

Q. From your observations and the comments that were made regarding your performance and your qualifying exercise of correcting scrams, would you deduce that the THRESHER crew, generally, were pretty well trained and often exercised at correcting situations which result of a scram?

A. During my stay aboard THRESHER, and prior to fast cruise, the crew never had an opportunity to practice any of the drills with it out of commission. I would say that the experienced people aboard THRESHER, that the people were of the original crew, were very well trained.

Q. But there were no blackboard or other training exercises held on keeping new people or to insure that new people, would be trained in this field? In other words how did you learn to do what you were supposed to do?

A. The engineering officer Lieutenant Commander Lyman was also the training officer and he had a training program in effect that would cause the entire engineering department to continuously study. Each week on Wednesday afternoon, examinations were given to everyone in the engineering department. If they didn't pass a particular examination he would spend extra time aboard that week and be re-examined again the next week.

Q. Each week on Wednesday.

A. Yes, sir.

Q. These examples were given. Did these examples involve correction of flooding casualties and scram casualties?

A. Yes, sir. They covered all our procedures--casualty procedures--the reactor plant manual and ship's information.

Q. You have in your previous testimony, I believe, indicated that you heard no serious indication of lack of confidence on the part of THRESHER personnel in either the ship or its officers and crew, is that correct?

A. Yes, sir.

Q. Now, did you hear any sort of joking going on between the men that would indicate a sort of nervousness for the THRESHER?

A. No, sir.

Q. Neither informal or seriously?

A. I don't recall ever getting the feeling that the men were nervous about it. If they were, they didn't show it.

Q. The fact that a new commanding officer had come to the ship had not, in your opinion, caused any loss of confidence on the part of the personnel?

A. I would say, sir, that going out for sea trials would be a routine matter and the engineering personnel had so much confidence in the engineer that they very rarely went beyond that. I heard them refer to him a number of times as "the guy that could handle everything." They very rarely spoke about the commanding officer or gave any indication that they did not or did have confidence in him.

Questions by a court member, CAPTAIN OSBORN:

Q. Were I to say to you, "tomorrow you're going before the hatchet squad," would that mean anything to you?

A. Yes, sir.

Q. What would it mean?
A. It would mean that I would be orally examined by the safeguards committee.

Q. And the safeguards committee you refer to is what?
A. Code 1500.

Q. Translate Code 1500.
A. Code 1500, Bureau of Ships.

Q. Now the examination would be primarily directed toward what?
A. Insuring that my knowledge and--well that I would operate a nuclear plant safely.

Q. That is, you would say primary emphasis would be on safety?
A. Yes, sir.

Q. Now I ask you, do you know the significance of a b(1) leak in the main coolant loop?
A. Yes, sir.

Q. Has the significance of this been brought to your attention with respect to the reactor plant manual and the consequences thereof?
A. Yes, sir, we know exactly the rate at which we can control, the pressure in the primary system; we know the rate at which we would call a leak b(1) and when it would be a b(1)

Neither counsel for the court, the court, nor the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing else to add at this time.

WITNESS: The overall classification of my testimony is ~~confidential.~~ UNCLASSIFIED

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

(b) (6) relieved Donald E. Lamont as reporter at this point.

The court recessed at 1455 hours, 19 April 1963.

The court opened at 1502 hours, 19 April 1963.

All persons connected with the inquiry who were present when the court recessed are again present in court, except RADM Palmer, who was absent at his own request. RADM Palmer's counsel was in court. LDCR Hecker and his counsel were present at this session.

CDR Dean L. Axene, USN, a former witness for the court was recalled by the court, warned that his previous oath was still binding, and examined as follows:

The witness was informed that the court was sitting with closed doors and classified information could be divulged. At the end of his testimony the witness could state the highest classification of the testimony he had given.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Did you have any significant difficulties with the high pressure air system during your tour on THRESHER?

A. Yes.

Q. Can you describe them?

A. High pressure air system was probably the most serious recurrent problem that we had in THRESHER during my tour. These problems began right at the very start of the operation of the air system, and continued with little abatement until about March of last year. The type problem that we had centered around the high pressure reducing valves and the problem was largely eliminated in the Spring of last year by the installation of a new type of reducer, which functioned perfectly satisfactorily until just as the ship came back into the Shipyard for PSA. Now the problems that we had, the original reducers were air loaded. We had problems keeping a proper air loading on the reducers, so that the reduced pressure was what it should be. We had trouble with the seats scoring, seats and poppets, I guess both. It was a continual job to try to keep-- particularly the (b) (1) (A) reducers in operation. Now in the Spring of last year the Marotta valve people installed two reducers which eliminated the air loading feature and replaced it with a spring loading feature. These valves did operate properly but started to give us trouble towards the end of the shock tests and as the ship came back up to Portsmouth for PSA. These troubles were two-fold, to the best of my recollection. One was that the spring packs which loaded the reducers broke, and this appeared to be from shock, an item of shock damage, because not only springs in the operating reducers but spare springs we had in our spare parts were found to be broken. The other problem was that the seats in the reducers again scored. The seats were not replaceable and we were unable to satisfactorily grind them in place. I think if you will look at some of the ship's deficiencies which were submitted to the Shipyard, all of these problems are well documented, including the post shock deficiencies.

Q. Please describe the rig for dive and the electrical controls of the air bank valves of the THRESHER.

A. I assume that you would like to know how we rigged the air banks for normal operations of the THRESHER. We normally kept three main air banks in service in a normal cruising situation. These were three banks other than the No. 1 main bank, which was the emergency bank. One rig for deep submergence, which we did while I had the ship, any time we were going to proceed below b(1) feet, part of the rig for deep submergence included the cutting in of the fourth non-emergency air bank.

Q. Can you describe the preparations, plans, communications and the personnel setup for a deep dive in THRESHER, such as you conducted out of this Shipyard?

A. The instrumented deep dive which we conducted as part of THRESHER's initial builder's trials, was first of all an all hands evolution. It was conducted with the ship at battle stations, probably modified in some slight respects to cover the fact that it was a deep dive and not a torpedo shooting battle type situation. I don't recall what those changes might have been. In general our best watch standers were on each watch station. Telephone communication was established throughout the ship, and repair parties were standing by in both ends of the ship to handle any damage that might have occurred. The conduct of the dive, the initial dive, included cycling of all valves and equipment that was subjected to sea pressure. Now this was rather a last minute change in the deep dive procedure, which was effected shortly before we made the initial deep dive, and was made largely at Admiral Rickover's insistence, due to the fact that the ship was going to a greater depth than had previously been the case. The depth increments that we used, I don't recall exactly, but again are a matter of documentation here in the Shipyard. No increment greater than one hundred feet was used, to the best of my recollection, and during the latter part of the dive I believe fifty foot increments were used. This was not so much my choice from an operational standpoint as it was the choice of the technical people who had instrumented the ship for this dive. I don't know whether I covered everything that you wanted me to.

Q. What speed did you make during the dive?

A. As I recall the initial deep dive, we made a speed of seven knots, which was a compromise between a relatively high speed for good ship control, and a speed slow enough to permit the escort to stay with us and maintain communications.

Q. At what speed did you operate the main coolant pump?

A. I honestly don't recall any special instructions as to the main coolant pumps. I would estimate that they would probably be in slow speed.

Q. Would that be the normal position in which you would operate them in for a deep dive?

A. Well, I would think so, because you must realize that with the pumps at slow speed the ship is capable of making b(1) which is the speed she made at b(1) With the pumps at fast speed she can make more than that, perhaps b(1) but the speed differential is quite small. Now it is possible that the deep dive procedure specified the condition of the pumps, so it would be a matter of record. I honestly don't recall. I did not make it a matter of operational policy to have the pumps

at fast speed each time I went to test depths.

Q. Can you give the court an insight into the planning and rationale, both of yourself and the ship's company, in taking action as necessary to isolate leaks in the auxiliary salt water system?

A. As I believe I pointed out to the court in my previous testimony, I felt from the very beginning that the flooding casualty was the one that was potentially the most dangerous in THRESHER due to the fact that she went to so much greater depth than we previously had been accustomed to. I tried to impress this on my people also. Now as far as leaks isolation in the ASW system was concerned, and I was particularly concerned about this ASW system, because there were literally feet of that type in the ship. There were many, many rubber hoses to provide flexibility in that system, and to totally isolate it from sea it was necessary to close something like from eight to twelve separate sea valves, and I might point out that one of the first deficiencies that the ship submitted to the Shipyard was one which complained about the difficulty that we would encounter in trying to isolate a salt water leak in the system. We recommended, and I never expected to get this in THRESHER, but I hoped it would be worked into the later boats, that something like a ballast control panel be built for these ships to provide centralized quick salt water leak isolation. Now insofar as isolating a leak from the ASW system was concerned, we were on somewhat of the horns of a dilemma, in that you wanted (1) to keep the salt water out, but at the same time if you totally isolated that system you very shortly would lose the reactor plant due to the loss of salt water cooling to the fresh water system which cools b(3) 10 USC 130 We had no detailed ship's operating procedures when it came to leak isolation. We tried to make our people realize the situation with regard to isolation of this system so that in the event we had a salt water leak in the ASW system they could use their judgment and try to balance the seriousness of the leak against the seriousness of loss of propulsion in determining whether or not they isolated the system entirely.

Q. Will you describe any difficulties you may have experienced with the trim system in THRESHER, particularly covering shock and heat pressure and noise resulting from water hammer effects?

A. This again is a subject that is thoroughly documented. I mentioned that on the initial deep dive we cycled all valves and other equipment that saw sea pressure. In proceeding to test depth the first time that we got all the way down, this was the second attempt at the deep dive, we did experience quite serious water hammer while cycling the sea valves to the trim system. This actually resulted in a leak at b(1) on the test dive. The water hammer was enough to blow out a (b) priming line in the trim section line outboard of the crew's washroom. The leak fortunately was near the control room. We could hear it and we immediately isolated it; it caused us no trouble so far as controlling the ship was concerned, but it did open up an area of serious deficiency in the design of the ship, in that the trim system simply wasn't designed to take the type peak pressures that were being experienced when these valves were cycled at depth. A very extensive test was set up and conducted here at the Shipyard following that dive, in which the ocean was simulated by a large tank under pressure connected to the trim system. The valves were again cycled in drydock and pressures were actually measured in the system. As I recall pressures

were of the order of four or five times that for which the system was designed were experienced as a result of the cycling of these valves. Now correction of this condition was fairly easy, in that it was found that by simply slowing down the operation of the valves, these high peak pressures did not occur and in general this was the solution to that problem.

Q. Was there any defect found in the sil-brazed joint in the priming line that failed?

A. Again I'm relying on my memory. I have seen many bad sil-brazed joints. To the best of my recollection this joint was obviously not a good joint when we saw it after the pipe carried away.

Q. Directing your attention to another phase, Captain Axene, to the time you were turning over command to Captain Harvey. Did you give him any significant or special advise on THRESHER at that time?

A. I covered with him in detail my concern over the seriousness of a flooding casualty in the ship at deep depths. I tried to impress on him, as I did my people prior to that, the fact that I thought this was the thing we had most to be afraid of in the ship. The other thing that I particularly covered with him was the handling of the ship on the surface in confined waters; she was a ship hard to handle alongside a pier and normally we used tugs to both berth and get underway. I covered this with him in great detail, and of course I covered in general the entire ship as one would normally do in the transfer of command.

Q. Did he seem to you to have a feeling of confidence in taking over THRESHER?

A. Yes, indeed.

Q. Now, if I may, I would like to postulate a set of conditions. I will read them and then give you the list so that you will have it for reference purposes. Following the postulating of those conditions I will ask you what action you would take in THRESHER if certain problems arose. First, the initial operating conditions that are postulated are that you are in the process of making your first deep dive out of the Shipyard. Test depth minus one-hundred feet to which we refer is b(1)

A. May I ask is b(1) the depth we are at or the depth we are going to?

Q. The depth you are at. Speed of eight knots. Ship about five thousand pounds heavy, but not known to the Diving Officer or the Commanding Officer. Trim angle zero degrees. Air banks b(1) pounds per square inch; three banks on the line. Reactor plant, the main coolant pumps on fast. running.

A. Might I point out, as I have already said, if I were at b(1) I would have four air banks on the line, not three.

Q. Would you please change the postulate to include the extra air bank. To the best of your memory, based upon your previous operating experiences in THRESHER, the following questions: At time zero, first, you have report of flooding in the engine room, and my question is, as Commanding Officer, what might be your response and action after receiving this report?

A. I would like to qualify this just a little bit in that another thing that I tried to do in THRESHER was that any report of flooding was

also to be accompanied by a report whether it was a serious flooding or not. In other words, if we had a pinhole leak or a drip that was one thing. If we had water gushing in that was something entirely different, and was reported as something entirely different. Now what kind of flooding are you talking about?

Q. Water gushing in.

A. I think my reaction would be to order my Diving Officer to start coming up as soon as he could. I would ring up "All ahead flank" and I probably would not have blown the tanks until I got a further report on the flooding.

Q. Would you order the Diving Officer to achieve a particular up angle, a specified up angle?

A. Probably, and it probably would have been something in the neighborhood of fifteen degrees. I don't think that I would have ordered a thirty degree up angle until I knew more about what the flooding casualty was like, and yet I would want a husky up angle to reduce depth as quickly as possible.

Q. Now thirty seconds go by. You have not received a report of isolation of flooding. You have only a slight indication of being heavy aft based upon amount of control surface being used and there is little apparent change in depth. What further orders might you give?

A. I think I would start blowing at that point, and it would be up to the communications system near the engineroom to find out what was going on back there

Q. Now one minute after you received the first report of flooding in the engine room, you receive a report of reactor scram, but you have retained b(3) 10 USC 130 (b) (1) (A) . What further orders would you give at this time?

A. May I go back a minute? I would like to point out something that I omitted but which would have happened automatically on the report of flooding. The ship would have been rigged for a flooding casualty and the word would be passed or the emergency alarm sounded; that sort of thing. The ship as a whole would be rigged for a flooding casualty. Now with the further loss of propulsion but the retention of b(3) 10 USC 130 I would order the engine room to answer the bells on the EPM which would be the only other source of my propulsion and would continue to reduce depth.

Q. You are now blowing all main ballast tanks, with all four banks, is that correct?

A. All ballast tanks, with the four banks that are on service, yes.

Q. Three minutes after receipt of that first report you observe that you are passing test depth in spite of all previous actions. You transmit to the accompanying ASR via UQC your predicament, a description of your predicament. Would you attempt to give an approximation of the text of the message that you would send to the ASR?

A. The conditions that you describe by this time I feel that I would feel that I was in serious trouble and would probably not pull out of this casualty; I would be likely not to pull out of the casualty. I think my words to the ASR would be something to the effect "I am in trouble; have flooding aft and am passing test depth". Now I would like also to point out one thing; part of the rig for flooding casualty in THRESHER, and as I say this would be automatic, would be to get the drain pump on the effective space. The drain pump was operated from the engine room of THRESHER and it should be on the bilges pumping for all its worth, which might or might not be worth anything.

Q. After sending that message you find that both depth and trim angle continue to increase. Can you envision any further acts you might take or messages you might send at this time?

A. Again I keep thinking of things that would be done under this rig for flooding. Another item which falls into that category and which should already have been in process is the isolation of the engine room and pressurization of the engine room with internal salvage air. I can think of nothing else that I could do to try and pull the ship out of this casualty except to add the fifth air bank, assuming that by now the pressure in the four in service had fallen somewhat, and the additional pressure from the fifth air bank might help. I do think that I would try to get off a final message to the ASR "At or near collapse depth", just to let them know what the situation was, and I don't know whether I would have that presence of mind in the actual situation, that I think I would try to.

Q. With the same initial postulates or conditions which we gave you before, except only three air banks and rigged for dive, and recognizing that some of your answers may duplicate previous answers, the following occurs: At time zero you have a report of flooding in the auxiliary machinery space.

A. Heavy flooding?

Q. Yes. As commanding officer, what might be your response and action after receiving such a report?

A. Again the word would immediately be passed on a flooding casualty, and all hands brought to bear on it. I again think that my action would be to order the Diving Officer to immediately start up. I would increase speed to the maximum that was available to me; in this case, flank speed, and I would order a fourth air bank on the line.

Q. When you ordered flank speed would the main coolant pumps be shifted to fast?

A. Yes, you postulated that they were already fast. Whether or not they were when flank bell was ordered this involved shifting cooling pumps to flank speed and it was done automatically without further orders from me.

Q. Now thirty seconds after receiving your original report you have not received a report of isolation of the flooding. You have only a slight indication of being heavy aft, based upon the amount of control surface being used, and little apparent change in depth. What further orders might you give at this point?

A. As before, I believe the next step would be to start blowing. One additional thing comes to my mind with the flooding in the auxiliary machinery space and that would be to isolate the trim system sea valves which could be done remotely from the ballast control panel, and I think this might be worthwhile, since that would be a potential source of leakage in the auxiliary machinery space.

Q. Thirty seconds later, one minute after the original report had been received, you received a report of reactor plant scram and within a few seconds you observed all lights on ballast control panel flicker and all air bank stop indicator lights are extinguished. What action would you take then?

A. Do I understand that just the ballast control panel lights flicker and not any other lights in the ship?

Q. All lights in the ship flicker.

A. In other words we are losing all our electrical power in the ship. Is that what you are telling me? I'm afraid I don't follow you.

PRESIDENT: Let's get the questions squared away here.

Q. I can amplify the statement concerning the ballast control panel flicker. It is associated with the loss of MG and a momentary automatic bus transfer.

A. I am of course relying on my memory of the way the ship was constructed. It may be you have checked on this and know more about it than I do at this stage of the game, but I think you are wrong on what would happen if you lost MG system. There was a forward automatic bus transfer switch but from my recollection this was for electronic equipment and could not cover the ballast control panel.

PRESIDENT: May the court ask counsel what he is trying to develop here?

COUNSEL FOR THE COURT: We are trying to reconstruct, if we can, any possible reason for the words "Attempting to blow."

PRESIDENT: Then why don't you ask it in plain English?

RADM Daspit: May I attempt a clarification? When you have three banks on the line and the Captain's bank in reserve and you lose power, we were told and shown that the three banks automatically would cut off immediately and the Captain's bank was cut on. I think this is what they are trying to get. They were further told that it would take a minute for the Captain's bank to come on. Is this what you are trying to postulate?

WITNESS: This is true, the air banks fail shut on banks 2, 3, 4, fail open on bank No. 1 on a loss of electrical power. I would take exception to the one minute for that bank to come on the line; the air bank stops were deliberately slow opening valves to prevent a diesel type explosion from the high pressure airlines, but my recollection is that it takes closer to fifteen seconds for a bank to come on service rather than a minute. Now if you are interested in any ideas I have which might explain why blowing the tanks would stop once started, I would suggest that you check with the design people and see how the main ballast tanks blow valves failed on the loss of electrical power. I frankly do not remember, but it may be they failed shut. If they do, loss of electrical power could explain why blowing stopped once started.

PRESIDENT: Commander, I have witnessed testing of the valve on TINOSA and it took sixty-eight seconds to get your cycle, for the lights to come on.

WITNESS: Did it take that long, Admiral, to get an indication that the pressure from the oncoming bank was on the service header?

PRESIDENT: Now we were counting the interval from the time that the power failed until the lights went back on, the little red lights behind the numbers of your air banks.

WITNESS: I've seen this operation many times in THRESHER only. I do know that the light comes on after the valve is actually open enough to let some air through. Whether it is fully open or not I do not know, and I say again, my recollection on the way THRESHER's valves worked was more or less like fifteen seconds than a minute. I do not know; there may be different valves.

RADM Daspit: This would still limit you to one bank on the line. What steps could you take to get the other three back on?

WITNESS: I honestly don't know, Admiral. I believe that those air banks stops could be over ridden manually, back to the open position, but I wouldn't swear to it.

PRESIDENT: I believe this is correct. We were shown that, weren't we?

RADM Daspit: Even if you had four banks on the line No. 1 bank would not shut it would fail open.

WITNESS: This was the way the system was designed to operate; I've never seen it go through this function, but that's the way it's designed to operate. I don't know any reason why it wouldn't.

RADM Daspit: In your earlier testimony you spoke about a fifth bank; did you have five banks in THRESHER?

WITNESS: Yes, sir. I hope I'm right on that; I'm sure that's right, but now you've made me wonder. I only recall four lights on the panel.

PRESIDENT: There are only four on the TINOSA.

RADM Daspit: The older ships all had five banks.

WITNESS: This again can be checked against the ship's plans, but I thought it was five: I could be wrong. I know that we had four banks on service when we rigged for deep submergence. Whether that was all the banks or four fifths of them I don't recall, but I do remember we had four rigged for deep dive.

Questions by the counsel for the court:

Q. Did the THRESHER ever have a scram during a test program or at any other time when the b(3) 10 USC 130 operated too slowly?

A. No.

Q. Then proceeding with the last postulated problem. Three minutes after receipt of the initial report you noticed you were passing test depth in spite of all previous actions and you transferred to the accompanying ASR via UQC notice of your predicament. Will you give an approximation of the message that you might send at that point?

A. I think it would be essentially the same as I said before with the change that "the flooding is in the auxiliary machinery spaces" instead of in the engine-room. "I am in trouble. Have flooding in the auxiliary machinery space. Passing test depth".

Q. Again, after sending that message both depth and trim continue to increase, can you postulate any further actions or messages at that point?

A. Again I would like to think that I would have enough presence of mind to let the ASR know when approaching collapse depth.

Q. Would you normally use, in the absence of experiencing difficulty in blowing, the phrase "Attempting to blow"?

A. Would you ask that again, please?

Q. In the absence of your experiencing difficulty with the air blowing do you think you would normally employ the phrase "Attempting to blow"?

A. No, sir. The ballast control bank was right there at the Commanding Officer's right hand shoulder; he could see what was going on; he could tell whether the tanks were blowing or not, and it would seem to me that it should be either "Am blowing" or if you were having trouble, then it could possibly be "Am attempting to blow".

Q. Did you ever hear Captain Harvey in his talks with you use the expression "positive up angle"?

A. No, sir, I did not.

EXAMINATION BY THE COURT

Questions by a member, CAPT Osborn:

Q. What is the power source of the UQC in THRESHER?
A. 115 volts, 60 cycles AC. I can't trace it back for you any farther to one of the AC busses.

Q. Can I recall for you and see if this appears correct? It runs off an automatic bus transfer switch off b(3) 10 USC 1: through your transformers to the equipment. Does that recall anything to you?
A. I honestly don't think I ever knew exactly where that equipment got its power. I dare say you're right, but I couldn't say.

Q. Are you positive that there is no battery system?
A. Yes.

Q. In your long experience in construction and the design of the THRESHER, were you furnished any design studies with respect to influence of flooding casualties on reaction times, sink rates, etc.?
A. To the best of my recollection, no. We asked the Shipyard on several occasions for design guidance with respect to a ship's operating procedures and maintenance procedures. I believe that we asked for such guidance with regard to the normal lineup of both the ASW system, but again I'm not positive.

Q. Have you written any letters to the Shipyard or to the operational chain of command on the design of the ASW system and flooding casualties?
A. I have indeed. I referred earlier to design change requests to THRESHER and more specifically for the follow ships of the class with regard to a ballast control type panel in the ASW system. This problem area I am quite sure you will find covered in my report of the ship's first year of operation which was submitted via the operational chain of command to CNO, I believe, with copies to most everybody.

PRESIDENT: At this point the court directs counsel to obtain a copy of this report.

WITNESS: I also sat in on a THRESHER Class redesign conference of the Bureau of Ships; I don't recall just when this was; I believe it was the Spring of last year, and made what I thought was an impassioned plea to get rid of the ASW system to the greatest extent it was possible to do so, and to go to a fresh water cooling system, for whatever you need cooling water for. There may have been other places, too. Those remain in my mind.

Questions by a court member CAPT Osborn:

Q. Do you have any ideas as regards to catastrophic casualties with respect to THRESHER, and if so, will you name them in any order, or the order you think they might most likely occur?
A. I'm not sure that I understand your question. I had no fear whatsoever of the strength of the hull in THRESHER, if you're referring to the possibility of the hull simply collapsing while operating down to her test depths, no; I had no fear of that. I did have concern about the ship's main sea water system and the ship's auxiliary sea water systems, both fore and aft, not because of any weaknesses that I knew existed in those systems but because of the fact that there were large quantities of sea water in the ship in those systems, many joints and many hoses, as I have previously indicated, and were a potential source of flooding, and again, my greatest concern from the start was a flooding casualty at or near test depth, because the one I had showed me how fast that water can come in.

Q. On the basis of that casualty, was any further design implementation furnished you or made at that time?

A. Well, the immediate problem in the trim system, protecting the trim system against water hammer, yes; we received the results of the test that was subsequently conducted and we did receive some operating instructions with regard to the trim system. I mentioned slowing down the operators on the sea valves; that was only one phase of the fix. There was also an interlock installed, which prevented opening -- I hope I'm remembering this right, I'm not sure that I am -- but as I recall prevented opening the sea suction valve at depths greater than fifty feet, and then thirdly we were given a ship's operating instruction, or told that the system should be operated by opening the tank stop first and then the sea valve when flooding, and shutting them in reverse order, namely sea valves first and tank valves second. There were three phases to that phase.

Q. On the basis of the redesign study that you attended at BUSHIPS, was this particular casualty and similar casualties discussed in detail?

A. Not to my recollection, other than the point that I mentioned earlier that I brought up myself with regard to the general subject of trying to design the auxiliary salt water systems out of the ships. Now wait a minute; I would like to take that back, in that a soft trim system was discussed, as I recall, one which would not be subject to the sea pressure.

Q. With respect to an intended redesign in THRESHER, would you advise of the marginality or lack of much margin in the ship with respect to the THRESHER's operating condition at that time?

A. Not to my recollection. The hull, I was repeatedly told, was designed for a (b)(1)(A) [redacted] I know that the sea water pressures were tested to (b)(1)(A) [redacted], and no other information was given to me with regard to what margin for error existed in the ship.

Q. If you were at the control stand and in the absence of all communications, no communications, all you would have would be indications that you have in front of you at the control stand, which are operative, at a speed of about eight knots and a large line, three to four inch line carries away in the engine room, what is the first indication that you would have on the control instruments that you are looking at with respect, to give you something that you can actually observe, and would you describe how you think they would change?

A. I think the first thing you would notice is that you needed more dive on the stern planes to keep a zero bubble, and this would be followed rather quickly by the need for rise on the fairwater planes to maintain depth.

Q. Do you think you would lose depth very fast?

A. If you're talking about a four or a five inch opening which was not almost immediately isolated, yes; I think the ship would go down very rapidly.

Q. Do you think, just in terms of speed, do you think that the angle would come on the ship faster, or you would lose depth faster, in relative scope now; I'm not saying with respect --

A. I think the angle would be affected more quickly. Now at a speed of eight knots, as I recall, you could control the ship, maintain depth on the ship and still be out of trim by something of the order of ten to fifteen thousand pounds. I think trim angle would be your first indication of the situation that you postulated.

Q. If you were to see these in terms of trim angle change from the time you had a rupture, do you have any idea of the length of time before you would be able to see it; that is in terms of five seconds, sixty seconds, two minutes, or do you have any idea with respect to this?

A. I think it would be something of the order of twenty to thirty seconds but this is just pure conjecture.

Q. I'm interested in your reaction.

A. I would like to mention, if you are not already aware of this, that the reserve buoyancy in THRESHER, as I recall it, was (b) (1) (A) and I don't think it would take very long to flood that amount of water through a four or five inch opening, at b(1)

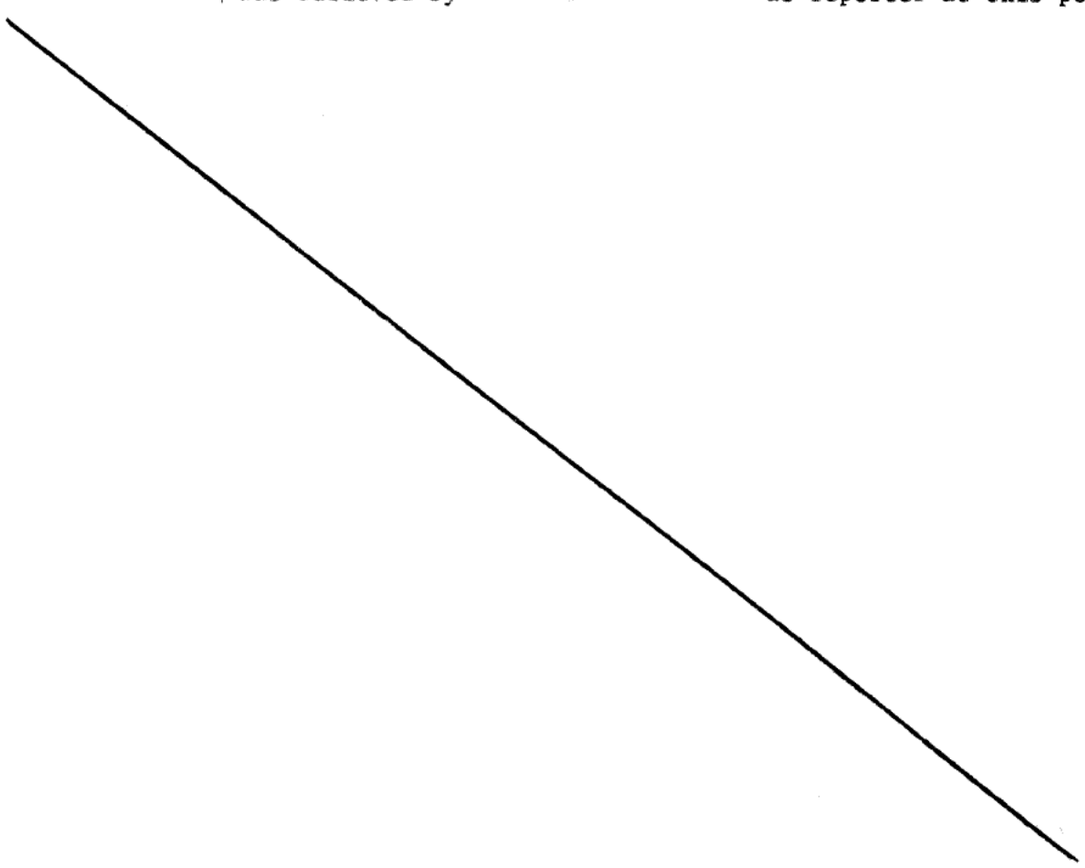
Q. Had you ever thought of providing equivalent circuits to the reactor SCRAM circuit with respect to automatic shutting of sea valves?

A. No, I did not. As I said, I recommended something on the order of a ballast control panel, which would give you centralized operations of your sea valves, but not automatic closure, and the reason that I have never felt that you should use this sort of thing on the sea valves was that you have got to be aware of the fact that you are liable to lose propulsion as the result of it, and this might not be desirable. In other words, I think somebody has got to judge whether the flooding is worse than the loss of propulsion would be, or not, and if you provide automatic closure you sacrifice that ability to judge.

Q. Is it your opinion that you have a better chance to judge than to use an automatic system, and this, I know, is just a matter of opinion?

A. Yes, I think so.

(b) (6) , was relieved by (b) (6) as reporter at this point.



Q. One more question: With respect to quality of workmanship and design effort, do you think that the systems that support the reactor are as well designed as the reactor systems?

A. Well, this area has changed a good deal since THRESHER was initially built. At the time THRESHER was built I do not believe that the non-nuclear systems received the same degree of quality control that the reactor plant did. Today, I think they probably do. For instance, there was no method of checking a silver-brazed pipe joint when THRESHER was built. Today there is such a method, and they are being checked. This is one instance.

Q. You've been in the Yard before the sil-brazed program and secondary systems - before the quality control program was instituted; is it your opinion that it has improved an awful lot?

A. Yes, sir, it is my opinion that it has improved a great deal.

Q. A lot of emphasis is being placed on this program at the present time.

A. Yes.

Q. What did you consider the most important thing to you with respect to the THRESHER and deep depth cruising at moderate speed - say 5 knots? What was the biggest thing?

A. Without question, the ability to ring up b(1)

Question by a court member, RADM Dapit:

Q. Some time ago a question was postulated to you about a dive which considered the effect on flooding, after which you noticed a slight change in trim. Considering these 15 degree angles, don't they almost negate a slight change in feeling from trim as a result of flooding?

A. Yes, sir, it would, until the flooding became much more severe. At 15 knots you can control one of these ships at almost any degree of ballasting and not be aware of it.

Question by a court member, CAPT Nash:

Q. You mentioned earlier difficulties that THRESHER had with her high pressure air system. Were any of these difficulties such as to affect the safety of the ship?

A. Yes, sir. In my opinion, very definitely so. If there is one thing that a submarine should have it is an effective high pressure air system. During early days of THRESHER this was not the case. I would like to point out that I can recall at least one occasion where we did attempt to blow the ballast tanks simply to surface, and pressure dropped to zero. There was no ability to blow that ship to the surface at all. I consider that dangerous.

Question by the president, VADM Austin:

Q. What was the cause of that?

A. The early reducers we had with the air loading tops. I don't know enough about the way they operate, but basically the pressure at which they were regulating, the discharge dropped to zero, and the reducer didn't care about it, and it stayed at zero.

Q. (By court member CAPT Nash) I do not know the system very well, of course, but I did not think the reducer had an effect in your main ballast system.

A. I believe you will find that the ballast tanks are blown from the (b) (1) (A) header supplied by the (b) (1) (A) reducer on which the header is connected to the air banks. Again, I would like to point out all of these troubles in the air system were documented in the design changes and weeps to the Yard, and I am sure the documentation is available if you would like to get into it in detail.

Questions by the president, VADM Austin:

Q. Commander Axene, if you surfaced twice from a relatively shallow dive, say 200 feet, by blowing, about how long would you blow each time, and what effect would this have on the pressure in your air banks?

A. Admiral, are you speaking of routine surfacing?

Q. Yes.

A. I would like to point out, first of all, I never surfaced THRESHER from a depth of 200 feet routinely. Normal procedure was to come to periscope depth, search for contacts and to surface from periscope depth. This conserves high pressure air and assures that you will not surface under somebody. Our routine was to blow first the forward group, followed by the after group, until the indicated keel depth was about 35 feet. Again, I am estimating this, but I believe such a blow would take approximately 200 pounds out of three air banks.

Q. I believe you said that you could run with 10 to 15,000 pounds out of trim at 8 knots; is that correct?

A. Yes, sir, and this, again, is an estimate, but I do remember a rule of thumb that I used: we learned that at 5 knots we could handle 5,000 pounds out of trim.

Q. So that you were extrapolating?

A. Yes, sir. Perhaps the figure I stated would be too high, but the control of the ship got better very quickly as you increased speed, and by the time you reached 10 knots, you had exceedingly good control, even when you were quite a bit out of trim.

Q. Now, regarding your concern about the danger of flooding at test depth, did you have such concern before you had this casualty on your first test dive?

A. Yes, sir. I would like to say that this isn't something I went around and worried about all the time, but I felt this was potentially the worst thing that could happen.

Q. Yes, but you didn't need any handbook addressing itself to deep submergence to cause you to have this concern?

A. No, sir. I first learned this when I heard I was to be assigned to THRESHER. This isn't something we should sacrifice, but it is the price we pay for the ability to go to this depth.

Q. You said you requested the Shipyard to give you some design guidance regarding operating procedures. Did you feel you needed any design guidance regarding the rate of flooding and the results thereof at deep submergence?

A. I would say I did not feel that need. I am reasonably sure I never asked for the information and, therefore, probably did not feel the need for it.

Q. You could look it up in a Marx Handbook?
A. Well, I think I pointed out earlier that we did on the ship discuss this problem frequently, and we satisfied ourselves that something on the order of a 1-inch hole would be more flooding than we could handle with the air banks alone.

Q. This was a subject of not only concern but discussion and consideration with respect to how you would operate that ship at deep depths?
A. Yes, sir.

Q. Did you have any discussions on this subject with Captain Harvey after he relieved you, Captain, or before?
A. In the process of change of command, I did explain to him my feeling in this area and cautioned him that I thought he should be aware of this situation.

Q. Also to take this as a matter of serious consideration?
A. Yes, sir.

Q. Do you know whether or not any progress has been made in response to your recommendation for a design change regarding the ASW system?
A. I do not know, Admiral. I have heard of none.

Q. Do you think that the safety of this type of ship would be enhanced

b(3) 10 USC 130

so that you could have an automatic

closure b(3) 10 USC 130

so that you could use judgment

on the way to shut it down?
A. Yes, sir, definitely.

Q. Because then you would be able to reduce the number of feet of piping and the number of couplings and the number of valves that you had to keep under the highest scrutiny.
A. Well, I don't entirely agree with that statement. but if you kept the

b(3) 10 USC 130

you could isolate the rest without--

Q. Without any danger to your b(3) 10 USC 130
A. Yes, sir. On the other hand, you have to be able to use your b(3) 10 USC 130 which relies on salt water for cooling. However, it is not as critical there. I say again, however, that I think the thing we want to do is get the ASW piping out of the ship to the greatest extent that we can, and I think we should get rid of the silver-brazedd joints and use the nickel-copper welded joints as much as possible. I've felt very strongly about this for some time. I keep being told that a sil-brazedd joint is as good as a welded one, but I have never seen a nickel-copper welded joint break, and I have seen a sil-brazedd joint break.

Q. Commander Axene, do you feel that THRESHER had a high state of morale among her officers and men when she left to go on this cruise from all that you knew about her and your contacts with former shipmates?

A. I would say yes, but I would like to point out that I was relieved in January. I can vouch for the morale of her people up to that point. However, I had visited the ship only one time from the time I was relieved up to the time of this cruise. This was the Friday before she sailed. I had lunch with the officers. My impression on that day, in talking principally to the officers, was that they were in a high state of morale. They were anxious to go and were glad the overhaul was over with.

Q. A normal state of ready-for-sea attitude?
A. Yes, sir.

Q. Commander, you have had experience in shipyard overhauls other than at this Yard, have you not?
A. Yes, sir.

Q. In your opinion, how does this Yard compare with other yards at which you have had shipyard overhaul experience in quality of workmanship and follow-through on items pointed out as deficient?
A. I think that the quality of workmanship here at Portsmouth is just as high as I've seen at any other shipyard, commercial or Government. I think that follow-through on requested or recommended changes, I think they are better than most every place I've been before. In fact, I think they are far too easy in bending to the wishes of a ship's crew in making little changes in the ship. I think this costs a lot of time and a lot of money that is not necessary. As to the quality of workmanship, although you find occasional items that are bad, I think it is certainly no worse than I've seen at other yards and, in many respects, better than at other yards.

Q. In other words, it is kind of like a good quality make of car; every now and then they will turn out a lemon because somebody, who is human, has erred in checking a particular unit.
A. I would not say "lemon." I would say you would find a bug now and then. I would say that over all, it was very good. I always felt that, in my experience with THRESHER, that Portsmouth built a very find submarine. I think they took longer, and so on, but I always felt it was a high quality submarine.

Q. (By court member, RADM Daspit) I believe you attended a conference, you said, last spring about the re-design of the THRESHER class, where you discussed the cooling system. Was there any discussion of how much more room they might take in the ship, or any reasons why they did not adopt this?
A. As a matter of fact, the subject was never really seriously discussed in conference. There was some discussion about the size of the heat exchangers that would be needed. We talked a bit about using a wrap-around-the-hull type heat exchanger. This was felt it might be a feasible way of doing it. Does that answer your question, sir?

COURT MEMBER, RADM DASPIT: Yes.

PRESIDENT: Are there any questions by counsel?

CROSS-EXAMINATION

Questions by LCDR Hecker, a party:

Q. Dean, is it conceivable in your mind that the Captain of THRESHER, believing himself to be in extremis, could have sent over the UQC the message that we have in evidence before this court, "Experiencing slight or minor difficulties; have positive up angle, attempting to blow; will keep you informed"?

A. I cannot feature him sending that message if he believed himself to be in extremis, no.

Neither counsel for the court, the court, nor any of the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything relating to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing further to say.

WITNESS: The over-all classification of my testimony is ~~SECRET.~~ UNCLASSIFIED

The witness was duly cautioned concerning his testimony and withdrew.

The court adjourned at 1630, 19 April 1963.

VOLUME II OF 12 VOLUMES

RECORD OF PROCEEDINGS

of a

COURT OF INQUIRY

convened at

U. S. Naval Submarine Base New London
Groton, Connecticut

and

Portsmouth Naval Shipyard
Portsmouth, New Hampshire

by order of

Commander in Chief
U. S. ATLANTIC FLEET

To inquire into the circumstances
of the loss at sea of

USS THRESHER (SS(N)593)

which occurred on

10 April 1963

Ordered on 10 April 1963

Page 281 to 558

EIGHTH DAY

Portsmouth Naval Shipyard
Portsmouth, New Hampshire
Saturday, April 20, 1963

The court met with open doors at 0907.

All persons connected with the court who were present when the court adjourned were again present in court, except Mr. (b) (6) (b) (6) was the reporter. Also absent was counsel for RADM Palmer, Captain French. Both RADM Palmer and his counsel expressly waived their presence. Also absent was counsel for the court Captain Katz. Commander C. R. Davis, USN, Assistant Counsel, was present as counsel for the court.

Samuel R. Heller, Jr., Captain, U. S. Navy, was recalled as a witness for the court, and reminded that his previous oath was still binding. The witness indicated his awareness of his rights under Article 31 of the Uniform Code of Military Justice, as well as the subject matter of the inquiry, and was examined as follows:

The witness was warned not to testify concerning classified matters.

DIRECT EXAMINATION

Questions by assistant counsel for the court:

Q. Would you please state your name, grade, organization and present duty station.
A. Samuel Ries Heller, Jr., Captain, U. S. Navy, Portsmouth Naval Shipyard, Design Superintendent.

Q. Would you please spell your last name for the record.
A. H-E-L-L-E-R.

Q. Captain, do you have an official responsibility with regard to debris material recovered from the scene of rescue operations being conducted in connection with the loss of THRESHER?
A. Yes, sir, I do.

Q. What is your official responsibility?
A. I have been designated as the custodian for the Shipyard to retain the material with proper safeguarding until requested by this court to produce this material.

Q. Do you maintain a positive receipt system for this material?
A. Yes, sir, I do.

Q. In performing this duty, have you officially and in due course received material for your custody which you are satisfied came from the scene of rescue operations being conducted in connection with the loss of THRESHER?
A. Yes, sir, I have.

Q. Do you now have such material in your custody?
A. I do.

Q. Would you produce it and identify it by item?

A. Yes, sir. The material in this canvas bag was received from Gunderson--initials E. J., an engineman second attached to the staff of Deputy COMSUBLANT. The material was brought in, in the bag, in the same way that I will bring it out. It consists of four plastic bags, each of which has material in it. The first--although marked Number "4" contains two pads which appear to be the inside of a Kapok lifejacket. There are two bags, one of which is marked Number "3" and another which is marked Number "2" which contain miscellaenous bits of plastic of various kinds. And finally, in the bag marked Number "1," one large piece of what appears to be borated polyethylene. This is marked Number "1" and in each bag is the identification of the area in which it was picked up, position, the ship's name, date, time, and the officer reporting the recapture of this material.

The cited objects were then offered in evidence. There being no objection, they were so received.

REPORTER: These will be marked as follows: bag number 1, Exhibit 57; bag number 2, Exhibit 58; bag number 3, Exhibit 59; and bag number 4, Exhibit 60.

Permission was requested by assistant counsel for the court to withdraw the actual items of Exhibits 57, 58, 59 and 60, at the conclusion of the inquiry and to substitute photographs thereof.

PRESIDENT: The court will wish to examine the material but there being no objection, you will be allowed to substitute photographs, subject to the court's wish to retain any item after its perusal.

By Assistant Counsel for the court:

Q. Captain, I notice in the bag marked Exhibit 58 a piece of material indicating a marked letter "B." (Showing exhibit to witness.)

A. Yes.

Q. Have you attempted to identify that mark?

A. Yes, sir, I have, with no success. The letter was found on the piece of plastic at the time of its receipt and it was so photographed on removal from the canvas bag at the time of receipt.

Q. Are your efforts to identify this mark continuing?

A. Yes, sir.

Neither counsel for the court, the court, nor the party desired to examine this witness further.

The president of the court infprmed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning, further reminding the witness that the court was still open and, therefore, classified material was in the same category as before.

The witness made the following statement:

WITNESS: As before, Admiral, I reserve the right at a later time to make such a statement.

PRESIDENT: In view of the fact that the court does intend to recall you at a later time, such right will be accorded at that time.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

Mr. Frederick L. Downs, a civilian, was recalled as a witness for the court, was reminded that his previous oath was still binding, also of his rights against self-incrimination, and was examined as follows:

ASST. COUNSEL FOR THE COURT: Mr. Downs, this is an open session of the court. Therefore, we cannot introduce any classified information. Do not volunteer any classified information and if I ask you a question, the answer to which would call for your divulging classified information, simply tell us rather than attempting to answer the question.

THE WITNESS: Yes, sir.

DIRECT EXAMINATION:

Questions by Assistant Counsel for the Court:

Q. State your name, address and present occupation.
A. Frederick L. Downs, (b) (6) New Hampshire. My occupation is Supervisory Technologist, rubber and plastic.

Q. Please spell your last name.
A. D-O-W-N-S.

ASSISTANT COUNSEL FOR THE COURT: If it please the court, Mr. Downs' qualifications appear on the record previously and have been accepted by the court. With the court's permission, I do not propose to re-establish these facts.

PRESIDENT: Any objection? The court concurs.

Questions by Assistant Counsel:

Q. Mr. Downs, pursuant to your duties at the Shipyard, did you have an occasion to make a series of tests on any of the exhibits which I show you at this time? (Witness examines Exhibits 57, 58, 59 and 60)
A. Yes, I have seen all of these.

Q. Please state the means and results of the tests that you conducted. I would appreciate it, as you go through these, if you would identify each object as we take them out of the bags.
A. All right, sir.

Q. You may refer to your notes to refresh your memory. However, your testimony must be your own remembrance.
A. Yes, sir. (Examining Exhibit 57) This material appears to be borated polyethylene similar to that used in reactor shielding. Therefore, tests were made to establish that this was indeed polyethylene and, further, it was the borated type rather than virgin. My tests on this consisted of pyrolysis test to identify it as polyethylene. The identification was made by the characteristic smell of paraffin and by the way in which this material burns and drips. It was most certainly polyethylene. The

establishment of whether or not this was borated, we can assume that by the color, but this has to be made by spectographic analysis which was conducted later. We found on this particular sample a number of introductions of one sort or another. There was some fabric, bits of fabric or threads which were removed partially. I think there are some still clinging, and the ones I examined were small, usually white, but there was one piece of green thread, and these were identified by microscopic study as being continuous filament synthetic fibers, probably nylon. This seemed to check out in the burning test which gave the characteristic smell of amine. Other particles, such as this one, will be described further by another witness as to their nature. This is a metallic wire which has been embedded in the material. On the opposite side we removed--where these marks are--several particles of metals. These were examined with a magnet and at least two were nonmagnetic, and one or two were magnetic metal. They were examined by chemistry and will be described later. The char on this material appeared to me as a char not caused by burning of the polyethylene itself. It seemed as if it was a rush of flame against it carrying over from something else. The char is carbon, identified by chemistry, of course. I have nothing more on that. I have tried to duplicate tests to fracture this material, which was impacted. This is the sort of material which is a real rugged material, and I can't do it by any means that I know. Impact tests tend to break off a piece, a shearing type of break. You don't get anything like this at all. Compression alone won't do it either. As yet, I have been able to find no means to establish why this break occurred in this fashion.

Q. Mr. Downs, are you continuing to attempt to establish this?
A. Yes, sir, I am.

Q. Very well, proceed.
A. (Witness examines material in Exhibit 58) This particular piece marked "c" from Exhibit 58 is very like the material previously discussed. This was determined to be polyethylene by its characteristic grain, odor and drip and color of flame. It is, however, commercial type. Chemical analysis showed this contained titanium but not boron. This is something not ordinarily used in naval stores. It probably could have been a personal item--just what, I don't know. It is, however, commercial polyethylene.

This object marked "f" in Exhibit 58 is something that is found on vessels in various fittings. It is used to plug off valves to prevent contamination or to plug the end of a pipe, and this is frequently found in naval vessels and in shipyards where it may be used to cap a bottle. Again, it is commercial polyethylene.

This object with the letter "B" and our marking of "a" from Exhibit 58 is, again, a piece of borated polyethylene similar to this sample here, and the only difference about this one is, by its appearance, this section was against a welded area and the charred area here is the result of hot work having been done next to that area after this was applied, and it was identified by the identical means of the other one.

Q. Mr. Downs, have you attempted to determine with what ink the letter "B" was placed?

A. No, sir, we did not. This was a marking simply put on--we assume it was put on--by some previous identification, and the problem of identification there would be most difficult because of the fact that we buy these things, as many other things, on a bid basis and one time you have an ink from one manufacturer and another time, from someone else. So, it would be most difficult to go through all these and establish which it is.

Q. Thank you. Please proceed.

A. This piece of material marked with our marking "b" from Exhibit 58 is a piece of virgin polyethylene. This is something which appears usually adjacent to this (indicating). It was identified again

by pyrolysis and contains no boron or other materials so is virgin polyethylene. These pieces are also borated polyethylene. The one with our marking of "g" is obviously identical with the yellow sample. These two pieces with our marking of "d" were identified by the usual pyrolysis test and characteristic smell as epoxy resin. This is not a pure resin. It is the type commonly recognized as a filler compound, a silicate filler just to produce gloss and give it more body. This is found in many places aboard a submarine. Just where, I wouldn't know.

This piece is a little bit different. (removing piece of material from bag, Exhibit 58) This was identified again by burning and smell and by microscopic comparison with a known sample, as high density foamed polyurethane. This sample contains our marking of "e". We happened on this particular piece to notice a paint coating on back. A spectrographic analysis showed this to be the primer commonly used on plate material. It contained zinc and several other materials which occur in the zinc chromate primer usually used by the Navy.

This is Exhibit 59, and the article I have here is marked "d", I believe, and this is a piece of brown rigid plastic which under the microscope appears to be porous material identified as syntactic foam-polyester-microballoons void filler material. This is a flat piece indicating it was used to fill a small flat area probably for sealing purposes. This is frequently found aboard submarines for such uses.

This next piece from Exhibit 59 has our marking "a". Again, by the same test we performed on the previous large sample, it was determined to be borated polyethylene. This is one that started our curiosity as to why the ragged tear which is most unusual and is why we have been trying to run some sort of investigation as to what would produce such a tear. Incidentally, there is one more item here which I am not going to talk about and that is the grease appearing on here and the other samples here. It appears to be a petroleum grease but I didn't identify that so I will leave that one.

This is an item marked "c" (from Exhibit 59) and this again by pyrolysis test was found to be an epoxy resin-- a compounded epoxy resin--evidently similar to the material previously described.

The larger several samples stuck together here are identified by our marking "b" was again examined by pyrolysis and found to be virgin polyethylene as it has no other chemicals present in it. Again we have here adhering grease and within it some small particles of white material which were identified by pyrolysis and by microscopic examination as low density polyurethane foam. Outside of the grease, I think that is all we have in this one.

Q. Let the record show that the grease and small pieces of porous white plastic adhering thereto are items marked "e" and "f". Further let the record show that the witness is now examining Exhibit 60. Proceed, sir.

A. I think both of these items can be treated as one, although I guess they are marked with the same number for identification, Number "4". These appear to us to be interior parts of a flotation jacket. I opened one of these and took a small sample of the fiber out and find it is indeed a floating material. I ran a flame test on this which consisted of exposing a section of fiber to a bunson flame for a period of one minute. In the flame it did not burn and when removed from the flame, of course it didn't burn any further either. It did discolor-blacken- and I took it the material is Kapok which is commonly found

in these things. We further believe it came from a lifejacket by the orange-red discoloration which is the color of these lifejackets ordinarily. There were no further tests made on this.

Q. Mr. Downs, in your opinion, and based on your experience, would you indicate which, if any, of these objects could have come from THRESHER and why.

A. Any one of these objects could have come from THRESHER because all of the materials that we have examined here are things that are commonly found aboard submarines of that class, sir. However, I couldn't say that any one of them did. I couldn't be absolutely sure of it because they may appear on other submarines.

Q. Mr. Downs, did you prepare a written report of the tests that you performed?

A. I did, sir, in collaboration with Mr. Carrigan of the chemical section.

Q. I show you this report. Is this your signature?

A. Yes, sir, it is.

Q. As far as you are concerned, is this an accurate report of the tests that you performed on these exhibits?

A. Yes.

The Memorandum cited above was submitted to the court and was offered in evidence by assistant counsel for the court.

There being no objection, it was received in evidence.

REPORTER: This will be Exhibit 61.

Neither counsel for the court, the court, nor the party present desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing further to add.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

Mr. John E. Carrigan, a civilian, was recalled as a witness for the court, was reminded that his previous oath was still binding, also of his right against self-incrimination, and was examined as follows:

ASST COUNSEL FOR THE COURT: Mr. Carrigan, this is an open session of the court. Therefore, we cannot introduce any classified information. Do not volunteer any classified information and if I ask a question the answer to which would call for your divulging classified information, simply tell us rather than attempting to answer the question.

THE WITNESS: Yes, sir.

DIRECT EXAMINATION

Questions by Assistant Counsel for the court:

Q. Please state your name, address, and present occupation.
A. John E. Carrigan, (b)(6) : New Hampshire. My position is Supervisory Chemist, Chemical Section of the Materials Testing Laboratory, Portsmouth Naval Shipyard.

Q. Please spell your last name.
A. C-A-R-R-I-G-A-N.

ASST COUNSEL FOR THE COURT: If it please the court, Mr. Carrigan's qualifications appear on the record previously and have been accepted by the court. With the court's permission, I do not propose to re-establish these facts.

PRESIDENT: Any objections? Proceed.

Q. Pursuant to your duties at the Shipyard, did you have occasion to make a series of tests on any of the exhibits which I show you at this time? (Witness then examined Exhibits 57 through 60)
A. Yes, sir, I did.

Q. Mr. Carrigan, item by item within the exhibits, would you indicate the means and the results of the tests you conducted?
A. Yes, sir. (Examining Exhibit 57) On Exhibit 57 all tests conducted by me were done spectographically with the exception of one which was made on the apparent charred portion of this exhibit. The basic material was found to contain boron in a concentration sufficiently high to establish the fact that it was indeed borated polyethylene. I removed particles that were embedded in the polyethylene from these areas which are ringed. These varied in size from that of the head of an ordinary common pin to one--the largest one--which was about the size of a split pea cut in two--reduced in size. These items were, as I say, checked spectographically and one of them was found to be lead and one found to be low alloy steel, and the other two had all of the elements in them which would be normally found in sea salt, so it was assumed that there had been sea water on them and evaporation had taken place. On the charred area, a little bit of it was scraped off, with the intent of attempting to determine whether there might be some metallic elements in it. I ran that spectographically and also made a carbon determination on it. The spectograph indicated that there was carbon in it, although the carbon figured as I recall around 68 per cent. You would normally expect to find 82 to 84 per cent carbon in material of this type, but in addition to these two elements, there again were sea salts present which I believe accounted for the low carbon content. And that's the extent to which this sample was tested.

(b)(6) relieved (b)(6) as reporter at this point.

Q. Mr. Carrigan, I show you a bag containing various items marked "Exhibit 58". Would you identify the items in the bag and explain the means and results of the tests conducted? You may use notes to refresh your memory; however, your testimony must be your own remembrance.
A. (The witness was handed Item marked "A") This item here was examined to establish the fact that it was polyethylene, borated polyethylene, by spectographic examination which indicated the boron present in the amount required to classify that as such. Material was scraped from this skinny area here, and in addition to the elements present in borated polyethylene, there were also metallic elements

found in this area which indicated residue compounds of the elements normally found in low alloy steel. That's the extent of my examination on that. (The witness was handed item marked "B") This was checked spectographically and no metallic elements at all were found. That's the extent on this item. (The witness was handed item marked "C") The spectograph showed that this plastic material here contained titanium and contained no boron. (The witness was handed item marked "D") This I made no tests on this particular item. (The witness was handed item marked "E") I removed some of the yellow paint from this item here, examined it on the spectograph and found that it contained chromium, zinc, titanium, silicone, traces of magnesium, and aluminum; elements all present in zinc chromate paint. (The witness was handed item marked "F") We did check this spectographically and found no metallic elements. (The witness was handed item marked "G") The thickness of this -- I wonder if I could just check my notes on this (the witness was granted such permission and referred to his notes) -- That item was found to be borated polyethylene.

Q. I hand you Exhibit 59. I hand you item marked "D".
A. I have made no tests on this particular item.

Q. I hand you item marked "B".
A. On this item I removed some of the greasy material, and by means of several solvents and a flow point test, and also examination under the ultraviolet light, established the fact that this material here is a petrolatum type base.

Q. I hand you item marked "A".
A. Here again, this piece was established as being borated polyethylene by spectograph analysis.

Q. I hand you item marked "C".
A. I made no tests on this piece.

Q. I hand you items "E" and "F", consisting of brown grease--apparently brown grease--and white material.
A. I made no tests on this.

Q. I hand you Exhibit 60.
A. I made no tests on that.

Q. Mr. Carrigan, on those items to which you have indicated you conducted tests, which, if any, could have come from THRESHER, and why?
A. I would say that every item there, with the exception of the titanium type polyethylene, could have come from a submarine because I have either tested materials similar to these or I know that materials similar to them are listed in the Navy Stock Catalog; and I am referring in this particular case to the chrome paint and the petrolatum type grease.

Q. Did you collaborate with Mr. Downs and prepare and sign a report covering the tests on these exhibits, sir?
A. I did.

Q. I show you Exhibit 61. This is a Test Memorandum Report.
A. I signed that with him.

Q. Would you indicate your signature?
A. This is my signature (The witness pointed to his signature on Exhibit 61.)

Neither counsel for the court, the court, nor the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing further to say.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

(b) (6) , (b) (6) , (b) (6) , New Hampshire, was called as a witness by the court, was informed of the subject matter of the inquiry, was advised of his rights against self incrimination, was duly sworn, and examined as follows:

The witness was warned not to testify concerning classified matters.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Will you please state your name, address, and present occupation?
A. (b) (6) , (b) (6) , New Hampshire, Supervisory Nuclear Power Engineer.

Q. Please spell your last name?
A. (b) (6)

Q. Would you summarize your educational and professional background in the field of radiological measurement?
A. I have a Master of Science Degree in Chemical Engineering. I have been to the Westinghouse Atomic Power Division School in Bettis, Pennsylvania; Radiological Safety School at Fort McClellan, Alabama; and I have been a member of the Nuclear Power Division at Portsmouth Naval Shipyard for four years.

Q. Pursuant to your official duties at the Shipyard, did you have any occasion to perform tests for radiation on the exhibits which I now show you? I ask that you examine Exhibits 57 through 60, individually and in detail.
A. (The witness checked each item in Exhibits 57, 58, and 59, and the items in Exhibit 60.)

Q. Would you describe the nature and results of the tests you performed on the items in Exhibits 57 through 60?

A. I surveyed each part with an AN/PDR-27-J, which is a radiation detector which measures BETA and GAMMA radiation, and I repeated the survey on each item with an AN/PDR-56, which detects ALPHA radiation.

Q. And what were the results of these tests?

A. I found no radiation level above natural background.

Q. Were the same tests performed on all exhibits that I have shown you?

A. Yes.

Q. Neither counsel for the court, the court, nor the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing further to say.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

COUNSEL FOR THE COURT: If the court please, a five minute recess is requested, sir.

PRESIDENT: Let's say ten, and then make it ten.

The court recessed at 1000, 20 April 1963.

The court opened at 1017, 20 April 1963.

All persons connected with the inquiry who were present when the court recessed are again present in court. CAPT French, counsel for the party, RADM Palmer, entered the court at this opening. Captain Katz returned as counsel for the court.

(b) (6) , Lieutenant Commander, U. S. Navy, was called as a witness by the court, was informed of the subject matter of the inquiry, was advised of his rights under Article 31 of the Uniform Code of Military Justice, was duly sworn and examined as follows:

The witness was warned not to testify concerning classified matters.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, rank, organization and present duty station?

A. (b) (6) , Lieutenant Commander, United States Navy, presently attached to the Staff of Deputy Commander Submarine Force Atlantic.

Q. And would you spell your last name?

A. (b) (6)

Q. State briefly your naval and submarine experience?

A. Well, I was in destroyers for a couple of years. I went to the USS TRIGGER, an attack class submarine, in which ship I qualified in submarines and spent three years on board her as Engineer. I was selected for Nuclear Power Training in 1955, and was, after nuclear power training, assigned to the pre-commissioning detail of the USS SKATE, SSN-578. I served on SKATE -- put her in commission -- and served on her for two years, including the two Arctic trips on board her. I was then sent down to Pascagoula, Mississippi, to commission the first nuclear submarine to be built in Ingals shipbuilding, USS SCULPIN, as Engineer Officer. I served on SCULPIN in excess of two years before receiving orders to the USS THRESHER as Executive Officer in March of last year.

Q. What are your duties on the Staff of the Deputy Commander Submarine Force, United States Atlantic Fleet?

A. I have the job of Tactical Training Officer and fulfill the duties of Nuclear Power Advisor to the Staff.

Q. Referring first to your days of service in the THRESHER, describe your duties on that ship and the operations in which you participated?

A. My primary duty during the entire period on THRESHER, which was from March of '62 until January of this year, was Executive Officer, in which job I was generally responsible for the training, personnel matters, and administration of the ship. I also fulfilled the job of Operations Officer and Navigator during a portion of this tour. You want me to go into operations?

Q. Yes, please do.

A. I joined THRESHER in March, as I said, and during the first two weeks sort of rode as an observer in advance ASW exercises, and then relieved as the Executive Officer and we went to sea for a VIP cruise and took the ASW Council to sea, conducted an ORI the first week that I was aboard.

Q. Please refrain from using abbreviations which are not generally understood and explain for the record what you meant by "ORI"?

A. ORI is an abbreviation for Operational Readiness Inspection. It's an annual inspection and examination of the ship's readiness to perform its military functions, so that shortly after I relieved as Executive Officer we conducted this drill inspection. We operated out of Charleston, South Carolina, on a couple of press cruises and local operations out of that area, then returned to Electric Boat Company for a two week pre-shock hardening availability. From there we went to the Florida area and conducted special services and technical tests regarding some of the new equipment on THRESHER. During this period we operated out of Cape Canaveral also, and it was at this time we were holed by a tug during a mooring exercise -- holed in the ballast tank -- a very minor type of accident but it did require us going back to EB and having it repaired.

Q. When you say "EB," to what do you refer.

A. Electric Boat Company in Groton. It required us going back there and having repairs made prior to our going on our big operation, which was shock trials. We left Electric Boat and returned to the Key West Area and were there for approximately a month, during which time we operated and conducted class shock trials.

Q. With regard to the holing incident which you have described, are you satisfied in your own mind that it was adequately repaired and that the pressure hull of the submarine was in no way affected?

A. Yes, sir. The holing was only in the thin-skinned ballast tank. It had nothing to do with the watertight integrity of the ship. It was a small hole in a very thin section of the ballast structure. This is sort of like a superstructure on a ship and has no effect to watertight integrity of the ship and no way affected the watertight integrity of the ship, and it was, of course, adequately repaired before we continued.

Q. Please go on?

A. We completed shock trials. It was a long, exhaustive operation. We then returned to Portsmouth Naval Shipyard in July, 1962, to commence post-shakedown availability. The rest of my term on board THRESHER was involved with post-shakedown availability from July of '62 until January of '63, sir.

Q. You have told us about your service as Engineer Officer in SCULPIN. What were your duties in SKATE?

A. I served in most of the Engineering Division Officer jobs in SKATE. For the most part. I was Diving Officer on her, and Main Propulsion Assistant.

Q. As Executive Officer in THRESHER, you have delineated your duties relating to personnel and the training of personnel in her. Having served as Diving Officer in the SKATE, Engineer Officer in SCULPIN, and Executive Officer in THRESHER, how would you compare their respective personnel capabilities and the state of their training?

A. Well, as the court is well aware, the qualifications for assignment to duties in any of these ships is extremely stringent. The training and background of the people that go to these ships is the last word, the utmost in training, so you are really asking me to compare what I consider to be three of the finest ships in the Navy. I would say that the THRESHER, as far as the personnel and training and readiness, compares favorably with the other two. And, as Executive Officer on her, since I was responsible to a large degree for her training, of course, I'm probably a little bit biased, but I think that without a doubt the THRESHER was the finest trained, had the best crew of any ship I've ever served with.

Q. Referring to the period during which you served as Executive Officer in THRESHER, are you familiar with the rate of turnover of personnel in THRESHER?

A. Yes, sir, I am.

Q. I would like you to direct your reply then, particularly to the period of the post-shakedown availability and that portion of it during which you were Executive Officer. From the standpoint of the competence, readiness, and state of her training of her personnel, did you consider the effect of that rate of turnover excessive?

A. No, sir, I did not. I would say that THRESHER's personnel turnover was, if anything, a little better than the average for the attack nuclear submarine. This was, undoubtedly, due to the fact that she was first of her class, a more complex ship than some of the others. She was new. In this area in her career her turnover was somewhat average, I would say. Probably better than average. I have looked at her roster, of course, since then, and it struck me how many really experienced people were still on board; that is, people that had put her in commission. In every group of people, the officer group, the various rating groups, the senior people, the hard core people were all the original commissioning crew and extremely experienced people. Of course, I knew them all personally. I knew them very well. And I looked at this because I'm interested in it; and looking down, in each group, I come across this hard core of very experienced people. There were new people on board, quite a few that hadn't gone to sea with me before, say approximately thirty; but I think, in general, if you look at it closely, you'll see these people were in excess of allowance. They were on board for training purposes and generally did not fulfill any billets. Key billets were filled by very experienced people.

Q. As to the reply you have given, to clarify it in my mind, is it true that the reply you have just made relates only to the periods during which you were Executive Officer, or do you wish to extend your reply to extend beyond that period.

A. My reply reflected the total period from the time I was on board until the THRESHER was lost. As far as during the period when I was Executive Officer, just that period, I would say in general the same remarks still apply. We kept

the real experienced people and we didn't lose very many of the top notch key personnel. We did get a few new people in, but it was after I left that they did get a large influx. By and large --again, I'm speaking comparatively--there were several people who were new aboard that I didn't know.

Q. You referred to a core of key personnel, a hard core?
A. Yes, sir.

Q. Can you go into some detail with regard to that?
A. Yes, sir. If you desire, I can go down the various groups and speak of the people by names who were very experienced personnel on board.

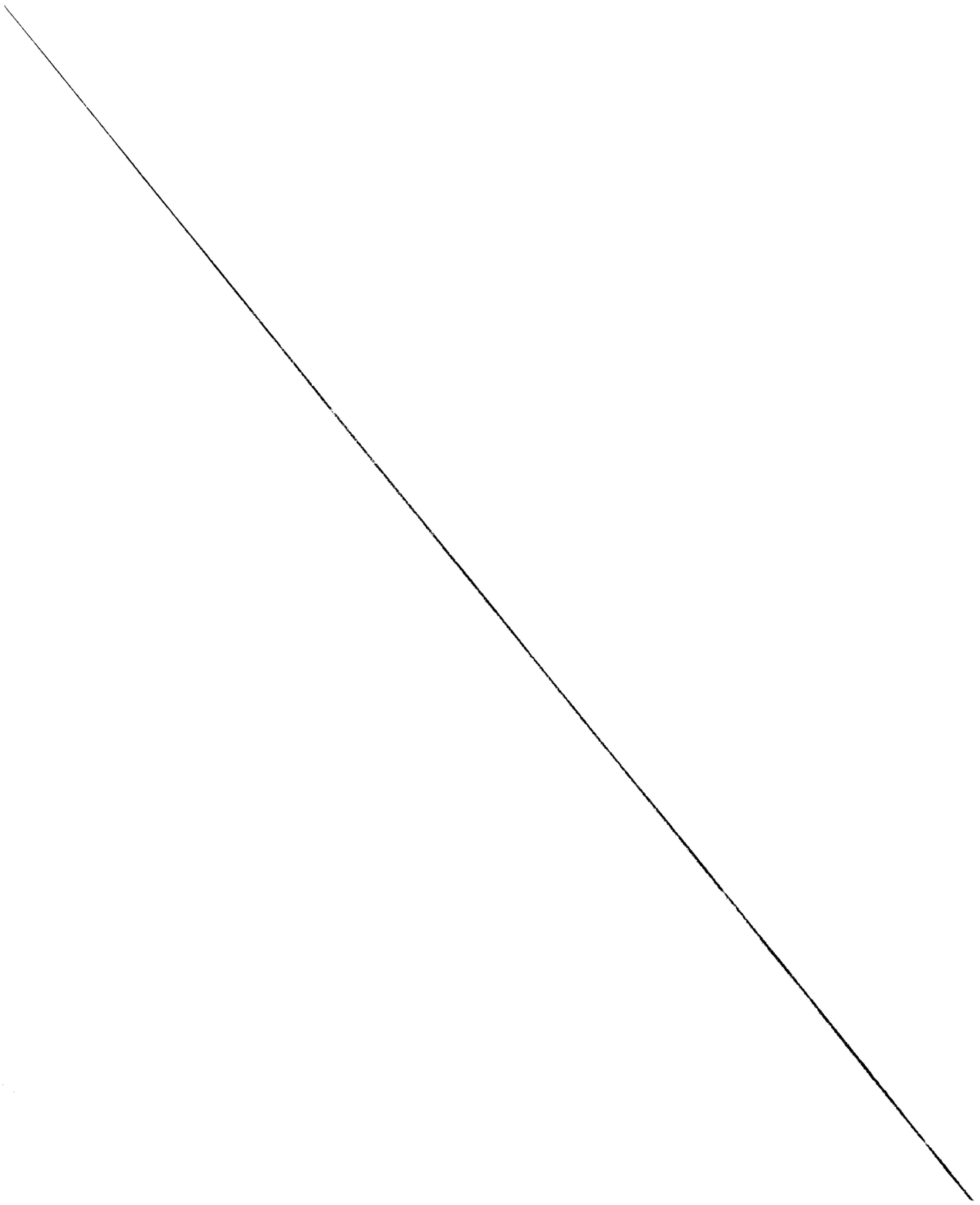
Q. Enough, perhaps, to give this court an idea of the hard-core, key personnel on board? Please do that.
A. Yes, sir. In the officers, the three people who had been on board right from commissioning and fulfilled the key jobs in the officers' structure, with the exception of the CO and XO, were Lieutenant Commander Lyman, the Engineer- had put the ship in commission-- was a methodical and precise, exacting officer who I had the utmost respect for. Lieutenant Commander DiNola had recently assumed the jobs of Operations Officer and Navigator, had been on the ship from commissioning, was qualified for command of submarines. Lieutenant Smarz was one of the most outstanding of our line integrated officers-- that is, an officer who had been selected from the enlisted ranks to be an officer. He had qualified for submarines on a conventional submarine. He had served as an enlisted man on the NAUTILUS, the first nuclear submarine. His submarine experience was very extensive. He was an outstanding officer; in my opinion, the best officer of the deck we had on board ship. His job at the time THRESHER was lost was an extremely critical one, Auxiliary Division Officer. He was the Diving Officer of the ship and, undoubtedly, had the dive at the time of the loss.

Q. Are you presuming that that was so from the fact that that was his billet?
A. I am presuming it from the fact that that was his billet, and also that in this type of evolution the ship's Diving Officer always had the dive. I don't know from personal knowledge, for sure, that Smarz had the dive, but I assume that with a fair amount of assurance.

Q. But did he ever state to you that he was going to dive her when they took her out?
A. He did not, sir. There were three other officers who were not qualified in submarines, but who had been on for a period of about a year. Each had been on all the time I had been on. Lieutenant Guy Parsons, the Gunnery Officer, who had had a year in destroyers and this was his first submarine-- I considered Guy to be one of the very outstanding, young, direct input officers in the Navy. I looked for him to really go far.

Q. What did you mean by "direct input officer"?
A. We have a direct input program presently where we take officers, graduates from the Naval Academy, NROTC Units, and start right from the beginning and train them in submarines and in nuclear power and then assign them to submarines. In years past-- in my case, for example-- it was conventional for an officer to go to destroyers or surface craft first, and then go to submarines. This business of taking them directly, we refer to them as direct input officers. Lieutenant Parsons was not really a direct input officer in that he had served a year in destroyers before going to submarines. Lieutenants (junior grade) Henry

and Babcock were on board during my whole tour, were very bright, smart and energetic officers. The other officers on the ship, the four recent arrivals, I was not familiar with; and they were, in general, unassigned to duty-- well, they were not assigned to duties; they were in excess of allowance in general and in a training status. The Executive Officer, Lieutenant Commander Garner,



relieved me, was a shipmate of mine on SKATE; I served with him for a good period of time. He's one of the few officers in the Navy who I knew I could have turned over the job to with absolutely no worry or concern about his ability to fulfill it. I knew Lieutenant Commander Harvey only by reputation and as a friend.

Q. What was his reputation as you knew it?

A. His reputation was of being one of the most outstanding officers in his year group -- the same year group that I'm in. He was the first officer of our group to get command of a nuclear attack submarine; and this, in itself, was indicative of the regard that the Navy had in Captain Harvey. In the enlisted group, I have looked down the roster of the people who were attached at the time she was lost. In the Quartermaster group, the whole group, as reflected in the allowance, the whole top group of quartermasters were on board during my whole tour and were, in fact, on board from commissioning. The Leadingman, Gunter, was my assistant navigator during a long portion, or all of my period on board, and was the finest assistant navigator I have ever seen. In the Sonarman group we had, three of the six were extremely experienced sonarmen. Chief Forni, the leadingman, was the most experienced BQQ-2 sonarman in the Navy. Torpedomen--the chief of the boat--Johnson, was always 4.0. He was my assistant, of course, as Exec, throughout my tour and I had nothing but the utmost admiration for him.

Q. Commander, in order that there will be no mistake as to what you mean by 4.0, would you paraphrase it in a word?

A. It was my duty to mark the Chief of the Boat in his semi-annual fitness. We mark on a basis of 4.0 to 0.0.

Q. 4.0 means one hundred percent, does it?

A. 4.0 means one hundred percent, yes, sir; and it's rare we have a man who consistently across the board receives 4.0. Johnson always received 4.0. In Fire Controlmen we had two of the three who had been on board approximately two years. Electronic Technicians, I count four that had been in the original commissioning crew, four others who had been on board about two years. Radiomen, two of the four were original commissioning. One of them was due to -- the senior one -- was due to relieve, possibly, as Chief of the Boat, according to my recent conversations with Lieutenant Commander Garner; Johnson was going to be transferred to another new submarine. The only rating groups in which there were relatively new people as a group were in the groups of yeomen and cooks, completely untechnical personnel, and this, I feel, has very little effect on the matter. In the Machinist's Mate and Enginemen categories I could go into the same routine there. The leadingmen in the "M" Division, Wise and Aresenault, were two chiefs who had been on since commissioning. Wise was so outstanding that he was fulfilling the billet of MPA aboard the ship.

Q. What's that?

A. Main Propulsion Assistant aboard the ship. The Auxiliarymen, Chief Johnson, who was the leading auxiliaryman, had been on board since commissioning. Three of the other five auxiliarymen had been on board since commissioning. In the Electrical ratings, the Shafer brothers, one a Master Chief and the other a Senior Chief, who were in charge of the gang, had been on board right from the beginning. Ben Shafer, the senior one, had been on board at commissioning; his brother, John Shafer, had come aboard about a year later.

Q. Did you know them?

A. Yes, sir, I knew them very well.

Q. Could you give us an evaluation of them as you remember them?

A. Well, the senior one, Ben Shafer, was the administrative assistant to the Engineering Officer. His duties surpassed just the normal electrical chief's duty. He was the senior petty officer in the Engineering Department and, as such, was very similar to being the chief of the boat to the engineering gang. He performed all the administrative tasks of the Engineer, took a tremendous load off the Engineer. His professional competence was tops. I have seen few like him in the program. His brother--they were very close, of course--and his brother, in general, was the man who ran the Electrical Division. Ben Shafer was more an administrative assistant to the Engineer.

Q. With reference to the Shafers, did you speak with them after you left the ship? Can you recall any contacts with them in the period after you were detached as Executive Officer?

A. I had contacts with many of the personnel after I left. I do not recall personal contact with either of the Shafer brothers, though.

Q. All right, please continue.

A. Another chief in the electrical gang, who was in charge of the reactor control division was Chief Pennington. I did talk to him within two days prior to the casualty. Pennington was one of the hardest working, conscientious Navy men it has been my privilege to serve with. I think those are all the comments I have regarding the personnel, unless you have any questions.

Q. You, in all your comments, have expressed confidence in the personnel of THRESHER. Was there any man or billet on board as to which you had some question?

A. No, sir.

Q. --as to competence?

A. Because of this thing that I've spoken of, where I've gone through and looked at these, I found such strength and experience in each of the critical groups of personnel on board, I can see no weakness in the personnel situation and it was remarkable that it was still as strong on this date in the ship's career.

Q. You have covered now the personnel in THRESHER. Looking back at the time when you left THRESHER, what did you think of the ship, itself?

A. Let me say that prior to that time, when I was attached to SCULPIN and even before, I had thought of the THRESHER as being the ultimate and the last word in nuclear attack submarines, and if the Bureau of Naval Personnel had given me my choice as far as duty, I would have picked the THRESHER for duty out of all the other ships in the Navy. And during my tour on board I never experienced or saw anything that made me change that impression. She was the last word and the utmost materially, operationally, and in every other way, and I wouldn't have traded my job as Exec on the THRESHER with any other Exec on the river.

Q. Then, you had confidence in the ship and its construction?

A. Utmost confidence, yes, sir.

Q. Now, you mentioned earlier in your testimony that your present billet on the staff of the Deputy Commander Submarine Force Atlantic Fleet is as Tactical Training Officer and nuclear adviser. Can you succinctly describe the duties of your billet?

A. Well, as Tactical Training Officer, I am responsible under the Force Commander for training of submarines of the Force in fulfilling their tactical mission; that is, in the techniques and methods involved in pro-submarine warfare; that's it.

Q. Would you say that your job in that respect is the training of submarines in the Force in tactical matters, such as, anti-submarine warfare, evasion, fire control, and tactical attack procedures?

A. Yes, sir.

Q. And would you give us a word of description as to your duties as nuclear adviser?

A. I am the officer attached to the Staff who has had nuclear submarine operational experience and, as such, advises the Deputy Commander Submarine Force regarding matters of training and operation of nuclear propelled ships.

Q. Then, after you left THRESHER and during the remaining period of her post-shakedown availability, did these duties make it necessary for you to have continuing contacts with her personnel?

A. It did, yes, sir. THRESHER was readying herself for a period of operations. She had a lot of equipment to evaluate and, as such, her people continuously contacted me and I contacted them regarding the state of completion of the overhaul regarding these operations that they were going to perform regarding training matters and personnel matters.

Q. Do you then have personal knowledge concerning the attitudes of the crew, what individual members of the crew were thinking and their morale up to the period when she put to sea after her post-shakedown availability?

A. Yes, sir, I had occasion to talk to several of the members of the crew within a week to two weeks before the sea trials. I could go into the details of the conversation but, in general--

Q. If you think there was something in those conversations which will help the business of this court, then please do so thoroughly.

A. Sir, as I mentioned before I talked to Pennington--Chief Pennington--an Electrician's Mate Chief, only a few days prior to April 10th. We had borrowed the services of Pennington--"we" being Deputy ComSubLant--had borrowed the services of Pennington for a motivation trip, that is, a recruiting trip to Chicago, and he was to make an attempt to motivate and recruit a number of young high school lads in Chicago. When he returned from this trip I spent one whole morning talking to him. He, of course, had been the logical man to send because he was so enthusiastic about the Navy. They desired a smart, capable man who had been attached to nuclear submarines, preferably a Negro. Pennington fulfilled these qualifications. He had been a steward in the Navy and through in-training in the Navy, with diligent hard work and study had converted to electrician's mate, eventually made chief electrician's mate and was so outstanding that he succeeded to the billet being in charge of all the reactor control division on the ship. After he returned from this trip, and he was somewhat upset about the angle that the visit had taken, and he talked to me about this, but he also talked to me at some length about the THRESHER, and he was very upset because he thought he had missed sea trials. Sea trials had been delayed three days. I advised him he had not missed them and he was delighted to get up here and he of course subsequently did. He had a fierce pride in his ship, I would say almost to excess. I also had occasion to talk to Lieutenant Smarz and Chief Forni within the weeks prior to the loss of THRESHER regarding some new equipment that they were getting on board that they had tremendous confidence in. They were anxious to get to sea and prove this equipment. There are many people in the Navy that have questions about whether this particular gear will really work and Smarz and Forni were so enthusiastic about

it, they talked to me at some length about this gear and their confidence and great expectations for THRESHER's future. I had occasion to read a letter written by Captain Harvey. I read it after the event, of course, but in this the general tenor was confidence in the ability of the crew during ~~shock~~ trials and I recall a statement made that is probably noteworthy, that they certainly intended to walk before they ran on the trials.

Q. To whom was that letter addressed?

A. The letter was a personal status report from Captain Harvey to the Squadron Commander Commodore Andrews. I talked to Lieutenant Commander Garner and Lieutenant Parsons on the phone several times within the week prior to THRESHER going to sea regarding training and personnel matters. In general, the tenor of all these conversations was one of confidence and enthusiasm for the ship. These people knew me, I knew them very well. I am sure that if there had been any underlying concern about the status of the PSA, they would have expressed it. The only thing that was universally expressed, and as an operator I have expressed many times myself, was the impatience of the durations of the overhaul and the anxiety of the people to get them out. It is pretty much an operator's job and they consider it their job to keep the overhaul pushed.

Q. Then in addition to all the expressions of satisfaction and confidence, there were some complaints, is that correct?

A. I don't know if "complaints" is the item. I mean, there was a general attitude. I have been in many shipyards. I have been in Pascagoula, I have been in Mare Island and I had it up here before I was detached from THRESHER, an irritation at the slowness of the availability. There was no question about it; there were many delays in the availability and this irritates operators who want to get their ship out to sea. This is a complaint, if you would, that generally was held.

Q. They were impatient.

A. Impatient, yes, sir.

Q. Did they blame anyone in particular for their delays?

A. No, sir.

Q. They just wanted to get back to sea, is that it?

A. Yes, sir. The feeling is always that the Yard isn't putting enough people on the job, and they aren't pushing it as fast as they ought to, and when I first came up on the overhaul I didn't expect it to be much in excess of five months, although from experience we knew that it would be.

Q. Did you think it unusual that three members of the crew did not sail with the ship at the end of her post-shakedown availability?

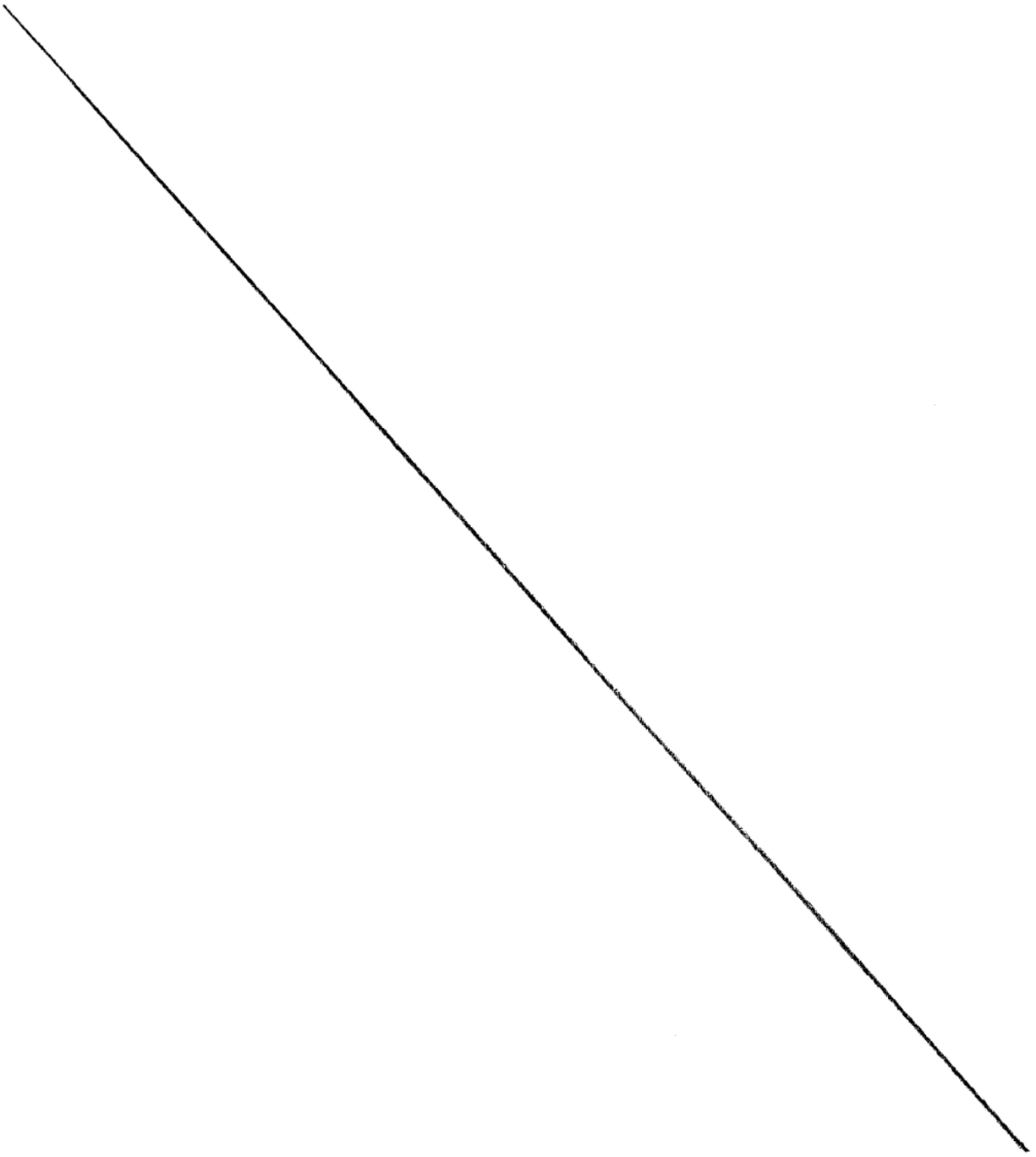
A. Yes, sir, I did consider it unusual. I would have fully expected ten to twenty people to have missed that trip. Normal routines for a short trip are to leave people in on leave, particularly in this type of a situation where the families in many cases were in the process of moving from Portsmouth to New London--there are always personnel problems, there are always desires for leave. Frequently some of the crew aren't feeling well, sick or something, and as I look down the roster, the sailing list of people who went, I was looking for many lines to be across their names which is the indication that people stayed in and I was shocked to find only three of that whole crew that didn't make the trip. And subsequently of course, from personal knowledge I know that in the case of two of them, Ray McCoole and Chief DeStefano, that they were basically kicked off the ship. Knowing McCoole, he would have probably had to be kicked off, and in his case it was strictly a case of

emergency leave due to a severe accident to his wife. In answer to your original questions I did think it unusual, yes, sir. I would have expected many more.

Q. She was better manned than you would have expected her to be then?

A. She was and I think this is further indicative of the confidence and enthusiasm these people had to go to sea. They weren't going to miss this trip for any minor reasons.

(b) (6) was relieved as reporter by (b) (6) at this point.



EXAMINATION BY THE COURT

Questions by a court member, CAPT NASH:

Q. When you related from the letter which Captain Harvey wrote, you mentioned that he referred to trials. Would you say, again, for the record, what trials he referred to?
A. He was referring to the readiness of the ship to go on sea trials.

Q. Did you, personally, have reason to question the quality of any of the Shipyard work?
A. No, sir.

Questions by a court member, CAPT HUSHING:

Q. I would like to go to this matter of material condition a little bit. You served in SCULPIN, I believe?
A. I did, sir.

Q. Do you have a feel for the relative quality between this shipyard and the shipyard which built SCULPIN, in a general way, as far as the general over-all condition of the two ships was concerned?
A. Portsmouth is, of course, a much more experienced submarine constructor than Ingalls. SCULPIN was the first nuclear submarine to be built by Ingalls. They had to rely to a great extent on Portsmouth and Electric Boat for technical background. I think, in the final analysis, SCULPIN came out very well but, naturally, being built in a brand new shipyard with personnel not familiar with this type of submarine construction, we had no right to expect that the material of the ship was equivalent to that which went into THRESHER. For this reason, I would say that THRESHER's material excellence was probably--it probably surpassed SCULPIN's.

Q. Let me broaden the question to include the other shipyards in which you have seen overhauls, repairs, or new construction. You mentioned Mare Island, Electric Boat, Ingalls, and Portsmouth. Thinking of THRESHER against this backdrop, what do you say about the quality of the ship?
A. I don't know, Captain, if I am qualified to be able to pass judgment on that question. I am not a constructor. I have felt in my own mind--and it might be purely a subjective feeling--that Electric Boat is our best submarine constructor. But this is strictly a personal opinion based on an operator's point of view. I consider the Naval Shipyards to be excellent, speaking of Mare Island and Portsmouth. I had no concern ever about the quality of workmanship--only the rapidity of the job.

Q. Specifically asking you to think about the quality of the piping systems, for example, did you feel that the THRESHER, as constructed and modified during the part of the post-shakedown availability that you saw was receiving an adequate degree of quality from the Portsmouth Naval Shipyard?
A. Yes, sir, up to the degree that we have reached in this area, I think Portsmouth was--I have some reservations about that degree, but I think Portsmouth's quality control was equal to, if not better than, other shipyards.

Q. Are your reservations related to the processes or to the design, or to a combination of the two?

A. Related to the processes involved.

Q. Which processes?

A. I'm not sure if we're getting into a classified area, but I've had considerable reservations concerning sil-brazing processes.

Q. How about flexible hose connections?

A. I do not have any reservations in that area.

Q. How about welding?

A. I consider the welding to be adequate, sir.

Q. Then, from your answers, do we understand that you considered the quality of the piping systems in THRESHER up to the time you left, considering the condition they were in--that is, not finished--that the quality was adequate?

A. Yes, sir.

Q. How about the area which involved main propulsion units, such as installation of turbines and gears and clutches?

A. Well, we had the S5W plant in there, and it operated perfectly all the time I was on board. We were in a state of cleaning and fixing things in the Yard.

Q. How about the electrical installations in the ship as relate to power and power distribution?

A. It was extremely reliable by construction and design.

Q. How about interior communications in the ship?

A. There were many duplicated systems, some of which every ship has periodic trouble with. However, it was no cause of any particular trouble on THRESHER.

Q. How about the hydraulic systems on the ship?

A. Hydraulic systems have been one of our biggest problems in submarines. This was as reliable as submarine hydraulic systems are.

Q. Is that an adequate degree of reliability, in your opinion?

A. We always try to improve these systems, and "adequate" is a word--well, I would like to see it better, but this encompasses the general area of attempting to improve things. THRESHER was the last word in this respect. She had received improvements which other ships did not have. She was not less adequate than other ships. We are always trying to improve things.

Q. Did you think there was any question of safety relating to hydraulic systems?

A. No, sir.

Q. How about the air system on the ship?

A. Since the casualty, of course, I have thought about the effectiveness of air systems which we have in these ships for blowing at deep depths, and, obviously, we have limitations here.

Q. Are you talking about design aspects?

A. Yes, sir. As far as material condition of the system, we had the typical valve problems that I've experienced on all ships. We had valves that we had to replace. We had newly designed valves that we had

trouble with. If we didn't have trouble with these things, we wouldn't need a crew on board.

Q. Did you have any question of safety of the ship as related to the air system?

A. No, sir, not at the time. I mentioned the design problems of deep depth blowing.

Q. How about the main salt water circulating system, including such things as condensers?

A. Well, I was always more concerned about the auxiliary salt water systems with the large quantity of piping that we had, which perhaps, by design, could be reduced. We get into the sil-brazed area here, and this has always been a concern in the Navy.

Q. Relative to the auxiliary salt water system, did you have any feeling relative to the design of it? You mentioned reduction in the number of openings and the number of lines. Did you have any other feeling in this connection, that you wanted to make it simpler, perhaps?

A. Wanted to make it simpler and to reduce as much of the piping as possible, because we did have a feeling for the type of casualty we're talking about should these lines fail, and it was an extremely serious casualty. If we reduce the lines, we reduce the danger.

Q. Would you repeat again for us the over-all excellence of THRESHER from a material standpoint compared with the other ships with which you are familiar?

A. THRESHER was different from the other ships in that she had more complex equipment to increase her performance factor. When you get more complex equipment, you, of course, get more material problems. I had never any cause to worry about the general material status of the ship. We concerned ourselves about - as we always had on submarines - we thought about areas which could be improved.

Q. Considering, though, that she was a higher performance submarine and considering the things which you have mentioned, would you rate the THRESHER as being higher in material reliability medium, low, unsatisfactory?

A. Certainly not unsatisfactory, and certainly not low. In no way dangerous. I would consider her material readiness relatively high.

CROSS-EXAMINATION

Questions by the party, LCDR HECKER:

Q. Commander (b) (6) who could have been expected to man the UQC in a test dive of the type on which THRESHER was proceeding?

A. It could have been, in my feeling, one of three people - one of four people, perhaps. I would expect that most logically it would have been the Exec. It could have been Lieutenant Commander DiNola. It might have been the leading quartermaster Gunter, and in an emergency the Captain is likely right next to it. During my tour on board, the Exec or the Captain always felt free to reach over and talk on the UQC if he so desired, and normally there was one other man there to handle it on a routine basis.

Q. And could we expect that these individuals that you have named could have been in close proximity to one another?

A. They would have been.

Q. Are you aware of the last two UQC messages received by SKYLARK from THRESHER?

A. Yes, sir. I was with Admiral Ramage during the first three days of the search and rescue mission.

Q. Let me ask you this question with reference to the first of those messages: We have testimony in the record to the effect that the voice transmitting those messages was calm, confident and without hysteria. Now, with reference to your answers to my previous questions, do you feel that if any one of those individuals whom you have named as being expected to transmit a message over the UQC were the least bit concerned, that they would have transmitted the first of those last two messages in the manner in which they were transmitted?

A. Least bit concerned? If they were a little bit concerned, I would think they would be calm. If they were extremely concerned, I would think it would show in their voice. I don't know if I'm answering your question.

Q. Yes. Yes, you are. So at the time that message was transmitted by an individual, one of these three or four that you have named, that individual did not believe THRESHER to be in extremis?

A. No, sir.

Q. Nor did any of the other individuals who were in close proximity?

A. Due to the time elements of those messages, are you talking about the first of the two?

Q. The first.

A. The impression I received was that they were not real concerned. It seemed like they were just trying to keep the SKYLARK cut in that they had a problem, but it wasn't a severe problem at that time.

Q. With reference to the second of those messages, we have testimony in this record that the second and the last message received from THRESHER was initiated by the use of call signs, and then there was a garble, and then there were two words, testified to in the record before this court of inquiry to be "Test depth". Now, at that time, had this individual using the UQC been concerned, worried for the safety of the ship, would he have been likely to have used call signs, or would it not have been more likely that he would have grabbed that UQC and put his message in the water immediately?

A. I don't believe I can answer that question, sir.

Q. What would you have done under those conditions?

A. I don't know. There are two considerations here. One is a matter of habit, when the first thing you normally do is use call signs. How much habit would control and how much the extremity of the situation would control, I don't know. I would be just guessing, sir.

Q. As Executive Officer of THRESHER, one of your responsibilities lay in the training area. During the period of time you served as Executive Officer of THRESHER, did you discuss, cover in any way, or train in any way in casualty procedures?

A. Yes, sir.

Q. Now, once again I will admit I am talking to the former Exec. of THRESHER and the Training Officer. Did you feel that such casualty training was conducted frequently enough to permit you to assure the Captain that, in your opinion, the crew was well trained in these procedures?

A. Yes, sir. In direct regard to that question, we trained almost to excess prior to shock trials, because we expected to have casualty conditions, and this was the largest operation which I served in on board THRESHER, so that prior to that period this was our No. 1 job, and we trained over and over and over again in the casualty conditions. After we left shock trials, we came to the Yard, and there was no opportunity to perform on-board training while going through post shakedown availability.

Q. During the conduct of such a training program, did you train and discuss and cover flooding casualties?

A. We did.

Q. In connection with this particular training, did you cover certain conditions of flooding and arrived at an operator's solution to handle these types of flooding?

A. Well, yes, sir. That's the whole purpose of casualty drills, and you simulate a casualty and assure that the personnel take the proper course of action. As you do this, you have a critique afterwards and discuss the problems encountered. When we discussed these drills, it was generally my practice to simulate in my own mind many types of casualties and write them down on slips of paper, and then walk around the ship, hand a problem to one of the sailors and tell him, "This is a casualty; you take it from there." The whole ship would spring into action, and we would determine whether they were handling it in the proper way.

Q. But in your over-all training in this area, were you satisfied, at the time THRESHER came into the Shipyard, that her officers and crew were well trained in the handling of flooding casualties?

A. There was no better trained crew, because of the shock trials. This type of thing was foremost, and they performed in an exemplary manner during that period. They were extremely well trained at that point in casualty control.

Q. In your over-all thinking with reference to the handling of flooding casualties, would you say that your primary reliance was on main propulsion, or air, or pumping with air, the trim and drain systems or any combination thereof?

A. Captain, you are relating this to-- Let me back up just a little bit. Most of our training in this area was training at shallow depths, because we were assumed to be at shallow depth for the trials. Is your question directed to deep depths?

Q. To all types of flooding casualties.

A. Would you then repeat the question, sir?

Q. With reference to your over-all thinking in handling flooding casualties and in your discussions, both in the wardroom and among the crew, was your primary reliance in handling these casualties placed on propulsion, blowing, the use of your pumping system available to you, your air, or any combination thereof? In other words, what was your primary reliance?

A. Primary reliance was, first of all, isolation of the leak or the flooding incident. As far as the control, the primary reliance was always on propulsion.

COUNSEL FOR THE PARTY, LCDR HECKER: I have no further questions, Mr. President.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. In response to questions from the court, you expressed opinions about the relative ranking that you would give specified shipyards and prefaced those remarks by saying it was your personal opinion, and that you were not a constructor. To your knowledge, would other submarine officers rank the shipyards in some different order?

A. Most certainly. Each has his own ideas along these lines.

COUNSEL FOR THE COURT: That's all I have in open session, sir.

Counsel for neither party had any further questions.

PRESIDENT: Commander (b)(6) ., the court has questions which they will ask which will elicit information of a classified nature, so please remain when we clear the court. The court is cleared for closed session.

The court was cleared of spectators, and the following proceedings were held behind closed doors. The witness under examination continued his testimony as follows:

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. From your experience in THRESHER and other submarines, do you have any reservations about the auxiliary piping systems in THRESHER?

A. I have. As I mentioned, I think, in open session, personal reservations about the piping systems, specifically those piping systems having sil-brazed joints in them. I say this because on the SCULPIN we had to go through extensive research into the sil-brazed problem at that time, as I am sure the court is aware. The piping through the reactor compartment was removed and was the subject of a SHIPALT during the post-shakedown availability of SCULPIN, and welded piping was substituted therefor. The stripping that we experienced was terrifying to me to look at, because they were poorly jointed, and some appeared to have no bond at all. None of them had pulled out and leaked, but this caused a thorough investigation by the Bureau of Ships, with which I was closely associated. The decision with SCULPIN was to compromise by welding between the sea valves and back-up valves in the engineering spaces and to institute a great deal of quality control measures on the sil-brazing. I refer again to my limitations as a constructor, but I personally feel we would have done better to weld all the piping.

Q. Regarding the shock tests to which you have alluded, go into greater detail that in your unclassified testimony, with particular reference to significant material failures and personnel performance.

A. Personnel performance was outstanding throughout the thing. The crew's performance with casualties was outstanding. In general, the ship performed much better from a material standpoint than any of the experts predicted. We had anticipated that we would lose power and we, in fact, never did lose propulsion. All shock tests were more severe than any other ship had ever received, and we expected to have to resort to SCRAM, to lose propulsion, but it never happened. The tests were designed to

Unclassified

cause material weaknesses, and the number of failures were relatively few. There were some pull-outs of sil-brazed joints--generally small pipes that caused no severe effects, but supported my feeling that sil-braze is a weaker joint system than a welded system. As far as the crew goes, there was only one man of the total on board who had any real serious mental reservations about the thing. He had a psychological problem, and we eventually left him on the beach, and he was not on board when THRESHER went on sea trials. He was eventually discharged from the Navy.

Q. What was his name--you say he was discharged from the Navy?
A. Yes, sir.

Q. Then do not name him. Proceed.
A. The most severe material failure didn't show up until days after the shock trials. It was important in that we had a weep on a weld around the PUFFS hydrofoam weld. This was only through a real stroke of fortune that we found this thing. A puddle of water had developed low on the ship, and upon tasting it, we found it was salt water, and it took some time to discover where it was coming from. We had, in fact, been performing deeper dives, and it was up to the Commanding Officer how deep, based on the amount of material failures, and I am fairly certain we did not go to test depth. As I recollect, we went down about b(1) and later, when we discovered this weep, we reported it in a routine fashion to SUBLANT, and SUBLANT directed us to discontinue dives. We had only a few more sea trials to complete at that time, and they were at the shallow depths, and we assured COMSUBLANT that it was relatively safe, because we had no bad reaction before the deep depths, and therefore we felt we could continue sound trials at 100 feet. We were given this permission with this limitation imposed on the ship. I think it is important to note that we did not go to test depth after the sea trials. This was probably the first time since shock trials that the ship had been to test depth.

Q. In your testimony you alluded to the fact that we were getting into the classified area. Is there anything else of a classified nature which you would like to volunteer to the court which would help us in this inquiry?
A. Only if you want me to get into suppositions of what might have occurred based on less evidence than the court has.

PRESIDENT: The court would like to hear any suppositions that you have but we would like for you to reserve that until just before you leave the courtroom, so that you will not prejudice any of the questions that are going to be asked you in the interim.

COURT MEMBER, RADM DASPIT: Mr. President, this testimony about the leak in the PUFFS hydrofoam appeared two or three times before. I suggest we direct counsel to have the Yard look into this and to get testimony for us on this item at some later time.

PRESIDENT: Counsel, you are so directed.

COUNSEL FOR THE COURT: Aye, aye, sir.

Unclassified

REEXAMINATION BY THE COURT

Questions by a court member, CAPT NASH:

Q. What tests were conducted after the shock trials--that is, here in the Yard--and are you aware of any defects that were discovered?

A. There was a number of extensive periods of tests conducted by us before we got to the Yard, checking systems and going over with a fine tooth comb the various systems to determine whether or not there were any late casualties. We were worried not only about the things that showed up immediately and were repaired, but the later effects, such as stern plane failure. There were several job orders prepared during the post shakedown availability, and the reason for the long PSA was to repair defects sustained during the shock trials. As far as the details of the various tests, I know there was a hull integrity surveillance made, the details of which are a matter of record in the Shipyard files. I have only a general knowledge of them.

Q. Are there any items of possible concern that you can think of that you have not already mentioned? I refer to piping connections or whole sections, or anything which you think might have been damaged as a result of the shock tests and might have been, to you, an item of concern?

A. Let me say that any items of concern that we had--and John Lyman, of course, was in this in much more detail than I was--and he was such a thorough officer and so meticulous, that he would have turned over every single item of concern. I was not personally concerned about the repair of shock damage items. I was concerned about other matters of design in the ship, which had very little to do with the loss.

Questions by a court member, CAPT HUSHING:

Q. You mentioned that there were extensive investigations conducted by the Shipyard, I believe you said, after the shock trials?

A. Yes, sir.

Q. Were there any areas which were not investigated thoroughly enough to your satisfaction?

A. No, sir. For a period of nine months they inspected the whole thing inside and out.

Q. So that you think the inspection was thorough, complete, and there were no doubts in your mind that it was a thorough inspection?

A. No, sir.

Q. Were there any items disclosed by this investigation as being deficient that were not corrected, to your knowledge?

A. There were not.

Q. Relative to the start of the whole shakedown availability, there were many other sources of work items. I refer to the several items made by the inspection and survey people, the various SHIPALTS, and so on. Considering the work package as the ship entered the Yard and as the post shakedown availability developed, were there any major items of work affecting the ship's safety or integrity not undertaken by the Shipyard?

A. Not to my knowledge.

Q. Were there any items of lesser consequence which might have any bearing on the loss of THRESHER which were not undertaken by the Shipyard?

A. No, sir.

Q. Did you understand, then, that the work package undertaken by the Shipyard, if properly accomplished, constituted the necessary work to make THRESHER fully ready to go to sea at the end of the PSA, with all defects corrected?

A. Yes, sir. If we had any items of work at all, we could have got them accomplished.

Q. So that there was no resistance, no lack of funds, and there were none of the administrative deficiencies that one sometimes finds in a post shakedown availability or an overhaul?

A. No, sir--nothing.

Q. During the period in which you were on board as Executive Officer, were the jobs in this work package being accomplished in a reasonable manner? By this, I am trying to say, were they all finished during this time, and did it look as though the work was adequately planned and assured in regards to quality?

A. In regards to quality, yes, sir.

Q. How about in regards to timeliness?

A. I felt that the emphasis on completion in a reasonable time spent was not adequate.

Q. You mean, by this, that it was slower than you would like to have seen it?

A. Yes, sir.

Q. But it was not faster than safety might have indicated?

A. No, sir.

Q. On the temperate side, would you say?

A. Yes, sir.

Questions by a court member, CAPT OSBORN:

Q. Following the casualty, in what position were you to analyze from publications you had on board at Deputy COMSUBLANT the ability to investigate flooding casualties?

A. The best document that I was able to immediately go to, Captain, in this regard was a command thesis that I had which had been published

and was considered outstanding in this respect was entitled, "Speed Depth," and dealt with the safety of deep dives. This was the best source of information I could find and, in fact, I think is the best available on the subject.

Q. I am speaking with respect to official publications which were available on THRESHER or available in the chain of command as dealt with the effects of flooding casualties and their effects on margin for error in the ship.

A. If there were any such publications, I do not know of them.

Q. Would you be in the best position to have access to them at COMSUBLANT and Deputy COMSUBLANT?

A. Well, there are officers concerned with this subject who undoubtedly would be in a better position than I would, but if they had been available, I would have been able to find them.

Q. Were you on board when the trim line priming system casualty occurred on THRESHER at close to deep depth, close to test depth?

A. I don't recall that incident, sir.

Q. You were not aware of any studies initiated at that time either on the ship, local internal procedures or external to the ship, in terms of design studies?

A. No, sir, I'm not aware of any such studies.

Q. Have you or members of your crew discussed large angles in conjunction with low speeds?

A. The thing that always worried me--and we used to discuss this frequently--was large angles with regard to fast speed, specifically while running at high speed. This always worried me on THRESHER. And even on SCULPIN, where you have such a short time to recover from a plane casualty. We talked over this casualty a lot in the sense that, well, what do we do? We have to assure that the people in control react instantaneously. We can very quickly reach and exceed test depth. As far as large angles at slow speed, we do know of one instance which caused concern relative to large angles at slow speed, and this had to do with failure of the stern plane.

Q. What did you consider your capacity for sustaining large flooding casualties--I say "large" by any degree you want to apply--with only emergency propulsion?

A. We knew in general that this was an extremely serious casualty, for this reason: We very seldom ran at or near test depth. We never ran at test depth unless we had to cover a specific operation, and then we ran at test depth for short periods of time.

Q. Had you ever operated the EPM at close to test depths for any reason other than a test?

A. No, sir.

Q. Shifting at test depths to EPM, then, I consider was not a very routine thing?

A. Absolutely not. You wouldn't want to handcuff yourself with low propulsion at test depth.

Q. With respect to the sea trials and associated delays, beginning from 1 April to 9 April, was the operational chain of command concerned at the last moment with reschedules?

A. They were extremely concerned from before 1 April. There was a series of delays that started many, many months before that--delays in the sense of pushing forward to completion. When I first arrived, the length of the overhaul was something in the neighborhood of four and a half months; that is, anticipated length. This was quite optimistic, but it got pushed forward and forward. The operational chain of command was anxious to get THRESHER out, and it bothered us.

Q. Was there, in the last three weeks, a personnel inspection of the ship by anyone in the operational chain of command just to see more or less how things were going along?

A. Not to my knowledge. There might have been, but I do not know of any.

Q. With respect to the crew's training and experience, which I consider probably the best of any ship for this length of time, with respect to old hands aboard and their ability to handle flooding casualties, what is your opinion in this regard as compared to the other ships you've been on--was it excellent, good, or poor?

A. Well, in comparing with other ships, you are talking about ships that could not go to that depth. As far as the state of training in casualties is concerned, I would rather have that bunch on THRESHER than any other crew.

Q. Was there any concern with respect to you that you had in your main blowing system a b(1) ?

A. I had no personal concern about that, but I never really gave it too much thought.

Q. Did you ever have occasion to question in your mind why that might have come about?

A. Having a b(1) ?

Q. Yes.

A. No, other than they probably--and I'm just guessing--that the reason we have this b(1) blow system and the reducer is because it was a quick and easy way getting from b(1) . I'm really out of my realm in discussing this.

Q. There was no doubt in your mind that it started out b(1) system and ended up as a b(1) system?

A. No, sir.

Q. What are your reservations with respect to blowing at deep depths?
A. Well, as of this moment, having read the thesis I mentioned, it is very obvious how little blowing is going to be done at this depth. I thought it was much less effective. It was not driven home to me how little effect it had until I read the thesis and saw the rate at which you could remove ballast.

Q. You came to this conclusion purely from a thesis written by an officer, not on THRESHER, but associated with a deep-diving submarine, but not on the basis of any technical information you had available to you?
A. I would imagine I had a general feeling before-hand, but when I read this, the effect was much less than I had felt previously.

Q. With respect to one more question, as you are establishing the status of the ship, going on a deep dive, would it be your opinion with respect to the experience you had in operating the ship that the main coolant pumps would be in fast speed?
A. I've thought about that. It would be my opinion that they would be in fast speed, because in general we keep them in fast speed for critical evolutions. This is always a toss-up. You have to balance the possibility of losing power against the need for power immediately and the worry about fouling up during deep evolutions. Most people balance these two things in order to make a determination.

Q. There are some ships using such procedures as going to battle stations, Condition 1; in all probability, do you think it would be a battle station condition?
A. Yes, sir, particularly so because we worked up for shock trials a very extensive bill indicating exactly where everybody was to be and in an advanced state of readiness. The crew was familiar with that routine which we had established for shock trials, and I think it would be logical to assume that they would have used some similar type of special bill.

Questions by a court member, RADM DASPIT:

Q. Were you aboard THRESHER for the first trials when it was necessary to abort the deep dive?
A. I was not on board, sir.

Q. Were you aboard on the second series of trials?
A. No, sir.

Q. This was when the 1-inch pipe failed.
A. No, sir.

Q. Now, there was discussion, and a new procedure was developed, for handling the trim valves because of the failure of that pipe. Was that discussed while you were aboard the ship later?
A. I don't recall any such discussion, Admiral.

Q. In your auxiliary salt water system, if there were a failure, I presume the initial step would be to attempt to isolate the particular section of the pipe that had the failure?
A. Yes, sir.

Q. Who would make the decision to isolate the entire system?
A. The procedure was such that if there was a leak in the AMS or in the engine room and it was not immediately apparent, the watch stander had authority to isolate all sea valves. It depends on the degree of the leak, I would think. If he felt he had time, he would get permission to do so. Most of the watch standers, if they felt it was in extremis, they would isolate the whole compartment ASW.

Q. Assuming you were making a deep dive, with all water-tight doors secured, would it be a simple thing to get the word to the next compartment? I understand both compartments have to be shut.
A. The 2MC is the normal communication method which is immediately available, and all engineering officers of the watch would immediately react to pick that up and pass the word.

Q. There has been testimony that the periscope hydraulic system was hooked up backward, and there is also testimony that a subsequent design change resulted. Have you had any discussion on that which you think might be helpful to us?
A. No, sir. You moved the control handle one way, and it goes the other way, but I don't think this mattered too much.

Q. This court is concerned with the safety of the entire ship. The testimony indicates that during shock tests the reactor plant was never SCRAMMED. Was it necessary to take unusual precautions to make sure this did not occur?
A. Yes, sir. b(1)

Questions by the president, VADM AUSTIN:

Q. Commander, you have stated, with respect to the auxiliary salt water system, that you had some qualms about its design. Would you suggest to the court a better design in general terms for the ASW system?
A. Yes, sir. I think that we had much too much ASW piping through the engine room which tended to run all over the place, and if we could come up with some design minimizing some of that, we would be better off. Secondarily, I mentioned that I am personally much opposed to sil-brazed joints, not because they are not water-tight, but because when they do fail, they fail catastrophically; whereas welded joints provide much better quality control. When a welded joint is not a good one, it just weeps and we can take steps to correct it. For this reason I have always, in the last few years, been of the firm opinion that we could minimize the piping in the auxiliary salt water system, and change all the joints from sil-brazed joints to welded joints. This is particularly desirable in the reactor compartment--primarily because it is in a remote location.

I think we want to make sure there are no leaks anywhere, and if it is right in the reactor compartment, it is right in the engine room. Therefore, my recommendation is that we minimize piping and change to welded joints.

At this point, (b) (6) relieved (b) (6) as reporter.

Q. Would minimizing the piping involve more holes in the hull?
A. No, sir, it would diminish the number of holes in the hull, also.

Q. In your opinion, the ship was well trained for handling casualties when it entered this yard for its post trial availability. Would you feel that the state of training, the handling of casualties would be higher if a period at sea were provided before a ship were allowed to do her test depth dive?
A. Undoubtedly, Admiral. A ship in the yard, its ability in this regard gradually goes downhill; the longer they are in the yard, the less able they are in shipwide drills, and this, of course, was the purpose of the fast cruise, to get them up on the step; the more they can practice on this, the better they are going to be.

Q. But, in your opinion, fast cruise is probably not quite adequate to insure the highest state of training?
A. No, sir. Getting out and operating in the sea, a fast cruise is no substitute for that, sir.

Q. Now, Commander, in answer to a question by another member of the court, you referred to a Command Thesis. By whom was this Command Thesis written?
A. Lieutenant MacDonald of the SAM HOUSTON, I believe.

Q. In this Command Thesis, is any concept advanced which is new to the art of operating submarines?
A. I think it's new in the sense that he compiled all the various parameters involved and attempted to give enough information for a commanding officer to best decide in his own mind what his optimum depth at various evolutions is. There's nothing brand new; I'm sure many commanding officers independently come to these conclusions. I think it was a well written thesis, in that he did summarize in one neat package all the thoughts of this matter, and the pertinent portion was the section on safety, in which he collected all the Electric Boat's design studies that had been done, and all the other information available in ships' information books and put it together and remarked, himself, the paucity, the scarcity, and the need to obtain more information, but this was available and it was information that I, personally, had never read before. For this reason, I think it was worthwhile to publish to the Submarine Force to get this information around to the various people.

Q. Was the information such that it would help to be developed by new formulas, or is it more or less elementary information which could be obtained from a Marx Handbook or a simpler compilation of information regarding flood rates through given sized holes, etc?
A. It was the type of information that we usually develop with our modern computer techniques. Whether or not it could be done without a computer--I'm sure it could be--it could be done by hand laboriously, and computed on the basis of age-old formulas.

Q. Did you, as the Executive Officer of THRESHER, have a good appreciation, in your opinion, for the margin of error that you would have at test depths of the THRESHER in the event of a failure which would give you a flow of water into one of the in compartments of the ship at that depth?

A. Admiral, I only think that I had a very general idea of this, and I have a much better appreciation now, having read the thesis that I discussed, and of course having thought of this incident. I know I didn't have as good a feeling as I have now.

Q. Do you feel, having read this thesis, that you had been as inquiring as you should have been, as the Executive Officer of the THRESHER, with respect to her safety at such depths?

A. Perhaps not, Admiral.

Q. In other words, an officer preparing himself to be qualified for command of a submarine certainly has available numerous sources of information in this field than would the Executive Officer of the ship who has already been qualified for command?

A. Yes, sir.

Q. Is that correct?

A. Yes, sir, I think I see what you are saying, Admiral. I did not know previously of any compilation of my own knowledge of this information, and the thesis I refer to was one that was only published some three weeks ago.

Q. Have you ever requested information from the builder of a ship regarding its characteristics?

A. Many times, sir.

Q. Have you ever been denied information which you requested?

A. Only if it wasn't available, sir.

Q. Even if it weren't available, doesn't the builder usually try to provide it?

A. Sometimes, yes, sir; sometimes, no, sir. The only thing that comes immediately to mind was an attempt--I recall, in SCULPIN, and this was a minor instance, an attempt to obtain information about the SEALOL seal piping, which was not available, and it was very difficult for me to get the information. I dealt with the Shipbuilder, the SEALOL Company, and I eventually made up my own operating instruction. I do not mean to say, in general, that I'm not able to get information from the shipbuilder.

Q. Don't you have recourse to authority higher than the shipbuilder in case he fails to provide information that you require for the safe operation of your ship?

A. Certainly, sir.

Q. And would it not be your duty to go to higher authority for such information if you found the information available to you for the safe operation of your ship were in any way deficient?

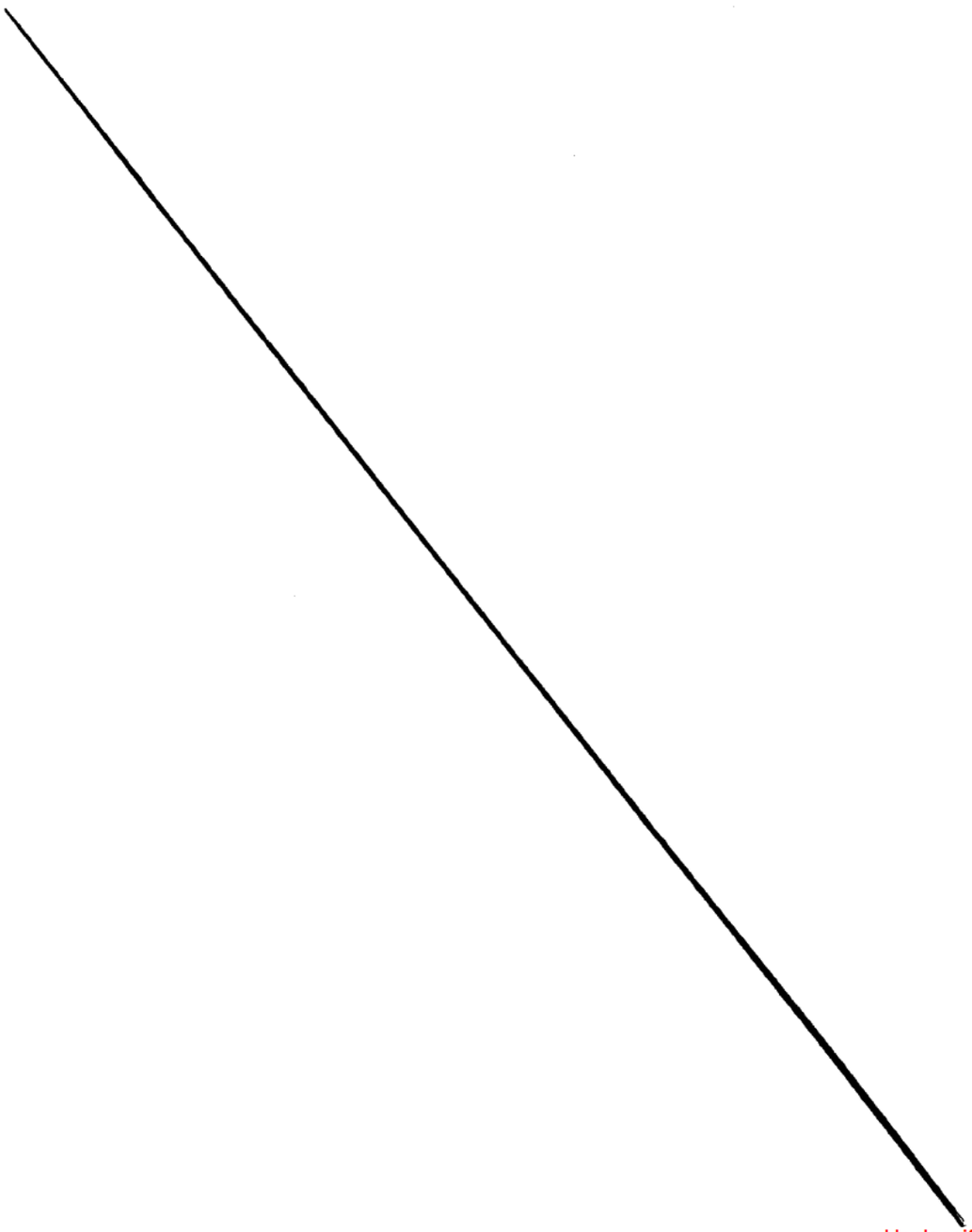
A. Yes, sir, had I considered the safe operation of the ship was in question, I would go and get the information.

Q. Even if you went up to the Secretary of the Navy?

A. In this regard, Admiral, I didn't mean to suggest that I never had any information that I knew was directly associated with the safety of the ship, from the shipbuilder who was directly connected with the safety . . .

Q. Does the Commander Submarine Force, or the Deputy Submarine Force Commander have a method of promulgating to the operating forces information which is developed by one ship which applies to and is pertinent to the safe operation of other ships of his command?

A. Yes, sir.



Q. What is that method?
A. Force Instructions, Force Notices, Force Regulations. Frequently, Force Notices particularly speak of some particular deficiency that has been found.

Q. What has been discovered and what is done to minimize the probability of a similar casualty?
A. Yes, sir.

Q. In your opinion, having read this thesis to which you refer, the Command Thesis, is there information in this thesis that perhaps should be promulgated to the operating forces?
A. It has been promulgated.

Q. And it was only available three weeks ago?
A. Yes, sir, it was promulgated to the Command Thesis Library, which is set up in each squadron for availability to all submarines. An individual submarine can go to the library and get a copy. Periodically a list goes out giving the topics of the Command Theses in the squadron library. I believe the date was mid-March when we promulgated this thesis to the Force as a subject of interest. Of course, Command Theses are not promulgated as Instructions or requiring any action by the ship; only as library information.

Q. As a source of information which might be interesting and pertinent to the duties of people who have duties in the area treated by that thesis?
A. Yes, sir.

Q. And it does not have any authoritative directive effect?
A. That is correct, sir.

Q. The subject matter of the thesis was not such as to cause the Force Commander to say "You must tell the people immediately to do this or they will be in some danger"?
A. It wasn't that type of thing; it was merely a compilation of the information available. I think Captain Osborn was asking about casualty studies at deep depth. Maybe this information is available elsewhere, but I don't know. This was a nice compilation.

Q. Well, each year at the Naval War College we have theses written by hundreds of officers, and many of these theses turn out to be so interesting as to be requested by the Chief of Naval Operations and others for consideration by people having responsibility in the area discussed by the student, but of course, as in this case, the thesis itself has no official status. It is simply a medium through which the thinking of smart officers is transmitted to others who have responsibilities in the areas of design or operation treated by the writer of the thesis.
A. Yes, sir.

Questions by CAPT Osborn:

Q. Lieutenant Commander (b) (6) I'm sure that Captain Axene attended the THRESHER redesign studies sometime in the Spring of 1962, at which certain design features of THRESHER, or design limitations were limited, and what they were going to do about it. Did you, as a result of that conference, change any of your operating procedures or discuss in detail why the new changes were going to be made?

A. I do not recall any change of operating procedure, based on the redesign which you mentioned.

Q. Disassociating the emotion attached to the loss of a ship that you have been very intimately associated with, and the impact of Lieutenant Commander MacDonald's thesis, and the attendant loss of the THRESHER, do you have in your own mind, were you on a ship of that type and appreciated that you would have to do an exceptional amount of study, a bare amount of study or no study with respect to handling large flooding casualties?

A. I don't feel that I ever thought I had to do much studying to handle a large flooding casualty. I would just have to isolate it. I don't really follow the question.

Q. I'm trying to get your appreciation for the problem. Would you have a bigger appreciation for it with more attention to it than before, and I know you devoted an awful lot of attention to it, - or less?

A. The only thing I can say is that I have a much better appreciation for it now, having thought about it a lot in connection with this casualty.

Questions by the President:

Q. Don't you think, Commander (b) (6) every officer in submarines has a better appreciation of the dangers of operating at deep depth than he had before this casualty?

A. I certainly do, Admiral.

Q. It is a heavy price to pay, but unfortunately sometimes we do not bestir ourselves mentally as much as we should unless we are given the impetus of something like this very unhappy tragedy.

CROSS EXAMINATION

Questions by counsel for LCDR Hecker:

Q. Commander (b) (6) have you, in your operations in THRESHER with surface vessels, noticed any significant masking of UQC?

A. I have noticed masking of UQC with all submarines that I have operated on at various times, sometimes due to waves, sometimes due to aspect, but no more or less in THRESHER than in other submarines.

Q. If you were to have a SCRAM in THRESHER how long would it be before you got main propulsion back again?

A. We could recover b(3) 10 USC 130

Q. You personally know the results of the fast cruise conducted prior to sea trials in THRESHER?

A. Not from personal knowledge, no sir.

Questions by counsel for RADM Palmer:

Q. Commander (b) (6) ., I would like to direct your attention to the testimony you gave earlier on the general subject of the impatience of the officers

and the crew to get to sea, and of the lengthy time the overhaul required. If I heard your testimony correctly, at one point you indicated that the initial planned length of overhaul was five months, and that at a later time you indicated that it was four and a half months. I would like to ask you to think about the originally scheduled overhaul, the duration, and I ask you if it was not six months in duration?

A. When I was first attached to the ship in the operational period we talked, of course, about post shakedown availability, how long we expected it to be, and it was my recollection at that time that we were thinking in terms of four and a half months. If you are referring to when we arrived at the Shipyard, what was the estimated completion date, it might very well have been six months.

Q. It could have been six months?

A. Yes.

Q. Would the date January 18, 1963 mean anything to you with regard to the originally scheduled availability?

A. That is one of the dates of completion. Whether that was the original date -- it seems to me that it was not the original date, and that it only came in when the PUFFS job was taken on. That, of course, was right at the beginning of the overhaul. It seems to me that the original completion date was sometime estimated in November, and then the PUFFS job came on and they added time enough to complete it, and the completion date was January 18.

Q. But have we agreed then that your testimony was that the original scheduled availability could very well have been six months in length?

A. If you define originally -- at what stage in the game? I think, for planning purposes it was less than six months. When we arrived in the yard it could very well have been changed, or changed shortly after to six months.

Q. To refresh your memory I show you a copy of a Message from CNO to CINCLANTFLT: Would you look at this and tell us if it does refresh your memory?

A. May I ask what month this is?

Q. July, 13 July.

A. Yes, sir, it was six months at that time.

Q. Now, Commander, turning attention to the work items and changes that were added from time to time since the originally planned availability, can you help the court on the nature, type or scope of items added and change items added?

A. There were a number of items added all along during the overhaul, the major ones were the extensive PUFFS job which was right at the beginning. Most of them were in the electronics area, the Loran "C" was added at one stage. Generally speaking, what happened, we were in here for a long time and every development that they thought might help the evaluation was added to the shipbuilding burden, and forced pretty much on the Shipyard to put in, and this was a contributing, probably the major fact in the overhaul.

Q. Would you agree with me if I said that many of these items required a great deal of new design work and problems of material procurement?

A. Undoubtedly, they did, sir.

Q. And the source of these additional items, and change items were from THRESHER itself, from this Shipyard, and from forces outside the Shipyard; is that a true statement?

A. Yes, that's a true statement.

Q. Now, having in mind, Commander, all of the changes that were added from time to time, and the complexities of them, could I have your judgment, as an operating submarine officer, as to whether you considered the length of time this yard consumed in the overhaul unreasonable?

A. All I can say in this regard is I think more emphasis could have been placed on the completion of the ship on time and more resistance to some of this new work, in order to get the ship out on time. This is just a personal feeling. I am in no position to say that the Shipyard dragged their feet or were unreasonable in the length of time that it took, based on the number of jobs that they did on us.

Q. Now, if I may change the subject for just two questions. Would you tell the court what speed THRESHER could make with main coolant pumps in low?

A. You could make in the neighborhood of b(1)

Q. One last question, sir. What is the relative power demand of the main coolant pumps in slow or in fast?

A. You add about (b) (1) (A) when you switch the total power demand of the ship. A much greater demand on fast than on slow.

Q. Can you translate this relative power demand in slow and fast in terms of horsepower?

PRESIDENT: Counsel, I believe that we have better sources of authority for answers of that type of question than the witness who is trying to rack his memory.

CAPT Osborn: The answer to the question is b(3) 10 USC 130

REEXAMINATION BY THE COURT

Questions by the President:

Q. Was the THRESHER in Priority 1 for the facilities of this yard, or was some other type of ship or activity at the yard a higher priority?

A. Admiral, I'm sorry I don't know what the actual priority was. I know the FBM's had a high priority and I know that THRESHER had a high priority; I don't know who had the higher.

Q. The court is of the impression that all of the FBM's have a higher priority than any other work. That may have in part accounted for the feeling at times that the number of yard personnel on board was not what you would like it.

A. Yes, but I'm upset a little bit, Admiral. I think I've gone out of context, or something. I tried to emphasize in the beginning that in every shipyard I've been in, and I've been in a lot of them, during PSA's overhauls and construction, that the operator's feelings are always that the yard isn't pushing fast enough. I spent two years in Pascagoula when I was supposed to be there nine months, on a new construction ship. I didn't mean to say that this was abnormal; I only wanted to point out the question whether the people were upset about the yard, or felt concerned about the yard's ability, the only direct relation they had to me was this business of when are they going to get us -- if you'll excuse the expression -- the Hell out of there and put the ship back together.

Q. It's understandable by anyone who has been to sea, and I assure you that all the court has been to sea. We understand you, I'm sure, but counsel for the Shipyard Commander naturally wanted to develop the exact extension of the period and I don't think there is any misunderstanding.

A. Thank you.

The president of the court informed the witness that he was privileged to make any further statement covering anything relating to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement.

Well, regarding my theory, Admiral, which I mention, of course, just as a theory, and based on less evidence than is before this court, but from my knowledge of the ship and the people, it seems to me that the most logical cause, and this can later be proved to be totally wrong, but the most logical cause to me was that a salt water piping ruptured, specifically the part of a sil-brazed joint. The force, of course, of the water entering at these depths would be of such a nature that it would be difficult if not impossible to determine where the rupture had occurred. I can recall an incident where we had a small gauge line part in relatively deep depth and we thought the water was coming from the overhead. We were searching up there and it was actually down in the bilge. It came all the way around so this type of thing is very difficult to find. I talked to people in THRESHER where they had a similar casualty after their initial deep dive, the salt water line had parted forward of the engine room, and had been spraying back against the shaft seal; everyone thought the seal had given away. It wasn't until they got up and calmed down that they found that the rupture was actually a considerable distance away from the point where they thought it was. For this reason it seems to me that they probably would not be able to figure out where the casualty was, and so the instantaneous thought in everybody's mind in these types of casualties is to isolate. That is in a case aft; in a case forward the first thought in flooding would be to get up, so that it seems to me that the after personnel would quickly shut the salt water valves, including the main sea water valves probably if they hadn't gotten it stopped, thinking that this was the No. 1 cause. This would shortly thereafter cause them to lose steam propulsion. They would have taken on quite a bit of water. They might have isolated it or partially isolated it by this time. Forward they would attempt to blow, which would do very little good, particularly with the added weight aft, which would cause the up angle referred to in the UQC Message. Instead of going up they would gradually go back down, and without any propulsion they would be unable to correct this downward trend, and eventually, if the leak was not isolated, they would have blown out the interior bulkheads, and if this leak had been isolated they would go to deep pressure. This would seem to be the most logical sequence. They would probably have attempted to regain power right up to the end, but they would be faced with the impossible choice of opening up the salt water valves to the leak again and regaining propulsion, or not regaining propulsion and trying to do it on the EPM. and with the time alloted to them they wouldn't have any chance with doing either. This, of course, is just a theory. I think that's all I have.

REEXAMINATION BY THE COURT

Questions by the the President:

Q. Commander, one of the messages by the THRESHER referred to a positive up angle. Would you interpret that to be a large up angle or just something above zero?

A. The word positive doesn't add much to it. I don't know what they meant by that, sir. They might have been excited.

Q. The terminology of positive up angle was not commonly used in the ship to your knowledge?

A. The only thing that I could say was they were getting some upward movement and they therefore meant they had an up angle and were going up somewhat at that stage of the game, and this would jibe with the feeling that they weren't in a real extremis condition at that time. They had flooding, and forward they didn't realize the extent of this flooding.

Q. From your memory, can you tell us what would be the most likely small leaks which would interfere with the continued operation of the nuclear plant other than a failure in the nuclear plant itself? In other words, what salt water connections, or flexible couplings, would be most likely to give you a shower bath effect on the controls, the maneuvering controls?

A. I think that at those pressures and depths, Admiral, there would be any number of joints that if they failed could spray on the electrical controls and cause the circuit to trip out; any number of them, because the water would tend to spray great distances.

Q. As you pointed out in the actual cases that you mentioned, but would there be any one or two that you think would be more likely to have this affect, even though a small line?

A. Those in closest proximity to the panel, sir, than others, sir, but I don't think that this would be really pertinent. I think if any of these lines would go the spray would hit some electrical work. The panels are all drip proof, but not waterproof.

Questions by RADM Daspit:

Q. You indicated that a gauge line had failed while you were aboard. At what depth did this fail?

A. I tried to remember, Admiral; I don't believe it was in excess of five hundred feet but I don't recall.

Q. Could that failure be heard in the next compartment?

A. No, sir.

Q. I was thinking about the auxiliary machinery space being alerted by a failure in the engine room from the noise.

A. I've never known of a failure at test depth, so I don't know the rush noise there, but with the one I was experienced with, a small gauge line, there really wasn't much noise associated with it at all.

Q. If the auxiliary salt water system was secured, about how long would it be before the plant SCRAMMED?

A. A considerable time if it was just the auxiliary salt water system, but I'm surmising the main salt water system went also.

Q. How long would that take before it SCRAMMED?

A. b(3) 10 USC 130 Now SCRAM--I avoided the word SCRAM, because I think it is more logical that we b(3) 10 USC 130 and not necessarily SCRAM, the reactor.

Q. How long would it be before the main coolant pumps would fail?

A. If we were losing the b(3) 10 we would switch the main coolant pumps to slow and they wouldn't have to fail. We could pick them up b(3) 10 USC 130 They are not necessarily lost of main coolant pumps by the type of casualty that I'm thinking of.

Q. I'm trying to develop a time sequence. We think we have a pretty good time as to when the main coolant pumps stopped. Now, about how long before that do you think it might be the circulating salt water system secured?

A. b(3) 10 USC 130

Neither counsel for the court, the court, nor the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing else to add at this time.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

(b) (6) relieved (b) (6) as reporter.

The court opened after recess, at 1402 hours, 20 April 1963. Present were all members of the court, counsel for the court, RADM Palmer, party, and his counsel. (b) (6) relieved (b) (6) as reporter.

The court met with open doors.

COUNSEL FOR THE COURT: At this point in the proceedings Rear Admiral Palmer, a party to the inquiry, is called as a witness by the court and will be duly sworn.

Charles J. Palmer, Rear Admiral, U. S. Navy, party, called as a witness for the court, was duly sworn, warned of his rights under Article 31, Uniform Code of Military Justice, and also of his rights as a party, and was examined as follows:

The witness was cautioned not to discuss classified material.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, rank, organization and present duty station.
A. My name is Charles J. Palmer, Rear Admiral, U. S. Navy, Portsmouth Naval Shipyard, Shipyard Commander of the Portsmouth Naval Shipyard.

Q. Can you very briefly give us a little of your professional background?
A. I entered the United States Naval Academy in 1928, graduated in 1932, served at sea, went to Massachusetts Institute of Technology and received a Master's Degree in naval construction in 1937. Since that time I have been engaged in engineering type of duties.

Q. As commander of the Shipyard, will you outline for the court some facts concerning the capability, operation and management procedures of the Shipyard which can be of value--background value--for us in the work in which we are engaged?
A. Yes, sir. I would like to start out, of course, with the mission--the basic mission--of the Portsmouth Naval Shipyard, which is the design, construction and repair of submarines. It also incidentally, performs the duties normal to a naval station and certain other duties normally performed by a naval base. With respect to our organization, in all important aspects, our organization is the same as that of any other naval shipyard which has nuclear power plant overhaul capabilities. In this connection, I would like to submit for the information of the court, an organization chart of the Shipyard.

Q. This is a true and correct copy of an official chart of your Shipyard?
A. It is. I offer it to the court for the purpose of introducing it.

The Organization Chart of Portsmouth Naval Shipyard was submitted to the court and was offered in evidence by counsel for the court. There being no objection, it was received in evidence.

RPTR: This will be Exhibit 62.

Q. Proceed please, Admiral.

A. From the point of view of ship construction and overhaul, the three principal operating departments are Planning, Production and Supply. The Planning Department is headed by Captain W. E. Roseborough at present. His is the responsibility for the preparation of the plans, specifications, test memoranda, job construction and also initiating procurement of material, and also funds to do our work.

Q. Admiral, the design of a modern submarine is a difficult and complex task. Could you expand upon your Shipyard's capabilities in this area; that is, technical and engineering personnel available to you, their experience and any other factors you consider pertinent?

A. Of course, Portsmouth has been in the design business of submarines for a great number of years. It is one of the two shipyards in the country which has over the years been responsible for the complete design of submarines. And during the past ten years, for example, Portsmouth has designed the ALBACORE, the TANG class, SALMON class of SSR, THRESHER, and presently the DOLPHIN. In connection with the difficulty and extent of know-how required, I would like to point out that some of these really new developments of submarines requiring advance--or having advance--characteristics, involve much more than just going into the files and pulling out blueprints of what we did last time. In point of fact it requires a rather sizeable research and development program to start out with to test out all of those fittings, components and so on which will be subjected to the new service required. This was the case in the case of THRESHER design and currently is the case in connection with the DOLPHIN design, which is an experimental submarine.

Q. Can you tell us about your various departments now?

A. Yes. The next department which I think is of interest from the point of view of ship construction--our principal operating department-- is the Production Department. It is headed by Captain J. G. Guerry, Jr. This department is responsible for completing shipwork in an economical manner, in a timely manner, in accordance with the plans and instructions which have been developed by the Planning Department, and of course in accordance with sound engineering practice. In addition, this department provides the engineering services for the entire Shipyard and planning implementation and the monitoring of a total quality assurance program for the shipyard.

Q. That is quality control?

A. Quality control is what we call quality assurance, yes.

Q. Quality assurance program-and that includes, in this case, THRESHER?

A. That is correct.

Q. Continue please.

A. The Supply Department, which is our next principal operating department, is headed by Captain W. F. Harvey, Jr. In essence, it is really responsible for procuring the special materials required and requested by the Planning Department and maintaining stocks of materials and certain receipt-inspection of parts.

Q. Now do you have any detailed structural and functional charts of the organization you have described?

A. Yes. These are available, but I do not have them with me. We have detailed structural and functional charts of the shipyard which we will be glad to furnish the board upon request.

Q. Can you give us briefly, sir, a description of the operating procedures?

A. Well our operations fall into four main functional areas--Production Planning and Control, Automatic Data Processing, Material Management and Quality Assurance, and as indicated by the chart which is attached to the one submitted as an exhibit, the Shipyard has interdepartmental committees working in each of these areas. These committees are assigned tasks in their area by the Shipyard Commander or by the Management Policy Board. They submit their recommendations to the Shipyard Commander via the Management Policy Board which consists of the head of departments and offices and in this manner, of course, the principal line official is responsible to the Shipyard Commander to review the work of these staff committees.

Q. Referring to that plan, Admiral, which is attached to Exhibit 62, I note some abbreviations thereon. Could you explain--it is a very simple chart--could you explain that?

A. "PP&C is Production Planning & Control. "ADP" is Automatic Data Processing.

Q. And the other two are committees?

A. Material Management Committee and Quality Assurance Committee.

Q. Thank you.

A. Additionally the chairmen of these functional area management committees have additional duties as coordinators for the entire Shipyard in their respective areas and considering the area of possible interest to this court, Captain J. B. Small--a production engineering officer--is the Shipyard coordinator for Production Planning & Control. Commander W. H. Kosky as Assistant Supply Officer, is the Shipyard coordinator for material management; and Commander S. E. Rule, who is our Quality Assurance Superintendent, is the Shipyard Coordinator for quality assurance.

Turning now to the matter of capabilities, Portsmouth is one of the four shipyards which has overhauled nuclear-powered submarines. For us, this represented a first cost investment of about $875,000 in training and some 1.2 million dollars in facilities. This is a first cost.

Q. For overhaul of nuclear-powered submarines alone?

A. That is right,--to achieve the capability of doing it. Portsmouth is one of the two shipyards which has a Polaris missile system overhaul capability and this capability was acquired at a first cost of about $900,000 in training and about 6.5 million dollars in facilities. As I pointed out before, of course, Portsmouth had the detailed design of THRESHER and is one of only two shipyards in the country which has been given the complete responsibility for the detailed design of submarines.

Q. Does that include the detailed design of the reactor plant?

A. It does not as far as Portsmouth is concerned. Thank you for bringing it up. And as a matter of interest, the construction of an attack type submarine required the preparation of about 3,000 detailed working plans.

In connection with training, I have mentioned the matter of the initial effort to obtain special capabilities. However, of course we have to maintain these capabilities and we have to maintain the capabilities in new developments and we also have to maintain and re-train in our more conventional skills. This is a continuing matter. During the last calendar year, for example, we invested about 1.9 million dollars in such training.

Q. That is during the last calendar year?

A. Calendar year, correct, which ranges all the way from job training in specific skills to cooperative college engineering training programs. And during the course of a year about 45 per cent of our people receive training in one field or another. In this connection Mr. A. E. Prescott is the coordinator of our training effort.

Q. You have explained to us the amount of money expended in the training program during the last calendar year. Can you give us some idea of the progress of your training program during the period from the commencement of construction of THRESHER until the end of her period of post shakedown availability?

A. I do not have specific figures here. I can tell you that it has grown considerably for several reasons. The first is we have attempted to place special emphasis in improving our skills, for example, in the welding area and also in the pipe shop area. During the past two years, for example, we spent 1.3 million dollars on welder training and about four hundred thousand dollars in the training of pipe shop personnel, which indicates, I think, a rather concentrated effort. Of course, directly related to the matter of training is the direct quality assurance through test and construction, and over the past two years we have built up, I believe, a very strong quality assurance organization. The number of people engaged in quality control, as to test inspection only during this period, has grown from 152 to 243 or 60 per cent, and our current rate of annual expenditure in quality assurance is about 2.8 million dollars as compared to 1.2 million dollars two years ago. We feel that we have given great emphasis in the quality assurance area. As to our personnel--

Q. Before you get to personnel, how long have you been in the Shipyard?

A. A little over two years.

Q. All in your present capacity as Shipyard Commander?

A. Yes.

Q. Have you had previous shipyard experience?

A. Yes, three years at Long Beach.

Q. Please tell us about the other personnel.

A. Right. Of course, a great majority of our personnel are Civil Service personnel. We have an allowed employment range of 8800 to 9300. We have some 9,000 on board now. About 580 of these are engineers and engineering technicians. We have an enlisted roster of 80 and an officer roster of about 71, and of course, our officers are primarily specialists--engineering DO's, Civil Engineering, Supply, Medical, and Dental. To give you some idea of the size of operation, first of all we operate under an industrial fund. We are presently capitalized at seventeen and a half million dollars. The annual volume of our business is about ninety ~~billion~~ dollars, over 80 per cent of which is in new construction.

Q. What efforts do you make in the field of management review?

A. Of course, obviously, management review or audits on the part of the Shipyard Commander on an operation of this size requires a rather detailed plan of action, an op-plan if you wish to call it that. I do have such a personal work plan. I would like to submit it for the information of the board. It is rather lengthy. I would suggest we don't read it now but it is possible some of the members of the board might like to refer to it later as a matter of interest.

The Work Plan for Commander Portsmouth Naval Shipyard, dated 15 February 1962, was submitted to the court and was offered in evidence by counsel for the court. There being no objection it was received in evidence as Exhibit 63.

RPTR: This will be Exhibit 63.

Q. Admiral, this illustrates the scope of management review in general?
A. Yes.

Q. We are, of course, interested in management review in particular as it applied to THRESHER. Can you describe that for us?
A. Yes. As indicated in this so-called work plan or audit plan which I have submitted for information, I have had numerous avenues for audit and direction of the progress of the THRESHER post shakedown availability. Getting down to day to day operations, these consisted of about four avenues. First of all, a daily conference with the Production Officer and the Planning Officer on work status. This was usually a Monday through Friday basis but was also done at other times when appropriate. In addition I received from the production office weekly written reports of status on control of jobs, the job we considered to control. We had weekly conferences with the commanding officers and also I made periodic personal inspections of the progress of the work.

Q. Admiral, we have heard a considerable amount of testimony as to the way in which the period of post shakedown availability in THRESHER dates was extended, more than one, more than several times. How did this affect the work that you did on it at the Shipyard.
A. Well this, of course, was one of many areas that I was principally concerned with during the overhaul of the post shakedown availability of THRESHER; namely, not only work progress but also the total of the work package, and the facts of the matter are that in a "can do" spirit, we repeatedly took on more jobs without adequate advance planning lead time, and without a good knowledge of the availability of material. Additionally we underestimated the size of some of these jobs. This could be explained, at least in part, by the fact that these were new jobs or large jobs, new jobs which the Yard had never done before. But in this connection, first of all, the obvious result of this was extensions in time and costs exceeding the estimates.

Q. Did you take on any jobs which you weren't convinced were important?
A. No, sir.

Q. These decisions then for new jobs were supported in your own mind with good reason?
A. Absolutely.

Q. What effect did all this extra work have?
A. Well the sum total of the effect, as I say, was more time and costs in excess of estimates. And I'd like to say this based upon my audit of the operation as we went along and our performance in this particular area of the post shakedown availability is the only one which I considered the shipyard's performance to be unsatisfactory.

Q. Unsatisfactory in what way?
A. In that we took on more work without a good knowledge of, or grasp of, what we were doing.

Q. Are you suggesting that the work performed was unsatisfactory?
A. I am not. I am suggesting that what was unsatisfactory was our management review of the size of the package that we were taking on and the

availability of our materials to do the job. I'd like to say, also, that actually since the loss of THRESHER we've made a very careful post audit of our quality control during the availability and we've reviewed our quality control records in connection with each of the jobs that we felt could possibly affect her integrity of deep submergence. I am informed by my Production Officer, Captain Guerry, that this audit is completed, the records of this audit are available for inspection, and that they indicate satisfactory work. In that connection you may wish to call upon Captain **Heronemus, our Repair and Ship** Superintendent, or our quality assurance personnel to discuss this further. I think this is about all I have to say of a general nature.

I would like to say that the entire personnel of the shipyard are, of course, available to this court. We are most anxious to cooperate fully in any way we can and I have mentioned some of the members. We are somewhat handicapped in this, in that our Assistant Design Superintendent, our Assistant P & E Superintendent and our Assistant Shipbuilding Superintendent were lost with the THRESHER, and they were the ones closest to the work with an overall view of what was going on, who could have dredged up information, but it's here. There may be some lag in getting to it but we will do our best.

Q. I will say there has been no lag in getting it to me and it has been completely available with the fullest cooperation to date, sir. You mentioned that the Portsmouth Naval Shipyard was responsible for the preparation of detailed plans for the construction of THRESHER; Were there other plans which **were not** the responsibility of the Shipyard?

A. Well, there are all kinds of plans, sir. You have to go further, talking about plans as a whole. You have to go, I guess, back to the birth of the design process, really. Is that what you have in mind?

Specifically, as far as working plans are concerned, of course, the plans in connection with the reactor plant were not the responsibility of the Portsmouth Naval Shipyard.

Q. And there were contract plans and specifications from which you drew your working detailed plans?

A. That's correct.

Q. That was what I was attempting to develop.

A. Right.

Q. From what sources did the Shipyard receive the authority, the guidance and the detailed instructions to do the job of building THRESHER?

A. The Bureau of Ships.

Q. In the construction of THRESHER, will you give us a very brief summary of the key events which occur from the start of her construction to the delivery of the submarine?

A. Well, of course you mention the start of the construction which was somewhat of the theoretical nature but it is the time when we essentially start fabricating steel. At a certain point we have enough steel assembled to lay a keel on the ship ways to make it meaningful. The hull is assembled on the ship ways and at the same time the outfitting is going on at the greatest extent we can. And we like to carry on the outfitting as far along as possible on the ship ways because we can use construction openings which will be below the water line for access after launching, which is one of our most difficult problems in constructing submarines. At a certain point, we have to have the boat overboard in

order to start conducting tests on machinery of various kinds at which time it is launched and, hopefully, at this time we are ready to start our testing program of our main machinery using shore steam. At the same time the outfitting is going on, completing the preparation of the nuclear plant for criticality and for hot operation, power operation and, finally, integrated operations with the propulsion plant on. After this point, we will have an alongside-training cruise followed by a set of sea trials, which you might call builder's trials, and just before our first set of sea trials, or just after, we would go to our acoustic measurement basin in order to determine the noise level of the various machinery components. Depending upon the ship and the status of her construction, we may have two sets of builder's trials. We then take the ship through a preliminary acceptance trial. This is followed by a short period for correction of any deficiencies which might develop, at which time she is completed and accepted for restricted operation by the fleet commander.

Q. In the case of THRESHER, how long a period of time did those events comprise?

A. I don't recall. THRESHER, I don't think, was a good example because she was the first of a class and had many developments involving a number of radically new developments and it was longer than the usual period of time. I do not recall offhand the period.

EXAMINATION BY THE COURT

Questions by a court member, Captain Hushing:

Q. Admiral Palmer, you mentioned that you have a quality assurance organization which has grown during the past few years. Is this quality assurance organization within the Production Department?

A. It is.

Q. Does it report directly to the Production Officer or through some other division of the Production Department?

A. The Quality Assurance Superintendent reports directly to the Production Officer.

Q. Then, the Quality Assurance Officer and the Quality Assurance Group is separate from the Shipbuilding and Repair Superintendent's organization?

A. Correct.

Q. It is also separate from the individual shop organization?

A. Correct.

Q. And it, therefore, gives an independent assessment of the work of the shop organization?

A. That is correct.

Q. Is there a group of process instructions which indicate the way in which technical and complex processes should be carried out within the Shipyard?

A. There are. The number, I don't have available. It is probably approaching, say, about 50 which would have a process--we would have a process instruction, for example, on our bus hoses-operations like this.

Q. Do you find that the requirements for process instructions are growing more complex?

A. Well, the question first of all, yes, there is a need for something of this nature. Now whether you call it a process instruction or whether you call it a standard method, it is a matter of choice, but you are quite right.

Q. Does the inspection group, the quality assurance group, check every point in a process, or does it use a statistical surveillance method or a combination?

A. Ofcourse, in some instances it checks every one. For example, take a pipe welded joint. Every pipe welded joint is radiographed and the radiograph is read and it has an individual pedigree. Materials identification is done on a sampling basis. It is a hundred percent requirement on the part of the shop but only on a percentage basis by the quality assurance organization. I don't recall exactly the percentage.

Q. Do I understand from the answer to your question that on pipe welds, for example, that you have a pedigree for each type joint that has been made in the shipyard during the past month, say?

A. On P-1 piping--

Q. Will you explain what P-1 piping is?

A. That is piping that achieves pressure above a certain point, which I believe is 250 pounds psi, or temperatures in excess of a certain temperature, which I forget for the moment.

Q. Relative to quality, do your tradesmen and shop organizations have any responsibility for quality of the product?

A. Yes. Anyone who is any way involved in the process is responsible. If you want to pick one particular item then we can follow it through.

Q. Well let us take, for example, a sil-brazed joint and discuss that as regards responsibility.

A. Well, I would, of course, prefer someone who has recently read the instruction to go through it step by step, but I know the sense of the process. Of course, it is a check for material identification when it leaves Supply. It is checked one hundred percent for material identification when it is issued to the mechanic, and the mechanic is responsible to be sure that this material is marked to indicate the material itself. The mechanic is responsible at various stages in the process to call in either his supervisor or a shop instructor, as the case may be, for check on fit-up; and also, finally, it is inspected for final inspection of the joint.

Q. Do you find that the ship's force has a tendency to inspect your work?

A. Well, they are required to. Of course they don't have the means available that we do, but our inspection records are open to them.

Q. The ship's force, then, serves to some extent as inspectors above your quality assurance organization and your tradesmen organization to assure quality?

A. Our quality assurance program, if you wish to call it that, is not based on the assumption that it will be inspected by ship's force. This is an inspection that is required of them by Navy regulations. But we don't count on it.

Q. You count on your own organization to finally provide quality and count on the ship's force as an additional check, then. Is that the sense of it?

A. Well, we know that they will. I say we don't count on it.

Q. Relative to your shipbuilding and repair organization, I understand that its primary function is to coordinate the effort and insure timely and economical completion of work. Is this correct?

A. That is correct.

Q. Does your shipbuilding and repair organization also provide some inspection of work?

A. It provides it through the medium of the ship superintendent assigned to the ship. Again, our quality assurance program does not depend upon this, however.

Q. This is an additional check.

A. This is an additional, on-the-job inspection as you go along.

Q. Can you give us a feel for what a ship superintendent does?

A. Well, I think he perhaps--to put it best--he is a coordinator to coordinate the work on his projects, as the case may be. This coordination actually extends to the entire Shipyard, expediting plans, job orders, material inspection and what have you, as well as scheduling on the spot, in many cases, jobs which require real tight scheduling in a tight area.

Q. Turning to ship construction and repair priorities, what is the priority, what is the first priority in the Shipyard at this time?

A. Polaris.

Q. Polaris?

A. Polaris submarines.

Q. And what would be the second priority classification of work?

A. It would be any emergency repairs if we had emergency repairs. The next would be restricted availabilities. Third would be regular overhaul of ships in commission.

Q. Relating THRESHER to this priority system, during its post shakedown availability, would it be near the top of your priority or near the bottom?

A. Near the top of the priority list.

Q. Would we expect from it being near the top of the priority list that it would generally have assigned to it your higher caliber workmen for the important jobs?

A. Yes, sir. The THRESHER is pretty much the pride and joy of these people and you usually find a better grade of mechanic in the critical jobs.

Q. Would you expect that THRESHER would also get its share of management attention because of its priority?

A. I think more than its share, sir.

Q. Why more than its share?

A. Again, because of the--well let us say--sentimental attachment of the Shipyard to the ship.

Q. Let me turn your attention to the heart of the post shake down availability, say during March and during early April. How did you assess the readiness of this ship for sea?

A. Based upon the reports I received from the Production and Planning officers and also the commanding officer.

Q. What were the major problems that you learned of during March and April, if there were any?

A. I'm afraid I can't pinpoint any specific jobs. There were a large number of what I would call normally minor jobs but they just hadn't gotten around to complete them because there was a large amount of work involved.

Q. Well let me take a period, say, or date, of approximately 1 April. Did you know of any job affecting the safety of that ship on sea trials which was not at that time completed?

A. I'm afraid I can't pinpoint my memory quite that precisely in point of time. There were at that time what we call weeps which I would certainly not ask a commanding officer to go to sea with. At that particular period of time, as I recall it, we were still having trouble with the reducing valves-air reducing valves.

Q. What I'm trying to get at is did you have regular conferences with, say your production and planning officers with regard to THRESHER during this period?

A. Every day.

Q. And so you felt at the time that you were devoting attention to THRESHER yourself?

A. Yes, sir.

Questions by a court member, Captain Osborn:

Q. Admiral Palmer, for my information will you briefly describe the development of a new submarine type from its concept in terms of operation characteristics from a ship's characteristics board to say the Portsmouth Naval Shipyard as a design activity?

A. Right. We'll start with the characteristics. These are developed by the Ship's Characteristics Board in the office of the Chief of Naval Operations and this board is comprised of representatives primarily from CNO but also from the Material Bureaus and even the Marine Corps on occasion. The Ship's Characteristics Board works with,--taking a new construction ship--works with the preliminary design people in the Bureau of Ships and in developing these characteristics primarily from the point of view, is it feasible to build a ship with these desired characteristics. And when both the Ship's Characteristics Board and the design people are convinced by the Material Bureaus, particularly that it is a feasible design, and the characteristics are approved by the Chief of Naval operations, they are sent to the Bureau of Ships and this feasibility design is further refined in what we call a preliminary design. A preliminary design is, of course, primarily a little more detailed design study than was done in connection with developing feasibility as far as the operating personnel are concerned. Once the preliminary design people feel that they have got a design- as far as the principal characteristics are concerned- which can be built, it is turned over to the contract design people who develop plans and specifications in sufficient detail to provide a basis for the contract, and once this is done and the construction of the ship has been authorized, it is advertised for bids and the successful bider may also get the design or he may not. In case of the THRESHER class submarines, of course, the design was

assigned to the Portsmouth Naval Shipyard and the other yards building from these plans received the plans from Portsmouth.

Q. Then I understand that the degrees of increasing detail are Ship's Characteristic Board, the contract section of Bureau of Ships, and the design agent, in this case Portsmouth in the case of THRESHER, represent increasing detail in construction?

A. Right. You left out one step. It is the feasibility study with the Ship's Characteristic Board, then preliminary design, then contract design and then detailed design.

Q. In terms of specific, with respect to progressing down the line of this particular ship as she entered from a concept to begin to take shape in hardware, were any design margins highlighted as to how they affect operation and operational procedures to your knowledge?

A. I am not familiar with the design of THRESHER, in view of the fact of design of THRESHER in that I was not connected with it. The operational requirements and military requirements, of course, are set for it in the characteristics which are approved by the Chief of Naval Operations. Furthermore, certain areas of the ship which vitally affect operations such as the arrangements of control spaces and some of the electronic spaces and so on are marked up and the Ship's Characteristics Board views those usually at a very small scale. The Ship's Characteristics essentially establish the military requirements for the ship.

Q. Can you estimate the degree of complexity in such terms of relative numbers of say an ALBACORE, TANG, SWORDFISH, THRESHER class submarine.

A. Well, I think you've arranged them in about the proper order of complexity. I don't think I could assign a factor except that THRESHER along at the end of the line was, of course, tremendously more complex than ALBACORE but not much more so than- what ship did you mention third?

Q. SWORDFISH.

A. Well, probably it might have been more than the SWORDFISH.

Q. Would you say they would vary some place between one and ten?

A. If I did, I'd be guessing.

Q. At the same time the construction complexity increases, do you think the operational complexities would increase proportionately?

A. Of course, I am not really qualified to answer that question. I would say that it would.

Q. In terms of your test program, did they?

A. Yes.

Q. You could perhaps give me a fairly good idea about it with respect to the detailed test program.

A. I think you could get much more reliable information on this if you would ask our design people, for example, for instance the number of testing modes.

Q. I was more interested, Admiral, in a general way rather than a specific listing of a number of tests. Did the very recent investigation of THRESHER redesign studies undertaken in the spring of 1962 influence your ideas on any item of a safety nature as they pertained to THRESHER?

A. Of course, the Electric Boat Company was doing the detailed design work in connection with that design. There was a board appointed which met in Washington, I don't know who was on it except I know Captain Roseborough here was on it and I am sure that he could offer you a much more detailed opinion on that than I can.

Questions by court president:

Q. Well, Admiral Palmer, the court is conscious of the fact that the loss of the THRESHER and those on board has been a particular source of not only sorrow but concern to this establishment which you head. The court appreciates the very high order of cooperation which it has been receiving from your organization despite the other duties imposed upon you and I'm sure that you appreciate that this court, in view of the fact that your organization did perform the last work on the THRESHER before it was lost will have to ask very searching questions. I want you to understand that this is not done in any spirit of pointing any finger at anyone but we must determine every fact we can in this case. And so, when our questions are very searching, I want you to understand that we are not being unkind; we are just doing our job, as I am sure you appreciate we must do.

A. I certainly do, Admiral and thank you very much.

Q. Now I would like to ask just a few questions, Admiral. There have been witnesses before this court who have expressed impatience on the part of the personnel of the THRESHER at the extensions of the time in this post availability overhaul. Would you give the court what you consider to have been the main reason for these extensions of time?

A. Yes, sir. The reasons, I think, are essentially as I cited them before. The THRESHER is our pride and joy and when people came along with what looked like an added improvement, we said we wanted the THRESHER to get them. We did them without further advance planning lead time and without really good knowledge of the availability of materials and this got us in trouble; and, additionally, because some of these- like the PUFFS installation for example- are a completely new and different thing for us. We underestimated, really, the scope of the job and the reason for the extensions was number one, I guess, the inability to say "no," and number two the failure to look at the thing really hard before we said "we'll go."

Q. Admiral, you have been here now roughly two years. Do you have any jurisdictional or other difficulties in your organization which mitigate against high performance and good quality control in your opinion?

A. No, sir, we do not.

Q. What proportion of your key officers have had submarine experience?

A. Mr. President, I think I'd have to--

Q. Look at your roster?

A. --look at the roster. By submarine experience do you mean operating experience or people who have lived with submarines practically most of their lives on the other end of it?

Q. Well, I think that what I want to know is those who have a proper appreciation for the problems inherent in the safe operations of submarines under various and sundry conditions.

A. Yes. sir.

Q. If you could refresh your memory on that and provide the information at a later time, this court would appreciate it.

A. I would be delighted to, Mr. President.

Q. You stated that your organization has made post disaster analyses of jobs in order to see if you could find anything that might have caused this tragedy. Have you found any job which, although not conclusively the cause of the accident, might have been more probably a cause than any other?

A. I do not know of any, Admiral. I have not personally gone through each one of these plans, job orders, condition reports, quality control reports, but those who have and who have reported to me, indicate that they consider the work was satisfactory. Furthermore, they have the work packages assembled and they are available for inspection, and furthermore, we have people who are available to testify with regard to them.

Q. Of course, there is a difference between satisfactory and satisfactory beyond the shadow of a doubt, and so the court will wish to call experts from the Shipyard to go into each of these job orders which the court feels might possibly have been the approximate cause or the cause of this accident.

A. Yes, sir.

Questions by counsel for the court:

Q. As the period of THRESHER's post shakedown availability drew to a close, did you have any conferences or other dealings personally with her commanding officer?

A. Oh yes, every week.

Q. Could you tell us, briefly, of any significant things you learned in dealing with him as to his state of mind and confidence in the quality of the work that was being performed on his ship?

A. Well, number one, Captain Harvey was concerned, just as I was, with the status of work and getting it completed. This was the principal thing which he brought to my attention. There were a number of items of work which were not clearly established as ship's force responsibility or shipyard responsibility. In those cases, I ordered the Shipyard to go ahead and fix them up to the captain's satisfaction. And in the last conference I had with him, with all the other commanding officers present, he expressed great appreciation at the way we were turning to and cleaning up his weep list.

Q. Did you get an impression- did you draw an impression of him- in comparison to other commanding officers of submarines with whom you had to deal?

A. I couldn't compare them. I think my experience has been all the submarine officers I have come in contact with are unusually capable and he certainly measured up to the level of a capable submarine officer. Of course, I didn't know him as well as I knew Captain Axene.

Q. Did you learn anything significant from him which you think could be helpful in the deliberations of this court?

A. No, I did not.

At this point (b) (6) relieved (b) (6) as reporter.

Q. This Shipyard had been building many different types of ships for decades, has it not, sir?
A. That is correct.

Q. Yet several times in your testimony, once when you were referring to an abnormal amount of management attention to THRESHER, you referred to the sentimental attachment of the Shipyard for THRESHER, Another time you said she was the pride and joy of the Shipyard. What did you mean by this and how did it affect the performance of the work being done on her?
A. First of all I don't believe the word I used was "abnormal."

Q. No, that was my word, sir. I think what I meant to convey was she got a little bit more than her share.
A. Well, a lot of things go into make up an attachment for a ship that an organization has. Of course, number one, it was **designed** here. However, I think that the personality of the first commanding officer had a lot to do with it. He was highly regarded by everybody in the Shipyard, including me, and I guess they'd have given him the Shipyard if he'd asked for it.

Question by the president, VADM Austin:

Admiral, sometimes you thought you had, didn't you?

WITNESS: Well, looking at the price tag, I am sure they did give him a good part of it.

Questions by counsel for the court:

Q. But the ship was also the pride and joy of the workers?
A. Right.

Q. That is what I was getting at. Were they interested in the ship?
A. They were, right.

Q. Now I understand that the work on ships on this shipyard is arranged by priority, that is some types of ships are accorded a higher priority in work than others. Did THRESHER have the highest priority?
A. No.

Q. Please explain this answer.
A. Well, the Secretary of the Navy has established the priority of the work in connection with the POLARIS program and this, to the best of my knowledge, did not in any way affect the THRESHER because she would be, number two, excluding any emergency repairs or restrictions, of which I don't recall any. We had several other boats around here with lower priority--TINOSA, JACK, DOLPHIN, so that there should have been--on a strict priority basis, she should not have suffered at all.

Q. That would not then have contributed to any extension in the total period of her post shakedown availability.
A. No, sir.

RE-EXAMINATION BY THE COURT

Questions by the court president:

Q. Am I to interpret your answers to counsel's questions as indicating that the Shipyard was not short of any artisans in any area which affected the time it took to overhaul the THRESHER?

A. The THRESHER, that is correct. We had shortages but they did not affect her.

Q. Did not affect her. If those shortages existed they affected ships of a lower priority than THRESHER?

A. Yes, sir.

Neither the counsel for the court, the court, nor any of the parties desired to examine this witness further.

PRESIDENT: You will resume your seat as a party.

RADM PALMER: If I may withdraw I would appreciate the privilege.

COUNSEL FOR THE COURT: You waive your right to be present then, is that it?

RADM PALMER: Yes.

The witness was excused and withdrew from the courtroom.

Shelley E. Rule, Commander, U.S. Navy, was called as a witness for the court, was duly sworn, was warned of his rights under Article 31, Uniform Code of Military Justice, informed of the subject matter of the inquiry and examined as follows:

The witness was cautioned not to discuss classified information.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, rank, organization and present duty station.

A. I am Shelley E. Rule, Commander, USN, Quality Assurance Superintendent in the Production Departement.

Q. Do you head the Quality Assurance Division-- is that the proper title?

A. I head the Quality Assurance Division, yes, sir.

Q. Can you briefly describe the mission of that division?

A. Yes, sir. The mission of that division is to take an overall look at the quality that's being produced in the shipyard at all times throughout the Shipyard, not only in the production department, to look over the material control and the workmanship control as well.

Q. Briefly state your naval and professional background.

A. I attended the Naval Academy for three years, then went to the Georgia Institute of Technology. I went on active naval service in 1941, was at sea in destroyers. From there I went to PG School, thence overseas to China, back from there to PG School at Annapolis, MIT; then to shipyard duty at Philadelphia; then overseas to Viet Nam and back to Portsmouth.

Q. When you say, "back to Portsmouth," do you wish to leave the impression that you have twice been on duty at the Portsmouth Naval Shipyard?

A. Yes, sir, this is my second tour of duty at the Shipyard.

Q. What was the nature of the duties performed by you in your first tour?
A. My first tour, I started off as Assistant Planning and Estimating Superintendent for one year, and then three years as Planning and Estimating Superintendent.

Q. All told, how many years of service have you completed in this Shipyard?
A. Six years, sir.

Q. Can you describe for us the manner in which the Shipyard controls and monitors the quality of materials used and the quality of the finished product as it relates to critical submarine components and systems?
A. May I refer to some notes, sir?

Q. Please do, so long as you testify of your own knowledge.
A. The Quality Assurance System as prosecuted and monitored by the Quality Assurance Division has been in a period of steady growth for the last seven years at this Shipyard, which coincides almost exactly with the conception, construction and life of the THRESHER. During that time the Quality Assurance Division has grown by about fifty percent in size. Its functions cover material identification and control; the control of structural fabrication, both the material in that and the workmanship; piping control, especially in the making of pipe joints; the pre-trial operational testing and inspection of installations; and then the laboratory and non-destructive testing that are related to these other functions. Overall there is a responsibility to audit throughout the entire Shipyard what is actually being done.

Q. Can you go into more detail for us in describing the nature of your procedures or practices for the specific area of material identification and control?
A. Yes, sir. The first formal instructions which comprehensively covered material control were in 1956. This instruction and revisions to it have remained on the books to the present time -- until this past month, that is. This covered what we call target material, which is a special material for reactor plants and other materials of any critical use in the ship, whether structural or piping. The instruction covers the procurement phases of material; that is, the selection in the Planning Department, procurement by Supply, and Inspection on receipt --

Q. Excuse me, what's the connection between procurement and the material identification control process?
A. When material is procured, the process of procurement is defined to begin with the writing of the initial specifications here, and then followed up by the purchase. The initial specifications contain requirements for special marking in order that when a material is received from the vendor it can be identified with a certification that is required to come with it.

Q. Are you saying that if you order a particular kind of pipe, you also order the entire length of that pipe marked in a way so your people can identify the material of which the pipe is made?
A. That is correct.

Q. You put that into the contract when you procure it?
A. Yes, sir.

Q. And how do you make sure when you get the pipe that it is properly marked and it is the material which it purports to be?
A. We do destructive testing. That is, we cut on a sampling basis actual samples from the lot of pipe.

Q. Well that's testing. You receive it first. Do you have an inspection upon receipt?
A. That is a part of the inspection on receipt that I'm speaking of.

Q. Please describe it?
A. Whereas the material is compared to the papers that come with it to see if it apparently corresponds to the certifications and carries the marks which the paper says it's supposed to carry and has all the appearances of being the proper material. Then samples are cut while it's still in the Receiving Section and sent to the laboratory for analysis. This material, if it passes these tests, is then further marked by the Shipyard and put in storage, properly segregated if it's a type that calls for segregation.

Q. What further procedures do you have in this field of material identification and control?
A. The sampling that I spoke of takes place both on material received from vendors and material which is transferred to the Shipyard in the Supply System from some other supply point. As an indication that this system is in working order and does work, about one percent of our orders on an item basis are rejected. This Shipyard instruction that I speak of was modified and the structural materials separated from the piping material, in essence. More exhaustive requirements were put on the identification, and traceability of piping material, in June of last year. This is another Shipyard instruction now on the books which covers that.

Q. Do you have complete written instructions which tell people exactly what to do in this field, from top to bottom?
A. We have written instructions which cover the phase of identifying the material and maintaining that identity, maintaining the traceability through the system. We have instructions which cover telling people how to fabricate this material and how to cross-identify the material with the plans from which they are working so that they know they have the right material called for on the particular blueprint from which they are fabricated.

Q. Does your system allow for failures in it? Do you make errors in the markings of materials? Have you been able to find some of them?
A. We have from time to time found errors in the system. As part of our duties that I mentioned, we do have an audit system; and one of the features of our audit is to look over material to see if any is not marked or improperly marked. On rare occasion we have found such.

Q. What sort of corrective action is taken in this case?
A. We remove that kind of material from the system and send it back for rejection. In certain cases it can be reidentified and given a new pedigree and start through the system again; in some cases it cannot.

Q. Do you have anything further on that?

A. I could say that the field of piping has received particular attention. This, under the local name of the "Arrow System" is another type of material which we have paid particular attention to. We have covered this on the basis of first categorizing the piping systems in what we call levels of essentiality which, from the negative approach, possibly is an evaluation of how serious a casualty would occur if something failed in the system; and having categorized these on these levels, then we suit our quality assurance to the level itself, paying most attention to the top level piping.

EXAMINATION BY THE COURT

Questions by a member, CAPT Nash:

Q. Your system also covers quality control of performance?
A. Yes, sir.

Q. Could you do the same sort of thing for performance? You've explained how the procurement system works.
A. Our system calls for the shop supervisors, the line supervisors in the fabricating shops, to inspect the work of the men as it goes through the process. The nature of this varies, of course, in accordance with the type of work. In the Structural Shop it would be different from Piping. But essentially, in either case, if there is a fit-up involved, the supervisor must inspect the fit-up before any joining, in this case welding or brazing, occurs. The shop mechanic when he first receives the material from the supply center--that is, the shop store or bin from which he draws it--at that point must verify that this is indeed the material that he has to use; and in this case he frequently goes so far as to use an acid test on the material at the time to differentiate, say, between nickel base materials and ferrous materials. Later on in the process the inspection force, as well as the shop supervisors, inspect the product in process, and then finally the finished job. And, of course, at the end if it's a product that is appropriate to have hydrostatic tests, then the inspector uses the hydrostatic tests.

Q. Would you explain to me a little more in detail the fit-up inspection?
A. The fit-up inspection in the case of structure has to do with the type of joint prepared for welding, the root opening, the fairness of the plates, also the condition of the edges. Some plates, HY-80, are known to have limitations. This is, of course, searched for in the raw material but again looked for when the edges are prepared and before the joint is made. And then in the process of welding the inspector looks at the root passes of welding, sometimes employs non-destructive test conditions for visual inspection, and then goes on to inspect the intermediate and final presses as appropriate to the particular job. The corresponding system holds in piping.

Q. What is done specifically to silver brazed or welded type joints?
A. Welded piping has a careful joint preparation, just as structure does. There are two or three types of pipe joints, some with backing rings and some without. The type of inspection employed, of course, will vary with the type of joint.

Q. Well let's take -- you pick some type at random and give me the detailed process?
A. The detailed process, for instance, for a welded type -- or would you rather talk about silver brazed?

Q. Yes.

A. Silver brazed joint, the detailed process involves cleaning the fitting and the pipe that are to be joined. Silver brazed process involves, of course, an insertion of the pipe in the fitting and socket from the joint. The fitting has to be sized, that is, measured carefully to see that the pipe fits with the proper clearance. The pipe, if it is not of the proper size, has to be sized to correspond to the fitting then. The fitting of the type that we now use in the Shipyard altogether has a pre-inserted silver alloy ring. This has to be inspected to see not only that it is present but that it is of the proper grade. Each one of these rings, by the way, is marked with punch marks, so there can be no mistake in that. Then the pipe is inserted. The supervisor at this point inspects it for cleanliness and for clearance and for alinement. Following that, the brazer makes the joint. in practically all the cases, this is by torch heating. We do make a few joints by induction heating. After the joint is made, it is inspected again to see if the silver alloy was properly drawn up around the joint so that it's visible all the way around.

Q. Now is there any form of test or an inspection other than visual?

A. I might add that after the visual inspection, in certain cases, there are exceptions, there are repairs made to the joint before further test is made. These are on particularly sharp joints. After that there is a non-destructive test, almost invariably in the form of ultra-sonic testing. The entire periphery of the joint is examined and then the amount of bond that the ultra-sonic test shows is averaged out to see whether it passes or not.

Q. What is the determination as to whether or not a particular joint receives this last test?

A. It has to be a joint in a sea water system over two inches in size and done in place.

Q. If it is a sea water system less than two inches, does it receive a test and, if so, what type?

A. Less than two inches, it normally does not receive an ultra-sonic test. This has been done in some cases. Ultra-sonic testing is, at the present time, not too satisfactory, we found, below two inches. That's one of the reasons for the limit. There are also other ways of testing. Silver brazed joints can be radiographed, but this does not show the same information that the ultra-sonic testing does. It's done for a different reason, normally, to show whether or not the pipe was properly inserted in the fitting.

Questions by a member, CAPT Hushing:

Q. How many persons do you have in the quality assurance group?

A. I have two hundred and ninety at the present time.

Q. Do you know approximately how many productive workers there are in the Production Department?

A. About six thousand.

Q. So that this is roughly five percent--

A. That's right.

Q. --of the six thousand. You've mentioned the auditing process. Do you also audit the qualifications of the workers involved in such process?

A. Yes, sir.

Q. Let's be specific for a moment. How about silver brazing; do your silver brazers carry a card?

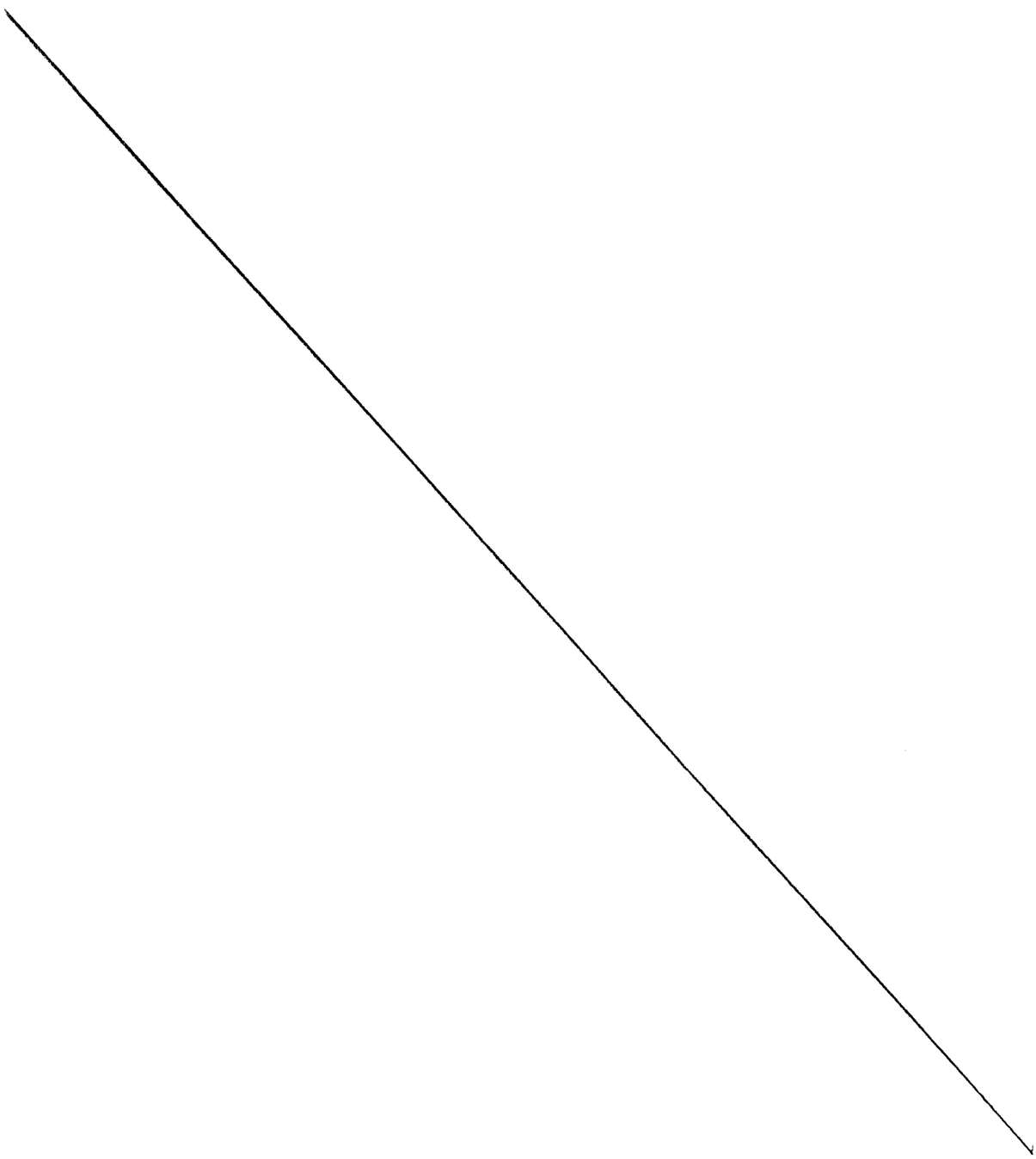
A. All silver brazers carry a card, yes, sir.

Q. Do you audit the cards for currency?

A. We look at the card for the date and for the type of qualification the man has.

Q. And you match that against the process he is working on?

A. Yes, sir; type of material.



Q. How about radiography, do you have a similar system for radiography?
A. Yes, sir. Welders are qualified and they are qualified for certain materials in certain positions. This is checked.

Q. So that you not only check the material and the adherence to the process, but you also check the qualifications of the persons performing the process; is that right?
A. Yes, sir.

Questions by a member, CAPT Osborn:

Q. You stated, Commander Rule, that the life of your Production Assurance Division and the life of the THRESHER were about the same. Why did your organization come into being?
A. This, grew, I think I could say, as an appreciation of the growing complexity of building submarines and the growing importance of checking on the quality. There had been for a long time what was called the Inspection Division. This was the core around which the Quality Assurance Division was built up.

Q. Was this associated with something a little bit more specific, say, a pipe casualty?
A. I can imagine that the occurences on the BARBEL could have lent some momentum to it, but it started before that. The material control started back in the days of prior trouble with material substitution on other ships. This happened from several sources over some years.

Q. Were you one of the first organizations to set up such a program in a Shipyard?
A. We, I believe, have come along as much and as far as any in this respect, sir.

Q. Have other shipyards visited you to establish quality of your procedures, adopt your procedures, and do you consider yourself a leader in this field?
A. We have visited back and forth from one yard to another with this respect, yes, sir.

Questions by the president, VADM Austin:

Q. Commander Rule, does your organization insure against a worker who performs repeatedly unsatisfactory work not continuing to perform that type of work?
A. When we run these audits that I spoke of, both on the technique of the people and their qualifications, we report to the Production Officer and to the shops what we find in the way of people who are turning in higher than the average number of rejected jobs or people who are not qualified by their credentials which they bear at the time for the particular work which they are doing.

Q. That is interesting, but it does not answer my question. As a result of these reports do you still continue to have workers performing unsatisfactory work which you have already reported on?
A. Yes, sir. We have an audit. We report on a certain rate of rejects and we have also a record of those who were not qualified in this line. The next time we perform an audit, maybe on a monthly basis, or weekly in some cases, we turn up the same type of rejects. They do not, of course, always turn up against the same man. Sometimes we turn up the same men repeatedly working on this type of work. We search with our analysts to try to get a tie in between the individuals and the rejects as well as between the type of work. Sometimes we find a pattern like this and we then can take steps to eliminate the man or to have him eliminated.

Q. In other words, when you do find that the rejects are coming from one who is not sufficiently skilled or careful, you do take steps to see that that source of unsatisfactory work is corrected?
A. Yes, sir.

Q. You do take positive steps to see that this is done, not just report it to someone and forget it?
A. The Quality Assurance Division has no power to remove anyone. We have only the power to uncover him and report him.

Q. I realize this, but you do have the power to re-examine and report to the Commander of the Shipyard and make sure that all of your effort is not just spinning wheels, don't you?
A. Yes, sir.

Q. All right. We have had evidence before this court to the effect that a number of check valves, for example, were installed backwards in the THRESHER during her overhaul. Could you give the court good reasons why so many check valves were installed backwards despite this very fine quality control organization of yours?
A. I don't have enough knowledge of the details here, sir, to answer it possibly the way you'd like to have it answered. There is an installation inspection made of each system when the installation is complete and this is one of the things that we found in inspecting systems. We find other things from time to time and have them corrected. Each deficiency that is found, there is an unsatisfactory report turned in on it and these are cleared. I could not pretend in this case, I'm afraid, to give you a reason for the check valves being in backwards.

Q. Are the check valves marked so that a normally careful individual assigned the task of installing them would be able to tell which end was which?
A. The check valves that I have seen, sir, are almost invariably marked.

Q. It would seem that no degree of quality inspection and control and assurance -- I'm not sure the word "assurance" is properly used -- would succeed in eliminating hazards to submarines on which work is done if there is not absolute assurance that when the work is completed there are no check valves in wrong and that there are no joints that were not properly inspected. Now, will you tell the court how you insure that this high degree of assurance can be given to the ship that your work has not increased the hazard to the ship?
A. The inspections that take place on the ship vary from a sampling, in some cases -- I have cited the case of materials that we sample --

Q. I know, but getting the right material into the yard and all of that is all wonderful; that's a good step in the right direction. But how do you assure that when you have worked on, for example, the auxiliary salt water system of the THRESHER, that you haven't left something in that system that is going to be a source of danger?
A. In the case of an installed system, at the end, when the hydrostatic test is put on the system, every single joint is inspected for leakage while the hydrostatic pressure is on the system. This is every joint, without exception, from one end to the other. In the process of hydrostatic tests, or, not always concurrently, but after the system is completely installed, an alinement check and a check for proper mounting of hangers is conducted. This again is a 100% inspection from one end of the system to the other. This comes prior to an operational test, which, in the case of, let us say a controlled system in hydraulics, would be a matter of seeing whether the hydraulics operated the

mechanism the way it was supposed to. These checks are one hundred percent in coverage; however, it has been shown that inspectors in any business frequently will turn in a better record on a sampling inspection than they will on the one hundred percent inspection. However, in the type of piping inspection that I speak of, the one hundred percent inspection is taken to be the best and the one to give the greatest assurance.

Q. If valves are installed backwards, then, you do check before the ship goes to sea to insure that they are corrected and the whole system tests out all right?

A. Each one of the valves in the system is looked at for that and for other things.

At this point (b) (6) relieved (b) (6) as reporter.

Questions by the President:

Q. Commander Rule, in your opinion, were the tests conducted on THRESHER thorough?

A. I believe they were, sir.

Q. And in your opinion did everything get done that needed to be done from the Shipyard Quality Assurance viewpoint, that needed to be done to maximize her safe operation of those parts of the ship that had been worked on by this Shipyard before she went to sea for her trials?

A. Insofar as I have been able to determine; on a careful review of all the records since that occurrence we have covered everything that was required to insure safe passage.

Q. That isn't what I asked. I asked ~~that~~ if in your own mind and conscience all had been done that could normally be done to insure the safe operation of those things that the Shipyard had worked on?

A. Yes, sir, I believe so.

Q. In retrospect, even, and examining the jobs after the event, you do not in your own mind know of a place where there was a shortcut taken that probably shouldn't have been taken?

A. I can't think of one at the moment, sir.

Questions by a member, Capt. Hushing:

Q. Going back to your audit of workers in the Shipyard for qualifications and that sort of thing. Where you find a worker performing a process who is not qualified in carrying his card, what do you do?

A. This is reported to the head of the shop; reported orally at the time to the supervision on the spot, and reported later in writing to the head of the shop.

Q. And how about that work; what happens to it?

A. The work, if it passes an inspection, and this, of course, calls down more inspection on that piece of work, if it passes that inspection the work is continued.

Q. Where you have evidence of an individual's sub-standard performance, for example in welding, do you in the Quality Assurance Division have any power to disqualify that man from that kind of process, for example, welding?

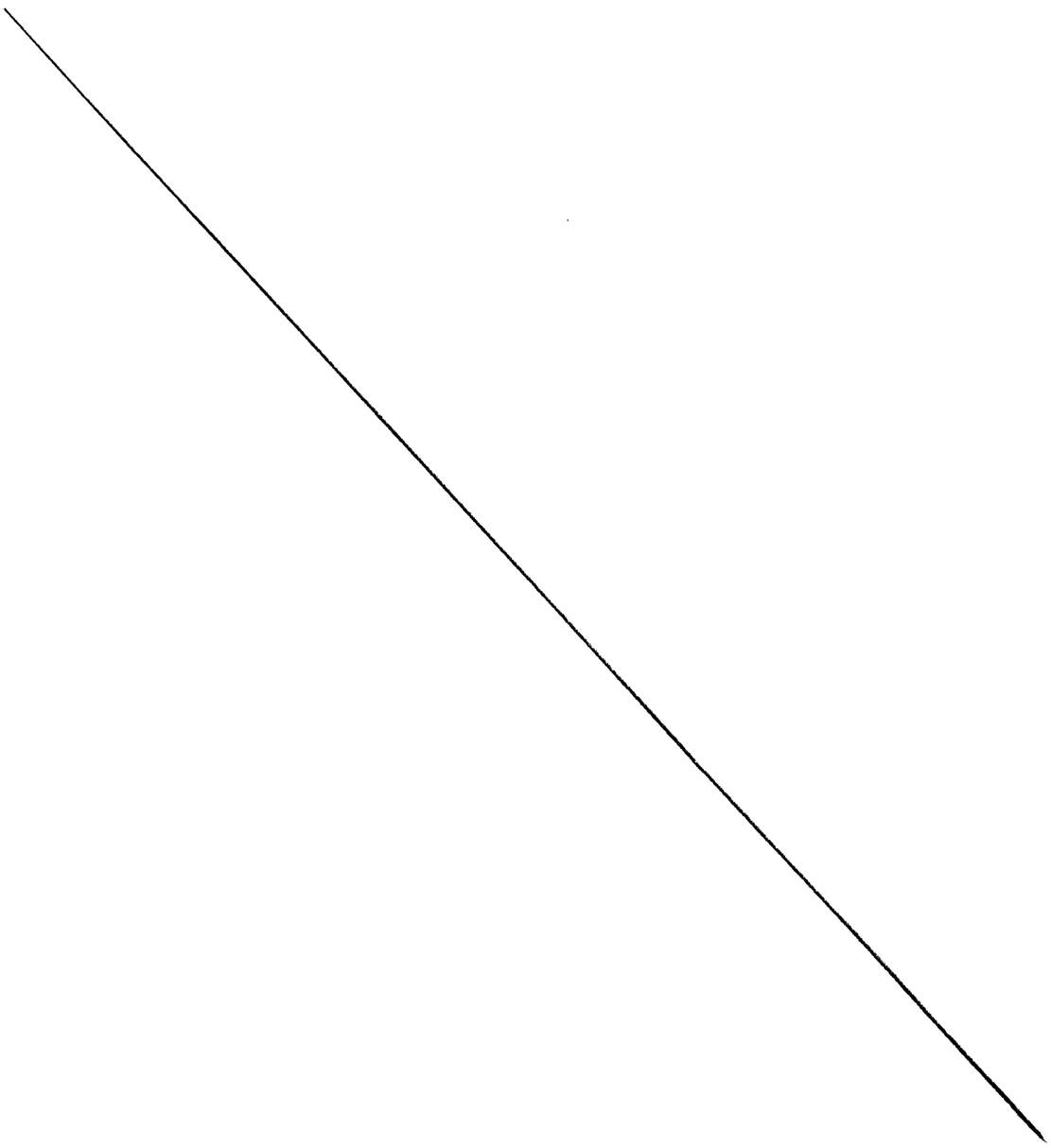
A. In this Shipyard the welding engineer is not under Quality Assurance. The qualification of welders comes under him and therefore the removal of qualification.

Q. Let me change in to silver brazing; does that come under Quality Assurance?

A. The inspection of it, but the silver brazing technique and qualification again does not.

Q. Where you find a man who has on a series of inspections had rejects and in the opinion of Quality Assurance the percentage of rejects was far too high, do you have any authority or power to disqualify the man from silver brazing?

A. We have the power to report, but not the power to summarily remove.



Q. Now, relative to responsibility; you do have responsibility, I believe you said, for quality assurance of the project? Do you have any responsibility relative to timely completion of tasks in the Shipyard?

A. Only the responsibility insofar as my own staff is concerned, not to hold up the work; that is when their inspection is called for to report on the spot. I have no responsibility other than that for the prosecution of an overhaul on schedule.

Q. What I'm getting to is, if you know that the ship is behind schedule or very close to schedule and you are required to perform a quality assurance inspection, is there any responsibility on your part, or that of your division, to insure that the completion date is met?

A. No, sir, there is a responsibility to see that the inspection is performed.

Q. And that the quality of the product is assured?

A. Yes, sir.

Q. How about the matter of costs; do you have any responsibility as regards cost of a particular process?

A. No responsibility, only the common-sense approach to see that our means of inspection do not inordinately increase the cost.

Q. Do you have any other responsibility than quality assurance?

A. No, sir.

Questions by a member, RADM Daspit:

Q. To whom, besides the shop master, do you send copies of reports of unsatisfactory work?

A. With this type of report we send reports to the Production Officer; certain reports are sent to the Bureau of Ships and Special Programs.

Q. Does the Production Officer get copies of all reports that the shop master gets?

A. I would hesitate to say yes across the board. I would say in most cases.

Questions by a member, CAPT Osborn:

Q. With respect to the reactor piping, do you have a control of that inspection?

A. No, sir; under the Nuclear Power Division they have their own Quality Assurance.

Neither the counsel for the court, the court, nor any of the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything relating to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

I would like to make one short statement of my instructions to my own people on the way we are supposed to inspect. I told them that the position of the Quality Assurance Division is to inspect those things which are required to be inspected, and to report what they find, regardless of what it is, and also to report anything else which they incidentally notice in the process of these inspections, even though it may not have been called for. We assist the shops in clarification and interpretation of any specification requirements that we feel we are qualified to do. Beyond that, we request interpretations, sometimes from the Design Division, sometimes from the Bureau of Ships on interpretations. We refer the shops, when they have what we consider a deficiency, to Design or to the Welding Engineer for a waiver, if they so desire. This is not always for deficiencies, I might add, but in case of waiting periods. We make recommendations for changes in requirements where we think it appropriate to the Shipyard or to the Bureau. We do not issue any waivers ourselves.

The witness was duly warned concerning his testimony and withdrew from the courtroom.

The court adjourned at 1555 hours, 20 April 1963.

NINTH DAY

Portsmouth Naval Shipyard
Portsmouth, New Hampshire
Monday, 22 April 1963.

The court met at 1030 hours.

All persons connected with the court who were present when the court adjourned were again present in court. The interested parties, RADM Palmer and LCDR Hecker were absent. Counsel for RADM Palmer was present. (b) (6) was the reporter.

Sherman Pelton was called as a witness by the court, was informed of the subject matter of the inquiry, was warned of his rights against self incrimination, was duly sworn, and examined as follows:

The witness was informed that the court was in open session and classified information should not be divulged.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, residence and occupation.
A. Sherman Pelton, (b) (6) Maine, Head of the Quality Assurance Engineering and Analysis Branch, Production Department, Portsmouth Naval Shipyard.

Q. Give a brief description of your experience and background for your present job.
A. I came on the Yard in 1951 in the Design Division, Radio and Radar masts. In 1954 I transferred to the Torpedo Tube Design Unit. In 1960 I transferred to Deputy Head of the Inspection Division. In July '61 I took over my present position.

Q. What is the exact nature of the work that you do?
A. The nature of the work that I do, that my group does, is to prepare documents to assure the quality of the work and the quality of the workmanship, to insure for the Shipyard a satisfactorily built product.

Q. What is your Shipyard Code?
A. 303A.

Q. Can you describe in some detail your quality assurance procedures as they relate to piping systems in a submarine?
A. In April of 1960 the first instruction for torch brazing of ferrous and nonferrous piping initiated brazer qualification tests and qualification certificate cards for the mechanics and the brazers. In March of 1961, a Design Memo listed the types of joints for sea water systems for new construction. Between the hull and backup valves, below three inch IPS silbraze, using only pre-inserted ring type pipe joints.

Q. What do you mean by IPS?
A. Inch diameter. Three inches diameter and larger shall be welded joints. Inboard of the backup valve, four inch diameter and below, sil-brazed joints, using only pre-inserted rings. Above four inch diameter, all welded

joints. 28 March 1961, an instruction by the Head Inspector to all inspectors, listed the inspection criteria for sil-brazed fittings, which in brief is a hundred percent inspection of completed joints, twenty-five percent in process inspection, and ten percent check of all materials used, using an acid spot check method. In March of '61 an instruction for fabrication and inspection of sil-brazed pipe joints. Also a new qualification procedure for brazers in accordance with the ASME Boiler Code. In April of '61, the Planning Department issued an instruction to eliminate the use of all face fed fittings in submarine piping systems over one-quarter inch outside diameter. In April of '61 there was a Production Officer's Memo, a special one-time inspection on sea water systems in the 593, 605 and 606 would acquire data on material already installed. In August of '61 the Shipyard issued an instruction for joint certification and fabrication and inspection of non-target systems. This has been our basic instruction for control of piping, since that time, and provides a consolidated reference to currently effective directives for fabrication and inspection of non-nuclear target pipe joints where the piping is greater than one-half inch outside diameter.

Q. Relative to the 1961 Instruction, would you call that your major instruction pertinent to the matter under inquiry relating to piping systems?
A. Yes.

Q. Does that cover vital piping systems of all submarines?
A. Yes.

Q. Can you produce it?
A. I can.

Q. Can you identify this, please?
A. Production Department Instruction 4410.4. This includes seven changes from August of '61 to the present time.

Q. The last change being dated 28 March 1963?
A. That is correct.

Production Department Instruction 4410.4 and enclosures was offered in evidence, and there being no objection, it was so received as Exhibit 64. The reading of the exhibit was waived at this time.

Q. Mr. Pelton, in your testimony you referred to non-target piping systems; can you explain what you meant by that reference?
A. Non-target refers to that piping that does not come under the control of nuclear systems.

Q. Returning to your history of instructions, do you have any further background material at this time; background information?

A. Because you have waived reading of that, I gather that you wouldn't be interested in what it consists of.

Q. If you can summarize it briefly we would appreciate that.

A. 4410.4 has five enclosures to it, one of which is the supplementary instruction for sil-brazed joints. Two, a supplementary instruction for welded joints. Three, an instruction for mechanical joints. A joint identification system, and a joint certification card, a joint certification card to control all joints in these hazardous systems. It's this here; it consists of five cards, 1 through 5, which are used in the control during

fabrication of the joints, and as a final record of the joints. It has a place for the pipefitter's name and number, the brazer or welder's name and number, the supervisor's name and number, and the inspector's name and number. As far as the joint identification system is concerned, 4410.4 is the basic instruction initiating these, and the cards that you have, it was planned primarily where the Design Division supplies the instruction filling in the information on those cards.

Five copies of a blank Joint Certification Card were offered in evidence and there being no objection they were received in evidence as Exhibit 65.

The witness continued his testimony:

A. There are several departmental instructions on the use of these cards for the different ships under construction or overhaul in the Yard by the Production Department. Foreman of Shop 56 memo of 10 January 1962 is the instruction that covers the use of these cards, 593 PSA.

Q. Will you designate the number of that instruction, please?
A. It's just the Foreman 56 memo of 10 January 1962.

A memorandum of the Foreman of Shop 56, dated 10 April 1962 w/enclosure dated 10 January 1962 was offered in evidence, and there being no objection it was received in evidence as Exhibit 66.

Q. Do you have further information concerning governing instructions to present at this time?
A. I don't understand quite how detailed you want me to go.

Q. Have you given us enough now to show that your inspectors knew the type of inspections that they were to carry out in the piping systems, and knew the qualifications of the personnel who were to do the work that they inspected?
A. Well, Instruction 4410.4 requires that Shop 56 or 26 supervisors, as applicable, to examine every joint after fit-up prior to brazing or welding. Also, during the process of brazing and welding, and after final completion of the joint.

Q. Does it cover material identification?
A. It covers material identification procedures, starting at the point where the mechanic draws material from the shops stores issue. At that time he is required to identify the material using a chemical acid spot check method, compare the findings of this check with the markings previously applied on the material, the material is then etched with the composition or class of the material, the piece and plan number and the hull number. This material marking is required to be maintained throughout the fabrication and installation process.

Q. Throughout the process? If this court were to visit any submarine in this Shipyard, and examine any piping in the vital systems, would it find the pipe identified as to material by some sort of mark?
A. Yes.

Q. What kind of things do the inspectors look for in this regard?
A. The instruction calls for in-process inspection to be performed for the size, the material, fit, alignment, support and the joint preparation. For completed joints they are required to check for misalignment, excessive heat, excessive fillet, incomplete brazing, excessive repairs, cracking of the braze or fitting, indication of filing or grinding, leakage, improper support.

Q. And all this was covered in the basic instruction which you have offered in evidence?

A. Yes.

Q. Does it provide for an in-process inspection of the joints?

A. The supervisors are required to perform a hundred percent in-process inspection of the joints, and twenty-five percent of the joints are to be in-process inspected by personnel of the inspection division.

Q. Have you fully covered the procedures governing the final inspections of the joints?

A. No, this instruction requires that all joints three inches in diameter and greater, brazed in position aboard the ship, require a radiograph of the joint to determine if the brazing ring has melted and the joint has been properly bottomed in the socket.

Q. Can you clarify what you mean by three inches in diameter and greater? "Greater" is what we would like to have clarified.

A. If the joint is three inches, or any joint where the piping is larger than three inches in diameter and there is a joint in it, it will be radiographed, X-rayed.

Q. We would like to discuss in more detail the requirements for making and checking certain pipes of critical pipe joints. In the first place, the sil-braze type of joint. Will you tell us the procedures followed in qualifying and inspecting personnel and work performed in the sil-braze process?

A. All brazers, since April of 1960, are required to pass a brazers qualification test. On passing this test they are given a brazer certification card. I'm not positive, but I think this card has to be reissued every six months and the brazer has to be requalified every six months. The inspectors and the shop supervisors can, upon request, demand the card from any brazer in the process of brazing to determine if that man is qualified to do the brazing work he is working on.

Q. "Can and do," or can?

A. Can and do. In February of 1962 an ultrasonic test group was established at this yard to determine by means of ultrasonic testing the percentage of bond in a sil-brazed joint. By Bureau directive the acceptance standards for sil-brazed joints ultrasonically tested, is 40% bond for the total joint and a minimum of 25% bond on either one of the two lands that make up the total joint. In August of '62, this bond requirement was raised to 50% average bond for the joint, except in the case of those joints being surveyed which were previously made at another period when the requirements remained at 40% bond for the joint. In January of '63 this bond requirement was raised to 60% for all new joints. On 15 March '63, the 60% bond reverted to the 50% requirement.

Q. You refer to a Bureau, will you be specific in designating it?

A. I haven't it available right now.

Q. Would it have been the Bureau of Ships?

A. Oh, excuse me, I thought that you meant the directive number; BUSHIPS, yes.

Q. Now what type of in-process and final inspections do sil-brazed joints undergo?

A. Prior to brazing, the supervisor is responsible to inspect every joint for the correct size, correct materials, proper fit, proper alignment, proper support and joint preparation; for all joints two inches in diameter and

larger there is a requirement for two brazers to be present during the brazing process. One doing the actual brazing and the other determining that he is following the correct procedures and getting the correct results during the brazing process.

Q. You have presented in evidence certification record cards with regard to identification of joints and the personnel who perform the work. Can you go to any submarine in the Yard and identify the specific brazer who brazed a specific sil-brazed joint?

A. In that regard I will say that we are supposed to be able to. There are fifty thousand joints on a submarine; this would take a good deal of record searching, but at one time, and I'm not positive of the date, because I cannot find it recorded in an instruction until January of 1963 --

Q. Designate the instruction, please.

A. Inspection Department Instruction 4410.7 requires the brazer qualification number to be marked on each fitting the brazer forms the braze on.

Q. What rejection rates have been experienced in this Shipyard with specific reference to sil-braze work done in THRESHER?

A. The only rejection rate that we have any record of are of those joints that were ultrasonically inspected, and this is for those joints two and a half inch in diameter, and larger, that were brazed in position on board the ship. On THRESHER there were two hundred joints in this category; twenty were rejected; 10% rejection.

Q. Did your answer apply only to the work done in the recent post shakedown availability of THRESHER?

A. Yes.

Q. Do you have any figures for the period of her construction in that respect?

A. No, sir, because ultrasonic testing was not in existence at that time.

Q. The 10% figure then not only relates simply to the post shakedown availability period, but also is limited to the rejection rate for ultrasonic tests. Were there other rejections, besides, of sil-brazed joints?

A. Yes, but these would not be recorded. The supervisors inspecting the joints in-process and final and the inspectors by visual examination could reject a joint before it was finally passed on to the ultrasonic test methods.

Q. Can you give me some idea what that rejection rate was in THRESHER?

A. No, sir, I cannot.

Q. Would you say that even the 10% figure which you have mentioned is a high rate or a low rate?

A. Compared with the overall Shipyard average during that time; the overall average for the Shipyard was about 13%.

Q. Can you account for the fact that the rate was somewhat less in the case of THRESHER?

A. No, I cannot.

Q. You have told us now of the various tests and inspections, the various checks being made and the work on THRESHER as they apply to silver brazed joints. If you had to give an estimate of the number of people who check and the number of checks made on a single silver brazed joint before it is accepted, what would you say?

A. For joints two and a half in diameter brazed in position aboard the ship; I would say there would be five different people look at this joint, two of them would look at it more than once. For joints less than two inches in diameter, I would say there would be three people looking at each one.

Q. And those figures, of course, do not take into account the inspections performed by ship's company on the work performed in their ship?
A. No, sir, they do not.

Q. Has the rejection rate for silver brazed joints increased in recent years at the Portsmouth Naval Shipyard?
A. We do not have any records of rejection rates on sil-brazed joints prior to February of 1962 when we started using the ultrasonic inspection method.

Q. We have heard some opinions voiced on the relative reliability of silver brazed joints in comparison with welded joints. What is your view of their relative reliability?
A. I base my opinion on a Bureau of Ships special assignment to Electric Boat Company to investigate this that you just asked, and the results of their report on it is that properly made sil-brazed joints are wholly reliable in a piping system.

Q. Did that report indicate, if you know, that there was an adequate factor of safety which was satisfactory for the service for which the joint was intended?
A. I'm sure it did. I don't know quite exactly how to express it. Maybe it would be best if I were to get that instruction, or the report of that test, and answer from that.

Q. Please obtain that report and present it to counsel at some later time.
A. Yes, sir.

Q. You mentioned ultrasonic testing of silver brazed joints; is that ultrasonic testing done in the ship or in the shop?
A. Ultrasonic inspections can be done most any place. It is done in the shop and it is done in the ship. There are some cases where the area in the ship makes it inaccessible for ultrasonic testing.

Q. In such cases are ultrasonic tests performed prior to installation?
A. I'm not sure of the date of the instruction, but it is one of the changes in 4410.4, that states that any joint two and a half inches in diameter, or larger, fabricated in the shop, that will be inaccessible for leakage repair, will be ultrasonically tested before it is installed in the ship.

Q. Now, was that the process in the case of the special post shakedown availability?
A. I would say yes, but I do not know definitely.

Q. Have you ever seen a total failure in-service, or in a shop test, of a silver brazed joint?
A. No, sir.

Q. I put the same question to you in respect to a welder's joint?
A. No, sir.

Q. Turning then to welded joints. I would like you to provide for this court the same sort of information you have given in the case of sil-brazed joints, starting with the qualifications of the welders, the procedures for qualifying welders, the inspection methods, joint identification, etc. First, the qualification of welders.

A. 4410.4 calls for the qualification of welders in accordance with Mil Standard 248. The welders are required to carry a certification card of their qualifications and are required to produce it upon request of their supervisors or inspectors. All welding procedures are set forth in so-called welding - engineering instructions that are put out by the Welding-Engineering Division. In-process inspections by supervisors and inspectors prior to the joints being welded, are to be checked for depth of counter bore, separation of the root face, groove angle, groove radius, the squareness of the end of the pipe and the cleanliness of the area to be welded. The joint is then turned over to Shop 26 people for welding. The Shop 26 supervisor inspects the joint again for the above criteria. He determines the welder's qualifications who is to weld the joint. He checks for the correct welding procedure to be used. If the joint is to be pre-heated this is to be checked with the use of a temple stick, and he observes tack welding of the joint, and as much in-process welding as he needs to certify that the joint is welded properly. The completed joint is inspected for surface appearance, undercutting, slag, weld spatter, overlapping or weld beads, the appearance of arc strikes, and other evidence of damage, slag hammer marks, and a liquid penetrant inspection that inspects for cracks.

Q. What is that temple stick that you refer to?
A. Actually it is a crayon type thing that melts at a certain temperature. They apply this to the joint to be welded, if the temperature of the joint is correct this stick will melt.

Q. Proceed with your description of the inspection methods.
A. After the joints have been completed satisfactorily and visually inspected, all but welded joints, if called for by plan or other work instructions are radiographed. Radiographic acceptance standards -- actually Mr. Rogers has most of the information on what the radiographic acceptance standards requires.

COUNSEL FOR THE COURT: We propose to call him later as a witness.

Q. Can you tell me what the rejection rates are for welded joints inspected by radiography?
A. I will name two types of piping material in that regard. Copper-nickel for all boats in this yard has a rejection rate of 33%. For the 598 during PSA, the rejection rate was 55%.

Q. 55% relates to THRESHER?
A. Yes, during the PSA. Carbon steel for all boats in the yard the rejection rate 17%, for THRESHER PSA 13%.

Q. Why do you give this court the rejection rates for only two types of welded joint material?
A. These were the only two piping materials involved in weld radiography of pipe used in THRESHER PSA.

Q. Would you regard the figures which you have cited to us as low, moderate, high or extremely high? These figures relating to the inspections in THRESHER.

A. The rejection rate is high, but the rejection for all shipyards is high in pipe welding rejections.

Q. What is the reason for that?

A. The radiographic acceptance standards for pipe welding radiograph are very definitive in their requirements. The Bureau of Ships, in August of 1962 initiated a pipe welding project in this regard. All shipyards, private and Government, involved in submarine construction, are involved to determine if new acceptance standards should be set forth for pipe welding because the rejection rate overall is so high.

Q. Which shipyard is the project manager to see if we have new standards in this regard?

A. Portsmouth Naval Shipyard. CAPT Guerry, the Production Officer, is the Production Manager.

Q. You said that the standards are very definitive. Would you say that they are severe and high as well?

A. Yes, I would.

Q. Turning now from your description of the quality assurance for welding pipe and joint systems, I would like to direct your attention to mechanical joints. Can you define the term "mechanical joints" for us?

A. Mechanical joint is a joint where the pipe and the valve have flanges, the flanges being held together by bolts or studs, or a joint where the coupling is actually a screw thread.

Q. Again I will ask for the sort of information with respect to mechanical joints which you have already submitted in the case of the other two types of joints; qualifications of the pipefitters who work on them, inspection methods, and instructions governing them, and the records which you have on these?

A. Basic instruction 4410.4 has a supplement to it for mechanical joints.

Q. Has that supplement already been introduced into evidence?

A. Yes, it has.

Q. Very well, proceed.

A. The joint certification card has a place on it for mechanical joints. Mechanics making up mechanical joints do not carry qualification cards except for those mechanics making up what is called a "bite type fitting".

Q. What is a "bite type fitting"?

A. It is a fitting that has a screw thread type of coupling; that when you tighten it down there is a ferrule on the underside that bites into the piping, that affects the seal and the strength of the joint. These joints are prohibited now; and have been since March of 1961, on all joints over a quarter inch outside diameter.

Q. What type of tradeworker is required to fit a flanged type sea valve to the pressure hull, for example?

A. I believe he is rated as first class outside machinist. For further inquiries along this line I would like to pass to somebody more qualified to speak on it than I am. Mr. Poor is Group Master of the Outfitting trades.

Q. Such a workman would not have to carry a card; is that correct?

A. That is correct.

Q. But still his work would be subject to the inspection of your personnel?
A. Yes.

Q. And again, that type of inspection is covered by the instruction to which you have alluded?
A. Yes.

Q. Is there a joint identification system for mechanical joints too?
A. There is a joint identification system for mechanical joints over one-half inch in diameter in those hazardous systems.

Q. What records are kept of the men who made mechanical joints on THRESHER during the post shakedown availability?
A. I haven't that information with me.

Q. Who would know that?
A. Instruction 4410.4 requires the shop supervisor to make up one of these joint certification cards for every joint one-half inch diameter and larger, in the system, and to submit a card on each joint to his shop office.

Q. That answer then is held by the shop cognizant of the individual?
A. Yes, this would be Shop 56.

Q. Do you have knowledge of the rejection rate for mechanical joints in THRESHER; completed in THRESHER during her post shakedown availability?
A. No, sir.

Q. Are records kept?
A. Records are kept. To the extent that they were finally completed as to the number of times they may have been rejected, I don't think so.

Q. The records do not necessarily reflect the rejections you had?
A. No, sir.

Q. Who keeps such records?
A. Quality Assurance Inspection Branch.

Q. What code number is that?
A. 303B

Q. What individual holds that position?
A. Mr. Young.

(b) (6) was relieved as reporter by (b) (6) at this point.

(b) (6) relieved (b) (6) as reporter at this point.

EXAMINATION BY THE COURT

Questions by a court member, CAPT Osborn:

Q. Mr. Pelton, how many joints have you personally inspected in connection with your quality assurance program on the THRESHER?
A. Myself personally?

Q. Yes.
A. Zero

Q. None?
A. That is correct.

Q. Have you every been to sea on a submarine?
A. Many times.

Q. Were you ever to sea on the THRESHER?
A. Yes, sir.

Q. When was that?
A. The dates I do not recall exactly, but I went on every sea trial that the THRESHER went on after the new construction period.

Q. Do you personally understand in a semi-operational way the operational significance of the quality assurance program?
A. Would you repeat that, please?

Q. Do you personally understand in a semi-operational way - and I wouldn't expect you to understand this the way a person serving in a submarine would - the operational significance of the quality assurance program?
A. I believe I do.

Q. Are you familiar in detail with the physical conditions under which joints are inspected on the ship itself and the likely possibility of personal error in key salt water joints?
A. I personally have no information on the joints as such.

Q. I am asking a question about the geometry involved, and do you know the location of those joints where one is most likely to make a personal error?
A. Joint by joint, no, sir, I do not.

Q. Have the variations in percentages in bond with respect to sil-braze joints - that is, the 40 per cent bond, then 50 per cent bond, to 60 per cent bond, and returning to a 50 per cent bond - indicate to you that we may be in an area of uncertainty with respect to joint specifications?
A. Yes, sir.

Q. Have you ever made a sil-brazed joint or welded joint yourself in order to familiarize yourself completely with the process of your supervision?
A. I have never made a joint, and actually, this process I do not supervise.

Q. Let me rephrase the question: Have you ever made a sil-brazed joint or welded joint yourself in order to be completely familiar with the quality

assurance program and the results thereof, over which you have supervision?
A. No, sir, and I have never had the opportunity to make one.

Questions by a court member, CAPT Hushing:

Q. Mr. Pelton, turning your attention to the silver braze operation, you mentioned that you radiographed joints about 3-inches in areas which are difficult to perform the sil-brazing, is that correct?
A. Yes. That was the initial requirement for 3-inch, and then it went to 2½, and is now down to 2 inches.

Q. Do you radiograph any other joints of less than 2 inches on a spot check basis?
A. No, sir. The ultrasonic method is limited to joints 2 inches and larger as far as it has been developed here at Portsmouth Naval Shipyard.

Q. I asked, or I intended to ask, about radiography.
A. Oh, excuse me. I believe this is done. In the radiograph test you take the pre-inserted ring, melt the--

Q. Yes, I understand this, but do you, on a spot-check basis, check pipe joints by radiography on joints less than 2 inches?
A. No, sir - not to my knowledge anyway.

Q. You mentioned ultrasonic tests, radiography of certain joints for the sil-braze process. Do you also hydro test systems and parts of systems involving silver-brazed joints?
A. Every system is hydro'd upon completion of the system.

Q. This is an additional test over and above the radiograph and ultrasonic tests?
A. Yes, sir.

COUNSEL FOR THE COURT: Do not refer to any pressures.

THE WITNESS: No, sir.

Q. (By court member, CAPT Hushing) Is this hydrostatic test a quick hydrostatic test, or is it a long hydrostatic test? Can you describe the hydrostatic test in general?
A. In general, a hydrostatic test is put on the system by the shop, and it is kept on for a period of time until the shop is assured the system is tight, at which time they call the inspectors down to visually inspect the joint for leakage. As soon as the joint has been inspected, it is dropped from the test.

Q. Is this determined solely by the judgment of the shop, or are there definitive specifications for this process?
A. There is a test memorandum put out by the Planning Department, and it very well could contain the time as to how long the hydrostatic test should continue.

Q. Relative to silver-brazed joints, is there a procedure for soaking the systems?
A. There are procedures for flushing and soaking the systems.

Q. Do you know the purpose of flushing and soaking the systems?

A. One of the purposes is to remove any flux from the silver-brazed joint, and also to cleanse the system of foreign material.

Q. Do your inspectors witness the operational tests of systems?
A. They witness the operational tests of systems covered by the Planning Department test memorandum.

Q. In connection with the post shakedown availability, where the ship's force has the responsibility for operation of the system for test, would your inspectors normally be involved?
A. Only if the system was covered by the test memorandum put out for the post shakedown availability.

Q. Do you have any feel for this situation with regard to THRESHER?
A. I would like to make a statement at this time, if I may. Inspections and tests are under Code 303-B. I am 303-A. I would gladly answer these questions, but I am not the head of that group.

Q. Let me ask about the methods the inspectors use in their inspections, and this might be applied directly to silver-brazing, for example. What instructions are the inspectors given when they are told to inspect a joint?
A. This question, I think, would be better referred to the head of 303-B.

Q. Do you know, relative to silver-brazing, whether the fit-up of the joint is done by the same man or a different man than the one who actually performs the brazing?
A. I think in most cases it is done by different men.

Q. During the in-process inspection for silver brazing, which you mentioned was at the 25 per cent level, do the inspectors inspect the brazers' cards in each one of the 25 per cent cases?
A. I don't know the answer to that, sir.

Q. Is 303-B a better place to get that answer?
A. Yes. Of course, as it now stands, with the requirement that the brazer put his mark on the joint, this is the same thing as looking at his identification card.

Q. Yes, but that occurred during the THRESHER post shakedown availability, did it not?
A. I don't know the exact date when this started.

Q. Now, let's turn to the THRESHER's post shakedown availability; has the quality assurance group gathered the records of all the joints made during the THRESHER's post shakedown availability?
A. I know there has been a good deal of effort put in on this. Whether they have all of the joint records, I don't know.

Q. Would you know whether there has been an effort to go from the plans, listing part and piece number, to the inspection records to check each joint?
A. There are two things that come into this. Unless the joint required non-destructive testing, either radiography or ultrasonic, these record cards would not come into the inspection division but would be maintained only by Shop 56. Shop 56 is the place where records for every joint are kept, whether they required non-destructive tests or otherwise. They should be available.

Q. I understand this is the normal case. What I am trying to determine is whether these records have been gathered from Shop 56 and an analysis made to determine whether the required records are in fact available for each joint that was tested or made during the post shakedown availability.

A. In this regard, these cards were all handwritten, and I believe that Shop 56 Quarterman Collins has this package.

Q. You mentioned during your testimony hazardous systems. Can you broaden this to define the kind of systems that are involved. For example, is the ASW system included within this category?

A. Yes, it is. Instruction 4410.4 refers to all sea water systems, all hydraulic systems, air and gas systems at pressures at 225 PSI and above.

COUNSEL FOR THE COURT: PSI?

THE WITNESS: Pounds per square inch. And propulsion auxiliary machinery, lube oil systems, and flexible hoses which are an integral part of the piping systems.

Questions by a court member, CAPT Hushing:

Q. Let me turn your attention to the period 1961-62 relative to welding of the piping systems. Were the specifications for welding and non-destructive tests thereof tightened up by the Bureau of Ships during this period?

A. There was quite a bit done in this regard. On 14 September 1962 Portsmouth Naval Shipyard Note 9480, non-nuclear piping, non-destructive testing applicable specifications and standards for radiography. This instruction consolidates and implements the many instructions issued by the Bureau of Ships applicable to radiography standards.

Q. Would it be normal for rejection rates to rise as the standards are increasingly tightened up?

A. I would say yes.

Q. Comparing, say, 1959 or 1960 to late 1962, was the rejection rate at Portsmouth higher at the later date?

A. The time that you speak of was about the time when they started to do a lot of welded piping systems. During THRESHER's building period, with welded systems and radiography acceptance standards, the rejection rate was very, very high. A program was started here in the Shipyard for copper-nickel piping to see if the radiograph acceptance standards were, in effect, good standards. And I refer now to a memorandum from Code 200 to Code 300, memo 242 ssm 593/9480 of February 19, 1960 dealing with copper-nickel piping on THRESHER.

Q. What does that memorandum generally do?

A. It sets forth the results of an experiment conducted here at Portsmouth to compare the results of the joint, strength-wise, under test in regards to the standards of radiography. In effect, to try to reduce the standards of radiography more in line with what the joint is expected to do.

Q. Do the tests included in that memorandum indicate certain joining processes?

A. Yes. We made 105 sample joints of several different sizes and purposely put in poor welding and good welding. Each joint was subjected to hydrostatic tests, so many thousand impulses on an impulse machine, and each joint was cut apart. No joint failed on this test. We recommended as a result of these tests that the standards be reduced. A letter went to the Bureau of Ships on that subject, and the Bureau of Ships did approve a lessening in the standards for

porosity and slag, and so spelled them out in the BUSHIPS letter.

Q. So that, in addition to various kinds of non-destructive tests, you have conducted actual operational tests for the kinds of joints and service they might experience?

A. Well, for operational tests, the sample joints were put on a testing machine in a laboratory and subjected to many thousands of cycles of pressure that the pipe would see in service.

Q. You mentioned in your testimony, I believe, that the silver-brazed standards and procedures in this Shipyard have been tightened up since 1961, did you not?

A. Yes, sir.

Q. You have mentioned that the welding requirements and procedures have been tightened up since 1961?

A. Yes, sir.

Q. Under such conditions, would you say that the THRESHER's post shakedown availability was conducted under more rigid quality control set-up than was the building of THRESHER?

A. This is in regard to sil-brazing?

Q. To silver-brazing and welding.

A. Well, during its construction period, ultrasonic inspection of joints for percent bond was not in existence, and I am very vague about the requirements now during the construction period as far as the welded joints are concerned. I just referred to a memorandum where they were outlined. Yes, we had more detailed and rigid inspection requirements for the inspection of sil-brazed and welded joints during the PSA than we did during the original building period.

Q. Did this lead you to a higher level of confidence as far as the hazardous systems on the ship were concerned after the post shakedown availability than before PSA?

A. Yes. There was another thing that took place during PSA that hasn't been mentioned, and that was a requirement to go back and check certain systems. I was trying to think what those systems were. And in particular in regards to sil-brazing, we used the ultrasonic test method to determine the percent bond of joints made during the building period and were not to be reworked during the PSA. This requirement was mostly for the sea water systems and for those joints that were acceptable without major removal of machinery or unlagging of pipe.

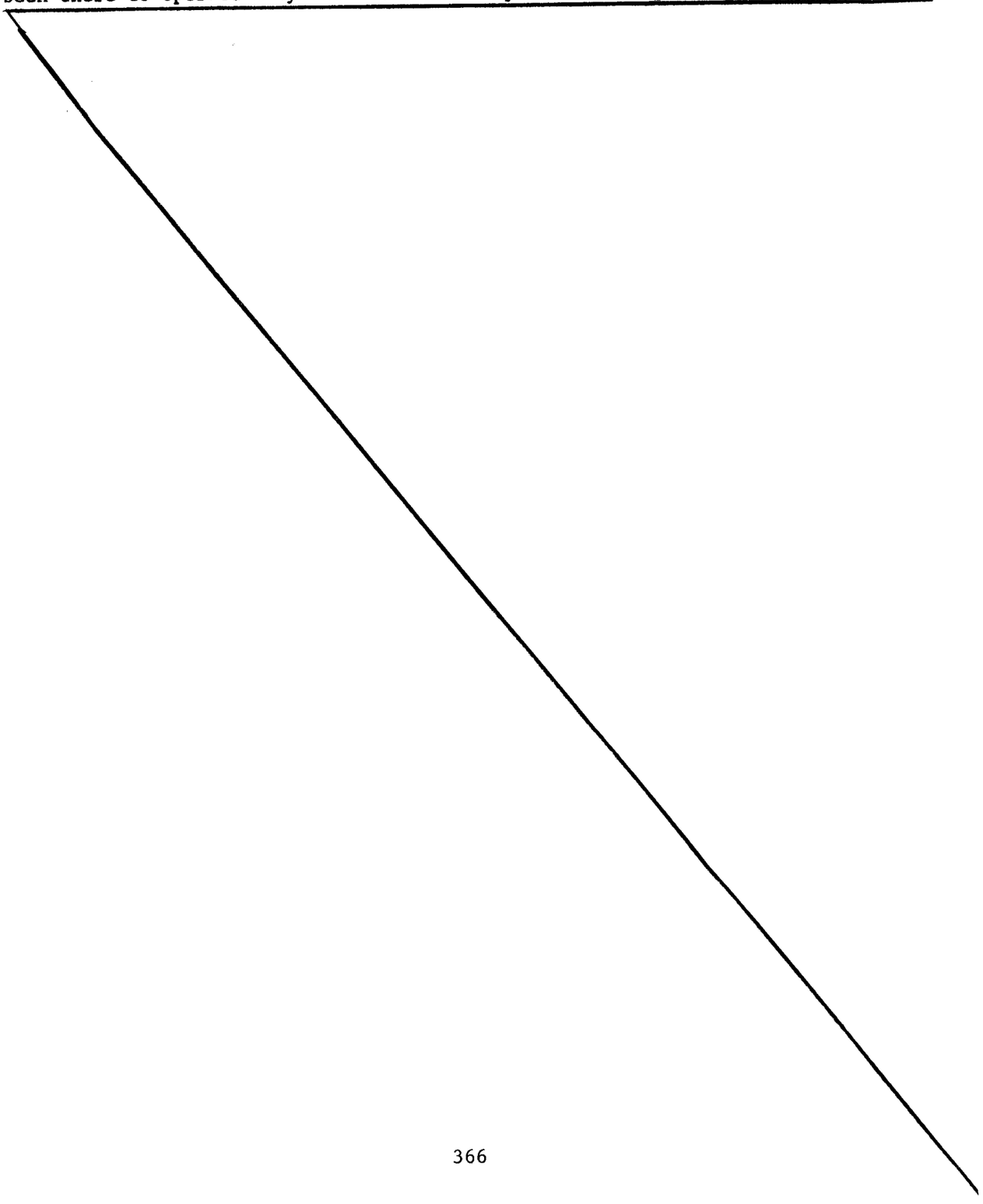
Q. Were there also similar requirements to go back and recheck certain welded joints, recheck the radiographs of those joints?

A. Not to my knowledge.

Questions by a court member, RADM Daspit:

Q. Mr. Pelton, in your testimony you have described a very thorough system which involved checks at every stage while fitting up the valves, and things of this nature, and if properly performed would almost guarantee that we never had a bad joint; and yet we have heard testimony that in the auxiliary salt water system a considerable percentage of check valves were installed backwards. It seems to me this would have been caught long before the valves were finally installed. Could you perhaps account for this?

A. If it was an installation of a new system during PSA, the inspection of this system would be covered by the Inspection Division, or the Inspection Branch. If it was a system that was overhauled and not covered by the Planning Department Test Memorandum, the inspection of this would be the responsibility of the ship's force. The installation of check valves being in backwards, the inspection of the system for things of this type is usually performed after the hydro, when the shop brings it to the inspection division for final inspection. From my own personal experience, I too have found check valves installed backwards when I've been there to operate a system. I cannot explain how it gets that far.



Questions by the president, VADM AUSTIN:

Q. Mr. Pelton, realizing full well that there are many vagaries of human nature and that it is not always possible to write an instruction which will, in fact, do what the instruction is intended to do, I am going to ask you some questions. You are head of the Quality Inspection and Analysis Branch?

A. Quality Assurance Engineering and Analysis Branch.

Q. Quality Assurance Engineering and Analysis Branch. Is it one of your duties to insure that instructions and systems of inspection are promulgated to comply with various requirements placed upon this Yard for specified qualities of work?

A. We are responsible to see that the instructions are prepared and issued, but we are a staff function and do not have the authority to see that they are put into effect.

Q. Do you, as head of this branch, have any responsibility for reporting to the proper authority in the Shipyard, failures to comply adequately with your instructions?

A. Yes, sir.

Q. What means do you use to determine that instructions and systems are in fact working? For example, we have these five vari-colored cards that meticulously set forth what shall be done to insure that every joint, insofar as the state of the [redacted] will permit, is a safe joint. Now, do you know whether these cards are kept in a perfunctory way, or are they accomplishing the purpose for which this system was set up?

A. In answer to your question I would like to point out there are just four of us in the Quality Engineering and Analysis Branch. We have prepared what we call audit procedures to check the things that you mentioned. We have an audit procedure for checking the radiography techniques that are being used. We have an audit procedure on how to perform in-process inspections of silbrazed and welded joints, and we have another similar audit to keep record and control of the pipe welding, but mostly the people that have to do our auditing for us to see that they are, in effect, being carried out are the personnel of 303-B, the Quality Assurance Inspection Branch.

Q. The procedure in effect is that checks are made to determine the effectiveness of the system, but they are not under your branch responsibility; someone else does it for you?

A. This is true. I would like them to be under my branch, and I think that they are going to be. We are only four, and we've had to, since 1961, set up the quality assurance program, and until we got things established, we couldn't utilize more people to audit the procedures that we put out. We are just now hiring a new man, and we are trying to get others to keep this more under our control.

Q. I noted in one part of your testimony that you said that instructions required someone from a specified shop to do a certain inspection. Who sees that this someone from this specified shop in fact does that inspection?

A. I think that you are referring to inspection of pipe joints, and the certification card...

Q. The card would show that?

A. ...has a place for the supervisor's signature certifying that it was done.

Q. Mr. Pelton, as head of the Quality Engineering and Analysis Branch, you certainly have a feel for the effectiveness of the measures and instructions, procedures used to determine quality of the work which you try to insure is done correctly. Will you tell this court whether you consider it probable, highly probable, improbable, possible, or impossible, that a joint made by personnel working on the THRESHER during the post shakedown availability failed at deep submergence - just from your general knowledge? I want to get a feel for the probability that you think there was for a defective welded joint or sil-brazed joint, either one, to have given way at the depths that the ship was required to submerge.

A. Well, I would say it was very improbable.

Q. Very improbable. In other words, you have a high order of confidence in the actual workability of your quality assurance procedures and inspections?

A. Yes, sir.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. You spoke of a Bureau of Ships requirement that the Shipyard go back and examine ultrasonically all sil-brazed joints that were not worked on by the Yard during the period of post shakedown availability. Did the Shipyard actually make those inspections?

A. Yes, sir.

Q. Do you know the results of them?

A. I have a copy of those results with me, though I personally was not involved in the inspection or in getting up the results.

Q. Please produce it.

A. Here it is.

The said report was submitted to the court and to counsel for the party, RADM Palmer, and was offered in evidence by counsel for the court. There being no objection, it was received in evidence and marked "Exhibit 67."

Q. (By counsel for the court) In speaking of hydrostatic tests before, I would like to ask you some further information concerning your testimony. You should not, in your reply, mention any exact pressures, although you may wish to use a ratio, such as two times working pressure, or three times working pressure. The question is, were the vital piping systems in THRESHER given a hydrostatic test equal to working pressure or some greater pressure?

A. Some greater pressure, yes.

Q. Can you indicate the order of its magnitude?

A. You can specify it as one and a half times working pressure.

CROSS-EXAMINATION

Questions by counsel for RADM PALMER, a party:

Q. With regard to your last answer, Mr. Pelton, can you help us, at least give us your opinion, as to whether or not hydrostatic tests conducted at one and a half times working pressure should have revealed any potential joints which would fail at working pressure or test depth?

A. Yes, it should do this.

REEXAMINATION BY THE COURT

Questions by a court member, CAPT HUSHING:

Q. Mr. Pelton, I am going to ask a question over again, because I don't think I have your answer firmly in my mind. With relation to your inspectors conducting inspections on, say, a sil-brazed joint, do you give the inspectors a check-off list and require that the check-off list be filled out and additional information submitted which might not be on the check-off list, or do you give the inspector the applicable specifications and allow him to make the inspection from the specifications?

A. Inspectors, again, are not under my jurisdiction, but I don't think there is a check-off list as such for each joint. The basic instruction 4410.4 spells out for him step by step what he should inspect for, and refers, I believe, to NavShips 637-2, which has pictorial examples of different things that are unsatisfactory for a sil-brazed joint.

Q. Let me phrase my question a little differently. Does the Quality Assurance Engineering and Analysis Branch review specifications and prepare such check-off lists for delivery to the Inspection Branch, Code 303-B?

A. Not a check-off list to be used individually on each joint, no.

Neither the counsel for the court, the court, nor counsel for the party, RADM Palmer, desired further to examine this witness.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing further to say.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

PRESIDENT: We will now take a short recess of approximately 10 minutes.

The court recessed at 1207, 22 April 1963.

The court opened at 1227 hours, 22 April 1963.

All persons connected with the court who were present when the court recessed were again present in court, with the exception of (b) (6) who was relieved by (b) (6) as reporter.

(b) (6) , (b) (6) New Hampshire, was called as a witness for the court, was duly sworn, was informed of the subject matter of the inquiry, was warned of his rights against self incrimination, and examined as follows:

The witness was warned not to testify concerning classified matters.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation?
A. (b) (6) , (b) (6) ; and my position in the Shipyard is assistant to the Chief Marine Mechanical Engineer in a staff position, and Project Engineer for flexible connections.

Q. Do you spell your name (b) (6) ?
A. That's right.

Q. Can you state your duties in connection with your work, touching on flexible connections?
A. My duties are varied. In a staff position there are many different types. But in the area of flexible connections I am responsible for the design, the proper application of them throughout design and plans. I have a certain responsibility to see that what is required is in fact being done in production by my own personal observations, meaning that I am required from time to time to visit production and shops to see that those requirements which I require by instructions are being complied with.

Q. At this stage in the proceedings the court is examining into the area of the quality assurance programs and procedures of the yard. It is now directing its attention at the area in which flexible hoses are involved. We understand the need for flexible joints for noise quieting in THRESHER, so you need not go into that aspect of such joints. Please relate, if you will, how the shipyard assures reliability of flexible hose, how they did so in THRESHER in particular? Can you first tell us a little about the history of flexible hose application in this shipyard?
A. Yes. The first application of flexible connections, to my knowledge, was on the TANG Class, that general area where I would say approximately a hundred or so flexible connections were used in mounting of sea water pumps. THRESHER Class has 625 flexible connections. These are in all types of applications: hydraulics, air, plumbing, fresh water, salt water, to mention a few. The specifications for the ships require that only approval is received from Code 648 in the Bureau--

Q. Bureau?
A. The Bureau of Ships -- for each flexible connection that's used. The specifications also invoke BUSHIPS INSTRUCTION 9110.6, which is an instruction on the installation of flexible connections, the last revision of which is dated in 1956. It has been revised since then with many supplemental letters to try to update it to the THRESHER type application. The THRESHER design required the development of many new flexible connections which had never been used before: salt water, hydraulics, steam drain, air, to mention a few. Bureau of Ships notice -- should I read the notice actually?

Q. Just designate it for us and tell us the subject?
A. 9480 of 27 October 1960 forms the actual approval for flexible connections used on the 593, 608 and 616 classes. This approves several different types of flexibles which I'll skip at this time. As far as -- I could, if you desire, give some indication of the number of flexibles involved in sea water systems, if the court desires --

PRESIDENT: Too much information of a detailed nature on THRESHER is not desired in the open court hearings. I don't believe we need to know the exact number. We are more interested in the quality and in the reliability of methods of installing and inspecting than we are in the information which would give to a foreign power the information which they might desire regarding this ship.

Q. Tell us, then, about the shipyard procedures relating to installation and testing of flexible connections in THRESHER?

A. Prior to the THRESHER PSA, flexible connections were ordered on working piping drawings and installed in accordance with Portsmouth Naval Shipyard Instruction 1004.1, issued in September of 1957. Inspection and acceptance of flexible connections at that time was accomplished as part of the system operational tests; there were no specific inspection procedures so designated. In view of the increased number of flexible connection applications on the THRESHER, the attention paid to the assembly and installation of flexible connections has increased extensively, reaching its highest level ever in this shipyard, and I personally believe in any shipyard, during the THRESHER PSA. The following procedures were in effect at the shipyard during PSA: Flexible connections are specified on each system working drawing; Design Division Instruction Sheet 16-61, dated 17 October 1961, delineates a standard method by which each person in design designates the flexible connection. It also contains, as an enclosure, special receipt inspection procedure which must be attached to each order for flexible connections. It cites those flexible connections which are obsolete or in the past have proven should not be used on submarines. This instruction is available to the Supply Department and requires the Supply Department to so inspect in accordance with this special inspection procedure. Each drawing calling for flexible connections references the process instructions to be used in the assembly and installation of flexible connections. These process instructions are 1004.5, which covers the selection, assembly and shop inspection testing of hose type flexible connections. This was issued 6/27/62. Process instruction 1004.6 covers the installing of resilient

mounts and flexible connections to components installed on resilient mounts. This was issued 7/17/62. Both of these are lengthy documents. I can, if the court desires, run down through the subjects covered in each of these process instructions. P. I. 1004.5 covers and lists the approved types of hoses, the approved types of fittings, and the approved types of configurations to be used in the way of assembling hoses; it tells how to identify the hose, how to identify the fitting. It gives the procedures to be used to inspect the hose prior to assembly to insure there are no cuts or bruises of any kind. It emphatically points out if there are any questions as to whether the hose is or is not a good piece, it shall be thrown away and a new piece obtained. This is repeated several times, that if the man has a question in his mind he is not to use the hose. It also lists the obsolete fittings and how to inspect fittings which are approved for possible damages, which we have found in the past to have occurred, per information received from the Bureau of Ships. Hose stowage, hose cutting, hose sealing, identification after assembly, stowage and handling after assembly, specific assembly instructions for each type of hose is also covered in the procedure.

Q. The Bureau to which you refer is, again, the Bureau of Ships, is it?
A. It is.

Q. Please designate the Bureaus when you mention them.
A. Yes, sir. Special assembly instructions are also provided for flexible connections which require spring inserts, how to put them in, types and size. As a final part of the instruction, the inspection and shop tests required for each flexible connection are specified, at twice the working pressure hydrostatic test. This is in excess of Bureau of Ships requirements at the present time, which is 167 percent. Also contained in that instruction is information on the minimum length of the hose that is acceptable, the minimum bend radius it can be bent; it has fitting illustrations, hose illustrations and configuration illustrations. On the process instruction for installing flexible connections, it gives the procedure by which the component itself shall be so positioned prior to taking of templates for the flexible connection. It gives the alignments, or misalignments rather, that are permitted. In our case, or in the case of this instruction, it allows a one-eighth of an inch misalingnment. This is in excess of the Bureau of Ships requirements, which maintain that three-eighths are acceptable. It also covers the installation of the Electric Boat type fitting, which is also used in salt water systems. I understand that both of these instructions are being extensively used in New London and in many other shipyards at the present time. At the time of the assembly in Shop 56, they keep a record of each flexible connection which is assembled on a card, recording on this card the type of fitting, type of hose, the date they assembled it, the date the hose was made, and other data which would be pertinent to its application, such as, the tests that were conducted on it, the pressure that was exerted against it. At the time a system working drawing is prepared in design; in the case of the 593 this was later than the working drawing; it was just prior to PSA -- design prepares an EAM listing --

Q. What does that mean?
A. This is electronic --

Q. Electronic Accounting Machine?
A. -- data type processing, machine type run-off forms in which every flexible connection in the ship is listed and all information relating to it, the type of hose, the type of fitting, the fitting number. The information in these feeder forms, as I will refer to them from here on, is sent to our machine room downstairs and is keypunched into a flexowriter tape. While producing this history tape of all the flexible connections in the ship -- this is all flexibles, metallic as well as rubber, teflon, or any nature -- while producing this tape the original issue of the flexible connection's

selected record drawing is produced as a vellum copy of the drawing. This tape is then reprocessed, extracting the data necessary to produce the Flexible Connection Post Information Test Memo -- I might add, the first of its kind, used on THRESHER. Copies of the selected record drawing which list each flexible and all information about it are sent to Shop 56 and Code 303B, for use in verifying the assembly and installation of each flexible connection as it is put together. Shop 56 checks the shop assembly record card against the selected record drawing to verify proper assembly. Shop 95, which is our Print Shop, receives a copy of the selected record drawing and, from it, produces a label tag for each flexible connection in that ship. On that label tag is contained the selected record item number, which is also the test memo item number; it contains the system drawing number; it also has the type of hose or type of connection, the service in which it is installed, the assembly piece number, and it provides blank spaces for recording the date assembled, where assembled, date installed, and where installed. These dates are filled in by Shop 56 at the time of assembly or from their record card in case that the tag arrives after assembly. The completion of the test memo by Code 303B verifies the following about each flexible connection in the ship: properly tagged, properly assembled and shop tested -- this is a verification from the card; where the hose was assembled or the connection was made; shock clearance proper support, proper alignment, minimum radius not exceeded, minimum free length adequate, lay line of the hose not twisted, and the general condition of the hose. Each of these items is listed in the test memo to be checked off on each hose in the ship. Each of these items refers back to the paragraph of the process instruction by which the hose was either assembled or installed, forming the basis for the inspector to use as a standard for acceptance. In addition to the above, from our history tape we prepare a set of cards, data cards, containing the hose number, the fitting number, etc. We then process these cards and come up with the ships allowance items and spare parts. Also prepared from the same tape -- all item numbers refer to the same number on all documents -- we prepare a Record Inspection Log for use by the ship's force in checking flexible connections between overhauls.

Q. You have told us, then, of your procedures governing the installation of flexible hose couplings. Do you know, of your own knowledge, whether the procedures laid down are known to and carried out by the workers who actually install the flexible hoses?

PRESIDENT: May I ask for a repeat on that question?

The reporter read back the last question.

A. From my personal observation in both the shops and the ships I would say yes.

Q. On what do you base that, what sort of personal observation?

A. Well I very frequently visit Shop 56, in which we have a hose assembly area, and the same people assemble hoses all the time. It's not a haphazard type of thing where a fellow just makes up a hose assembly. From my observation in 56 I know they are aware of the procedures, use them, and follow them very thoroughly. As far as the implementation of the test memo, I was a part of the inspection force, and that way can certify that -- I can't certify all of them, - but I can certainly certify that the test memo was being implemented.

Q. Can you give us a good estimate of the effectiveness of the inspection process as evidenced by rejection rates and any other information known to you?

A. No, I don't think I could answer that. I think it would be better if I referred you to the Inspection Division themselves for the results of the test memo.

Q. Would a Mr. (b) (6) from that division be more eligible in this area?
A. That's right.

EXAMINATION BY THE BOARD

Questions by a member, CAPT Nash:

Q. What procedure exists to guard against damage to a hose subsequent to the inspection and perhaps in connection with work in the same area?
A. In the hose area we employ what we call "metal guard strips", which are placed on the side of the hose and taped to it to keep the hose straight. This is the only one I know of that is used. This is on the smaller types of hoses.

Questions by a member, CAPT Hushing:

Q. As part of the true requisite of operational tests, are the hoses reinspected visually for cuts, bruises and abrasions?
A. Are you referring to --

Q. Let me set the stage just a bit for this question. You have assembled the hose properly in the shop, you have installed it properly in the ship, you have checked off inspection reports to this effect. A month goes by that it is in the ship before you get to the operational test of the system, which might be a salt water system, calling for operating the pumps and operating all the valves, and so on. Prior to the operational test of the salt water system, is there an inspection of the flexible hoses to see whether they have been nicked, cut, abraded, bruised?
A. In the case of the THRESHER, the test memorandum inspecting the general condition of the hose was conducted about two weeks before she left. Since this is the first test memo of its kind, (we are required by change order to prepare a selected record plan and, therefore, verify each flexible). I can say that we are behind schedule. Normally we would inspect these hoses earlier in her availability; I mean, earlier before she is going to sea. But in THRESHER and any ships at the present time, they are being inspected just before they go to sea.

Q. So that in THRESHER there was such an inspection at a very close time to her sea trial date?
A. This is true, yes. Within, I would estimate, a week. Every hose. Which, I understand, took about two weeks, two shifts a day, to inspect every hose on THRESHER.

Q. Let us now postulate a system in which all of the individual component tests have been completed and the operational test of the system has been completed. As a result of an alteration, or for some other reason, it becomes necessary to remove a large component from that system which is connected to the system by flexible couplings. What do the current instructions require regarding "rip out" procedures and clearance of "rip outs" with connection to the flexible hoses, flexible connections?
A. I don't think I could answer that in a definitive way, except that the existing instructions, or the instructions that were in effect for installing it originally would certainly apply for reinstalling it. As far as handling them, this is covered, since we put them in and take them out many times because of space, etcetera. As far as a retest in the shop, the flexible connection would not be retested in the shop. It would be retested, I would assume, on a system test of the ~~sytem~~.

Q. Let me rephrase the question a little bit. Does your "rip out" procedure define what should be accomplished relative to the flexible connections?

A. You're not reaching me. I'm not sure what you mean by "rip out", as such.

Q. All right, let me describe a kind of situation I have in mind. We have a system that is complete and operating. For some reason we need to remove a component from that system, which is connected to the system by flexible couplings. We remove that component and its flexible couplings to do some work. We put the component back in. We reconnect the flexible couplings. Now, going back to the point where we took the component out, this is often referred to as a "rip out", and in many shipyards there is a written memo, or "rip out sheet" which covers that specific removal. Is there such in this shipyard -- a job order, a supplementary job order? If you're not competent to answer this, by all means, say so.

A. Well, I'm trying, but I don't think I can really -- I don't really know quite what document you're looking for.

Q. Could we get it from the production people better?

A. I'm not even sure that perhaps it's not a planning and estimating function to give you the document which says "remove a component and its associated equipment with it, and what to do with it." On hoses, in THRESHER, they were handled across the board. They were not handled as an individual -- related to each individual job; they were handled as all of the hoses on THRESHER which cuts across all systems.

Q. I understand this full well, but after this had all been done and that job had been signed out, there is still a possibility that the shipyard has to disturb or remove one or more flexible hoses. What I'm trying to find out is what happens in this isolated case after the test memo is signed off?

A. I don't think I could answer it. I'll just leave ~~it at~~ that.

Questions by a member, CAPT Osborn:

A. Mr. (b) (6) , I was reviewing the flexible hose print with respect to TINOSA. I see on that particular document a larger amount of hoses were listed as applicable versus the smaller number that you reported on the THRESHER. What I'm saying with respect to this is that you have a real currentness of program, but I am interested in how up to date it is, and what precautions you take to keep your particular program very much up to date?

A. Your first question, I think you referred to the last number in that list. If you will thumb through the pages I think you will find several areas of blank numbers which were not used. The figure that I gave you was a total number, not a listing number. As to keeping the list current, we rely upon 56, who repeatedly contacts me by phone of any difference between the Selected Record Drawing and the assembly that they are making. If they call me. At this point we check the working drawings to find out if the flexible either had been eliminated by alteration to the working drawing, or in a case where it was not in the Selected Record Drawing, it may have been added as a result of a test.

Q. Then I understand the numbers quoted in references, say "x" and "y," that the total that you previously quoted to me was the subtotal, or could be summarized as the subtotal?

A. I believe that's right. It is the number on the ship and I'm sure would be quite close to the TINOSA.

Q. Now we all know involving the auxiliary systems that there are several sub-systems within a major system, say the ASW system, which are separately tested. Do you know of any tests at the completion of a large number of sub-tests, in which you test the complete system in toto?

A. It's not in my field at all to say one way or the other. I do not know whether every system is tested in toto.

Questions by a member, RADM Daspit:

Q. Mr. (b) (6) , we have had testimony at a prior time that during the installation on THRESHER in installing the hoses the workman twisted the ends and he was not even impressed of the necessity of not twisting the ends. The ship's force had to insist that it be installed properly. What is the effect of installing a twisted hose?

A. The effect of twisting a hose to a certain degree can contribute to its failure; this is why we instruct that the hose be installed straight and relaxed. As to how much it contributes to its failure, I don't think you can answer that question. It tends to twist the wire inside the hose, which is a strength member of the hose; but I know of a lot of hoses that can be twisted and they will still retain their pressure ratings without any question. These are not applications, but on the tests.

Q. Can the amount of twist be determined after installation if the installation is not observed by looking at the hose?

A. Yes.

Q. Then an inspector could detect the twisted hose and insist that it be reinstalled properly?

A. That's right.

Q. Could he determine from looking at it whether it had been damaged enough so that it ought to be replaced; are there any criteria for that?

A. As a result of the twist?

Q. As a result of improper installation and twist during installation.

A. It's certainly a matter of judgment. There are some guidelines which we provide which can only be rule of thumb. Badly twisted hose, we emphasize in our instructions, if you're in question, replace the hose.

Questions by the president, VADM Austin:

Q. Mr. (b) (6) , you have said that the Supply Department is given the information regarding hose that is unacceptable because of prior experience indicating its lack of suitable qualities for use in submarines, and they are given the responsibility for insuring that you don't get that kind of hose to install; is that correct?

A. I was more specifically referring to fittings.

Q. Fittings rather than hose?

A. Fittings rather than hose.

Q. Do you have a follow up inspection to see that the Supply Department is, in fact, preventing you from getting the wrong kind of fittings?

A. I think our Shop 56 provides this follow up. There is no formal individual who goes to Supply that I know of and monitors the inspection as to whether they are or are not. 56 has a process instruction which equally lists each fitting which is obsolete and under no condition should be placed on a submarine. In their assembly procedure, if they were to receive this type of fitting, I am sure they would reject it on the basis of that.

Q. Have you, in your own inspections, found any of these fittings installed?

A. No.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. You mentioned a "rule of thumb" regarding surveillance of twisted flexible hose installations. We have heard that personnel, such as welders and silver brazers, carry a card which identifies them as qualified to do the work which they do. Do those who install flexible hoses similarly carry such a card?

A. No.

Q. What sort of people do, then, install flexible hoses?

A. I don't think I could answer that. I think it would be better if you asked Production themselves. Everyone that I've seen has mostly been more than competent to do it, but I wouldn't be able to classify it as to the rank or rate.

Q. It's not a complicated installation procedure, is that right?

A. It's one that should not be taken lightly.

Q. What was the maximum internal diameter of flexible hoses installed in THRESHER's salt water system?

A. Two inches.

Q. You spoke of a development program for flexible connections in THRESHER and new types of submarines. What sort of test program was carried out to assure the reliability of such new developments in flexible connections for service in THRESHER?

A. Project Pressure was established in which we established a single category called the "C" category, to cover all flexible connections. There were approximately two hundred items in Project Pressure relating to flexible connections. A Test Memorandum, T-743, was established to which all flexible connections on THRESHER were tested. This covered proof test, impulse, vibration, shock, final burst -- these tests varied depending upon the service.

COUNSEL FOR THE COURT: Don't itemize the services.

Neither the counsel for the court, the court, nor the counsel for the party RADM Palmer desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement.

WITNESS: I have one statement I would like to make. I believe the THRESHER had the best inspection procedures every employed in flexible connections in any submarine in the country during PSA.

Questions by the president, VADM Austin:

Q. Does this mean that the Yard's procedures were better, or the combination of the ship's and yard's procedures?
A. I mean the yard's procedures.

Q. You're speaking of the yard's?
A. Yes, they are, I feel, the most elaborate in the country today.

Neither the counsel for the court, the court, nor the parties desired to examine this witness further.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

PRESIDENT: The court is recessed for lunch.

The court recessed at 1311 hours, Monday, 22 April 1963.

The court opened at 1415 hours, Monday 22, April 1963.

All persons connected with the court when the court recessed were again present with the exception of (b) (6) who was relieved by (b) (6) as reporter. The interested parties RADM Palmer and LCDR Hecker were absent. Counsel for RADM Palmer was present.

(b) (6) , civilian, was called as a witness by the court, was informed of the subject matter of the inquiry, was warned of his rights against self-incrimination, was duly sworn, and examined as follows:

The witness was informed that the court was in open session and classified information should not be divulged.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation?
A. (b) (6) , (b) (6) Maine.

Q. And your occupation?
A. Supervisory inspector, Mechanical and Piping System.

Q. How do you spell your last name?
A. (b) (6) .

Q. What is the nature of your job as supervisory inspector?
A. Well, it is the review of all data collected by inspectors to ascertain its usefulness, whether the inspection reveals that everything complies with the specs, that is data gathered for test memorandum, personnel problems and man power. I think that covers everything.

Q. What is your Shipyard Code Number?
A. 303-B2.

Q. What background and experience do you have for your present job?
A. Well, I started in the Navy Yard here in 1940, in August; worked here until 1949. During that time I was a supervisor for about two years in the outside machine shop, and also I spent some time on loan to the Shipyard in Philadelphia. I returned to the Shipyard then in 1957, Shop 38, and the first of 1958 I went up to the Inspection Division. I've been there since.

Q. (b) (6) , the area of our interest in questioning you at this time relates to flexible hose in THRESHER. We have heard testimony on the instructions governing the quality assurance program in that regard, the requirements for the qualifications of workers, the methods employed and the recording of quality assurance tests in vital pipe systems of the THRESHER. Can you give us specific information on actual on-board inspections and shop tests made?
A. This extensive test memorandum that we used on the 593 PSA was the first of its type used. Previous to this, inspections were made along with the systems during system inspections of flexible hose connections. The shop responsible assembles the hose and presents it to our shop inspector as an assembled unit ready for flushing for cleanliness and strength and fitness. At that time the inspector sees it under pressure, insures it is clean and records this data on an inspection slip. The shop then takes charge of this

hose and installs it aboard the ship. After it is installed aboard the ship, Code 303-B2 inspects this hose to insure that it complies with process instructions issued for that inspection.

Q. How do you inspect it to insure that it meets the requirements?
A. By this, you mean what inspection is done?

Q. Yes.
A. This is clearly stated in the test memo itself. There are several column headings here. The first column is--

Q. Will you refer to the paper by name and identify it for the record.
A. This is a Flexible Hose Connection Test Memorandum.

Q. All right. Proceed.
A. The first column is "Tag." This is an identification tag installed by the shop, identifying the material, the date of installation, the responsible shop for installing the hose, and the data necessary for the ship to know in the future when this hose should be changed and what type to reinstall. This is a metal tag that is attached to the fitting. The next column is "shock clearance." I don't know whether this would come under classified information or not.

PRES: If you suspect it is to be classified, we'd rather you not give it in open court.

CAPT HUSHING: I think we understand what you are talking about.

COUNSEL FOR THE COURT: Mr. (b)(6), I will also warn you not to mention any specific pressures which are used in any test, or clearances.

Q. You may proceed.
A. The next column is "support." This-- and here again I don't know what I am getting into.

PRES: Just tell us the columns.

WITNESS: "Supports." The next column is "alignment." The next column is the minimum radius and length of the hose. The next column is the lay line of the hose. The next column is the condition of the hose at the time of the inspection. This constitutes the shipboard inspection of each flexible connection.

Q. Those are the criteria which are employed in the inspection of the installed flexible coupling?
A. Yes, sir. Each one of these items is checked individually and so noted in the test memorandum.

Q. Are there any other tests employed to determine the adequacy of the installation?
A. The only other tests that would be employed would be a system tightness test, which in this case would be operational.

Q. Performed in the presence of your inspectors?
A. Generally, our inspectors are present at the time of operations, On an overhaul we are not present at all testing. We are only present at the

testing that we are so authorized to do by Planning and Estimating.

Q. What sort of records are kept of these tests?
A. Records of tests that can be performed as a unit and signed off in a unit in the test memorandum are generally signed off in the test memorandum itself. If there's a partial unit of the test memo done, this is cleared and signed on a form--a 771 Form--which would indicate that the complete test has not been performed, only a partial test.

Q. Can records be produced which would identify the person making each flexible hose connection test?
A. Yes, sir.

Q. We have heard testimony that the persons who do the work, make the silbrazed joints and welded joints, carry cards which must be produced upon demand by an inspector so that he may insure himself that the person working on the joint is qualified to do so. Are similar cards carried by the persons who install flexible hose?
A. No, this is a relatively simple installation of making up mechanical joints. There's nothing complicated on the installation. The only complication is the manufacture.

Q. Have you yourself inspected many of such joints in THRESHER?
A. Not in THRESHER itself, no, sir. On the first new construction job, yes, I did. On the post sea trial availability, I did not.

Q. In the post sea trials availability, all of the couplings were replaced, were they not?-- If you don't know, simply say so.
A. I wouldn't say all--I won't say all.

Q. What proportion, if you know?
A. I would say I have records of at least 90 per cent.

Q. At least 90 per cent?
A. Yes, sir.

Q. Are you familiar with the number of such couplings which your personnel found fault with in the course of the THRESHER PSA?
A. This inspection was done in more or less of a team project manner, wherein the shop mechanics accomplished the inspections and corrected anything that could be corrected, on the spot. That facilitated the job in such a manner that the writing of unsatisfactory condition reports and so forth were not required in most instances. So, actually, the number of unsatisfactory conditions found, it would be almost impossible to ascertain.

Q. To your knowledge, however, they were all corrected, is that correct?
A. We had one unsatisfactory condition when the boat left. This was three flexible gauge lines on the trim and drain system which had a wireway in contact with the flexible connections.

Q. What size were these?
A. Quarter-inch.

Q. Would you say they could affect the safety of the ship in any way?
A. In no way.

EXAMINATION BY THE COURT

Questions by a court member, Captain Hushing:

Q. You stated that the inspectors formed teams with the mechanics to go around to inspect the installation.
A. Yes, sir.

Q. Do you think that this permits Shipyard management or the quality assurance group to have a feel for the competency of the mechanic making the installation??
A. Actually, we would have no way of knowing which mechanic made the installation in the first place.

Q. Let me change the question then to say, do you think that this would give management a feel for the total shop capabilities and competency in making such connections?
A. No, it would not.

Q. Do you think that anyone in management now knows what the competency of the shop was during this post shakedown availability in this regard?
A. This I do not know.

Q. Is there anyone in the inspection department who knows this?
A. Yes; I am aware of it.

Q. Well, what is your opinion?
A. My opinion is there could be a lot better work done.

Q. All right. Now you have stated a lot better work could be done. In what way? -- Were the connections twisted-- were the flexible connections twisted for example?
A. Some were twisted; some insufficient clearance.

Q. How about misalignment?
A. Misalignment was found.

Q. How about improper installation as regards the shape of the connections-- U shapes and S shapes and dog legs?- Were there discrepancies from plan found?
A. Not in the general configuration.

Q. How about the dimensional adherence to plan? -Were the dimensions in accordance with plans?
A. The dimensions on hose length were adequate.

Q. How about position, dimensional position, relative to component being served?
A. This was in fairly good shape, I would say.

Q. How about any other kind of discrepancy that you know about?
A. The only other discrepancies we found, other than those I mentioned, I believe, were mostly paint splatter.

Q. Is paint splatter a serious deficiency?
A. In this case, no. The laboratory examined the paint found on the hoses and issued a statement that this was not injurious to the hose itself.

Q. Will you recapitulate the kind of deficiencies that you are aware of?
A. Several instances of the lay line not being proper, clearances improper, paint splatter, and in some cases minimum radius.

Q. Were these discrepancies in areas where it is difficult to make a satisfactory joint or were they spread randomly through the installation?
A. In the case of new construction, it is quite likely that the working clearances were much better, easier to work on. On this availability changing hoses on a ship already built, some places were very difficult to get at.

Q. Well, as to the flexible connections that you found not to be completely in accordance with the design memo, were they generally in the places that were difficult to get at or were some of them out in the open?
A. Some of them were out in the open.

Q. So this is a question of workmanship on the ones that were out in the open rather than difficult work conditions?
A. To a degree, yes.

Q. Do you have any knowledge of any ripout procedures in use in the Shipyard?
A. Only in nuclear power.

Q. Only in nuclear power. Did the ship ask for inspection services for any of the ship's force work to your knowledge?--Did they ask from you?
A. Did they ask assistance from me?

Q. Yes.
A. Only at the time in February up until February 22nd. I had two men aboard the ship from the time she come in, taking care of the inspection work. At that time these two men were taken away from me. At that time my supervisor and myself addressed a letter to Code 303 stating that the loss of these men would be a handicap to us. We listed all the work we had to accomplish and at that time we asked what work we could delete from our schedule. In about three days, I believe, the Ship requested the ship superintendent to put them back on the job. This was the only instance I know of.

Q. So you did in fact provide assistance to the ship in this general area over an indeterminate length of time?
A. Only on such items as the Planning and Estimating Code asked us to do.

Questions by a court member, Captain Osborn:

Q. On your inspections where you corrected certain deficiencies, did you have to replace any of the hoses?
A. Some hoses were badly twisted so that they had to be renewed; the lay line was so badly twisted.

Q. Are you sure when these hoses were replaced that the system hydrostatic test, and tests ordinarily required, were completed after the hoses were installed?
A. The certification cards show this.

Q. And in any place where you experienced trouble, you corrected the deficiency and properly tested the piece of the system prior to the ship going to sea?

A. I think as I said before, we only tested those items that we were called upon for by Planning and Estimating.

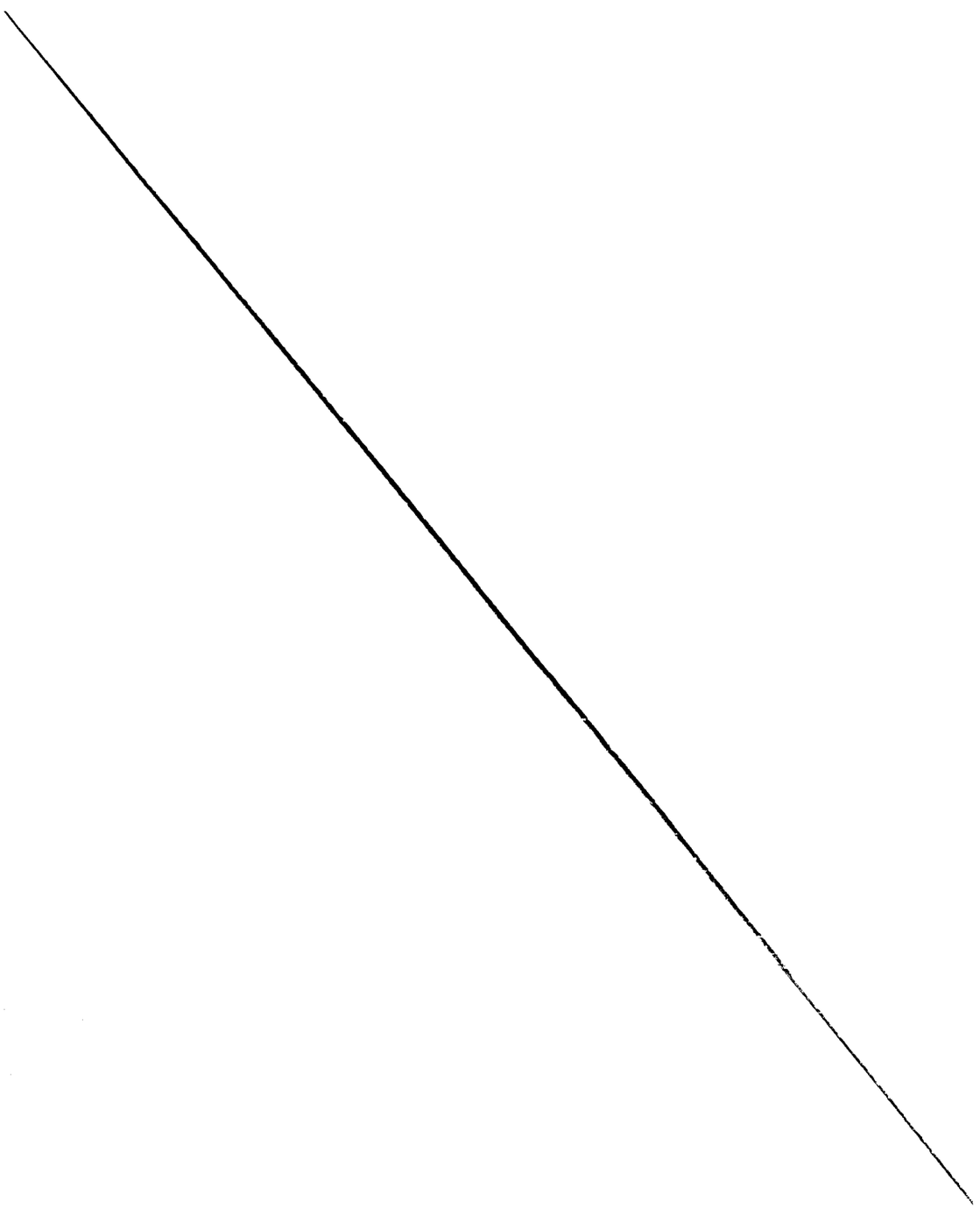
Q. Were there any other systems on which you replaced hose that Planning and Estimating did not require you to conduct tests?

A. Yes, sir.

Q. What systems were those?

A. I can't name them all.

Q. Do you have records in your possession that would indicate what these are?



A. I have records to show what jobs Planning and Estimating put me onto. I haven't got them with me.

Q. You are sure that there are some systems that did not receive hydrostatic tests?
A. Not under our cognizance.

Questions by court president:

Q. Mr. (b)(6), you probably better than most people, would have the feel for the degree of reliability of flexible hoses, their installation and the probability or improbability of their standing up to required pressures. Will you tell to the court, your own opinion regarding the probability of failure of one of the hoses installed by this Yard on THRESHER and inspected under your inspections system?
A. I think this probability would be very, very remote,--very remote considering the extra strength test they get.

Questions by counsel for the court:

Q. Would you clarify for me whether or not the records of flex connections, which are maintained, indicate the name of the person who installed them?
A. They do not.

Q. Do they indicate the name of the person who inspected it?
A. They do.

Q. You have mentioned to us some instances of poor installation and poor workmanship which have been uncovered in the course of your inspection. Yet you stated, I believe, that the actual installation is a simple or uncomplicated step. Would you say that specific training and qualifications of mechanics using the same identical card technique as in the case of welders and brazers would improve the quality of the work?
A. In most instances when you identify the workman to a job, for him to finish a job, the work generally improves, yes, sir.

Questions by a court member, Captain Osborn:

Q. What, in general, is the qualification of a person who installs large flex hose connections?
A. Large flex hoses aren't the ones that give us trouble. It is the smaller sizes. The larger flexible connections are so prominent and so noticeable they generally are installed in a very good manner. The EB type and the large sizes do not give us much trouble; it is the smaller sizes where they make up with a threaded fitting that generally we have trouble with.

Q. What do you consider a small size?
A. Anything under an inch and a half.

Q. Would you consider a two-inch hose small?
A. No, I wouldn't. That is a good size.

Q. Now, describe the qualifications of the people that put those hoses in.
A. The only qualification I know of for a man installing a hose is the fact that he works in the pipe shop.

Q. How many people do you have that work in the pipe shop, compared to what you call pipe shop technicians or pipe shop advance people? What is the ratio of those particular people?
A. This I do not know.

Q. You do not know?
A. No.

Questions by a court member, Captain Hushing:

Q. You earlier discussed a Portsmouth Test memorandum concerned with flexible connections in which each flexible connection was listed.
A. Yes, sir.

Q. And that there was a checkoff listing against each flexible connection. Do you have that document completed and available for review by the court?
A. The test memo was never completed.

Q. It was never completed?
A. No, sir.

Q. What was the nature of its incompleteness?
A. We have several hoses which we discovered that were not installed and the time available to us did not allow us to complete the installation inspection.

Q. You mean the replacement of several hoses?
A. We did not inspect several hoses on account of time limitations.

Q. You did not complete the inspection?
A. That is correct.

Q. But is the form complete as regards those hoses that were inspected?
A. Yes, sir.

Q. So that from perusal of these documents, we could determine which of the hoses were not finally inspected?
A. That is correct.

Questions by the court president:

Q. Do you have this with you, Mr. (b) (6)?
A. Yes, sir.

Q. Will you produce it?
A. Yes, sir. (Witness then handed a document to the court)

Q. Is this the only copy that you have?
A. It is the only copy that I have that is right up to date, complete right up to the last inspection, sir.

Q. In other words if we take this we are taking your book, are we?
A. Yes, sir.

COUNSEL FOR THE COURT: We can make copies, sir.

A document entitled Flexible Connections - Post Installation Inspection, was submitted to the court and was offered in evidence by counsel for the court. There being no objection, it was received in evidence.

REPORTER: This will be Exhibit 68.

Questions by a court member, Captain Osborn:

Q. Mr. (b) (6) you are obviously familiar with the mechanical checkoff sheet. In your estimate when the ship went to sea, were there any outstanding deficiencies of major importance?
A. No. I went over this with Biederman before the ship went to sea. We both checked it out. We both agreed at the time that the records were complete enough to insure that the ship was safe.

Q. And the ship was cognizant of the fact also?
A. The ship was cognizant of the fact.

Neither counsel for the court, the court, nor counsel for RADM Palmer desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning, further reminding the witness that the court was still open, and therefore, classified material was in the same category as before.

The witness made the following statement:

I believe we have covered the subject very well. I am satisfied it was a good test memo and a good inspection.

The witness was duly cautioned concerning his testimony and withdrew from the room.

The court recessed at 1450 hours, 22 April 1963.

The court opened at 1500 hours, 22 April 1963.

All parties to the inquiry who were present when the court closed were again present, except (b) (6) , who was relieved as reporter by (b) (6) .

Robert C. Arnold, Jr., was called as a witness by the court, informed of the subject matter of the inquiry, advised as to his rights against self-incrimination, was duly sworn and examined as follows:

The witness was informed that the court was sitting in open session and no classified material should be divulged.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, residence and occupation.
A. Robert C. Arnold, Jr., (b) (6) I am a mechanical inspector, Code 303E2.

Q. Briefly state the nature of the job you do as an inspector.
A. Briefly, my job is to check various systems, mechanical or piping, for components and materials that are satisfactorily used according to plan or plans, test memos, documents, for the ships of the United States Navy.

Q. What is your background and experience that fits you for such work?
A. Before I was a mechanical inspector I was a pipefitter in Shop 56 for approximately ten years. Since then I've been a mechanical inspector. I've been fourteen years with the Portsmouth Naval Shipyard.

Q. At this point in the inquiry the court would like some information concerning the test procedures, the inspection procedures and the results obtained, all in connection with the making of silver brazed joints in THRESHER. Are you knowledgeable in this area?
A. Yes, sir.

Q. Can you tell us first then the qualifications required of the people who make such joints?
A. The qualifications of the people making such joints. They go, first of all, to a training school for silver-brazed joints, and this is conducted by the Pipe Shop, 56. They have various materials and alloys to do this job. It goes into a function of different materials for different types of work on brazing. Their qualifications, that--they have a card signed by the welding engineers' code, I believe, which qualifies them; after a certain period of school they become qualified.

Q. Are there instructions under which these inspectors make their inspections of the silver-brazed joints?
A. Yes, sir.

Q. Can you describe them to us?
A. Briefly, there are several documents in the field, most of which I think you are after is what the inspector looks for. The inspector will look for, first of all, the proper material according to plan, the proper alloy in the plan. He then insures that the pipe joining the thing is inserted properly, for clearances and depths. Then he will observe the brazer, that is the qualified brazer, that the joint has been brazed. Then he checks the finished product of the brazer and he accepts it or rejects it, whichever the case may be. This is called in-process, visual inspection. There are hydros that are applied to these piping systems, and there again the inspector checks these fittings and joints.

Q. Do not mention any pressures in connection with hydrostatic tests. Is that what you meant when you said hydros?
A. Yes, hydrostats.

Q. In your view, are the instructions given your inspectors complete enough for them to make an adequate inspection?
A. Yes, sir.

Q. Can you tell us of the inspection methods in the shop as well as on the ship?
A. In the shop, the shop in mind, which would be 56, they are inspected by a supervisor as well as by an inspector in the shop.

Q. What do they inspect for?
A. It would be the same criteria as I mentioned before.

Q. And then what determines if the job is inspected in the shop or in the ship?
A. The criteria for the silver braze --

Q. Why is it that some work is inspected in the shop and other work is inspected on board ship?
A. Then again all work that is inspected in the shop is again inspected on the ship. Sometimes they are pre-fab jobs. You can only look at a certain phase of it, but when you reach the ship you've got it all. Is this clear?

Q. Then when a job is prefabricated in the shop it is inspected in the shop; is that correct?
A. Right.

Q. And if it is not, it is inspected when it is performed on the ship?
A. Yes.

Q. In any event, all work performed on the ship is inspected?
A. Yes.

Q. In the post shakedown availability period of THRESHER did you have a system of joint identification so that the name of the person making the silver brazed joint and the names of the persons inspecting it are a matter of record?
A. Yes, sir.

Q. Was that system applicable to all size silver brazed joints?
A. The system I have is not; it is just two-inch or above.

Q. You say the system that you have; is there a system elsewhere in the Shipyard?
A. No, there is the same system being introduced as I have. However, at this particular availability it was just the two-inch or over.

Q. And since then to what size has the system extended?
A. I couldn't answer that.

Q. It is being extended to smaller sizes; is that it?
A. Yes, sir.

Q. Are there available for us the actual records for each joint, a record of what inspections it passed, in the case of THRESHER?
A. In each case, joints that have been done at this availability as the result of salt water integrity inspections, yes, sir.

Q. What joints were inspected in THRESHER during the period of her post shakedown availability? What category of joints?
A. Sea water.

Q. Would you say that all the joints which were installed in Portsmouth during the post shakedown availability were inspected during the period of the post shakedown availability?
A. Yes, sir.

Q. To what sort of inspections were they subjected?
A. To the pre-fit up, the visual and the hydrostatic tests. Oh, also, nondestructive tests.

Q. Were they subjected to ultrasonic tests?
A. Yes, sir.

Q. In addition to all the silver brazed joints of the size you mentioned which were installed in the post shakedown availability period of THRESHER, were other silver brazed joints inspected at that time?
A. Yes, sir.

Q. Tell us about those.
A. The joints and the silver braze that I am talking about now right here are the ones I personally know. However, there were other jobs worked in the various systems, and other sizes, but I couldn't go into any detail right now.

Q. I'm referring to the silver brazed joints which were not worked on during the period of the post shakedown availability, but which had remained in the ship from the period before that. Were any of those inspected?
A. Yes, sir.

Q. Can you give us any information concerning the amount or the extent and the description of such inspections?
A. I do have -- I can't come right out now with figures; I didn't come prepared for this, but I do have these. I wouldn't want to go any further than this at this time. There were other joints. How many others and where they were I would have to break out my files in order to give you them.

Q. Within the area of your own knowledge, then, are you satisfied that the inspections which were performed were enough to insure that the joints which were passed were in fact good joints?
A. Yes, sir.

Q. And did or did not have a likelihood of failing under operating conditions on the test dive?
A. I can answer that this way: All joints that were inspected were passed visually and ultrasonically, and these were the remaining joints.

Q. Your answer simply tells me the nature of the tests performed. I would like, if you can to give us your best judgment as to the reliability of the joints that passed the tests.
A. I don't believe I understand you, Captain.

Q. You've told us about the tests that you performed and you've told us of their nature. Now the joints in THRESHER have passed those tests. How good would you say, then, the chances are that those joints held up under operating conditions?
A. Very good, sir.

Q. You have no reservations on that?
A. None.

COUNSEL FOR THE COURT: It will be necessary, sir, I think, to recall this witness on areas of inspection with which he is not fully cognizant now. I have no further questions at this time.

EXAMINATION BY THE COURT

Questions by a member, RADM Daspit:

Q. There has been testimony that in the auxiliary salt water system a considerable percentage of the check valves were installed backwards. When you inspected for fit of the valves, or things of that nature, are you required to see if the valves are being fitted in the correct direction?
A. To my knowledge, when these check valves were installed and at the time of installation, to my knowledge, they were not inspected. However, they were inspected one hundred per cent when the systems were hydrostatically tested. At this time there were a few noted; they were corrected.

Q. But aren't these valves required to be inspected for fit to insure that they are aligned and everything in connection with the silver soldered joint, the brazed joint?
A. Yes, sir, this is true; however, you are getting into a mechanical joint. There is a mechanical test area that is laid out to do this. At this particular time I'm not prepared to answer on mechanical joints.

Q. These check valves, then, are fitted up with mechanical joints?
A. Yes, sir.

Neither the counsel for the court, the court, nor counsel for the party, RADM Palmer, desired further to examine this witness.

The president of the court informed the witness that he was privileged to make any further statement covering anything relating to the subject matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing further to say.

The witness was duly warned concerning his testimony and withdrew from the courtroom.

The court recessed at 1517 hours, 22 April 1963.

The court opened at 1543 hours, 22 April 1963.

All parties to the inquiry who were present when the court closed are again present.

William G. Poor, was called as a witness by the court, informed of the subject matter of the inquiry, advised as to his rights against self incrimination, was duly sworn and examined as follows:

The witness was informed that the court was sitting in open session and no classified material should be divulged.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation.
A. William G. Poor, (b) (6) I am now the Group Master of the Outfitting Group, which includes Shop 56, Outside Machinists, and Shop 38, the Pipefitters.

Q. State briefly your background and experience which fits you for your present job?

A. I started in the Navy Yard in Boston in 1938 as an apprentice. In 1943 I was promoted to Leadingman at the same shipyard. In 1951 I was promoted to Chief Quarterman in the same shipyard. In 1957 I was appointed Master Machinist, outside machinist, here at Portsmouth, and in 1960 I was promoted to Group Master in charge of these two shops.

Q. Mr. Poor, the area in which the court begins to question you relates to the quality assurance of piping systems, and in particular as they relate to mechanical joints. We would like first of all for you to tell us what sort of people work on them, this is with relation to title , and their qualifications to do the job that they do.

A. In the case of mechanical joints, in both shops the people who work on them are a cut of regular workmen across the shop. It depends on the nature of the job, the nature of the system and the difficulties expected to be encountered. With the more simpler systems, the less well qualified. With the more exotic systems the people well qualified. The people in Shop 56 probably make up ninety per cent of all the joints aboard the ship. We ran training programs in the proper method of making joints, as well as other facets of the trade. In the case of Shop 38 we had informal training programs, not formalized with training procedures the same as the other was, but Shop 38, this wasn't deemed to be a hundred per cent necessary, because traditionally it has been 38's responsibility to make up pipe joints until the last few years, so we presumed that we could use our mechanics as we always had used them in making up piping joints on the ship. I would say that the people were qualified in the opinion of the Shop Superintendent; qualified to do this work.

Q. Did these people carry a card showing their qualifications for working on mechanical joints, in much the same way as those who worked on silver brazed or welded joints would?

A. No, they did not. The only identification that any one of them would have would be any of those people who finished formal training programs; they might have a certificate, but they certainly would not have carried it with them, so there was really no card carried such as the brazers have.

Q. Return then to the subject of the work which such people performed. Were there in existence during the post shakedown availability of THRESHER, instructions under which the inspectors carried out their inspections of mechanical joints?

A. In the case of new systems there were the regular procedures which go along with the inspection of piping in new systems in which the inspector did get involved. In the case of systems that were pulled down for repair of components they were treated much in the same manner as any other repair work is, in the fact that the inspection is that which is given by the supervisors and mechanics themselves, and finally by the ship's force. In the case of repair work in this Shipyard, the ship's force is the final authority for acceptance of work that has been done.

Q. Now with regard to the instructions under which the inspectors did carry out their inspections --

A. The instructions, I believe, are explicit.

Q. In your opinion are the instructions not only explicit but complete enough to insure an adequate inspection of the work?

A. Yes, sir.

Q. Were such instructions in existence prior to the post shakedown period of the availability of THRESHER, and in fact during the construction period of THRESHER?

A. They certainly were in force during the post shakedown availability of THRESHER, but I am not positive that they were all through the whole construction period, because in the last two to three years, since the BARBEL incident, the inspection procedures in this Shipyard have been undergoing rewriting and some changing, and there have been several preliminary instructions written and of course they have been followed up with permanent ones, and I'm not quite sure of the dates in relation to the THRESHER new construction period, but I would say that current ones were the same during the PSA.

Q. Measured against the backdrop of your own experience, starting back to the days when you first went into the Boston Shipyard, would you say this whole field of quality assurance program is a new and growing one?

A. Yes, sir, in the last few years it has grown by leaps and bounds, from practically none to what we have now.

Q. Tell us, if you can, how those instructions are carried out by the people who made the inspections; what sort of inspections did they make on mechanical joints?

A. In the area of the Quality Assurance Division there were three types of inspections. They witnessed the making of the joint, the qualification of the material, etc., and they actually saw the whole evolution take place, and then the final check from the hydrostatic tests were required to prove it. In the case of joints that were not checked by Code 303, in which the shop supervisor was the responsible agent, in his rounds among his workmen he would observe them doing their work and upon completion, if the system was ready to test, the final test would be the final result of the quality of the job. In this case here the instruction called for a working pressure test only, in the case of repair work.

Q. We have had some evidence before this court that some check valves in the salt water system were installed backwards. Can you explain to us how it is possible for this to happen when quality assurance inspections are made, and why some of them wouldn't come to light, and had to be discovered by ship's force in THRESHER?

A. I think that the only answer I could give you in a case like that would be simply my own opinion. There are others in the shop at the moment, now working in this area. What I know of it, a good many times, valves are used as what we call "dummies," to make up a line, to set a line. At this time the valves could be put in -- in the case of a symmetrical valve they could be put in either direction without any fear whatsoever. If they happened to be spotted at this time, someone could say that they were in backwards, if they really knew that the flow was in the opposite direction, but as far as knowing they were putting them in inadvertently because someone didn't know, I couldn't say that I had an opinion on this. All I can say is that every system was checked, every system was operating, and I have no further knowledge than that.

Q. What records are maintained by Mechanical Joint Identification on THRESHER which would show who installed the joints and who tested them, who performed the inspection?

A. None; no records; no specific records.

Q. Your answer relates solely to THRESHER, does it not?

A. Yes, sir.

Q. Can you tell whether records of mechanical joints identification on other submarines are in existence?

A. Yes, sir, there are, and have been for the past several months. The joint identification card program now in operation on the JACK, in which every joint is identified and there is a joint card bearing the name of the man who made the joint, the inspector, on every joint, regardless of whether it's mechanical, welded, brazed; there's a complete set of cards.

Q. How do you account for the fact that no such record was maintained for THRESHER?

A. The THRESHER -- well, in the first place the THRESHER was repaired, and under this procedure we don't normally keep that type of records, and in the second place up until this program on the JACK we didn't keep account of mechanical joints, and for that matter, on the 620 right now some mechanical joints are not considered what we call counters when we are counting the number of joints completed. The inspection and proof of the work on mechanical joints, since mechanical joints are broken frequently in the building period or in an overhaul period, because this is the most practical way to get into a system to test and evaluate and anything else you want to do with it. These mechanical joints are broken many times and the final test is on the system and these joints are sold on the test memo itself and when the test memo is signed out this is tantamount to every joint having been tested.

Q. By sold, you mean officially accepted by the ship's company?

A. In the case of new construction by Code 303, the Testing Division, and the ship's company on the first shakedown of the ship.

Q. From your own knowledge of the nature of the tests performed, and inspections performed and the persons who made the inspections, are you satisfied in your own mind as to the reliability for the service of the mechanical joints that were worked upon in the Shipyard during the period of post shakedown availability in THRESHER's case?

A. Yes, sir.

EXAMINATION BY THE COURT

Questions by a court member, CAPT Hushing:

Q. Did you have defects with mechanical joints - any unusual defects during this availability?
A. I would say not any type defects. We might have had a defect with an individual one here and there, but no type defects.

Q. That's what I'm getting at. This wasn't an individual case of--You were having no difficulty with E.B. type fittings or Portsmouth type fittings?
A. We were having no over-all difficulty with any particular type, no, sir.

Q. What provision does your group make for protecting flexible coupling type fittings after they have been installed?
A. Flexible hoses, you mean?

Q. Flexible coupling, flexible hoses.
A. I am not prepared to answer specifically on that. I know there are instructions out on it. At this point I can only assume we saw them. To be specific as to what they are, I can't say. There is in Shop 56 a training program on flexible pipe. There are only certain people in the shop who are trained and qualified. They make these up in the shop, hydrostatically test them in the shop, and they are installed in the ship and tested in the ship with the system, and the ship's force in the case of THRESHER was very thorough in their inspection of the installation. There was inspection of 681 flexible connections that we had before going to sea and we satisfied them that they performed as they should have. Since we have this specific training program in Shop 56 on flexible connections, I would have to say that the instructions obviously are out to the people. I don't know whether they are out in the form of specific instructions, however.

Q. What kind of steps do you take as the Group Master to audit the carrying out of process instructions by, say, Shop 56?
A. From my position I very rarely carry on an audit on my own - that is, looking for trouble. The way-- It usually is a case where some trouble is reported to me, and I follow up on it, but as far as walking through the Yard or through the ships and looking for myself for the difficulties being encountered or where regulations aren't being followed, I don't do this, because I am not that close to the pipefitting trade, although I hope I am learning.

Q. Do you have any staff to do this kind of audit?
A. No, sir, only the shop supervisory staff. There are no Quality Assurance people in my group to perform this function. In Shop 56 it's the foreman, or the chief quarterman, the regular supervisory staff.

Q. Does the Shop 56 foreman have any audit procedure to insure that the technical instructions are being carried out?
A. He is continually in the work area. Whether he has a written procedure, I don't believe he does, but being an expert in this area and, as far as I am concerned, my technical expert, he knows what is right and what is wrong.

Q. Take a purely hypothetical case and say you have a Shop 56 foreman who doesn't tell you about the troubles in the Shop 56 area. Would you then be in any position to know what was going on?

A. Well, it's pretty hard to keep secrets within the Shipyard, there being ship superintendents and project teams, and so forth. The advice gets back even if he doesn't tell me. I don't know of any instance where it hasn't.

Q. Take my hypothetical guy, a close-mouthed individual not bringing troubles up the line.
A. The only way I would get the information would be in the back door, so to speak.

Q. How about inspection reports by 303-B; do you review them?
A. Just in a general manner, more for progress reports of how we stand over-all with the ship, not for the quality of the individual items. I am more interested in the progress of the overhaul, the amount of manning, and so forth.

Q. Do you get any statistical feed-back of the results of 303-B inspections?
A. Not too many.

Q. Well, do you get any?
A. Only those that we get as a result of a meeting or a run-down of the week.

Q. How about a standard system of feed-back, do you have one?
A. No, sir.

Q. Do you feel you are currently adequately informed as to the capabilities of Shop 56?
A. Would you repeat that?

Q. Do you feel you are currently adequately informed as to the capabilities of Shop 56?
A. Yes.

Q. Do you feel that Shop 56's quality is adequate at this time?
A. Yes.

Q. Specifically as relates to THRESHER, did you feel that it was adequate before the ship went to sea?
A. Yes, yes.

Questions by a court member, CAPT Osborn:

Q. As I understand it, Mr. Poor, the Quality Assurance group inspects the product and you are really responsible for insuring fabrication of the product, is this true?
A. Yes, sir.

Q. Who processes the disciplinary action with respect to Shop 56 and Shop 38?
A. The disciplinary action?

Q. Yes.
A. The disciplinary action procedures are set up for the Shipyard and they require that the man's immediate supervisor process any disciplinary action taken against any other person. This being the case, advice of poor quality is

received, and the information is prepared by the man's immediate supervisor, who must take the necessary action. If the trouble is with a particular mechanic, for instance, the leadingman must take the initial action, no matter who uncovers the difficulty. In my position I have certain privileges to assign the amount of the penalty. I can approve suspensions up to a certain number of days, but the only ones I have authority to take disciplinary action against are the two foremen and the assistants in this group.

Q. But you would be cognizant of any disciplinary action that had been taken?

A. Yes, sir.

Q. Was any such action taken during THRESHER's construction, or any disciplinary action taken in the case of THRESHER's post shakedown availability with respect to quality?

A. Yes, sir.

Q. To what degree?

A. Letters of admonishment to several supervisors, an apprentice, and mechanics for improperly applying a test.

Q. Improperly applying a test on what?

A. On a reserve feed tank.

Q. Is that the only occasion?

A. The only occasion I can recall to memory right now, sir. There may have been others. Of course, previously there was one during the trials--during the shakedown of THRESHER after construction.

Q. Now, since the reserve feed tank isn't really associated with water-tight integrity as such, do you remember any specific instance with respect to salt water systems or sea water systems?

A. No, sir.

Q. There is one other question I would like to clear up in my own mind with respect to the standards of performance and the standards of acceptance as to quality with respect to, say, a new construction ship like JACK, which is after the fact, and the THRESHER, which was completed sort of half and half before this major program was really under way. Is there any question in your mind that the proper standards with respect to the fittings in THRESHER were not adequate?

A. No question in my mind at all that they were not adequate.

Q. There is one other general area I would like to consider. Quite frequently there is a difficult problem with respect to scheduling of tests or breaking down of tests of component parts with respect to a system in that you have to test some before the last minute. Now, are there any over-all tests very late in the game that give you an indication of general quality control which would be an over-all summation of several minor tests in a particular system?

A. I'm not sure I follow you, sir.

Q. For instance, an example like this: Say a salt water system consists of four major parts that could be independently isolated and conducted as four separate tests with respect to testing every individual component in the salt water system. Then after you get through with that particular test, do you make an over-all general test with respect to the entire system?

A. You mean an over-all test in the manner of working pressure hydros or some such thing as this?

Q. Yes.

A. I think in cases like this of repair work during PSA being treated the same way, it depends a lot on what you've had done during the period. I can't name a specific instance in the THRESHER where we did any piece-meal testing of a system and didn't follow it up with a general testing over all. But as I said in the beginning in my opening remarks, I am a few steps removed from the actual specifics. None were called to my attention, however.

Q. Did you personally go aboard THRESHER and talk to her officers and men about the product your people were delivering?

A. No, I did not.

Q. Have you ever ridden the ship?

A. No, sir, I have not.

Questions by a court member, RADM DASPIT:

Q. I understood you to say, sir, that the normal procedure is for the man's immediate superior to prefer charges. Should he not be willing to do this, can charges be preferred higher up the line?

A. I'm sorry, sir, I didn't get that.

Q. You said, I think, that if a man did some bad work, his leadingman was the man who should prefer charges against him. Suppose this leadingman doesn't want to prefer charges against him, can charges be preferred by persons in higher authority?

A. No, sir. The action has to be forced through the leadingman, and he has to be brought into line in this area. These can be embarrassing situations, but this is the situation. The charges have to be signed by the man's immediate supervisor.

Q. And if he does not, the only recourse is to prefer charges against the man's leadingman, is that right?

A. That's right, sir.

Q. I am not clear about the difference between signing off on repair work and new construction. I gather that on repair work the Yard assists in performing hydrostatic tests, and the only difference is that in new construction the Yard witnesses the test which the ship's force makes; and in repair work the ship's force witnesses the test made by the Yard?

A. Yes, sir, except in the case of new construction when there is a test memo involved, which is signed by all parties concerned, and in repair work the job order will state, "Conducted test as required according to current instructions." An exception is in the case of a new installation, and it reverts back to the new construction type of check-out.

Questions by the president, VADM AUSTIN:

Q. Mr. Poor, you stated, I believe that training for welders and silver brazers is done under Shop 56, which is one of the two shops of which you are the coordinating group master?

A. Just the brazing, sir.

Q. Just the brazing?
A. Yes, sir.

Q. Where is the welding training conducted?
A. That is conducted by Shop 56, the Welders Shop, under the control of the Foreman Welder, Group Master structural.

Q. Are you well informed as to the quality of this training for the silver brazers, as it were?
A. Yes, sir, I think I am.

Q. Are you sure that they only get a card when they have demonstrated a high degree of capability in this field?
A. The card is presented to the man; signed by the foreman only after he completes the course which is under a qualified Shop 56 pipe-fitter who has been designated as a brazing instructor. When he has demonstrated he is qualified, the card is prepared and signed by the foreman. This card is good for a period of time, and he has to be re-qualified.

Q. I appreciate that the system sounds very fine, but the system has to be administered in order to produce the results which it was intended that the system produce. Is it in fact producing a high quality artisan or is it done in a perfunctory way?
A. I think it is producing high quality artisans, and the reason I say this is because from 303 we get a report on the rejects by our brazers by number, and it was just last week that one name came up a few too many times, and the man in 303 called it to our attention that this man should go back for retraining and that his card should be lifted. The reports that I get from the people doing the testing leads me to believe that we are training people that are capable of doing a good job.

Q. I understood you to say that you do not, as a rule, study the 303 inspection cards except with a view to determining how the progress of the work on a particular ship is going.
A. Yes, sir.

Q. You depend, therefore, on the 303 people to inform you when a specific brazer, for example, is having too high an incidence of rejects; is that right?
A. Yes, sir, because they inspect the work by means of ultrasonic testing. They put out a report setting forth the results.

Q. Would it give you a better feel for the quality of the training being conducted in this school if you did not depend upon someone else to call to your attention the faulty work of a man who apparently did not get well trained there?
A. You mean audit ourselves, sir?

Q. Well, you have passed through your hands these inspection cards. Shouldn't that give you one way of seeing whether the training under your general supervision is producing good men or not?
A. I guess my remarks back there were misleading to you. The cards that I meant were not in fact cards. They are sheets reporting the number of tests, items accomplished, the number of weeps outstanding, and so forth, but I don't see any cards or report that come to me that report on the quality of the work of the brazers other than when they--

Q. Other than specific cases brought to your attention by 303?
A. That's correct, sir.

Q. So that these cards don't go through your hands at all?
A. No, sir, they don't. If there is specific trouble appearing in a particular area, they pinpoint it.

Q. I see. I did misunderstand.
A. In the case of THRESHER, we had a rundown of weeps toward the end. My interest was, how many are we getting done and how many more are required to get the job done.

Q. Mr. Poor, were you satisfied completely with the work on the THRESHER from a quality viewpoint insofar as your own knowledge and responsibilities were concerned?
A. From the knowledge that I had of it and from perfunctory talks with the quartermen and discussions I had with foremen, they pointed out areas of trouble which they encountered. I would say generally we were satisfied with the quality of the overhaul. We had passed our tests. The systems were operating. We were satisfied, except that we were late, as everyone knows. I felt fairly well about the quality of work.

Q. Has anything come to your attention since this disaster which has raised doubts in your mind as to anything that was done on the ship under your overall area of responsibility?
A. I have spent many hours thinking about this, and I cannot pinpoint a thing specifically.

Questions by a court member, CAPT OSBORN:

Q. Were there any hydrostatic tests in the sea systems brought about by the over-pressurization of the b(3) 10 USC 130 tank?
A. No, sir. You mean in the sea water systems?

Q. Yes, in the sea water systems?
A. No, sir.

Neither the counsel for the court, the court, nor counsel for the party RADM Palmer desired further to examine this witness.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing further to say.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

COUNSEL FOR THE COURT: Counsel requests a brief recess in order to consult with the next witness.

PRESIDENT: How long, Counsel?

COUNSEL FOR THE COURT: Ten minutes, sir.

PRESIDENT: We'll take a ten-minute recess.

The court recessed at 1630, 22 April 1963.

The court opened at 1640, 22 April 1963.

All persons connected with the inquiry who were present when the court recessed are again present in court.

Benjamin T. Bragdon, Jr., a civilian, was called as a witness for the court, was duly sworn, was warned of his rights against self-incrimination, was informed of the subject matter of the inquiry and examined as follows:

COUNSEL FOR THE COURT: Mr. Bragdon, this is an open session of the court, and there are members of the public present. For that reason, it is essential that classified information not be divulged. You will not volunteer any classified information. If a question asked by members of the court or counsel should, in your judgment, require the inclusion of classified information in the reply to make it complete, you will not make reply but will so indicate instead. Do you understand?

THE WITNESS: Yes, sir.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address, and present occupation?
A. My name is Benjamin T. Bragdon, Jr., and I live at (b) (6)
New Hampshire. I am a Naval Architect with the Quality Assurance Engineering and Analysis Branch, Portsmouth Naval Shipyard.

Q. How do you spell your last name?
A. B-R-A-G-D-O-N.

Q. And what is your code number at the Shipyard?
A. 303-A(3).

Q. Can you briefly describe the nature of the duties which you perform in the shipyard?
A. My function is, in essence, to see that the submarines' hulls are built in accordance with the specifications, and that the Production Department is supplied with the procedures and the documents necessary for them to carry out this fabrication in accordance with specifications. I also look -- I am in charge of the records to make sure the records are kept up to date that are required.

Q. What is your background and experience for this job, Mr. Bragdon?
A. I have had -- I will have finished two years in the Quality Assurance Branch. We have had formal training in quality assurance work. My real background for this job was twelve years in design. Part of this period in 1955 I was loaned to the Bureau of Ships, where I made calculations, did the stress and analyses work for the basic hull of the SKIPJACK. I did the stress analysis and calculations for the Phase 3 of the ALBACORE job. A year prior to my leaving Design, I was Project Engineer for the Fatigue Model Program. This, in essense, is my background..

Q. The manufacture and inspection of the pressure hull of submarines is vital to the safety of submarines. With that in mind, would you describe for us the quality assurance system that was used in THRESHER's post shakedown availability to assure her safety for dives to test depths?

A. First, I would like to talk about the NAVSHIPS 250-637-3 document--

Q. Is that an instruction?

A. It is a Bureau of Ships Instruction, a document prepared by leading welding engineers and structural men in all shipyards for HY-80 steel. It covers it in detail from material procurement to in-process inspection, quality control, and records, final inspection, BUSHIPS reports, and so forth. This document has been implemented in the Shipyard by a formal instruction 9110.4. The title of the BUSHIPS Instruction is "Fabrication, Welding and Inspection of HY-80 Submarine Hulls." The Portsmouth Naval Shipyard Instruction implements this Bureau document in detail. It assigns responsibility and duties in each phase of this BUSHIPS Instruction. There are in-house, in-shop, and in-quality assurance documents which support this, In other words, a foreman might put out an instruction on how he wants the work carried out. I would like to say that I personally wrote this implementing document, and when it was written, we had all supervisory personnel, every leadingman and above, in the Welding Shop and Shipfitter Shop and every inspector, and we gave them a course and taught them what the steel was and what was expected of them. We had tried this prior to the implementation of this instruction. We had a trial run without benefit of the document, so to speak, and we had our hull inspectors test our leadingmen and steer them along. I think this pretty much is about all I would like to say about the instruction. The HY-80 hull instruction is one of the most comprehensive documents ever written.

Q. When did this convocation of all those key men occur?

A. Well, the document was issued in December of 1961. So it would have been either in December of 1961 or January of 1962.

Q. What procedures do you have for procurement and inspection of the material itself?

A. The material first is procured from the vendor in either of two ways. Primarily it is procured through the MIL-Specifications. I believe it is MIL-S-16216. The vendor is required to furnish the Shipyard certificates for quantitative certification of the chemical and physical make-up of the material and the ultrasonic thickness reports taken on the required specific pattern. The Shipyard then receipt-inspects in one of two ways. One, 100 percent in accordance with NAVSHIPS 250-637-3, a document which requires soundness on a grid pattern, the requirements of Brinell hardness, thicknesses, visual inspection of the plate, and so forth. We have the vendor certify it as complete. The other method is that if the vendor receipt-inspects the material in accordance with the MIL-Specifications, then we have a sampling plate where we do it again in the Shipyard in accordance with NAVSHIPS Instructions. There is a slight difference between the MIL-Specifications and the NAVSHIPS-250-637-3 in the area of ultrasonic testing. It turns out a sampling plate which in all cases must be better than 50 percent, depending on what was found. It could run to 100 percent inspection.

Q. Was this receipt-inspection and procurement inspection procedure followed in the case of THRESHER?

A. On the post shakedown availability, yes, sir.

Q. With reference to her construction, were similar procedures followed?

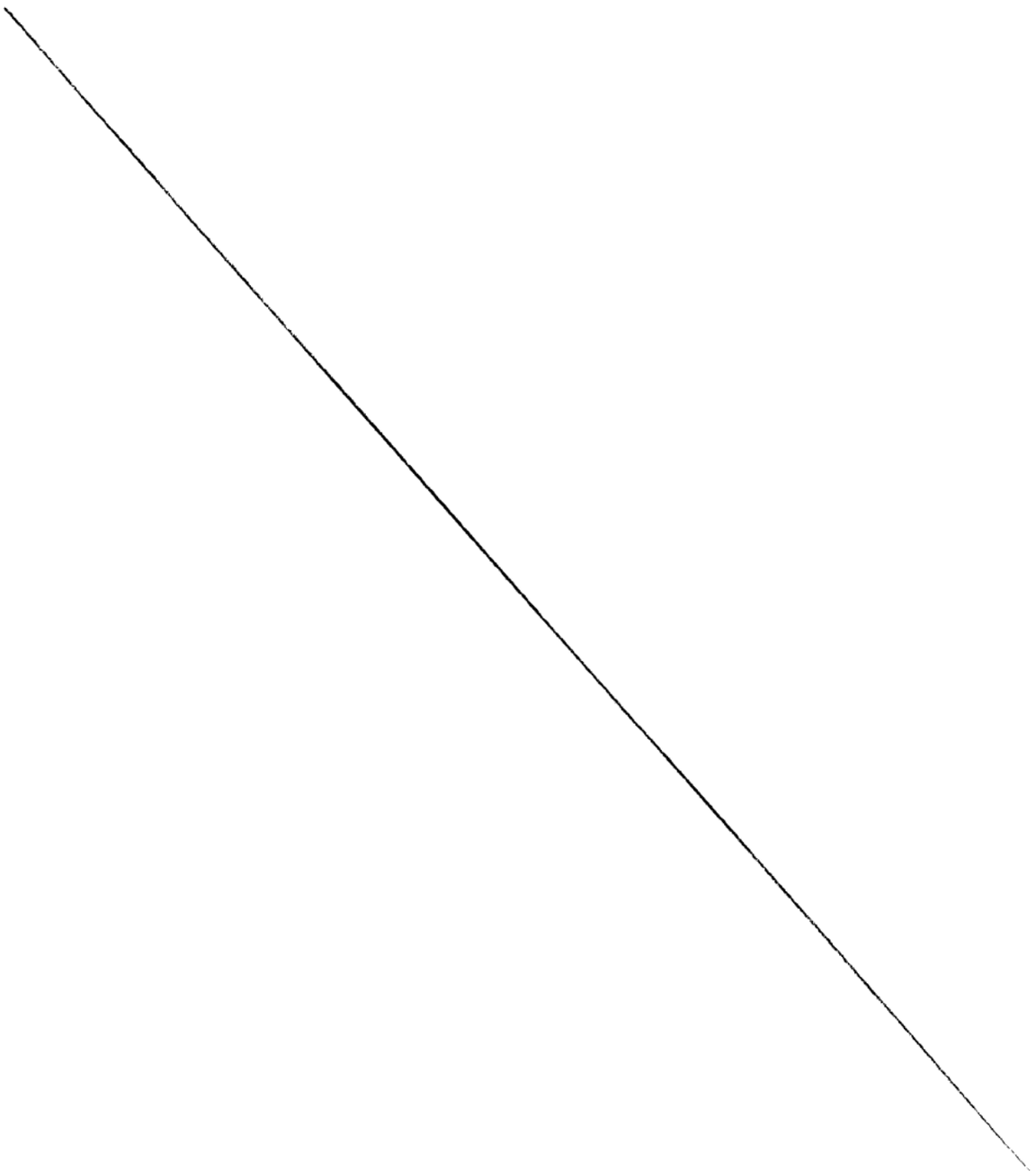
A. On the initial fabrication every plate was gone over in the Shipyard to the MIL-Specifications. If you recall, NAVSHIPS came out in November of 1960, and the keel was laid in 1958, I believe, but this material was 100 percent inspected by ultrasonic tests and Brinell hardness. In fact, we had occasions where it was inspected, rejected, documented, and replaced. We have certifying documents showing these inspections in the Design Division. I would like to go a little further on this matter. Not only do we have a certification by Design, but we prepare a specific cutting sheet for a specific plate. It is serialized

and tied into the heat numbers, and the vendor nomenclature that identifies the plate. This goes to Production for a specific job. That plate is stubbed out for a job, and the prescribed piece is cut in the plate. We tie the plate to the hull in this way. I've been talking about HY-80 steel. The requirement is on high-tensile steel plates subject to submergence pressure. We put 100 percent inspection to NAVSHIPS 250-637-3 on a plate. This is the most stringent inspection we can give a plate.

Q. With regard to your reference to pressures, do not refer to specific pressures or depths in your testimony.

A. No, sir. I think that pretty well covers material inspection.

(b) (6) was relieved by (b) (6) as reporter at this point.



Q. Can you tell us about pre-weld inspections and fitting up inspections?

A. Yes, sir. Here again I keep referring to this NAVSHIPS document which sets up the procedures. We do have a quality assurance check-off list. The form number is 1ND PSN 1747. The responsibility for the fit up is with the supervisor, either the supervisor shipfitter or supervisor welder, and it turns out they get together, and they go down over this list to make sure they have the right material, make sure it's identified as HY-80 or HTS; that the joint preparation is correct; that the sizes of the joints, of the fabrication, is correct. I have the form here which I can go through, but in essence the requisites of the document are spelled out on the quality assurance check-off list. It works out well to have the fitter and the welder do it together because the welder is responsible for a good joint. If he accepts something that isn't well, he puts himself in a vulnerable position. This is also checked after pre-heat. This, I think, covers this.

Q. What inspection is made of the joint itself?

A. At the time the joint is being made the welder has to put in a certain amount of weld, and then it has to be back-gouged. This then gets a formal magnetic particle inspection. All double bevel welds in pressure structure have to be back-gouged and magnetic particle inspected. There are cases with specific welding processes, such as dual arc or something like this, where due to the nature of the process it isn't required to do this. However, if I might go back to welding qualification first to stay in sequence --

Q. By all means, tell us how the welders are qualified for work on the pressure hull structures?

A. We have two types of welders, one that is formally trained here at the shipyard and the other would be the journeyman welder that came into the Employment Office. In the case of the trainee, he is put into the Training School, which is under the cognizance of the Welding Foreman, and he is started at a certain phase, flatwork say; he is given certain examinations to pass with physical samples, where these have to be radiographed, bend tested, things of this nature. Once he has passed the training and done this part of it, he then might go on the job and work at this part for which he is qualified. The welding engineer actually evaluates the samples. The welding foreman is in charge of the training while he is doing the work, but the results of his tests are under the cognizance of the welding engineer. In the case of the journeyman coming to the gate, he gets all the tests in the book for each position: horizontal, vertical, overhead, flatwork. He makes all these samples; they are evaluated by non-destructive tests and by destructive tests. They also have bend tests, which are prescribed, and the weld has to make this test.

Q. Who evaluates them?

A. The welding engineer. In all cases the welding engineer evaluates the man. I would like to say that we have a run off each month which spells out what each welder's qualifications are. In other words, we know for every man welding, we know what he can do; and also the fact that we have the run off implies that he has welded within the past specified time.

Q. What is the "run off;" a list showing the status of each man working on welding?

A. Yes, sir, showing each man's qualifications. We have an audit in this type of work. We look at fifteen percent of the welders each day, each shift. We again have a quality assurance check off where we first check his qualifications, check the rod he is using, whether it is identified correctly or whether it's the right rod for the job, if the pre-heats are right, if the interpass temperatures are right, if the heat input is right, the quality of his work as it appears to the inspector.

Q. How long have you been doing this?

A. I would say since the inception of this document, say about January, 1962. We find this is very effective, very good.

Q. Can you tell us of the non-destructive test requirements?

A. I have to use pressure hulls to define a category of inspection. For instance, in the radiography field all pressure hull butts and seams have to be radiographed; all standing flanges of pressure hull frame butts have to be; all butt welds in web, if they are within the depth of the frame from the flange butt -- all of these welds also, that are radiographed, are required to be magnetic particle inspected. They are also visually inspected for undercut, contour, correctness of size, the whole force of the requirement. In the case of double bevelled full penetration welds which don't lend themselves to radiography, again, all of this which is subjected to pressure is magnetic particle inspected. I would like to point out that the document has specific requirements for the repair of defects found in all of this non-destructive testing. For example, if you find a crack in a weld, you're allowed one-sixteenth to grind it out providing you don't infringe on the design thickness of the plate. We define a crack as something that has to be repaired by welding. I feel, again, the book is most comprehensive. It tells exactly what should be done. It's implemented, and this is done.

Q. It is implemented; is that a statement of yours?

A. Yes, sir, that is very well said; it is implemented.

Q. And you're satisfied that you have an adequate number of people to see that it is implemented?

A. Yes, sir.

Q. And that was so in the case of THRESHER?

A. Yes, sir.

Q. Do you have a means of pressure-testing a hull?

A. Yes, sir. The detailed specifications spell out which tanks shall be hydrostatically tested. They also make note of the fact that it is impractical, or perhaps we don't have quite the equipment to do, say, a whole compartment to test depth, if you will; so the detail specs recognize this and they say that pressure hull butts and seams will be tested at time of sea trials; they prescribe that it be done in a certain order, of which I'm not cognizant. But they do recognize this limitation, that you can't practically or feasibly perform constructive tests at these times. I might point out that these are all radiographed and they are all magnetic particle inspected and get the benefit of all non-destructive testing that is available.

Q. What percentages of rejections of welding work performed on THRESHER can you tell us of?

A. I do not have the specific figures on THRESHER. If you'd like, I could give you, say, for the past year what our rejects are. I just made a sample chart where I've recorded the incidence of cracking each month, and this takes in all welding for all ships. We know that there are certain types of connections that have a higher reject rate than others. Consequently, it turns out -- I kept this record from February of '62 through January of this year to give me the full cycle over a year and our process average is .7 per cent for incidence of cracks. I might point out the high would have been in January -- I believe it was 1.35, and we have a low of .28. In fact, the whole thing has sloped down. I'm quite pleased with it as a matter of fact.

Q. Can you give us a better description of what these percentages mean?
A. Yes, what this incidence of cracking is, is the inches of welding found per inch inspected. If I said seven-tenths percent incidence of cracking, it would mean that there would be seven inches of cracking in a thousand inches. This is exactly what it means.

Q. Per thousand inches inspected?
A. Yes, sir, that is correct. We have it on radiography, but I don't have those figures with me now. I just thought I'd give you an idea of what I had.

Q. Well, in HY-80 pressure hulls there are cracking problems due to fabrication techniques, also because of fatigue type loadings; is that right?
A. That is correct, sir.

Q. Does the Bureau of Ships require that all submarines which use this material receive periodically certain inspections to insure the reliability and safety of their hull structure?
A. Yes, sir. This, I might say -- I want to say this--has a direct tie with the Bureau. They are very careful with this and they assign definite areas which they want looked at. They have high stress inspections, so called, by an engineer, the way you inspect, perhaps, higher than other places. They define perhaps, a cone connection where they will take, say, on the axis, and take so much of it and say, "You will look at all this and if you find more than a certain percent defective you will then look at all of it." They have a definite directive which says what parts of this ship will be looked at and how often. It's an optimum sort of thing, because obviously availabilities have to fit into it too. You try and work it in nearest to these optimum dates and still, I assume, run your vessel.

Q. Well now, that's a directive of the Bureau of Ships?
A. Yes.

Q. Can you describe this shipyard's procedures for monitoring the HY-80 pressure hull of THRESHER?
A. Yes, sir. We assigned a project engineer in design who works directly with a picked man inspector. This man is a man who has grown up with it and he knows what to look for and he is well skilled in non-destructive test work. The design engineer puts out specific definitive instructions. "This is where you'll look and this is how much you'll look at." They work together at all times. When the ship comes in, for instance, they go right aboard and the engineer and the inspector together look in these areas and if, perhaps, there are some areas that aren't accessible, he may substitute in the same particular joint of the same geometry and area, but still get what he feels is a representative sample of what he wants to look at.

Q. Do you have instructions for your inspectors here at the Portsmouth Naval Shipyard in the conduct of such inspections?
A. The instruction is put out by Design and it is very specific. There is no -- well, it's in great detail.

Q. No leeway?
A. Yes, sir, that's correct.

Q. Are these instructions for a specific ship?
A. For a specifc surveillance of a specific ship. In other words, what might have been done on the first surveillance of a vessel, they might go over some of this, but then take in more on the next one. For instance, feedbacks come in from the Bureau of Ships. Let's say the yards might submit certain things to the Bureau of Ships and they would like a specific area looked at. So this comes into Design and this becomes a part of the procedure,

but it is all backed up with requirements of this 9110.48, which is a Bureau instruction, plus individual letters, say, from the type desk, or perhaps from Code 443 I believe is the mother code on it.

Q. Then the inspections performed on THRESHER were the result of specific instructions with respect to that ship; is that right?
A. Yes, sir.

Q. What was the scope of those inspections?
A. I wonder if you could define scope a little better.

Q. How extensive were the inspections on THRESHER?
A. Well I could give it to you in terms of feet inspected; I believe I have that -- if this would answer your question.

PRESIDENT: Yes, you have to be careful here, Counsel. Let's not get into classified information at present.

COUNSEL FOR THE COURT: Well, if the court is satisfied that it was adequately described as "extensive."

PRESIDENT: I think you'd better leave it at that.

WITNESS: I would like to point out that they do put out a very informative record.

Q. Is the record available to this court?
A. I have one here and there is another. Both records are available, yes, sir.

PRESIDENT: We can look at those.

Q. What sort of training do the people have who perform those inspections?
A. In this case we actually have supervisory type people doing the inspections, these people that are long in the field and well skilled in the magnetic particle inspection, and they are picked because of this. They have been in the business long enough to know where to look, how to look, how to use the tools. I would consider them skilled, highly skilled inspectors.

Q. Are you satisfied with their degree of training and competence?
A. Yes, sir; yes, indeed.

Q. To backtrack for just a moment. Are you also satisfied that the welders who hold cards qualifying them as welders in this area are also fully competent to do the job their card says they're qualified for?
A. I would assume, having passed the test that they are required to pass, that they are qualified welders, yes, sir.

Q. Now back to the inspection procedure we were just discussing. Where can be found the criteria for these inspections?
A. The criteria is spelled out in the BUSHIPS Directive 9110.48. There will be also other documents which will back this up in the case of extra work that they would like to have looked at.

Q. Can you tell us the repair procedures employed in the HY-80 pressure hull for THRESHER?
A. Yes, sir. Once again, this is all covered by the NAVSHIPS document. We go right back to this book and they tell you.

Q. The minimum?
A. Well let me see. Well they take any defect and tell you how it is to be corrected.

Q. It's really the Bible then for this kind of work?
A. Yes, sir, and I can't say enough about it. I believe in it greatly.

Q. Well what can you say about the people who use the Bible?
A. What kind of an answer --

Q. Are you satisfied that they are competent to follow it?
A. Yes, sir, I am.

Q. Are there records of the inspections which you have described?
A. Yes, sir.

Q. Do these records relate to THRESHER?
A. Yes, sir.

Q. Can you describe the nature of the records for us?
A. We are still talking hull surveillance?

Q. Yes.
A. This record, which is prepared from results of the inspector working with the engineer, defines exactly where each of these defects discovered is and, in the case where a defect is found, it's supported by documents showing that it was corrected and that it was non-destructively tested. You see, the main document, which is submitted to the Bureau, defines in detail exactly what was found.

Q. Will the record show who did what work specifically?
A. Yes, sir. It tells the inspector --

Q. And the workman?
A. I would have to hesitate on that, sir; I am not sure that it tells that in fact.

Q. Where are those records kept?
A. This particular record, I have one here; and they are on record. They are submitted to the Bureau. I believe that other activities also have them. I'm not sure. The supporting records would also be in 303, by the way, in the Quality Assurance Division. But the main record is a documentary report.

COUNSEL FOR THE COURT: Mr. President, this witness' testimony will give a general background rather than a specific detail report. For that reason I have no further questions of him at this time, sir.

EXAMINATION BY THE COURT

Questions by a member, CAPT Nash:

Q. Are you aware of any extensive hull work that was done during the post shakedown availability?
A. Well there were several jobs done. I would hesitate -- I'm trying to define extensive, sir.

Q. A replacement of a hull section?
A. Not of the hull section, no, sir. There were patches, of course, I mean for access perhaps replacements of fittings and things of this nature.

Q. Would all of these be shown in the records to which you have referred?
A. Yes. Well I would like to clarify that a little. The things that you speak of would not be under the hull surveillance. It would be under the specific jobs that would be in the PSA. Hull surveillance is a special type project and it has its own people and its own attention, so to speak; whereas the other would be a normal production type operation and would get the same as new fabrication -- if that answers your question.

CAPT NASH: Yes, it does.

Questions by a member, CAPT HUSHING:

Q. Do you review the record of the surveillance in your branch?
A. No, sir, I do not; no.

Q. Do you review the records in connection with repairs, replacement of hull sections or hull portions?
A. The records that I see, sir, are usually the monthly reports of defects found per hull per area.

Q. Any kind of defects, whether it's porosity or slag, or one of the many other kinds?
A. Yes, sir. I don't as a general rule look at the documents as they're handled by the inspectors. I know that they have them and I know that I put out the procedures on how they are to be handled. I would go back to this audit. Any infractions that a welder might be involved in, I would see this deficiency report; in fact, I see all of those.

Q. Who then does the analysis of the various kinds of flaws and prepares reject rates and statistics?
A. We compile each month the total, for instance, by boat, each type of defect; in other words, per type of joint or per type of structure. This is broken down this way so that we can get a good look at where our most -- well, for example -- by looking at these records you can tell month by month, or you can anticipate where you're likely to find most defects and this is where you try to do your most work to try and bring this into line so people can see. We bring it to their attention and take every precaution we can.

Q. You say you bring it to their attention -- to whose attention do you bring it?
A. The welding foreman gets the reports, the welding engineer also gets these reports. They are submitted to the Bureau, by the way, each month, per structure, per vessel -- it breaks it right down, whether it is longitudinal, transverse, porosity, slag, lack of juice, and things of this nature.

Q. Does the groupmaster of the structural group of shops receive this report?
A. Yes, sir.

Q. Do you know of any conference which they may have had to attempt to improve the kinds of situations that are reported by these defect reports?
A. I know that the groupmaster takes this report and he goes to his welder foreman and they look this over and arrive at different -- in fact, I believe the groupmaster asks for explanations of why this might be so, and they go into it from there.

Q. Do the individual welders know what kind of performance they are giving to the shipyard?

A. Other than any tradesman knowing whether he is a good tradesman or not, I don't think there's a way that you could show him degrading facets of his work because, as you know, sir, it covers great lengths and has many passes. In one step there might be four or five journeymen involved, and it just isn't feasible to segregate the welder per foot of weld -- just can't seem to do this.

Q. So then the defects found are not necessarily tied back to the individual welder?

A. That's correct. We tie it to the leadingman. In other words, we know what leadingman is responsible for a seam in a section, and we can associate that with him but we cannot with the welder himself.

Q. Now there were several access cuts made in hull of THRESHER during PSA, I believe?

A. Yes, sir.

Q. Were the hull replacements in these accesses done in strict accordance with the procedures outlined in the BUSHIPS directives and the Shipyard directives for HY-80?

A. To my knowledge they were, sir. I have not yet had a chance to evaluate the total package to see that each and every record is there. Of course, that would be the proof of the pudding. If the record was there, then you would assume that it was. I have those put into packages by jobs and I am putting a description there, and I hope to get through these and tie record to operations, which, in my opinion, should have been done. I'm sorry, I don't believe I can answer you.

Q. You are in the process of gathering these records and you will, perhaps, at a later time be able to answer this question?

A. Yes, sir. I am not prepared to answer it right now.

Q. Do you know of any deficiencies in carrying out the applicable instructions?

A. I know of none right now, sir, no. I can quite accurately say that none were brought to my attention.

Q. From the best of your knowledge then, at this time, THRESHER went to sea in early April with all of her hull intact and having been subjected to the required Bureau of Ships surveillance plan?

A. Yes, sir, that's true.

Questions by a member, CAPT OSBORN:

Q. You seem to be quite impressed by the BUSHIPS specifications on this particular welding deal. Is this because you wrote it?

A. I had nothing to do with it, sir. I know it's not the thing for one man to tout another man's work, but I believe it keeps quality assurance -- well, it covers just where to go, what the requirements are. These were all top notch engineers in the field who wrote this. They were a year in the writing of this.

Q. I thought you might have had something to do with it when you were down at the Bureau of Ships.

A. No, sir, I lay no claim to that.

Q. The Quality Control Program, as such, has really been established on the follow ships with respect to the details of surveillance, as contrasted with the THRESHER, which was constructed really before the program was as full blown as it is right now?

A. That's exactly true.

Q. Are you sure from your own experience, familiarity with the particular conditions in the THRESHER, that she was of the quality as your follow ships will be?

A. As I stated previously, I have been only in quality assurance for two years. Are you referring to the initial construction of the vessel or PSA?

Q. Well you can run into two situations here. We have certain sections of the hull worked on during PSA, but the majority of the THRESHER's hull was constructed well before 1960. Now I'm sure that your group inspected certain sections of the particular hull and took extreme precautions because of the shock test and everything else. Was there anything you discovered that wasn't of first order of workmanship?

A. I would say -- I would like to confine this answer to the PSA -- and to my knowledge was discovered, I heard of nothing, outside of the work that was to be done, you see, and the surveillance, that would lead to any other conclusion. I don't think I have answered your question, but I think maybe it's that I don't quite understand it. Perhaps you could put this in some other way.

Q. I am confident that when the THRESHER went through shock tests that you were looking for certain affects on the hull and you did, perhaps, a greater degree of examination, perhaps, in retrospect with respect to quality control, to see if the quality were there. Did you see anything in your records on examination that wasn't of first order of quality?

A. No, sir.

Questions by the president, VADM AUSTIN:

Q. Mr. Bragdon, is there any inspection of welding skills of personnel who do the welding on these hulls in these yards by personnel not employed by this yard?

A. No, sir.

Q. Are you sure?

A. I should qualify that. To my knowledge there isn't, sir.

Neither the counsel for the court, the court, nor the parties desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

WITNESS: I would like to put on the record that I believe that this was a sound hull according to specifications. I have a lot of faith in the people that did the work on it, sir.

Neither the counsel for the court, the court, nor counsel for the party RADM Palmer, desired to examine the witness further.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

The court recessed at 1730 hours, 22 April 1963.

The court opened at 1741 hours, 22 April 1963.

All persons connected with the inquiry who were present when the court recessed were again present in court except Captain Saul Katz, U. S. Navy, who was relieved as counsel for the court for the examination of the next witness by Commander Charles Davis, U. S. Navy, assistant counsel.

(b) (6) , Torpedoman's Mate First Class, U. S. Navy, was called as a witness for the court, was duly sworn, was advised of his rights under Article 31, Uniform Code of Military Justice, and examined as follows:

The witness was warned not to testify concerning classified matters.

DIRECT EXAMINATION

Questions by assistant counsel for the court:

Q. State your name, rate, organization and present duty station?
A. (b) (6) , Torpedoman First, U. S. Navy; present duty station on board the USS ALBACORE (SS-569).

Q. Would you spell your last name for the record?
A. (b) (6)

Q. (b) (6) , when did you enter the Navy?
A. First of October, 1947.

Q. What was your first duty station?
A. I went through Great Lakes Boot Camp, SubSchool, then to the USS CATFISH.

Q. How long did you serve on board the CATFISH?
A. I was on the CATFISH nine years.

Q. Then where was your next station?
A. I went to Advanced Underseas Weapons School, Key West, Florida; and then to a year and a half shore duty at Advanced Underseas Weapons Shop, New London.

Q. What was your next duty station?
A. Then I went to the CUTLASS in Norfolk; it's a submarine also.

Q. Did you serve on board THRESHER?
A. Yes. I reported aboard THRESHER the first of January, 1961 -- the first part of January.

Q. When were you last serving on board THRESHER?
A. I went on leave the morning of the 9th of April, 1963.

Q. What duties were you assigned while on board THRESHER?
A. I am leading torpedoman, in the torpedo room, third platform. In port I stand below decks watch. This is in duty section status.

Q. What were your duties under way?
A. Under way I stood third platform watches which consisted of the torpedo ready room, the 20 man berthing area, and area generating room.

Q. (b)(6) , in comparison with submarines on which you have served, and based on your experience and association with the crew on board THRESHER, what was the state of morale?

A. It was a happy crew. The state of morale was awful high. They worked well together as departments. All the men pitched in on all jobs. There was very few squabbles. You are bound to have a few differences of opinion and what not on a submarine.

Q. (b)(6) , so far as material is concerned, in the area of your responsibility, were there any defects when THRESHER returned to Portsmouth Naval Shipyard for her post shakedown availability?

A. Yes, sir. We had quite a few defects due to the testing in Florida, and we were limited in our depth in coming back from the Florida tests.

Q. Did you have any other areas of general problems--defects?

A. Our hydraulic system was cellulube at the time and all these valves had to be worked out, off and on, to keep them in proper working order. This was prior to PSA.

Q. Based on your own personal knowledge were there other defects present on THRESHER when she arrived for her post shakedown availability?

A. The air system was kind of shaky. We were having a lot of trouble with our air system at the time. This was due to reducer valves not being built up to snuff. These were repaired by the Yard.

Q. To the best of your knowledge, (b)(6) , were all the deficiencies which you knew of satisfactorily corrected while THRESHER was in the Portsmouth yard.

A. Yes, they changed the hydraulic system over to 2190 oil and after our second "fast cruise" everything seemed to be going properly, working out pretty good.

Q. You spoke of the second fast cruise, were you on board THRESHER during the first "fast cruise"?

A. Yes, I was.

Q. For the equipment for which you had responsibility, can you recollect any deficiencies or defects which were brought to light during the first "fast cruise"?

A. In the third platform we had trouble with our air manifold. This is impulse air to the torpedo bottles. The "O" rings were giving way on this manifold and it seemed the piping was out of align so that the "O" rings were breaking down. Now we also had the two reliefs on this manifold were pulled during the PSA period here and dirt and grime and crud was found in them. They were renewed with new valves. They were sent to the boat and on the valve it says "2000 pound relief." Well that's what it was set for. Actually, the relief was supposed to be 2240. Now the starboard nest we had high velocity readings which was due to the tubes sitting so long that the system had to be worked out and the firing valves adjusted and everything, and once it was worked out, it worked right in with our velocity readings, come up to snuff, I'd say approximately a good reading on them; but they were getting high readings, and once they worked this out the reading dropped down. Prior to undocking when we got out of drydock--this is the drydock that we went into for the main overhaul--the WRT tanks and auxiliary tanks weren't complete when we undocked. The covers were still off and they had a lot of welding left yet to do in the tanks. They were building up stiffeners in the tanks. Now these should have been in drydock or in the water but these tanks weren't completed until about approximately three months before the fast cruise.

Q. Turning your attention to the period between the first and second fast cruise, were the deficiencies which you have spoken of corrected?

A. Yes, they were.

Q. Turning your attention to the second "fast cruise", did this uncover any additional deficiencies?

A. No, there weren't. Everything seemed to go well the second "fast cruise", which was a period of 24 hours. All the equipment was worked over and it seemed to be checking out okay.

Q. During the final phase of the repair work and prior to your departure from THRESHER on the morning of 9 April, were all deficiencies in your area of responsibility corrected to the best of your knowledge?

A. Yes, they were.

Q. On the basis of your personal knowledge, do you know of any uncorrected deficiencies on the THRESHER at the time you left the ship?

A. No, not that I know of.

Q. When did you leave the ship?

A. I got my leave papers and I was signed out by the duty officer at 6:30 on the morning of the 9th of April. I left the ship at approximately 7:10.

Q. (b) (6) , are you presently under a doctor's care?

(b) (6)

Q. (b) (6) , turning your attention back to an earlier question with regard to your answer, that THRESHER was restricted in depth after the Florida tests, do you know whether or not it is a routine matter to restrict the depths of submarines following tests off Florida?

A. We were restricted in depth because a problem had come up with the hydrophone. We had a leak in it. The hydrophone was topside on the first platform going through the hull. These hydrophones in this period were all changed to tank locations and a patch was put on this hydrophone where it was in the hull.

Q. To the best of your knowledge, was this deficiency corrected during the Portsmouth post shakedown availability?

A. Affirmative, yes, it was.

(b) (6) relieved (b) (6) as reporter at this point.

EXAMINATION BY THE COURT

Questions by a court member, RADM Daspit:

Q. (b) (6) , you referred to some work being done in drydock when they were welding stiffeners on the water round torpedo tank--the WRT.
A. Yes.

Q. As I understand it, this was the earlier docking of the ship and had nothing to do with the docking just before the ship got under way for the sea trials.
A. That is correct. I stated that this was the first major docking period.

Neither counsel for the court, the court, nor counsel for the party, RADM Palmer, desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement concerning anything relating to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

WITNESS: Yes, sir. On these reliefs that I mentioned, I might add these two reliefs are on the impulse manifold which has nothing to do with blowing of the tanks or anything like that. But these reliefs were pulled and there was an awful lot of dirt and crud and the auxiliaryman was going around steadily cleaning filters, and there was one instance where Reagan actually found a spike in a filter. This was back in the engine room. I actually seen the spike. He took it up on the barge. This was during the mid-period of the overhaul and he gave it to Chief Arsenault. Arsenault took it to the engineering officer and showed it to him.

PRESIDENT: What kind of a spike was it?

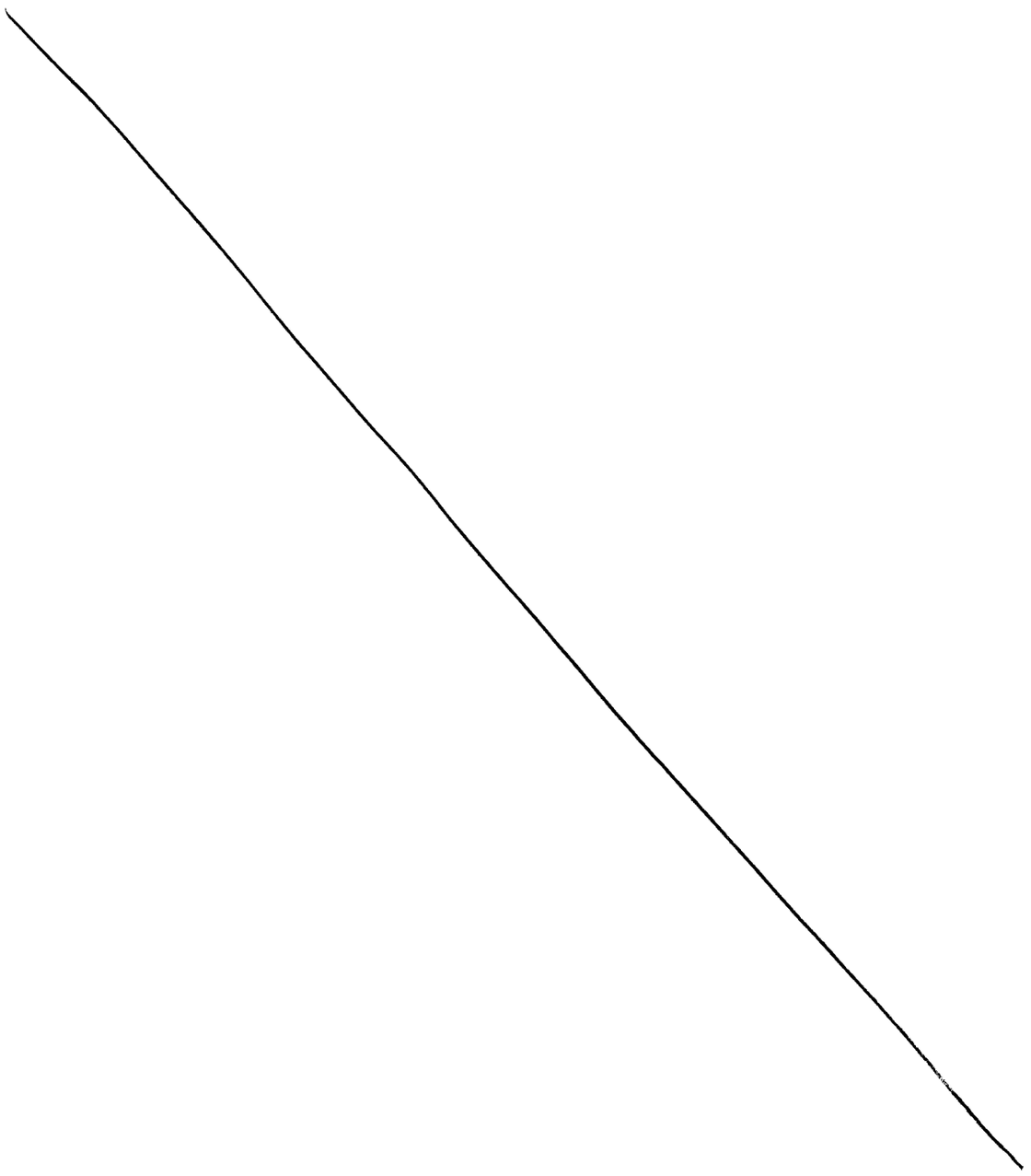
WITNESS: This was a spike, oh about that long, (indicating) like a nail. Now our hydraulics had always been sort of bad in that we had the cellulube with Butyl "O" rings. This butyl is supposed to be for cellulube for sealing purposes. We have always had difficulty with our hydraulics in that you had to operate them continuously on a regular basis or else they were unreliable and especially on our torpedo tubes. If we didn't operate them, we had to push buttons or operate them manually and work this cellulube out for operation. Now they used it with the regular hydraulic oil and they had to change all of these "O" rings and this was accomplished by the Yard. They pulled all the automatic valves and checks and flow control valves and renewed all these "O" rings and it seemed like the hydraulics was working a lot better. Our trim and drain we used to always comment when Mr. DiNola had the dive that on the midwatch, especially at deep depths, the trim and drain you'd flood a tank and it sounded like a train running through the living room. That is how noisy it was. We used to say "Mr. DiNola has the watch; there goes the night train." One time--this was on our first test- the Nash float valves--this is a ball valve that is in the high spot of the trim line--one of these Nash float valves was actually crushed by the pressure. This was remedied by the Yard by putting in valves to cut off these Nash float valves in the line on rig-for-dive, so

in "rig for dive" this was on the rig for dive list, so that these valves were shut, but the trim system took an awful beating, you know slamming, regularly with the pressure that you are operating at. I think that is about all.

The witness was duly warned concerning his testimony and withdrew from the courtroom.

PRESIDENT: The court adjourns and will spend tomorrow in reviewing testimony already taken and working on a review of some of the exhibits we have and we will not meet until Wednesday morning at nine o'clock.

The court then adjourned at 1802 hours, 22 April 1963.



TENTH DAY

Portsmouth Naval Shipyard
Portsmouth, New Hampshire
Wednesday, 24 April 1963

The court met with open doors at 0903 hours.

All persons connected with the court who were present when the court adjourned were again present in court.

James C. Rogers, civilian, was called as a witness by the court, was informed of the subject matter of the inquiry, was advised of his rights against self-incrimination, was duly sworn, and examined as follows:

The witness was warned not to testify concerning classified matters.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation.
A. My name is James C. Rogers, (b)(6) Maine. My present occupation is Assistant Quality Assurance Superintendent, Portsmouth Naval Shipyard.

Q. How do you spell your last name?
A. R-O-G-E-R-S.

Q. What is your Shipyard code number?
A. My Shipyard Code Number is 303B.

Q. Please explain briefly the nature of your duties?
A. I have under my direction five branches--the Quality Assurance Engineering and Analysis Branch; the Inspection and Test Branch; the Materials Test Laboratory; the Electrical Test Laboratory, and the newly organized Non-Destructive Test Branch. That is the most recently organized branch, the Non-Destructive Test Branch.

Q. What is your background and experience in this field?
A. I came to the Shipyard in 1936 as an outside machinist. A little over three years later I went to work for Mr. Harold Preble in the Inspection Division and I've been in that general line of work ever since. In 1952, Mr. Preble died and I took charge of the Inspection Division.

Q. The particular area of interest in my initial questioning will devolve upon the non-destructive testing and laboratory analysis procedures of this Shipyard. Will you, therefore, briefly describe the function of the services performed in this area and the type of inspections performed?
A. In the area of non-destructive tests, there are three main areas: Radiography, where we perform radiography on all structural welds and pipe welds as the primary function.

Q. Now would you just touch first the three main areas and then I will ask for details.
A. The other would be ultrasonic inspection; the third is magnetic particle inspection.

Q. Is there an area called chemical and spectographic inspection?

A. There is support in the Materials Testing Laboratory. We have the chemical analysis and material identification which supports the Shipyard, yes, sir.

Q. Now, are these testing functions, functions which you provide as a service to the inspection branches?

A. In most cases, the inspections by the non-destructive test groups are a function of the shipbuilding inspector. In other cases, a function to the shipyard--serving the Shipyard, excuse me.

Q. Turning now to the first general category of inspections that you mentioned--radiography--

A. Right, sir.

Q. --tell us enough about it, briefly, so we will understand the capability, the reliability of these tests and the primary applications of them.

A. In radiography, we have a primary function of radiographing all structural hull welds that are required to be RT'd.

Q. Would you please explain your abbreviation?

A. RT stands for radiography test in all cases, plus all piping welds. We have the capability of x-raying any thickness of material that we have here in the Shipyard. We have x-ray machines, several of them, up to 300 KVP, radioisotopes of radium and cobalt of varying Curie strength capable of performing radiographic work.

Q. Do you have enough equipment to handle any problem which comes up with regard to submarine construction in this area?

A. Yes, we do. We have enough equipment--and very fine equipment.

Q. Tell us a little about the kind of people you have, whether they are trained and whether you have enough of them to do the job assigned.

A. In the non-destructive test branch of radiography, I have approximately between 80 and 85 people. We have enough people. The radiographic operators are recruited from the appropriate journeyman trades. They are selected from a register and we give them a six-months on-the-job training with an approved Commission trainee plan. At the end of this time they are Metals Inspectors. These men at that time do not go out alone. They are teamed up with our more experienced people. Normally, a radiograph team consists of -- in this shipyard -- two men. Our men are well trained.

Q. You told us the primary application of these tests are hull, pipes and valve fittings, is that correct?

A. Yes, sir. I might add also, "and castings."

Q. Now, were such tests made on THRESHER in both her construction period and her period of post shakedown availability?

A. They were, both structural and pipe, nuclear and non-nuclear.

Q. You have told us about the people and the equipment. Now how good are they? Do they find defects, and when you dig into the material do you confirm that there were defects?

A. Yes. Our degree of quality or our quality of our film is such that defects, when they are there, are readily apparent with the present-day techniques in radiography. We have fine-grain film and we acquire a good sensitivity level. Defects are easily discernible in the film. Discontinuities or defects are readily discernible.

Q. You say, "readily discernible." Is it possible that one of these inspectors might not think there was a defect and another man looking at the same borderline x-ray might think that there was?

A. No, sir. They would both--a good reader-- they would both see the defect. You say a borderline case. It could be one reader would perhaps say that it was within the standard. The other reader, when he evaluated the defect, might say it is in excess of the standards. When you get down to this fine point--perhaps as an example, if I might cite one, would be a slag inclusion where perhaps one reader sees a little tailpiece on it, makes it a little longer and, therefore, goes over the limit. Those are very close cases. Any, of course, gross defects, or any defects that are outside the standard are readily ascertained.

Q. Who sets the standards and how do your inspectors have the standards promulgated to them?

A. The Bureau of Ships sets the standards through Bureau of Ships Instructions. For instance on our hull, the standard is NAVSHIPS 250 637-3; fabrication and welding of HY80 is spelled out. In the piping areas the nuclear power have their 1500 code which they evaluate. And we have, in the present case, NAVSHIPS 250 693-2 as modified by Bureau of Ships messages or change orders that have been in this past summer promulgated from the Bureau in this area. There have been changes. These have been made available by me to my radiographic inspection through my supervisors to my readers. They are readily available. In other words, they know exactly what standards they are supposed to be reading in any particular area.

Q. What happens when they find something which violates the standard and is considered faulty?

A. In the case of radiographs, the ship is notified of a defect in the structure or pipe, as the case may be, through a formal process. The defect, in the case of structure, is marked out on an overlay, a sort of Vellum which you lay over the film, and mark the defect out, so it can be taken to the ship, marked out on the hull, and then arc-gouged out, as the case may be, to remove the defect.

Q. Is there reinspection provided for it?

A. There is. Then before the record is cleared, we have to have a re-x-ray. If this defect, when going to the ship, is an obvious surface defect, it may be taken out by surface grinding and would not be cause to radiograph, but the record has to be clear, either by that statement or re-radiograph.

Q. Are there records of all such inspections performed on THRESHER both during her period of construction and post shakedown availability?

A. During her post shakedown availability, there are. To the best of my knowledge, they exist for the new construction period. I have been through all of the sequential item numbers and we have them all to the best of my knowledge on new construction. There is quite a volume.

Q. Turning now from the radiograph inspections to ultrasonic inspections, again we would like to cover the same areas, the capabilities of such a system and the people who operate it, the accuracy of it, the primary applications of it.

A. Ultrasonic has two main purposes here at this Shipyard. We have used it for many years in the soundness inspection of receipt material, structural hull plate, frames, in general other structures as called for, but generally plate and frames. More recently we have used this in the determination of the per cent bond in sil-brazed pipe fittings. About a year ago, in fact in early '62 we sent two men to Mare Island who had quite a bit of experience here in this Shipyard on sil-brazed inspection, sent them out there to qualify these men so that we could get

on with this program here at this Shipyard. We have sent men to Watertown Arsenal for training in this area. We have trained our own men as a result of our Mare Island experience. Today we have six people who are well qualified in the ultrasonic inspection of sil-brazed joints. This is more refined, I might say than the plate inspection. These men were previously qualified for the use of fitting guage or reflectorscope in the plate work.

Q. You then have trained men. Do you have enough of them to do the jobs laid on your department?

A. Yes, we have enough to do the jobs right now. I might add that we are getting into other fields of ultrasonic whereby we are supporting the radiography in the determination of the location of defects, particularly in thick structures in a weld. If there is a defect we will go in with the ultrasonic sound wave and pinpoint that area making it much easier to know which side to go on for the defect. Our people are working at that.

Q. But pinpointing THRESHER, did you conduct ultrasonic inspections of her both during her construction and her post shakedown availability?

A. Right, as a result of Bureau of Ships Confidential letter which came in on THRESHER--I have the reference here if you wish.

PRESIDENT: Please give us that.

WITNESS: It is serial 525-0232 of 28 August 1962.

Q. Will you produce it please for the inspection of the court?

A. I haven't the letter here but this is a reference. The letter is in my safe, sir. I am sorry.

PRESIDENT: Mr. Rogers, it is highly probable that that letter will contain classified information so be on guard not to divulge that.

WITNESS: Yes, sir. Primarily that letter told us in this Shipyard to proceed and ultrasonically inspect certain silver brazed pipe joints in specific systems, first of all between the main sea stop and the backup valve in the salt water system. There was the trim and drain, the Auxiliary salt water system and the stills, and other systems. We proceeded on that job and inspected a total of 190 joints with ultrasonic. Other joints were inspected on the THRESHER as a result of rejects and new work put back. As a result of certain alterations there were a number of joints inspected.

Q. Would it be correct to say that during the post shakedown availability you used the ultrasonic inspection process on not only plates and frames, but joints, but during the construction process the use of these inspections was limited to plate only--plates and frames?

A. I'm afraid I didn't get that, sir.

Q. During the construction period were ultrasonic tests and inspections conducted only on plates and frames?

A. Yes, sir. During the construction period we did not use ultrasonic at all. We didn't have the capability.

Q. To use it on joints?

A. To use it on joints, either on the THRESHER or any other ship under construction during that period. It has only been since about early '62 that we have had the capability of using ultrasonic or silver-brazed pipe joints two inch and up.

We do not at this time go lower than that.

Q. You told us you had an adequate number of people to perform these tests on THRESHER?
A. Yes, sir. We gave her the best two men we had in the outfit, who are slow, careful and meticulous men who worked on the ship.

Q. In your judgment, and if you know, in their work did they have adequate equipment to perform the tests required of them?
A. Yes, sir, we did and we used the sonar ray Model 50, which is adequate to do this job.

Q. Do you have the same level of confidence in ultrasonic inspections as you expressed in the case of radiographic ones?
A. I have that confidence, the same confidence. However, I might point out that in radiography the film is corrected; the man's signature is there that he did the job and you can see the work. In ultrasonic work, a man looks at a screen and makes a determination from his observation of the oscilloscope--the screen--whether he has a satisfactory bond or not. He has to be, I feel, a highly skilled man, with absolute integrity.

Q. And your standards have to be high, I imagine.
A. You have to know exactly where your standards are, sir.

Q. Again, who issues the standards, who sets the standards, and how is this information passed to the inspectors?
A. Well, in the case of standards of ultrasonic, we, in this THRESHER case, went by the confidential letter to which I referred. The standards in this area, the per cent of bond, have varied in six months a certain amount back and forth through documents which are on record. The Bureau of Ships has put out an instruction but to my knowledge, at this present time--I may be wrong I haven't seen it--there is a change order that revokes it. However, we are going by that and our Production Department instructions tell us exactly how much, what percentage of bond is allowed on any particular class of ship, new construction or overhaul. It is spelled out.

Q. Is that true in the case of THRESHER?
A. Yes, sir. I have the information right here, exactly how it went. On the 17th of August, 1962, we were using 50 per cent bond criteria.

PRESIDENT: I believe this is repetitious. We have information already in the record.

WITNESS: You probably already have it, sir, all right, sir.

PRESIDENT: It went from 50 to 60 and then back. I remember that.

WITNESS: It did, sir. It fluctuates.

By counsel for the court:

Q. You mentioned the two inspectors. What are their names?
A. Mr. Charles Lamprey and Mr. Clarence Colby, who did--I can't say all the work but a great part of it. The records will indicate that. We do have a record made and this is the form we use to record our per cent bond.

Q. Just mention the form number for the record please.
A. Would you like to see it? (Hands to counsel for the court)

Q. Yes, this is Form Number 1773?
A. Yes, sir.

Q. Of 6-62. Proceed.
A. Those are on file in our office for each and every joint that was done, showing the degree bond and the man who did it.

Q. Do you also have records of the tests performed for plates and frames?
A. That would be for the new construction period?

Q. Yes.
A. I can't answer that. I wasn't involved in that. Our outfit wasn't involved in it at that time, but the records are available. I do not have them. I might add that in this ultrasonic test business we were speaking about the degree of integrity. A man is checked, checked with machine; he is checked on a test piece in order to ascertain the fact that he is getting a correct reading and we do, on occasion, send another team down to double check an exterior joint, so we do have, you might say, an internal audit ourselves by our supervisors or our technicians on the reliability of our people doing this work.

Q. And, again, when defects are found, are the same procedures called into effect?
A. This information goes back to Shop 56. Repairs are made or the joint is ripped out and our records would hold a defect until that joint was cleared or a new joint substituted. In other words, we have to clear our records and that would indicate that job was satisfactorily completed. It may go back and forth, but there is an eventual cleared slip that stands in our record which shows what the job was, the action taken to delete, change over or repair.

Q. Now, a third type of inspection, sir, that was mentioned by you is chemical and spectographic. Would you again tell us its applications, your capabilities to perform it and the accuracy of such tests?
A. All of this work is done by our Materials Testing Laboratory under the direction of Mr. Sheehan.

Q. Would you spell that, please.
A. S-H-E-E-H-A-N.

Q. He has seven chemists, a couple of student chemists, and three metallurgists who perform this work. He provides a service to the Supply Department on incoming material that doesn't, or hasn't, had the vendor's certification. Material in shop stores is sent to the laboratory for analysis and this analysis may be to identify the material, which is a quick method to ascertain that it is the correct material. This will be usually field work. In the case of supporting Supply, it may be material certification which means a complete analysis by chemistry or spectro to determine that the properties are as required.

Q. Well, did you, during the period of THRESHER building and post shakedown availability, have enough people and enough equipment to meet your responsibilities in this area?
A. We have enough people to adequately carry out our responsibilities in the laboratory and this also includes such things as analysis of water, oil, samples brought from the shops or from the ship. It is water, as well as material. There are other functions that the laboratory performs that are not concerned with the overhaul of a ship.

Q. Is it a correct conclusion to draw from your testimony that any material used in a submarine is positively identified?

A. Not necessarily by the laboratory but through processes either by Supply's record, material marking, certificates, we are certain that it has been properly identified.

Q. Now, the last general category which you mentioned, of inspection, was magnetic particle inspection.

A. Yes, sir.

Q. Will you describe that for us.

A. Magnetic particle inspection is done by our hull shipbuilding inspectors, primarily on first of all structural hull welds, have to be MT'd would be the abbreviation--for surface discontinuities, or defects. We have 30 qualified people in this inspection in this area, plus ten supervisors who are qualified to do MT work. We have two methods of doing it. We use the AC Yoke and the prod method, the AC-DC rectified prod. These men are qualified by going through a formal qualification. We have test samples which are very carefully taken care of, with known defects on them. These men must pass at least a 90 percent finding of all cracks before we send them into the field to do magnetic particle inspection work. This takes about an average of at least four weeks to qualify, to qualify a good man to do this work, four to six weeks. It is a meticulous sort of job. A man must have good eyesight. He is looking at very fine cracks in welded material under adverse conditions, usually. So he must be very careful to go over this material very thoroughly. We do cover all structural hull welds a hundred percent. I imagine Mr. Bragdon in his presentation might have covered some of this area.

Q. You speak in the present tense. Were tests of this nature performed on THRESHER during her construction period as well as her post shakedown availability?

A. In the new construction period this was a responsibility in magnetic particle inspection, was a responsibility of Shop 26 with a spot check and random sampling done by our shipbuilding and inspectors only in critical areas due to configurations or geometry where we felt there might be a prevalency for cracking, our inspectors would double check those areas after 26 had checked them, and other areas on a random sample during post new construction.

Q. During post shakedown availability?

A. Since then responsibility has become one of the quality assurance division whereby we now have to perform a hundred percent of the MT work which we do and did on the THRESHER. All patches, inserts, on the THRESHER were MT'd.

Q. Do you regard the number of the people, their competence and equipment at their disposal to perform these tests, adequate to do the jobs required of them?

A. I do, sir.

Q. As to the reliability of such tests, it is not true that again, unlike the x-ray process there is no physical visual record of the tests?

A. That is correct, sir. There is no physical record. We keep records, quite complete records of all of the areas covered by footage and our findings. In fact this is to support NAVSHIPS 637-3 and our submission of our monthly reports to the Bureau. This is a requirement. We do this. We also perform, as in the case of ultrasonic, a spot check of our own people by supervisors or a man we figure highly qualified to do this work.

Q. One last question with respect to this work. Who sets the standards and how do the men who perform the tests learn of the standards?

A. The Bureau of Ships, NAVSHIPS Instruction would set the standards, but in this case it is sort of a "No Go" affair. There will be no cracking. You will have no cracking. That is the standard; there will be none. If you see any discontinuity or any cracking it is immediately rejected. A report is then sent to Shop 26 for repair and our records will stand until cleared.

Q. Thank you. Now, you told us in all of these tests, when a defect is found, the matter is reported and kept open until the matter is corrected to the satisfaction of the inspectors. Does it happen, for example, in the case of the sil-brazed joints inspection that you might find, what you consider an inordinate number of defects as a result of the work of a single worker?

A. That is true. I don't know it to apply to the THRESHER. I have no knowledge of that on the THRESHER, but, in general, or on other construction I know that has been the case here when we have found a high rejection rate and the man's check number on the slip so this can be traced back. And in this particular case, on one particular ship, my supervisory inspector in ultrasonic went to the quarterman in Shop 51 and the matter was taken up. The man was taken off the job. This now also takes place in the case of radiography in the butt-welded pipe. If we get a high rejection rate, the foreman in Shop 26 is notified so he can take corrective measures and action as necessary to train his men or to remove them to improve his reject rate.

Q. Do you learn of the final action taken in the case of individual personnel?

A. I do not.

Q. One last question on this phase of the test program to which you testified up to now: you have told us about the tests, but who determines what test will be performed and on what?

A. In which area?

Q. How do you get instructions to conduct tests?

A. Well, our documents, and our instruction is to conduct testing would come from the Planning Department, from the P & E, Planning and Estimating Superintendent. In the case of overhaul, restricted availability or of PSA. It is spelled out by them what areas we will cover. Now, in the area target we have talked about up to now in nondestructive testing, if they cut a hole in the hull, make alterations to pipe runs, this would be required not by the job to us, but by the general job order to the shop and we are a service to make sure that this work is performed, -- RT'd, UT'd, and MT'd. But in the case of other work tests and inspections to be performed, it would be the responsibility of the P & E Superintendent.

Q. Now, a new category under this same area of nondestructive tests that deals with shipboard tests and inspections: Can you first tell us the applicable instructions for THRESHER which dictated shipboard tests and instructions?

A. Test memos were issued to the Quality Assurance Division, job order briefs requiring tests or inspections were issued. These were all documented so that we had a complete package of Portsmouth Naval Shipyard THRESHER test check off List PSA Non-Nuclear. (Hands document to counsel)

The cited document was then examined by the court, and was offered in evidence. There being no objection by counsel for the party or the court, it was so received and marked as Exhibit 69. Counsel for the party, RADM Palmer, waived reading the exhibit at this point.

Q. What were the applicable instructions of the Shipyard with respect to shipboard tests and inspections? Is there an overall governing instruction?

A. Yes, sir, there is. Portsmouth Naval Shipyard Instruction 4855.2, a Shipyard instruction delineating the responsibility of various codes in both the Planning Department and Production Departments. We have the responsibility to carry out the test memos, test procedures as issued through the Planning and Estimating Superintendent. Our responsibility is to conduct these tests, witness the tests, make a record and turn the results back in to the Planning Department.

Q. Was this instruction applicable to any period of THRESHER's post shakedown availability?

A. Yes, sir, the whole of it.

Q. Let me ask you a question then. To what, then, does the Shipyard Instruction 4730.A of 15 March 1963 apply?

A. That is a new instruction, sir, a Production Department Instruction and it has to do with this same general area of further defining the responsibilities in the Production Department, exactly who will have the responsibility for what action and it is applicable to the 350 DOGFISH and subsequent ships undergoing overhaul or restricted availability.

Q. It did not apply at all, then, to THRESHER?

A. No, sir, we did have other documents, the Shipyard document.

Q. With regard, then, to shipboard tests and inspections, can you define the responsibilities of ship's force, Design, Planning and Engineering and Production in the conduct of such tests?

A. First of all, with respect to the tests that 303 conducts, we have the ship's force company present when we conduct the tests. It is not a mandatory, but it is a courtesy, and we extend it to them, of course. The ship's force in the 593 had certain areas of responsibility and they were on a document which I have here.

The cited document, Ship's Force Test Schedule, was then examined by the court and was offered in evidence by counsel for the court. There being no objection by the party or the court, it was so received and marked as Exhibit 70. Counsel for the party, RADM Palmer, waived reading the exhibit at this point.

Q. Proceed.

A. The Planning and Estimating Superintendent would indicate the scope of the test. This being issued, it would be the responsibility of those of Quality Assurance Division, as I have indicated, to carry them out to see that, in fact, they were accomplished in accordance with the test memoranda or job orders brief as issued. This was done.

Q. Weren't there some tests which were to be performed by the Ship's Force, themselves?

A. Yes, sir. I would assume that they were all on that document I just gave you, sir.

Q. With relation to the tests performed, shipboard tests and inspections performed, on THRESHER during her post shakedown availability

period, do you know, of your own knowledge, that every one understood his area of responsibility so that there was no chance for something to fall between the cracks and not get done which ought to be done?

A. Right. Yes, sir. The documents that I presented first, our area of responsibility pinpointed it for the shipyard exactly what the Quality Assurance Division was going to cover. The latter document would indicate the ship's force responsibility. Then, of course, there is the overall schedule. I don't know whether it is of interest to you at this time, but this shows the work that the shipyard undertook. Now, probably this has already been given, but this indicates the shops that do the work, the shop and support necessary. I repeat that among these three documents the whole work package was pinpointed explicitly.

The cited document was then examined by the court and was offered in evidence by counsel for the court. There being no objection by the court or the counsel for the party, RADM Palmer, it was so received and marked as Exhibit 71.

WITNESS: To answer your question more explicitly, I know of no area that was not nailed down as to responsibility.

Q. Did you ever have any difficulty in that inspection, any confusion, if you remember, as to who would do a test during post shakedown availability?

A. No, sir, we worked closely quite closely, with the ship's force.

Q. If the job orders, brief test memoranda, or work instructions required the system or component to be tested, whose obligation was it, the obligation of which code would it be, to see that the job was done?

A. It would be the obligation of the responsible code that had to accept the job to see that it was accomplished.

Q. What if the job fell across the responsibility of two shops?

A. There is one particular shop which will carry the lead. One shop or the other would have the responsibility to see that was done, and that would be our contact point with that particular shop through supervision.

Q. Now, you have testified to this before, but I want to make sure. Do you determine what is to be tested--does Code 303 determine what is to be tested?

A. No, sir.

Q. That comes from?

A. Planning and Estimating Department.

Q. Planning and Estimating?

A. Yes, sir.

Q. Supposing Planning and Estimating job orders, in your judgment, left out a vital element of the test. What would you do?

A. Call it to the attention of supervision of the Quality Assurance Division and telephone communication and memo would be forthcoming from 303 to the Planning and Estimating Superintendent pointing out this and asking action to be taken and we would follow through on that to

see that it was done so they either convinced us that it was not necessary, which could be the case--that is the case occasionally that we think something should be done and they point out to us through their engineering service that it would not be a requirement, in which case it would be deleted. But we would ascertain to our satisfaction and get a satisfactory answer.

Q. What I am trying to find out is whether your people are alert not to follow out their test instructions blindly?

A. I would say, definitely, that is the case. They use quite a little bit of initiative in that area.

Q. Now, there is an area I would like you to explain for the record. Is Code 303 as deeply involved in tests of overhaul and repair work, and I mean to include THRESHER's post shakedown availability in this, as they are in new construction work?

A. Code 303 is not deeply involved in overhaul or restricted availability or PSA and I think the indication of the scope of the work on that document submitted would indicate our area of responsibility, and it is much less than on new construction. On new construction, there is a test memo or a document that covers every test to be run or every inspection to be made and it is not always the case as complete on an overhaul.

Q. The test and inspection package is clear cut andclearly defined in the case of new construction, is that correct?

A. In its entirety. We have a complete set of test memoranda, that are actually our working instructions, our obligations to fulfill.

Q. But, in other than new construction, is it possible that there could be shops in some areas which have complete responsibility so that you might not be involved at all in the test and inspections?

A. Yes, there is certain work that goes on by the Shop that 303 might not have any cognizance over.

Q. Can you give us some examples?

A. I can't give you any specific ones on the 593 PSA.

Q. But, in general, could this happen in the areas of electrical equipment?

A. It can happen-for instance-- this would be generalization, on an overhaul of a pump or a motor, a pump by the shop and a motor by Shop 51. It could not conceivably come under the cognizance of 303. It very well could not.

Q. For example, a hydrostatic test?

A. Yes. Some hydrostatic tests. However, major work, the endeavor is to cover it all by suitable inspection. Now, it could be, in some areas, that the ship's force would be responsible for that inspection. The shop presenting it to the ship's force, rather than 303. But that would be a formal inspection accepted by the ship's force rather than the Quality Assurance Division.

(b) (6) relieved (b) (6) as reporter at this point?

Q. Is this procedure written down in any instruction at the Shipyard?
A. I would say that this has been historical, the condition in doing this.

Q. It is not written down; it is not formalized in an instruction?
A. I don't know.

Q. You've told us, Code 303 is responsible for tests; you witness the tests and you verify that the results conform to the specifications. If they do not, who are the addressees of any deficiency reports that you make?
A. We have two methods of approaching this problem. We have a work request Form 771, which comes to us from the shop, asking for our inspection facilities. Then, if there is a deficiency noted on the job, that is written on that form and returned to the shop. If it is corrected within twenty-four hours, or sooner, there is no further action taken. However, if this deficiency persists over one day, then we issue a formal rejection notice, Form 979, which goes to the Ship Superintendent. He, in turn, issues that to the shop to take corrective action, and that document, a copy of that goes to the CO of the vessel concerned. That is a formal method of keeping a record of all of our deficiencies.

Q. And the Commanding Officer of the ship is notified of such deficiencies?
A. Invariably he is. The Ship Superintendent screens these deficiency reports from 303, first to ascertain that the work is authorized, and whether he feels that the condition is unsatisfactory workmanship, and whether it meets the criteria of the plan and the tests. He, in turn, forwards this to the shop.

Q. Well, take, for example, the hydrostatic test of a system such as THRESHER's auxiliary salt water, sea water system. Would this come under the Quality Assurance Division, the conduct of such a test?
A. My people witness the hydrostatic strength test on the salt water system.

Q. During the post shakedown availability?
A. Yes, and we have a record; I have seen that record.

Q. Does Planning and Estimating establish a specific set of specifications to be met in that test?
A. They would say, "Test the system to the applicable pressure," and it would be the same as new construction; there would be no deviations. It would be the same hydrostatic test that she had when she was brand new.

Q. You told us that you were familiar with that particular test; can you state unequivocally that the specifications laid down for that test were met?
A. Yes, they were.

Q. Are these absolutely rigid specifications; are they subject to modification on the scene of the testing by the judgment of the tester or ship's force representative?
A. They are rigid. They wouldn't be modified by an inspector; he wouldn't have that prerogative.

Q. Nor would the ship's force representative?
A. No, sir.

Q. In the case of new construction, however, the pipes would be unlagged, would they not?
A. That is true, absolutely.

Q. Whereas in the post shakedown availability the pipes would be lagged. Does that make a difference?

A. It does. Many of the joints are unobservable, would be unobservable at that period of time. Work that had gone on in the PSA was left so that it could be visually inspected, and it was, but much of the system was just subjected to the hydrostatic test without visual examination. This is true for many systems at this stage of work in the PSA.

Q. You have told us that you have made a review of the tests performed in THRESHER by Code 303. Can you say that every test that was to be conducted in THRESHER was in fact completed, and completed successfully?

A. No, I can't. We had a record in our letter dated 5 April; it went to the Shipbuilding Superintendent, indicating by test memo number, what outstanding items had not been completed as of that date.

Q. Do you have a copy of that?

A. I'm sorry; I haven't, sir. I assumed that Commander Rule had submitted it. It can be made readily available.

COUNSEL FOR THE COURT: We will want a copy of that letter and will recall you to obtain it.

WITNESS: On that letter, I reviewed it, and there was nothing that would preclude this submarine from going to sea. That is the primary purpose of putting out such a document, to show the Shipbuilding Superintendent how the vessel stands at this particular period of time.

Q. The nature of the outstanding items was not such as to affect her safety at sea; is that it?

A. Yes, sir. As I recall, there were ten or a dozen items of a relatively minor nature. Some of them also had to be accomplished at sea; the test memo requirements had not been completed on the anchor deal and on the still. These were indicated as not completed, but actually sea trials were a necessity. The prerequisites had been done, the topside prerequisites.

EXAMINATION BY THE COURT

Questions by a member, CAPT NASH:

Q. Mr. Rogers, you have testified as to the responsibility for tests normally associated with work items. Do test requirements sometimes arise in the process of the conduct of the work or tests?

A. They do, sir.

Q. Whose responsibility is it to direct these additional tests?

A. We would refer them to Planning and Estimating for their authorization, if it was of any magnitude at all, first.

Q. Is it possible that you might not have knowledge of such a requirement?

A. In the PSA it might be; we might not be aware of it due to the shops being more involved than we.

Q. Would it, in that case, be the requirement of the shop doing the work to originate a test requirement?

A. Not to originate a test requirement, sir, but to let P&E know that such a requirement was necessary, to get authorization to proceed, would be the normal way. A document would be issued to take care of this situation. The shop would recognize this, as I have indicated.

Q. I'm sure that you have given a lot of thought to the work that was done on the ship and the test requirements. Do you now think of any work that was done which might have necessitated or warranted a test where such test was not conducted?

A. No, sir, I do not know of any area where any work was done, any major work, that wasn't adequately covered by test requirements, whether we were involved or not. I know of no such area.

Questions by a court member, CAPT HUSHING:

Q. Mr. Rogers, I have a couple of procedural questions. You mentioned your 771 form, I believe, which requests work of the Inspection Department, and you stated that if the defect was found as a result of that request you would annotate the form and send it back to the shop and to other people; is that correct?

A. This 771 form, Captain, would be sent only to the shop concerned. The deficiency in welding would go to Shop 26 or any specific shop. This would be for short term corrective action, usually of a minor nature, which they would fix. We set about a twenty-four hour period on that. It would come back by way of the Leadingman or Journeyman Mechanic. We would reinstruct and our record would be cleared. This would not receive other distribution than that.

Q. And the 979 form, then, is the one that is sent out if that form is not cleared within a reasonable time, say, twenty-four hours?

A. That's right.

Q. Now, then, in analyzing the deficiencies which are a part of the work process, do you count as deficiencies the items reported on the 771 form, or do you only count the ones which are reported on the 979 forms?

A. We have only counted in our tabulation -- well, in the case of structural work, this applies primarily (the witness displayed a 771 form).

Q. This being a 771 form?

A. Yes. They are counted because of the fact that in our summary report to the Bureau on HY-80 matters, it requires them to be counted.

Q. Now, how about pipe welding; are the 771 forms counted as deficiencies?

A. In pipe welding, there wouldn't be any count of the 771 forms.

Q. How about silver brazing; are they counted?

A. No, sir.

Q. They are counted only in the hull inspection?

A. Right, sir, that is correct.

Q. Let me ask you about the financial charging procedures used in the Shipyard as relates to the Quality Assurance Group. Is your time charged to overhead?

A. It is, sir.

Q. Is the time of the branch heads charged to overhead?

A. In all cases.

Q. How about the individual inspector within the various branches; is his time, when he is working on an actual job, charged to overhead or charged directly to that job?

A. In the case of the inspector working on the job, if he is doing a test, or work of that nature, it is charged direct. If it is a pure inspection procedure -- this is on new construction -- then according to BUSHIPS Instruction 7600, it would have to be charged to the overhead, but work that he would do, like magnetic particle inspection work, UT work, RT work or running a test aboard a ship, would be charged directly.

Q. Is this true in the case of new construction, as well as a repair job?
A. We use the same ground rules.

Q. So that the actual inspector, himself, is charged direct?
A. He is in most cases.

Q. Then, from an examination of the labor cards of the inspectors, we could find out which inspectors were on which jobs?
A. Yes, sir; pretty much so. There is one answer -- the branch heads are all charged to overhead, but the next level of supervision could quite conceivably be charged to overhead, also. In the case of Mr. (b) (6) yes.

Q. What I was after was, the individual inspectors who do the actual work of inspecting and running the tests on the scene are charged direct?
A. Yes, sir, they are.

Questions by CAPT OSBORN:

Q. Mr. Rogers, on a sil-brazed joint, what is the strength with respect to tortion twist?
A. I do not know, sir.

Q. Do you think it's stronger in tortion twist than it is in tension?
A. I would say that it would be stronger in tension; that would be my opinion.

Q. If you were to derange a sil-brazed joint or subject it to something that might cause it to fail, what do you think would be the worst thing that you could subject it to?
A. I would say vibration.

Q. The system of responsibility I've noted in the yard is one of a set of individuals for a particular system. Who is responsible for checking on these individuals as to overall quality with respect to a group of systems; say, the salt water system?
A. Are you speaking of inspectors, sir, or journeyman mechanics? I don't quite follow you.

Q. I'm trying to determine that you test specific groups of tests in a particular system, isolated tests, with respect to, say, pulling of a salt water pump and reinstallation. Who is responsible when the whole system is put back together to see that the overall system of tests is put on the complete system?
A. In the case of 303, there would be an individual assigned that responsibility. He might be an inspector, or he could very well be a supervisor or an associate supervisor, who would be responsible to see that the overall salt water system was back together, that the hydros had been made, and that the pump had been run.

Q. And he would be present, say, for the sub-system test on individual minor loops, as well as the major test?
A. We assign these by groups to individuals in our division.

Q. As a matter of judgment, how would you expect to maintain quality of a lag salt water system over a period of time?

A. I think hydrostatic strength and tightness tests is one very good way of ascertaining that the system still has its integrity. I think that is the best if you are going to keep the lagging on it.

Q. Inspectors usually hold up production and delivery of a system to the ship. Was there any case of pressure in the final days of completion with respect to your inspection group?

A. There was, and we had to put more people down there to accomplish the work. As you near the end of an availability, there is also an increase of work, systems are being buttoned up, come together, and we had to increase our manpower. We did on the 593, at the expense of some other jobs.

Q. Without fear of getting out of the context, this is always the case, I understand, but do you think that the quality in any case was sacrificed in the case of THRESHER?

A. No, sir, I think we had some of our best people on THRESHER.

Q. By what means would you know that an accidental derangement on the ship by shipyard or by ship personnel might negate a previously completed satisfactory test?

A. Code 303 might never know, sir, unless we were on the job, down in the compartment, or if it were not brought to our attention, we might never know.

Q. You specifically noted that the nuclear tests came out of your jurisdiction. Do you perform any inspections on nuclear systems?

A. Yes, sir, I do. I perform all the radiography of the entire shipyard which would include nuclear power divisions, piping systems, and we have NPEA's issued to perform radiography on specific pipe joints in their areas.

COUNSEL FOR THE COURT: Please explain for the record what NPEA means.

A. Nuclear Power Engineering Authorization. It is a form they use to indicate work.

Questions by a member, CAPT OSBORN, continued:

Q. Is there a difference in the standards for acceptance in these tests?

A. They are the ones that evaluate the results.

Q. Who in this case is "they"?

A. Nuclear Power Division.

Q. Was the trim and drain system in the original specification of the ship an all-welded system?

A. I believe it was not. I'm quite sure that it was not, but it's from my memory that I'm saying that. To the best of my memory, it was not all welded.

Q. Were the tests conducted by the Qualtiy Assurance Division in response to planning and estimating direction, or with a view to the overall safety of the ship?

A. We followed planning and estimating test memoranda and job orders. I am sure that they covered all essential and vital work. If we knew of any that came out before, or something that should have been covered and wasn't, we would indicate to the proper planning and estimating superintendent our feelings on the matter.

Q. I am particularly interested in the test that was incomplete on the still; was this an operational test?

A. It was an operational test to perform on the eight thousand gallon-a-day still, sir.

Q. If the quality of your inspection system is so good, would you say that a failure in this case was more likely to be one of design, or one of quality of production, and I realize that this has to be an opinion?

A. This is in relation to the failure of the ship?

Q. If there were a failure.

A. It's a pretty hard question for me to answer. It would seem to me, though, that it would be a material failure, because of the performance that she had made before on her previous tests and trials. She came through in fine shape. I was on her, myself, many days.

Q. Well, I asked you that question because on the basis of better than twenty-five years of operational testing with your group, your opinion with respect to that question would be very important to us.

(There was no answer by the witness.)

Questions by the President:

Q. Mr. Rogers, you have mentioned that there are two sets of standards, as it were, for the inspection of joints in the nuclear propulsion plant, and in other parts of the ship; is that correct?

A. I didn't mean to infer that idea. There are two separate standards, sir; they are compatible, Nuclear Power people evaluate to their standards, evaluate the film that I take. Essentially, they are the same level.

Q. But they require the same tests as the NAVSHIPS Instruction?

A. Yes, sir.

Q. There are, of course, on modern submarines, congested areas, where it is very difficult to inspect joints, castings, or other things that need to be inspected. What is done in such areas that need to be inspected, joints in such areas, or castings in such areas; do you have to tear them out, take them to the shop, for example, to do your radiography, or can you do it in place in those cases?

A. In most cases, in the cases of radiography, you can do it in place. If the mechanic can weld a joint, you can conduct the RT. In case of ultrasonic, you sometimes have an additional advantage, because you only have a small probe to get in that area.

Q. You could test, then, a joint which it would be impossible to make up without ripping out?

A. That could be the case. There are cases when you cannot get a hundred percent coverage. In case of radiography, certain size pipes only require sixty degrees to ascertain that the joint is satisfactory so that is often obtainable when you couldn't do the whole thing. Now, in the case of some joints, there was ripout made on other systems. Interference is removed so that you could get at joints, and there were certain joints that were only given a visual examination because it was impossible to perform either RT or ultrasonic.

Q. Now, I go back to the cleared slips in your records, which you said would insure that all was well with that part of the ship to which that slip

pertained. This would not, of course, insure against derangement of a joint which had been inspected by 303 and found to be all O.K.; is that right?

A. That is correct, sir.

Q. You have testified, Mr. Rogers, that in your opinion there was a clear and well delineated area of responsibility for the ship, for the 303 people, or P&E, or the various individual shops, and that there was no likelihood, I believe you said, that a test which should be done would fail to get done, because if fell between these areas of responsibility. I find it difficult to reconcile that part of your testimony, however, with answers to certain questions by the court, which would seem to me to leave the possibility that a system on which 303 had conducted tests might be deranged by a shop working on that system, or around that system, or making tests in the vicinity of that system, which might derange it and you not be told about it.

A. That could happen, sir.

Q. I believe you would say that it would be the responsibility of the shop to notify you or to notify P&E in such a case?

A. It would have to depend on the integrity of the man who was aware of the derangement.

Q. Or possible derangement?

A. Yes.

CROSS EXAMINATION

Questions by counsel for RADM Palmer:

Q. Mr. Rogers, counsel for the court made inquiry as to the degree of your involvement, and by that I mean your code's involvement, in test and inspections in new construction versus overhaul and repair work, and your answer, as I heard it, was to the effect that you are much less involved in overhaul than you were in new construction. At least I got the impression from your answer that the degree of inspection in overhaul work was less that it was in new construction. Could you clarify that for me?

A. Yes, sir. It may be the amount and not the degree and quality. It is the amount of coverage that we would provide.

Q. You mean the number of items which come to your attention rather than the degree of inspection of those items?

A. Yes, sir.

Q. Is it true, Mr. Rogers, that in overhaul where all alterations to a system are inspected --

A. To the best of my knowledge, Planning and Estimating issues the job orders to cover the inspections for all alterations, SHIPALTS.

Q. So it would be correct to say that we are in agreement that the degree of inspections and tests is the same in overhaul as it is in the new construction, so far as you know?

A. Unless specifically delineated, there will be a lesser acceptance standards on a particular item, but it will be clearly spelled out on the job order. That is completely true.

Q. Subject to that, are we in agreement, sir?

A. Yes, sir.

Q. With regard to lagging interfering with your tests and inspections and overhauls, in systems where new work was done in overhaul, or a PSA, the lagging would be left off until you had inspected, would it not?

A. That is true.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. We have heard that in inspection of silver-brazed pipe joints the percentage bond of fifty and sixty percent was the minimum acceptance level. Based on laboratory tests, do you know what factor of safety over working pressures is provided in a sil-brazed joint with a bond of between fifty and sixty percent?

A. It would be quite a high factor of safety. I can't tell you exactly that, but I can tell you somewhere near; that something less than twenty percent will hold the joint together under a strength and tightness test of considerable magnitude. Up to bonds over that amount, the pipe will fail before the joint will fail. We have conducted such tests. You mentioned fifty to sixty percent; of course, forty percent was in the confidential letters.

REEXAMINATION BY THE COURT

Questions by a member, CAPT HUSHING:

Q. You provided the court with an exhibit which listed the ship's force work and the ship's force tests, I believe.

A. I did, sir.

Q. Was the inspection group of the Shipyard requested to perform inspection work on any of the ship's force work that you know of?

A. Not that I know of.

Q. So the ship's force conducted their own inspections on their own work?

A. To the best of my knowledge that is true. I know of no particular item.

Questions by the President:

Q. Mr. Rogers, you have worked at this yard for over twenty-six years. That is a long time, and you have gained great experience, especially in the inspection field. Regardless of how thorough an inspection system may be, regardless of how much margin we allow in the strengths of our material, the joints and that sort of thing, a fine ship has been lost. Can you, as a result of your thinking about this, and I'm sure you have as we all have, can you suggest to this court any area which, in your opinion, might be more likely than other areas to produce information which would lead to the cause of this loss?

A. I can only surmise, Admiral, but in my opinion the failure of a pipe system would be the most hazardous condition that might occur. There could be many, many things that might have happened that could cause such a similar casualty, but that would seem to be the most likely.

Neither counsel for the court, the court, nor the counsel for the party, RADM Palmer, desire to examine this witness further.

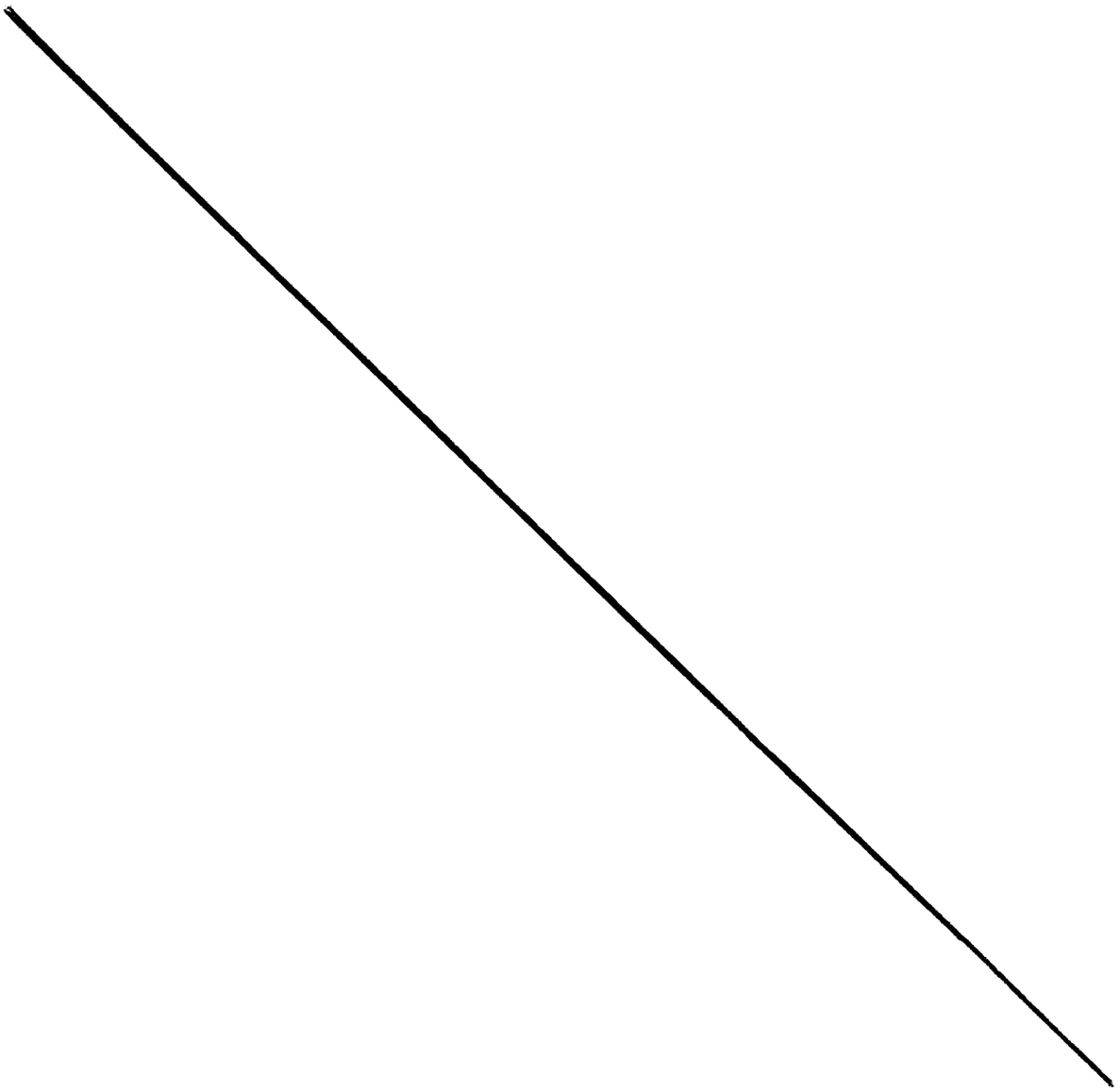
The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

Admiral, I've been going to sea on these submarines since late '39, on every builder's trial and INSURV trial, except during the war, when civilians couldn't go out, and I have the utmost confidence in submarines and the crews. I think that I would be less than honest with myself if I did not admit that this is of some concern in my own mind.

PRESIDENT: It all goes to show that the more complicated we make things, the more difficult it is to ascertain what, if anything, failed. We appreciate your testimony. It was against the background of great experience and we appreciate the frankness with which you have answered our questions.

The witness was cautioned concerning his testimony and withdrew from the courtroom.



(b) (6) relieved (b) (6) as reporter at this point.

(b) (6) , Lieutenant, U. S. Navy, was called as a witness for the court, was informed of the subject matter of the inquiry, was advised of his rights under Article 31, Uniform Code of Military Justice, was duly sworn, and examined as follows:

COUNSEL FOR THE COURT: Lieutenant (b) (6) , this is an open session of the court, and members of the public are present. For that reason, it is essential that no classified information be divulged. You will, therefore, in your testimony, not volunteer any classified information. If a question put to you by a member of the court or counsel should, in your judgment, require the inclusion of information of a classified nature in the reply to make it complete, you will not make reply, but will so indicate instead. Do you understand?

THE WITNESS: Yes, sir.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, rank, organization, and present duty station.
A. (b) (6) , Jr., Lieutenant, U. S. Navy, Assistant Planning and Estimating Superintendent for Repair and Overhaul at the Portsmouth Naval Shipyard.

Q. How do you spell your last name?
A. (b) (6)

Q. What is your Shipyard code designator?
A. Code 212, sir.

Q. Briefly describe the nature of the duties which you perform here.
A. For submarine overhaul and repair, my job requires me to authorize work instructions, check them, make sure of their adequacy, see that they are properly funded; to see that I only issue work instructions on work authorized by BuShips or the Type Commander; monitor the expenditure of funds; and keep records on them, so that I know the progress of the work; how much of the funds have been expended; how much of the funds I have left; and tell a customer when he needs additional funds.

Q. Does that fairly sum up your job?
A. Yes, sir.

Q. What is your background and experience in this area?
A. I have been assigned to this present job since December of 1961 until date.

Q. And can you give us a little bit of your naval and professional background?
A. Yes, sir. I enlisted in the Navy in 1948. I went through submarine school. I was first assigned to the SEA LION, and later to the IREX. I went through the electronics conversion school, and by this time I was a First Class Engineman and had the Auxiliary Division on the IREX. I earned my commission in 1956, after which I was first assigned to the SAILFISH in October of 1958. I then went to the BARBEL and put her in commission. From the BARBEL I went to the SABLEFISH for a year and then to the Shipyard, in December of 1962.

Q. We have heard that the Quality Assurance Division carries out the program of tests and inspections for delineated job orders and test memoranda. These orders and memoranda originate in the Planning Department, do they not?

A. Yes, sir.

Q. Tell us how you determined in that department what was to be tested and how it was to be tested in THRESHER during her period of post shakedown availability.

A. We have a Shipyard Instruction which now spells out the Test and Inspection Program for ships undergoing overhaul and post shakedown availability. I have a copy of this Instruction here, which spells out very carefully this program.

Q. Designate the number of that Instruction for the record.

A. It is Portsmouth Naval Shipyard Instruction 4730.8 of 18 March 1963.

Q. Did that Instruction apply to the THRESHER during her period of post shakedown availability?

A. Yes, sir, although the Instruction was not published until after the program had been underway on THRESHER, but the concept of the program did apply and was carried out on THRESHER.

Q. Then, it was the concept which applied and there was no mandatory Instruction which governed it; is that correct?

A. Yes, sir, that is correct.

Q. Please tell us, if you can, the concept of the program governing the tests and inspections performed in THRESHER during her post shakedown availability.

A. Well, the Test and Inspection Program is a program that we conceived during the overhaul of the U.S.S. SKIPJACK, and it spelled out very definitely the procedure to follow to insure that every system, every piece of equipment, was, in some way, checked out on the ship prior to fast cruise, dock trials, or sea trials. I have a copy of the letter showing what was done on SKIPJACK, which was presented to the Commanding Officer of the THRESHER, which I have right here, which spelled out the program as to how it was to be done, and requested the Commanding Officer's concurrence and comment on the program. The program itself consisted of a project team of officers: the Assistant Planning and Estimating Superintendent, who was responsible for authorizing job orders, work instructions, and monitored the funds; the Assistant Design Superintendent, who was responsible for seeing that the plans were checked and test memoranda and such were in accordance with specifications and modifications; the Assistant Shipbuilding Repair Superintendent, who was responsible for carrying out and executing the program; and the Ship's Engineer, whose function as a member of the project team was to insure that everything was covered by a test memorandum to his satisfaction, which would insure the fact that all systems were correct and operationally checked out and that proper tests had been performed.

Q. Did the Commanding Officer of THRESHER concur in the establishment of such a program team for his ship in response to your letter?

A. Yes, he did. (The witness produced papers in his possession.) This is the letter which was given to the Commanding Officer, and these are copies of all the enclosures to this letter.

Q. Lieutenant (b) (6) , simply read into the record the identifying serial number and date of that letter.

A. This letter is from the Commander, Portsmouth Naval Shipyard, to the Commanding Officer, U.S.S. THRESHER, dated 1 November 1962, serial SSN-593/4730.

Q. And the subject?

A. The subject is, "U.S.S. THRESHER (SSN-593); Non-nuclear Test and Inspection Program."

Q. Now, you have testified that the Commanding Officer, U.S.S. THRESHER concurred in the establishment of such a program. Please tell us, if you will, the names of those who composed the team which you have described.

A. Yes, sir. Lieutenant Commander Billings was the Assistant Planning and Estimating Superintendent; Lieutenant Commander Allen was the Assistant Design Superintendent; Lieutenant Biederman was the Shipbuilding Superintendent; and Lieutenant Lyman was the Ship's Engineer and the ship's representative.

Q. Now, all of the individuals whom you have named were lost at sea in THRESHER, were they not?

A. Yes, sir, that is correct.

Q. Do you have any knowledge of your own as to how they proceeded with their job as a team?

A. Yes, sir, I do. My knowledge consists of working some with Lieutenant Commander Billings, because he asked and checked with me in reference to history in connection with SKIPJACK's overhaul, as he was preparing and working up the program for THRESHER; at the same time, he was preparing the current Shipyard Instruction for the test program which I mentioned before. Lieutenant Commander Billings started on this project, I would assume, in November, as this is the date on the letter. It was in January that I was working with him on the Instruction and checking the different procedures that went into it. The procedures that were followed were that this project team first determined what was to be tested, what systems, and what components were to be tested and checked out on THRESHER. After they did this and prepared a list of all these things, they used the Shipyard record of trials, the original builder's trials, all the test memoranda, and so forth, to come up with the basic list of systems and equipments; they reviewed the various work requests; they asked for authorized alterations so that they could see that all systems and components had been changed. They came up with a comprehensive list of test memoranda requirements for THRESHER. I have a copy of a Planning Department schedule which indicates these test memoranda that were to be prepared for THRESHER, which is this paper (producing a paper in his possession), and also a copy of the Planning Department original test memorandum, which was reviewed and checked, to come up with the systems which had to be tested.

Q. Please identify the two documents to which you have referred in the order in which you referred to them.

A. The first document is the Planning Department Schedule of Test Memoranda for the SSN-593 dated 27 January 1961, which is a comprehensive list of test memoranda at the time by number and by systems for builder's trials and completion of the trip. This is the original document and later copies that this project team looked at to be sure they covered everything on the ship to the mutual satisfaction of the team.

The other one I have is a Schedule of Planned Action for the U.S.S. THRESHER, a test memorandum schedule, approved by Lieutenant Commander Billings and approved by Lieutenant (jg) Cima, who was part of this project team at this time, and this lists the required test memoranda on a schedule basis and they were issued by instructions to the Production Department.

Q. You told us then that this project team sat down at conference to work out the scope of these tests?
A. Yes, sir.

Q. Can you give us any indication of when that conference was held?
A. Yes, sir. This was a series of meetings or conferences that I know started and were in progress during January and February of this year, because once they determined all the systems that had to be tested, the next step was to prepare test documents and determine responsibility for testing. Many systems were to be tested by ship's force, and many systems were to be tested by the Shipyard, and they were presented to our Quality Assurance people and to the ship's force for acceptance of the quality and integrity of the work. This was a recurring type of conference. It wasn't a conference held on any one day; it went on for weeks - in fact, it was a couple of months before this program was firmed up and they got it going. All these test memoranda and the actual physical completion of the tests were scheduled for accomplishment on a schedule which showed the responsibility for conducting the tests and the responsibility for witnessing or accepting the tests. I have a copy of this schedule with me here.

Q. Identify it, please.
A This is a schedule for the U.S.S. THRESHER dated 6 February 1963, which lists the systems, test memoranda, number, responsibility for performing the tests, and the scheduled date when these schedules were to be completed by.

PRESIDENT: Don't we already have that in the record?

COUNSEL FOR THE COURT: Yes, sir. Let the record show that the witness is referring to a document already admitted in evidence as Exhibit 70.

Q. (By counsel for the court) In this project team concept, how was it established who was responsible for what test?
A. It was established by mutual agreement by all members of the project team. Whereas there was an authorized alteration or modification and the Shipyard performed the work, the team agreed that it was the Shipyard's responsibility to assure the ship of the quality and adequacy of its work. Some systems are not touched at all during the overhaul or post shakedown availability and no work is performed on them; still they were to be checked out to be sure they were working properly. These would fall into the responsibility of the ship's force. Some work was done by the ship's force, and these tests were performed by the ship's force. Another responsibility which devolved from this project team concept was that the Shipyard would support the ship's force portion of this test program by providing them with instruments and thermometers or such tools as they needed to conduct tests that were not Shipyard responsibility, and this is part of the test program support. This was in fact recognized and accepted by Deputy COMSUBLANT. This program was funded on the SKIPJACK; it was funded on the DOGFISH and the ALBACORE; and currently we are working on the same type program with the DOGFISH and will follow with the same program on the ALBACORE.

Q. How did members of the team make sure that every test needed to be performed during the post shakedown availability was actually accomplished in THRESHER?

A. Would you restate the question, please?

Q. Well, the members of the team, from what you say, conferred and arrived at a set of tests which they were convinced ought to be performed.

A. Yes, sir.

Q. In the concept which you have described as being in effect in the case of THRESHER, how would the members of the team ascertain that the tests they agreed upon were actually carried out?

A. I cannot answer to the effect that these actually were carried out. I can only tell you what the team planned to do and what the concept was, which was that all of these were to be scheduled, and then a check-off list was maintained so that, as they were completed, they were signed off, and the acknowledgement was made and documented that all of them were completed.

Q. That's the concept. Now, in the case of THRESHER, were all the tests which had been agreed upon and scheduled in fact concluded?

A. I cannot answer that question, sir.

Q. Whose responsibility is it to determine the answer to that question?

A. I would have to make-- The Quality Assurance people, I believe, would be the ones to tell you whether the scheduled tests were actually accepted.

COUNSEL FOR THE COURT: I have no further questions.

EXAMINATION BY THE COURT

Questions by a court member, RADM Daspit:

Q. Lieutenant (b)(6) , you said you were aboard BARBEL at one time. Were you aboard her when the salt water line carried away?

A. Yes, sir, I was.

Q. In what compartment relative to the line were you?

A. I was in the crew's messing compartment, which is right next to the engine room.

Q. Could you hear the line carry away from that compartment?

A. No, sir, I could not.

Q. What size pipe was that?

A. Five-inch.

Q. And you were in the compartment next to the compartment in which the line carried away?

A. Yes, sir.

Q. You cannot, from your own knowledge, testify as to how the leak looked, how much spray there was, or anything else?

A. No, sir. As our damage control was set up, we officers dispersed. The Assistant Engineer, I believe, was in the engine room, and I went to the crew's mess, which is next to it, and stood by the watertight door, and took charge of the damage control in that compartment.

Questions by the president, VADM AUSTIN:

Q. Lieutenant (b)(6) , unfortunately all members of this project team were lost with THRESHER, but you did have close association with this team and particularly with Lieutenant Biederman, I believe?
A. It was Lieutenant Commander Billings, sir.

Q. Lieutenant Commander Billings. Do you know, from your association with him, whether or not this team was unanimous in its agreement on the tests that should be conducted or whether there were disagreements on some items?
A. The feeling I have from working with Lieutenant Commander Billings and also with Lieutenant Biederman, who finished up this program on SKIPJACK, and knowing how he worked, I feel they were unanimous in their decisions, because the purpose was to keep kicking it around until they were all in agreement.

Q. When the project team produced its list of tests that should be conducted on THRESHER, who in higher authority, both in the Shipyard and in the operational field, approved their work as satisfactory?
A. The daily or weekly reports are made to the Planning Officer by each of us type-desk Assistant Planning and Estimating Superintendents, and we keep him aware of changing events as we progress. Whereas I can't say where anyone wrote a piece of paper and said, "I approve this program," the work by these people was under the cognizance of the Planning Department Officer and the Production Officer and the ship's Commanding Officer, and they were working with and for these people, and their work is approved by these people.

Q. The important point which I am trying to get at here is whether or not the work of this project team was considered in any way to relieve those in positions of responsibility of any of their responsibilities?
A. No, sir.

Q. It was advisory rather than otherwise - the work of this team?
A. Yes, sir.

CROSS-EXAMINATION

Questions by counsel for RADM Palmer, party:

Q. I believe you testified, Lieutenant, that you reported to this duty station last December. Was that correct?
A. December of 1961, sir. I got mixed up on my dates a little bit. I've been in the Shipyard since December of 1961.

PRESIDENT: You've been here, in other words, a little over a year?

THE WITNESS: Yes, sir.

Neither the counsel for the court, the court, nor counsel for RADM Palmer, a party, desired further to examine this witness.

The president of the court informed the witness that he was privileged to make any further statement covering anything relating to the subject matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

THE WITNESS: I would just like to say that this type of test and inspection program was conceived and used on SKIPJACK and resulted in what we feel is an exceptionally fine set of fast cruises and sea trials, as evidenced by the fine letter the Commander of the Shipyard received from the Commanding Officer of the ALBACORE. The Commanding Officer heartily endorsed this program and suggested that we start using it with DOGFISH. He was most pleased with it, and I am presently working with the DOGFISH with the same program, and they are well pleased with the concept of it and are quite willing to go along with this.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

(b) (6) , a civilian, was called as a witness for the court, was informed of the subject matter of the inquiry, was advised of his rights against self-incrimination, was duly sworn, and examined as follows:

COUNSEL FOR THE COURT: Mr. (b) (6) , this is an open session of the court, and members of the public are present. For that reason, it is essential that no classified information be divulged. You will, therefore, not volunteer any classified information. If a question put to you by a member of the court or by counsel should, in your judgment, require the inclusion of classified information in the reply to make it complete, you will not make reply, but will so indicate instead. Do you understand?

THE WITNESS: Yes, sir.

DIRECT EXAMINATION

Questions by the counsel for the court:

Q. State your name, address, and present occupation.
A. (b) (6) , (b) (6) New Hampshire. I am employed at the Portsmouth Naval Shipyard in the General Arrangements Section. My rate is GS-11.

Q. General Arrangements Section of what?
A. Of the Design Division, Code 247-A.

Q. How do you spell your last name?
A. (b) (6)

Q. What is the nature of your duties in the General Arrangements Section?
A. I am a project engineer. As a project engineer I provide technical and engineering assistance as required for the development of arrangement drawings, storeroom drawings, stores facilities, and painting schedules.

Q. Did you do such work in the case of THRESHER's design?
A. I did.

Q. What is your background and experience in this field?
A. Well, I have worked in this capacity for six years as a GS-11. Prior to that I worked in the same field at a lower grade.

Q. And your educational background?
A. I have a B.S. degree in architectural engineering. I have attended extension courses at the University of California for Naval Architecture for two summers, and extra courses at the University of New Hampshire for shielding and nuclear radiation.

Q. Have you had a full opportunity to study the items of debris which have been admitted in evidence before this court?
A. I have.

Q. Have you made such an inspection in an effort to determine in your own mind, first, whether the debris could have come from THRESHER, and if so, from what part of the THRESHER?
A. I have.

Q. Will you tell the court the items of debris which you have been able to identify and the most probable location of such items in the ship?
A. With the court's permission, I would like to use compartment arrangement drawings to demonstrate this. I would have to put it up on some board.

Q. Are they classified?
A. I have one item concerning shielding which I'm not sure is classified. They are general arrangement drawings.

COURT MEMBER, CAPT HUSHING: The general arrangement drawings are classified.

COUNSEL FOR THE COURT: In that case, I would request that the court be cleared in order to hear this testimony.

PRESIDENT: The court will be closed briefly for meeting behind closed doors.

At 1128 hours, 24 April 1963, the court met behind closed doors in the presence of all persons officially connected with the inquiry as delineated at the opening of this session of the court, all observers having withdrawn from the courtroom. The witness under examination continued his testimony, having placed two arrangement drawings on a board for demonstration purposes.

By counsel for the court.

Q. Mr. (b) (6) , will you proceed, please?
A. The first exhibit examined was Exhibit 28. I have a photograph of it here. This is a rubber glove, right hand, size large, paint smeared, bearing label "QM(CTM)-11705-E-62."

Q. Mr. (b) (6) , hereafter will you just describe the exhibit by its number?
A. All right. Well, I was unable to identify this glove as part of the U.S.S. THRESHER gear. The next is Exhibit 27. I was able to identify this as similar material that was issued to the THRESHER. This is a rubber glove, left hand, bearing the label "MILLER MP Rubber and Plastic Neoprene 10."

Q. Just identify it generally, if you please, Mr. (b) (6) - such as a rubber glove.
A. A rubber glove, left hand. This type of glove was issued to the THRESHER for use as an antidecontamination glove. We provided stowage for this type of gear here (indicating on drawing) over the GSK storeroom. This is at the first platform, and this stowage is in the upper level of this area at approximately

Frame 50 on the starboard side. Also we provided stowage for this item in the upper level of the auxiliary machinery spaces. This is at approximately Frame 64. This is in the upper level on the port side. I would like to state that the items are used in this area (indicating on drawing) on the port side, this sampling station, and also in the Nucleonics Room where they make tests for material.

Q. What frame reference is the Nucleonics Room?

A. It is around Frame-- Between 40 and 44 on the starboard side of the ship outboard.

Q. What platform?

A. This is the First Platform. Exhibit 25, described as a large glass, labeled "#3", contained two pieces of foamed plastic, white with oily black discolorations. This material was identified by the chemist as 6-pounds per cubic foot density polyurethane. This material was identified as material similar to that which was used on the THRESHER for the insulation of the refrigeration storeroom in this area here (indicating on drawing). This area is the Second Platform at the 14-foot, 8-inch platform deck. The frame number is from 48 to 52-- that's Bulkhead 51. This is on the starboard side of the ship. This room here is adjacent to the crew's mess area. This is an outline of the insulation here (indicating on drawing). Also found in the container, Exhibit 25, were small pieces of cork. I might stop here and add that we find several pieces of cork throughout the various exhibits. I would like to explain the locations of cork at this time and then revert back.

Q. Proceed.

A. Cork material was installed on THRESHER in the upper level of the engine room area. This material terminated 6 degrees from the vertical centerline of the ship, and in the upper level auxiliary machinery spaces also terminated 6 degrees from the vertical centerline of the ship.

Q. Is that attached to the pressure hull?

A. It is attached to the pressure hull. Also cork was installed in the overhead of the reactor tunnel. I don't have an outline of the tunnel drawn on here. For your information, the tunnel is approximately in this area here (indicating on drawing).

Q. Are you indicating the midships section?

A. This would be over the Reactor Compartment, from Frame 51 to Frame 60. in the platform-- it was a little higher than the platform at the 21-foot, 8-inch level, where there is approximately a 3-foot step-up. Cork material was also installed on the port side of Bulkhead 52, this area here. I might explain that this Bulkhead 52 installation extended down to the 21-foot, 8-inch platform which is indicated here.

Q. What deck is that, for the record?

A. This is the First Platform deck. Also for the record, when I refer to the 21-foot, 8-inch platform, I am talking about that section above the base line of the ship. This is in the entire forward side of Bulkhead 51. That is this area here. This area extends between the 14-foot, 8-inch deck to the 7-foot, 8-inch platform deck. That is this area here (indicating on drawing). Also the Battery Compartment 51 inches above the battery foundation step. I have no cross-section to show you in this picture. However, I will point out the bulkhead. This is the area of the forward bulkhead. This cork was applied on this bulkhead down to the top of the battery.

Q. You'd better read the bulkhead number and level.
A. This would be a Frame 36½, forward bulkhead. The after bulkhead would be at Frame 43.

Q. And have you given us the level in the ship?
A. This is considered as the hold. This is below the 7-foot, 8-inch platform. The cork was also installed between Frames 51 and 28 from the 14-foot, 8-inch deck to the 7-foot, 8-inch deck. It was applied on the pressure hull frame, and it was also applied to the structure of the torpedo impulse tank, which is above the 7-foot, 8-inch platform deck.

Q. What frame reference is that?
A. The frame reference for the torpedo impulse tanks is approximately 35. This is on port and starboard sides of the ship, outboard. Also, cork was applied above the 14-foot, 8-inch deck to frame webs, frame bars and deck mounts. This area is at the 14-foot deck, and these are the frames we previously referred to. This extended from Frame 32 to Frame 51 This is outboard, and the frames are attached to the pressure hull- just the frames. There are deck mounts for the platform that also have cork installed. This is the extent of the use of cork in the THRESHER.

(b) (6) relieved (b) (6) as reporter at this point.

Q. Do you have the exhibit number for that?
A. This continues Exhibit 25; this is part of that. Exhibit 24, a small bottle now labeled "2" containing a small piece of cork. The location is, as I just explained, for Exhibit 25.

Q. Can you identify the plan from which you have been testifying up to this point, just for the record?
A. This is a composite drawing of the general arrangement of the U.S.S. THRESHER, No. 1864628.

Q. Will you identify this plan now (referring to a second diagram from which the witness was preparing to testify).
A. This plan is the location of poured-in-place plastics for a 593 class submarine.

Q. What is its number?
A. Its number is 1943278.

Q. Proceed.
A. Exhibit 24--Item 2 contained in the bottle numbered "2," a small piece of polyester microfilm material. Similar material was located on THRESHER in the following locations: this was located exterior of the pressure hull--void at Frame 105--between 104 and 105: looking at this cross section; elevation-wise, it's in this area here, right between the intersection of your light plated and pressure hulls; this is a void right here.

Q. Would you designate the general frame area?
A. I did. Between 104 and 105. Also, voids in the stabilizers were filled with this material. These are the stabilizers here, port and starboard side--this is still the exterior of the pressure hull: voids of the rudders in this area here--this is approximately Frames 110 to 150: void in the bridge access--this is in the fairwater area. For THRESHER the plastic in this area was scheduled to be removed; whether it was removed or not, I cannot say. The void of the fairwater planes, starboard; void of the shaft bearing, outer shell--this area here; the forward messenger voids--this is in the area exterior pressure hull. The after messenger void is located approximately Frames 62 to 70 in the upper part of the exterior of the pressure hull plane and on the starboard side of the ship. Also contained in Exhibit 24, in the bottle labeled No. "2" is a small piece of plastic. This material was also identified as being six cubic foot density polyurethane material and, as explained before, this material was used around the refrigeration storeroom on the U.S.S. THRESHER. Item "4" of the same container, several small pieces of white off-colored gelatinous material--I was unable to identify this material and pinpoint it at any location on the THRESHER. Exhibit 23, one bottle of clear liquid about one-third full, now labeled as "1A," again I was unable to identify the material to pinpoint the location.

COUNSEL FOR THE COURT: Mr. (b) (6) , we may be able to shorten this if you will just tell us the items you were able to identify.

PRESIDENT: Yes, those that you didn't identify we aren't interested in.

The witness continued his answer as follows:

A. Exhibit 29, one small plastic squeeze tube with the following markings: "Bakers Flavoring, better to squeeze gently." If this material was from the THRESHER it would be located in the crew's mess area, officers' pantry, dry provisions storeroom or officers' quarters. If it required chilling, it would be located in the chill storeroom. Also in Exhibit 26 was one piece of plastic, off-white in color, with particularly visible markings. This material was identified as part of a capsule of Polaroid photographic material. This material I was unable to positively identify as part of the ship's gear; however, if this material was on the THRESHER it could have been located in the forward compartment, midship compartment, and possible in the auxiliary machinery room. Exhibit 20, two amber colored translucent rubber gloves, both right hand, size 8, similar to surgical gloves. One glove had stained fingers.

COUNSEL FOR THE COURT: We have them identified now; thank you.

PRESIDENT: You don't have to describe them; we have the articles here.

The witness continued his answer as follows:

A. This particular type of glove I was unable to identify as part of the THRESHER's gear; however, from inquiry to our Supply Department, I ascertained that surgical gloves issued bore a trademark of "WILGARD", manufactured by Wilson Rubber Company.

COUNSEL FOR THE COURT: These do not, for the record.

The witness continued his answer as follows:

A. A former crew member of the THRESHER indicated that the THRESHER purchased their gloves, of which the Supply Department has no record. Exhibit 19, one doughnut-like cylindrical tank float similar to a rope float. Here again I was unable to identify the material as part of the THRESHER's gear.

COUNSEL FOR THE COURT: Don't tell us about the ones you can't identify, Mr. (b) (6) .

WITNESS: At this time I'd like to put this other plan back up (the witness rehung the plan bearing the number "1864628", and continued his answer as follows):

A. Exhibit 21, one large yellow plastic sheet about one inch thick, twelve by ten inches in size, with two equal reasonably square edges and two irregular edges, showing evidence of a pipe having penetrated this sheet. Similar material was used on the THRESHER for the reactor shielding bulkhead at Frame 52 (the witness designated an area on the top diagram of the chart bearing two equidistant vertical red lines), and the reactor tunnel passageway bulkhead. This is not outlined here but it's on the port and starboard (indicating the areas adjacent to a line running between the two vertical lines previously indicated, this time on all three diagrams appearing on the chart). Exhibit 57, we have --

PRESIDENT: You don't have to describe it other than to tell us what it is so we can identify it, that's all.

The witness continued his answer as follows:

A. This material is identified as borated polyethelyne. This material also is located around the reactor shield bulkheads in the locations I have previously

described (indicating the area previously designated between the vertical red lines). Exhibit 58 -- please retract that; I am unable to identify that. Exhibit 59D, polyester micro balloon material. I have explained that during Exhibit 24. Exhibit 60, two plastic covered boron cushions, slightly stained, orange-red. Similar material was located on THRESHER in the Control Room area on the starboard side, approximately Frames 32 to 33. I would like to add that this material could be stored by the crew in the after engine room or the forward berthing compartment. And this, gentlemen, concludes the items that I could identify.

Q. Do you know whether Kapok life jackets were issued to THRESHER?
A. Yes. The Allowance List would reveal this.

Q. Do you have a written report on which you based your oral presentation to us?
A. I do.

Q. Will you present it, please?
A. (The witness handed a document to counsel.)

The notes from which the witness had testified were submitted to the party and to the court and were offered in evidence by counsel for the court. There being no objection, they were received in evidence.

REPORTER: These will be Exhibit 72.

Q. Does Exhibit 72 represent your own work and is it true to the best of your knowledge and belief?
A. Yes, sir.

EXAMINATION BY THE COURT

Questions by a member, CAPT Hushing:

Q. I would like to refer to the plan, which is plan No. 1864628. There are indications of voids of the transition ring in the vicinity of Frame 33. Do you know what material was put into those voids?
A. Yes, I do. On the THRESHER this void was considered as a high pressure void. It was filled with a rust preventative type compound, seal.

Q. Is that a heavy--
A. It's a grease-like material.

Q. --grease, dark material?
A. Dark grease.

Q. Dark greasy material?
A. Yes.

Q. And it is pumped into it under pressure?
A. Yes, it is.

Questions by a member, CAPT Osborn:

Q. Mr. (b) (6) , in discussing all your exhibits, could they all have come from the center compartment, or the control room area compartment, first, second,or third platform?

A. All of the items except the polyester micro balloons. Just for the information of the court, there were exhibits specified polyurothene type material of a high and low density. I was unable to identify this material because clarification of what is high or what is low would be needed.

Questions by the President, VADM Austin:

Q. Wouldn't it be likely, Mr. (b)(6) , that those were commercial products such as plastic baskets, or things of that sort?
A. Parts of it that I examined, they are a filled type of material. We have used that type of material aboard the THRESHER.

Q. Would it be a safe assumption that most, if not all of the exhibits which you have described and discussed as to location, could have come from a single compartment -- most, if not all?
A. Again, I say all the materials except the micro balloon material that I described could have come from one compartment or an adjacent compartment.

Q. Well if there be only one that couldn't have come, this statement "most, if not all," would be a fair statement?
A. Yes, sir.

Neither counsel for the court, the court, nor the party desired to examine this witness further behind closed doors.

The president announced, at this point, that the court would sit with open doors and permitted members of the press to return to their seats in the courtroom.

Questions by the President, VADM Austin:

Q. Mr. (b)(6) would you, in summary, say that most, if not all of the materials in these exhibits which you have discussed could have come from a single compartment?
A. Yes, sir.

Q. What is the general area of that compartment, your description of that compartment -- without referring to a diagram?
A. I would say it was in the midship area.

Neither counsel for the court, the court, nor the party desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing further to say.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

The court recessed at 1210 hours, 24 April 1963.

The court opened at 1300 hours, Wednesday, 24 April 1963.

All persons connected with the court who were present when the court recessed were again present in court with the exception of (b) (6) who was relieved by (b) (6) as reporter.

Mr. James C. Rogers, civilian, was recalled as a witness by the court, was reminded of his right against self-incrimination, and that his previous oath was still binding, and was examined as follows:

The witness was informed since this was a closed session of the court, that he could testify regarding classified matters.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Mr. Rogers, in your prior testimony you referred to an unclassified memorandum of 5 April 1963. Did that originate within Code 303?
A. Yes, sir.

Q. Is this your file copy? (handing document to witness)
A. This is the file copy.

Q. Is it a true and correct copy to the best of your knowledge and belief?
A. It is, showing by job order, test memoranda and paragraph, the outstanding items.

Q. Outstanding at the time prior to sea trials?
A. Yes, sir.

The cited document was then examined by the court and was offered in evidence by counsel for the court. There being no objection by counsel for the party RADM Palmer or the court, it was so received and marked as Exhibit 73.

Neither counsel for the court, the court nor counsel for the party, RADM Palmer desired further to examine this witness.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing further to state.

The witness was cautioned regarding the testimony he had given and withdrew from the courtroom.

Mr. (b) (6) civilian, was called as a witness by the court, was informed of the subject matter of the inquiry, was advised of his rights against self-incrimination, was duly sworn, and examined as follows:

The witness was informed, since this was a closed session of the court, that he was privileged to divulge classified information.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation.
A. My name is (b) (6) My address is (b) (6) New Hampshire. My occupation is Naval Architect.

Q. Where are you employed, Mr. (b) (6) at the Portsmouth Naval Shipyard?
A. Yes, I am Assistant Receipt Design Engineer for naval architecture. I have the responsibility for the development of the detailed work plans for the hull structure including the foundation and also for the development of the necessary naval architectural calculations for weight buoyancy and stability.

Q. What is your professional background and experience in this area, Mr. Dunham?
A. I was graduated from Bucknell University in 1937, with a Bachelor of Science degree in civil engineering and in 1939 I went to the Philadelphia Naval Shipyard, worked in the design section there in the structural section until 1945 when I transferred to the Bureau of Ships in the Hull Design Branch. From 1945 until '51 I was working primarily on surface ship design. In 1951 I was transferred to the hull scientific section where I was responsible for the calculations and design of submarine pressure hulls and structures and also for the directing of research work which would lead to the development of design criteria for designing sub-sections. I want to get from the Bureau up to here. In 1959, I transferred from the Bureau to the Portsmouth Naval Shipyard to my present duties.

Q. Would you give us a summary of the contract plans, detail specifications, and design philosophy and concept which led to the design of the pressure hull structure of THRESHER?
A. Yes, sir. The Portsmouth Naval Shipyard gets from the Bureau, three principal pieces of information to guide them in the development of the detailed design. The first concerns the shipbuilding specifications. The specifications provide the requirements for the operating department; they spell out the design collapse pressure. They provide requirements for circularity, reinforcement for openings in pressure hulls. They cite the material required for the pressure hull. The contract plans are the second piece of information we receive. They delineate the arrangement of the structure, including such things as the diameter of the pressure hull, frame spacing, shell thickness, frame size, and other major portions of the structure that they feel should be on some of the hard tanks. The third piece of information we receive is the design criteria which provides us with the equations to use for determining whether we have met the requirements of the detailed specifications. These design criteria - and this is where I think I will bring in the design philosophy if I may - are based on this design philosophy, that as far as the (b) (1) (A) is concerned, at the specified (b) (1) (A) The frames are designed to support the shell to that pressure and the equations there are based on (b) (1) (A) , taking into account the (b) (1) (A) as specified in the detailed specifications. I'd like to make the point that these design equations are not equations to determine (b) (1) (A) They are really design equations which we, as engineers, use to make sure that we will in effect provide the necessary

(b) (1) (A) , that is required by the specifications. The actual (b) (1) (A) is usually somewhat beyond the (b) (1) (A) that we expect (b) (1) (A) to occur. Those are the three major items that we get from the Bureau. Starting with those, we review the contract plan and make sure that in effect, the scantlings shown on those contract plans do meet the requirement and specifications.

Q. Would you explain for the record the meaning of the term "scantling"?
A. "Scantling" is the shipbuilding term for thickness in size of structure. Once we have completed this check of the contract plans to make sure that we are satisfied that the structures shown on them does meet the requirements of the specifications, then we proceed with the development of the detailed design. If we have any deviation from the contract plans we are required, and we do, notify the Bureau of Ships of these deviations. In the area of the structure that are not covered on the contract plans we apply the design criteria and determine what the scantlings are for those areas. This would include some of the hard tanks that are not shown in the contract plan. By "hard tanks" I mean those tanks that are required to resist the deep submergence pressure. We also calculate the structure required for reinforcement of openings. Sea chest structure is normally not shown on the contract plans. We determine the necessary thickness and the size of material to take care of those penetrations. Now I think I've carried that through the development of the detailed design. Have I completely answered your question?

Q. Up to that point, you have. I would like you, if you can, to tell the court whether there were any deviations from the contract plans which had to be referred to the Bureau of Ships?
A. We have made a thorough check of this and to my knowledge, there are, I would say, certainly no significant deviations to the contract plans. There were some having to do with the pressure shell and all of these were on the conservative side. By that I mean, the thickness that we finally showed on our detailed working plans was greater than that which was required by the contract plans.

Q. Was each such deviation reported to the Bureau and concurred in by the Bureau?
A. Yes, sir.

Q. You have mentioned the sea chests to us. Can you delineate where Shipyard Portsmouth took off independently from the Bureau of Ships specifications and the contract plans and design items of hull penetrations which affect watertight integrity?
A. Well, when you phrase it we "took off independently," I would assume this would mean that we had no guidance from the Bureau and if you want a list of those areas that we did design independently --

Q. Major items affecting watertight integrity?
A. Yes, sir. The main sea chest, the main sea water valve, 12 and 14 inch sea chests we designed. I think I could include all the sea chests and say, in general, that Portsmouth did design, without specified guidance from the Bureau as to exact detail, all the sea chests that went into the pressure hull of THRESHER.

Q. Can you summarize the factors of safety that the final design of THRESHER provided at test depths insofar as her hull was concerned?

Unclassified

A. Yes, sir. I have made a sheet which will summarize this very quickly. Want me to present this? (Hands document to counsel for the court.) That is a structural profile of the pressure hull of THRESHER and the indication is there, the points plotted there are calculated factors of safety using our design equations over the specified test depths of THRESHER. The minimum required factor of safety in the specifications is (b)(1)(A) You will note that we have reached the (b)(1)(A) in all areas of pressure hull including the sonar sphere, access trunk to the sonar sphere, in the cones, in the heads. The minimum factor I think occurs about (b)(1)(A) Superimposed on that I have indicated the factors of safety that were actually obtained from the structural model tests that were performed at the Model Basin.

The document cited above was then examined by the court and was thereafter offered in evidence by counsel for the court. There being no objection by the court or counsel for the party RADM Palmer, the document was received in evidence as Exhibit 74. Counsel for the party waived reading the Exhibit at this time.

Q. Can you tell us the calculated collapse depth of THRESHER?
A. The calculated collapse depth for THRESHER, using our design equation, was b(1)

Q. Was that calculation buttressed by any model information?
A. Yes, sir. We had three model tests of the THRESHER hull construction at the Model Basin. One, the first one, was a model of the control room space, a typical stiffened shell representing the large diameter in that area. The second model was in the area of the forward cone where the torpedoes penetrate. The third model was a complete model of the engine room.

Q. From your knowledge of THRESHER's hull design, if THRESHER transited beyond test depth, which area of the hull would you expect to collapse first? Assume an even keel trim, what type of collapse on failure would you predict?
A. I would expect that the (b)(1)(A) compartment would fail first. The failure would occur first by yielding of the plating between frames somewhere in that compartment followed very closely by an overall type of buckling formed and traveled, it would eventually hit a hard spot and a tear in the shell would result when the hard spot was reached. This is borne out by the third model test at the Basin where this type of collapse actually did occur in that model

Q. Would you expect failure in other compartments, or would internal flooding preclude other failure?
A. It is possible that the failure could be confined to the (b)(1)(A) and when the flood of water came in there, that the interior bulkheads were unable to withstand that pressure and they would rupture. Possibly it is possible, unless the ship were moving down very rapidly that the complete ship might be flooded because of the bulkhead failures. This would be entirely dependent upon how fast the ship were sinking at the time.

Q. Would there be implosions of appurtenances such as escape hatches?
A. This is possible. I know that such a thing did occur in the British tests when they tested full scale their X boats and they found the forward escape trunk went back into the machinery space.

Unclassified

Q. Based on your years of experience, and also your knowledge of the design of the pressure hull of THRESHER, what do you think is the possibility of a fault in the pressure hull design causing or contributing to her loss?
A. I don't believe there is any possibility at all, sir.

EXAMINATION BY THE COURT

Questions by Captain Hushing:

Q. Mr. (b) (6) can you elaborate a little bit on the full scale British tests? You mentioned implosions and the subsequent movement of the structure from one part of the ship to another, I believe.
A. Yes, sir.

Q. Can you explain that a little bit more fully?
A. Well, it has been quite some time since I reviewed those reports. I do recall very definitely that they lowered these ships into the ocean to test them. I don't recall how many but there were two or three tests that they conducted. I recall vividly the description of this damage on the picture of the craft after they brought it back up, and this was in my mind, the fact that this trunk had been carried from the forward compartment through the ship and wound up in the machinery space.

Q. Through the interior of the ship?
A. Yes, sir.

Q. Now thinking about THRESHER, which compartment in the ship, in imploding, if we consider only the main compartments--the engine room, the AMS, the Reactor space, the operations compartment, and the forward living spaces--which compartment would produce the lowest frequency noise spectrum on imploding in your opinion?
A. I'm afraid I can't answer that.

Q. Do you happen to know the number of the DTMB test to which you referred, the model tests of the THRESHER?

COUNSEL FOR THE COURT: Let the record show that DTMB was meant as David Taylor Model Basin.

A. The first test was report DTMB C-903, the second test was DTMB C-1025, and the third test was DTMB C-1026.

Q. What was the scale of these tests?
A. They varied in the order of three-sixteenths scale.

Q. Three-sixteenths?
A. Yes, sir.

Q. Do you know of any tests which have been performed to determine the reliability of model tests as relates to size?
A. Yes, sir.

Q. Can you describe those?
A. The 563, in its early design, was concerned over the increase in depth from 400 to 700 feet and it was desired to substantiate small scale model tests to make sure that they could reliably predict the collapse pressure of full scale structures so a series of full scale models of 563 were constructed and

Unclassified

tested at Portsmouth in the 30-foot diameter tank at Portsmouth. The first model was a--well I'm not sure which was first here. One of the models was the regular pressure hull ballast tank structure. The second model was one of the hard tanks. I think it was around the control space. The third model was in the after portion of the ship including the trim tanks. In addition to that, a full scale model of ALBACORE was built and tested in the same tank. That was a typical stiffened cylindrical shell of a length corresponding to the longest compartment in the ALBACORE. In each instance, the results of the full scale model test confirmed the fact, two facts. Number 1, that they did correspond with the results of small scale model tests which were run previously at the Basin, and second, they confirmed that the design equation used to predict (b) (1) (A) that (b) (1) (A) would be reached in the (b) (1) (A). were in effect reliable. One additional factor that we found from those tests was that the penetration hard spots, access trunks, all these things, did not reduce the predicted collapse strength.

Q. Will you elaborate on your last two statements relative to hull penetration?

A. Yes, sir. On the model when the model basin builds a small scale model, they are necessarily restricted to just constructing a model of a shell plus frames. At that small scale, it is not possible for them to duplicate the penetrations we have in a regular pressure hull such as the escape trunk, penetrations, this sort of thing. When we built the full scale models of TANG, we actually put into those models all the fittings, penetrations, trunks, that went into the actual submarine TANG. I can recall on the second model which I recall now is the normal stiffened shell, that when the failure did occur, it went as a buckle and then when the buckle reached one of these penetrations, which was a reinforcement around a pipe penetration, that a tear resulted when the buckle reached that. This would have never shown up on the small scale model because it would not have had that penetration.

Q. Do I understand that these model tests are all on compartment-sized models rather than on the full ship model?

A. Yes, sir. They break up the length of the model to simulate either a compartment or a length of cylinder between very deep frames. The only place this was not done was in the engine room where we tested that compartment really to determine if the deep frames were in fact adequate to properly break up the compartment.

Q. Then the end restraint on these models is calculated to be as close as possible to the end restraint which exists in the actual ship.

A. I would say so, yes, sir.

Q. Do you think there is any question as to the degree of restraint in the models being the same as that in the ship?

A. No, I do not think there is any question. I don't think it will have any effect on the results obtained.

Questions by a court member, Captain Osborn:

Q. Mr. (b) (6) I want to clear up an impression that I have on contract plans that is not necessarily associated with the pressure hull. Do you know whether the contract plans include definite specs with respect to ability to control flooding, particular studies to be made on flooding, and watertight as a whole?

A. I can answer that in part. The specifications do provide us with the required strength of these compartment bulkheads. They specify that the two end compartments, the bulkheads confining those two end compartments, shall be designed to hold at a head of b(1) The other internal bulkheads are designed to hold at three hundred feet. This is in the specifications. Other than that I don't know, of my own knowledge, of any other requirements to control flooding.

Questions by a court member, RADM DASPIT:

Q. Most of the flotsam which was recovered from the approximate scene of the loss of the THRESHER could have come from the midships compartment. On the model tests, of course, you would have a different bulkhead at each end to take this test. Would you consider it likely that this (b)(1)(A) might have failed before the (b)(1)(A) or after the (b)(1)(A)

A. Well, according to our calculations, the (b)(1)(A) would be slightly weaker, but the difference is so small that if you suppose, for instance, that the ship had an angle (b)(1)(A) so that the (b)(1)(A) would be (b)(1)(A) than the (b)(1)(A) this could conceivably happen.

Q. On your escape trunk, both hatches are normally sealed with the pressure, which is applied in the trunk. Do you have any figures how much pressure lifting that the lower hatch might take before it leaked or gave way? I am trying to determine if the hull floods first, whether the escape trunk would implode or just leak quickly before it failed strength?

A. Well, I can't say for certain, but I'm quite sure that the hatch would sustain the pressure. It would leak but I don't think it would fail under the design collapse pressure.

Questions by a court member, Captain Osborn:

Q. Coming up from the inside?

A. Yes. I think it would leak but I think that the fittings and holddowns are adequate to take the pressure. I'll have to admit that I'm perhaps not qualified to speak on this because we actually didn't design those hatches in our section.

Q. Mr. (b)(6) would the engine room be very sensitive, with respect to taking on say a large amount of water to give you say a residual pressure in the engine room of say some sizeable value, say ten to fifteen pounds; would this affect your overall collapse depth? Would it be very sensitive to this?

A. You mean an internal pressure?

Q. Yes.

A. Building up an internal pressure?

Q. Yes.

A. An excess over atmospheric?

Q. Yes.

A. Well, I think that this would--just the pressure that the hull sees-would be the differential so if you put in ten psi pressure in the engine room, that you then could take an additional ten psi externally if the reverse were true. You put in a vacuum, then you would have a reduced test. The real point here is that the hull sees a differential in pressure.

Questions by a court member, Captain Nash:

Q. I'd like to review your statement about the effect of hull penetrations. You said that the full scale tests proved the strength of an area in which there had been a hull penetration. You said, however, that this would be a likely point of hull failure because at that point the hull would tear. Can I infer from this that if there are more hull penetrations, then there are more points at which the hull might tear?

A. No, sir. I would like to clear that up. The penetration in the model did not precipitate the collapse, did not cause the collapse. The only thing that happened because of penetration when collapse did occur, again by yielding of the shell between the frames, and then after that shell yielding, it loaded the flat frames adjacent to it so the frames started to come in and a large buckle formed which included several frames and as this buckle grew, and it grows quite rapidly along its length, eventually at the crest of this buckle it came to a penetration. All I am saying is at this penetration, because of this rapid change of shape of the shell, the penetration being so thick and massive would not yield in the deformed same curvature as the shell buckled; therefore, a tear develops. So the only effect of penetration would be in eventually causing a tear but in no way would it precipitate the collapse; and this is what our model tests proved, that they did not reduce the collapse of the pressure hull in any way.

Questions by a court member, RADM Daspit:

Q. That brings me up to a shock loading where the hull yields within its elastic limits such as under a depth bombing. Would a hard spot be apt then to cause a tear?

A. Under an extreme shock load there is this possibility. I think that in general the precautions we take in trying to fair in these hard spots will delay this tear until the hull has reached a point where it's ready to go. The specifications do require that when we put in a penetration, a reinforcement around a penetration, that we provide a (b)(1) taper. That is, we taper it between the thick insert and the adjacent thinner shell, we provide a taper of about (b)(1) times the difference in thickness. The about would be about a (b)(1)(A) degree taper. This will eliminate that tendency or reduce the tendency to tear under the type of loading you are referring to.

Questions by the court counsel:

Q. Based on the British tests which you have mentioned, would you expect implosions of appurtenances to rupture the adjacent hull structure in THRESHER?

A. No, sir, I would not. I would like to clear up a possible misunderstanding there. I don't consider that the British tests showed that the failure was attributed to this particular access trunk. I think it was a by-product of the very extreme energy that was released when the failure started and I think that I would not want to say that the access trunk was the source of failure.

Q. Would you say penetrations do impose greater need for quality control of workmanship due to discontinuties and difficulty of x-ray and other inspection techniques?

A. Well, there are various kinds of penetrations. The normal penetration which is introduced into the shell with a butt weld, I would consider requiring no additional precautions over what is required on a normal butt joint. The other type of penetrations where you have a reinforcement--take the form of a heavy ring which is welded into the shell by means of a V-joint--that the restraints around this type of penetration are a little more significant and it does require particular precautions to make sure that the weld is properly made and the residual restraints do not cause cracking.

Q. In view of what you have just said, what was your evaluation of the PUFFS hydrophone insert defects which were found in THRESHER?

A. The evaluation there showed that the attachment of the PUFFS hydrophone to the shell, the weld was poorly made, improperly made. The actual detail of this joint differed from that shown on the plans and the variation I think attributed to the faulty welding.

Q. Can you tell us why these were not found by inspection?

A. I think that the defects occurred on the inside of the trunk which were not visible from an outside inspection. In other words, I don't believe that these defects were surface defects. They were defects on the interior side of the weld. They could not be x-rayed. The only means of checking this weld was by magnetic particle inspection and this would not show the internal defects in this weld.

Q. Is it true that they did penetrate, however, and result in a leak?

A. Yes, sir.

Q. Is it possible that similar defects could have existed in other type structures?

A. I don't believe so. This was a peculiar case to this particular installation where the decision was made to not install it in the sequence that was originally planned, and after the decision was made and they installed the PUFFS on the ship, the making of this particular weld became difficult, and it required making the weld when you have the shell up here and you've got to get in here (illustrating with hands) to make the weld, it was impossible to get any downward penetration into the top of the PUFFS shell. Normally, this condition would not occur on the ship. This was just a case of this particular sequence of events.

Questions by a court member, Captain Hushing:

Q. Are you familiar with the problem that SCULPIN had with hull welding?

A. SCULPIN was what number?

Q. The 591 or 592, speaking specifically of the problem that was discovered at Mare Island Naval Shipyard.

CAPT OSBORN: During her PSA.

WITNESS: I don't believe I heard it, sir.

Q. Let me then ask this question. You said that the hull inserts and hull penetrations have a (b)(1)(A) fairing.

A. Yes,sir.

Q. To the hull?
A. Yes, sir.

Q. This fairing is put in generally by welding?
A. Yes, sir.

Q. Do you feel that there was absolutely no question that all of the hull inserts on THRESHER were so faired into the hull?
A. Well, I wouldn't bank my life on it.

Q. Well, why do you have the opinion that you expressed earlier that there could not possibly have been a hull failure?
A. Because if this tearing had not taken place, it would not have affected the ability of the pressure hull to take hydrostatic pressure. In the event of a dynamic loading, then without the fairing, you would increase the possibility of getting a tear at that point, but it would not affect the hydrostatic strength of the structure.

Q. Does it affect the fatigue life of the structure?
A. Yes, sir, it would.

Q. Now let me give you a few postulations and ask for your opinion. You've indicated your confidence in the design that hull penetrations would not weaken the hull. In the ship we are faced with operating machinery which requires cooling water and we have many such requirements. We have a full spectrum of possibilities open to us that provide this cooling water by having one intake and one outlet through the hull and many take-offs from this circulating water line; or we have the possibility of having, at the other ends of the spectrum, a hull penetration or intake and outlet for each equipment requiring cooling water and, obviously, in between the two ends of the spectrum we have many other combinations. Considering hull integrity desires, and the need for cooling water, what in your opinion would be an optimum solution for this particular problem?
A. Well, being a structural man, we've always gone on the basis that the number of penetrations in the pressure hull should be kept to a minimum. This is, of course, based on the fact that we know that every penetration is a possible source of rupture under a dynamic loading. We do not worry about its effect on the hydrostatic pressure. Well, if you neglect dynamic loading first and consider this problem only on the basis of the existing hydrostatic pressure, then I would say that if there is any question in anyone's mind about the ability of internal piping and fittings to take hydrostatic pressure, then the solution--and I'm sure we would go along--would be to put in additional penetrations in the pressure hull to reduce this amount of internal piping. Understand, this is ignoring dynamic loading.

Q. All right now, do you have any responsibility for damage control considerations in design of the ship?
A. Indirectly in the design of our control surfaces we make sure that they are capable of operating under the extreme conditions, but if you are speaking of damage control of flooding, no, sir, I have no responsibility.

Q. Have you ever engaged in discussions of damage control problems with other sections of the Design Division? Have they come to you and asked you for more hull penetrations, for example, for this reason?
A. Not to my recollection. I don't believe I've ever turned them down on a request for a needed penetration.

Questions by a court member, Captain Osborn:

Q. I would like to clear up one question in my mind with respect to dynamic loading and see if I understand this correctly. By dynamic loading you mean the ability to sustain or fail without rupture of a dent or propagating permanent yield, is this correct?

A. Yes, or another way to put it, on a suddenly applied load you can withstand that suddenly applied load without a rupture occuring before the energy has been fully absorbed by the structure. It would be in effect a premature rupture because of the inability of the structure to deform and absorb the energy of the loading.

CROSS-EXAMINATION

Questions by counsel for the party, RADM Palmer:

Q. Mr. (b)(6) , I believe you said that you made a full scale model test of ALBACORE, is that what you said?

A. That is correct.

Q. Of what material was ALBACORE made?

A. Well, it was called at that time low carbon Steel STS. It's very similar to HY-80 material we are using today, and which was used in THRESHER.

Q. So therefore we can say that you did have the advantage of the full scale tests of ALBACORE made of essentially the same material as THRESHER?

A. Yes, sir.

Q. One other question, Mr. (b)(6) , what design improvements have been made since TANK design to reduce the effect of penetrations as hard spots?

A. The only significant one I can think of is that we have acquired the use of insert plate, thick plate welding in a taper, welded into the pressure hull, whereas in the TANG days they were permitted to provide the compensation in the form of a doubler and I think as a substitute to the TANG, that the specifications were changed to say in effect where you are required to provide reinforcement around an opening, such reinforcement will be in the form of an insert plate welded into the pressure hull, thickened up as necessary to provide one hundred per cent replacement of the area taken out, tapered, and the only place that they permit you to use a doubler is for the smaller openings.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. It is known that more recent submarine designs than THRESHER's have changed in detail with respect to the HY-80 pressure hull structure. Why were these changes made?

A. Primarily, I think, to improve the fatigue life of the design. We found out during a model test of THRESHER that the cone cylinder intersection on THRESHER was an area which had very high stresses and there was some question about the ability of that particular area to withstand repeated loadings. So we made a model test to determine the effect of repeated loadings on this particular detail and discovered that indeed there was a problem in this area. So an intensive program was initiated to look into the problem of fatigue and make design improvements to reduce the stress level at these

particular areas and by doing so, improve the fatigue life.

Q. Then notwithstanding those changes, would you consider THRESHER's structure adequate for her designed operating depth?

A. Yes, sir.

Questions by a court member, RADM Daspit:

Q. Following this on logically then, is it possible that the strength of the midships compartment would be weakened with time and fatigue cycles to the effect where it might collapse before the engine room compartment would?

A. No, sir. I think that the cone at the forward end of the engine room compartment is just as likely a candidate for fatigue failure as the cones in the other portion of the ships, the one at the forward end of the control space and one at the end of the reactor space. From the information we developed from the deep submergence trials of THRESHER, the stresses at the cone section and engine room were as high as those in frame 84.

Questions by court president:

Q. Mr. (b) (6) do you have any theory which might explain the collapse of the (b) (1) (A) earlier than the (b) (1) (A) other than the one which you have already cited of the vessel having a sharp angle (b) (1) (A) and thereby subjecting the (b) (1) (A) to a greater pressure at an earlier time than the (b) (1) (A)

A. Well, the only other possibility I can see of the (b) (1) (A) failing would be that if the vessel were going down fast enough so that assume you got failure in the (b) (1) (A) that before the water could rush in and go through the (b) (1) (A) bulkhead, through the (b) (1) (A) into the (b) (1) (A) --that couldn't do this rapidly enough that the vessel might have sunk rapidly enough to the point where the (b) (1) (A) could collapse. This would be the only other way I think it could happen. However, let me say this, I don't think that the difference between the strength of the (b) (1) (A) and the (b) (1) (A) is great enough from a design figure to throw out this possibility that our figures are based on a minimum yield strength of material that we expect to get from the manufacturer. It is possible that the yield strength in the (b) (1) (A) might have been five per cent higher, even as much as ten per cent higher. The yield strength in the (b) (1) (A) could have been just slightly higher. This could account for a ten per cent differential in the collapse pressure, which would, I think, more than make up for the slight differences in our design collapse pressures to those areas.

(b) (6) relieved (b) (6) as reporter at this point.

CROSS-EXAMINATION

Questions by counsel for RADM Palmer:

Q. Mr. (b) (6) do you consider the structural design of THRESHER in the way of the transition cones and their forged rings, which we were just discussing, improved over earlier SSN's or HY-80, such as SKIPJACK or GEORGE WASHINGTON?

A. Yes, sir, we did accomplish some improvements there. Instead of a fairly massive, thick, untapered ring, we provided a transition ring that

was tapered to ease out this continuity and stress levels at this point. We also reduced the cone angles considerable to also reduce these stress levels. On THRESHER itself we could not taper the connection of the ring to the forward cone, so in lieu of that we provided an increased thickness of cone plating to provide the additional margin of strength.

Q. In discussing the factor of safety, you mentioned the usual (b) (1). What does this mean in terms of feet of depth compared with previous designs?

A. Now on THRESHER, with a test depth of b(1) a collapse depth of b(1) this would provide us with a margin of b(1) by which we can exceed test depths before we reach collapse. Previous designs, on the b(1) boats, this margin was b(1) they had a design collapse specification of b(1) On the fleet boats, the 285 craft, we had a 400 feet test depth, and the design collapse depth in the specification was (b)(1)(A), which provided us with (b)(1)(A) feet.

REEXAMINATION BY THE COURT

Questions by a member, CAPT Hushing:

Q. Mr. (b) (6) you mentioned that this steel has an allowable variation of tensile strength --

A. I didn't mean a certain allowable one, but our specifications say that they must have a minimum yield point of 80,000. I don't think there is a maximum on the yield point.

Q. But there is a potential for something above 80,000?

A. Yes, sir, I have seen figures as high as 95,000 yield and thinner material, and the thicker material that we are talking about, it is quite likely to get a yield strength in the order of 85,000.

Q. Is there also an allowable variation in the thickness of plating which is purchased?

A. Yes, sir. On THRESHER, I think -- this was one of the first ships that we changed on ordering steel by weight, where the tolerances are plus and minus variations of something in the order of two to three per cent; you can get a minus three per cent and a plus three per cent. On THRESHER we ordered plating by thickness, and the tolerance when you order it by thickness is that you are permitted a minus tolerance of one-hundredth of an inch and a plus tolerance on the order of five per cent.

Q. So that if by coincidence you had simultaneously in a plate the larger thickness and a higher tensile than the minimum required, you might have a substantial difference in the strength of that plate as compared with one which just exactly hits the specifications, and that this difference might be as much as ten per cent in the aggregate?

A. Yes, sir.

Q. As I remember, you stated your calculations for the collapse depth of hull sections, were based on the minimum tensile strength of 80,000 psi?

A. That is correct.

Q. And on the average thickness required by the drawing --

A. Not the average, the nominal thickness, which would be one-hundredth of an inch over the minimum that we could get.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. Do you have records which show the thickness and yield strength used in various locations in THRESHER's pressure hull?

A. I don't; I'm sure that they are available. I think they were required to be furnished with the material. We are required by the specifications to ultrasonically inspect these plates, and as we made this test, thickness measurements were recorded also.

COUNSEL FOR THE COURT: Will you check that for us, please.

WITNESS: You would like to know if we have records of thickness and yield strength of the pressure hull plating on THRESHER.

Neither counsel for the court, the court, nor the counsel for RADM Palmer desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

I would like to say a few more words about the development of this design criteria that we have used. I was in the Bureau when this design criteria that we are now using was developed, and I was directly responsible for directing research work which was aimed at confirming the fact that this design criteria was a reliable indicator of our strength of pressure hulls. A series of high strength steel models were constructed and built at the Model Basin even before we were thinking of 593 designs. These models were so-called "sea models," and they covered a fairly wide range of possible geometries of shell and frame thickness, and in every instance the results of these model tests confirmed the fact that our design equations could reliably show that the collapse strength of those models could be reached using this design equation. In most cases the design equation was conservative, by an order of two or three per cent. When the 593 design then was proposed we had this information, plus three small model tests of SKIPJACK, which were available to us, which also confirmed the fact that this design criteria was indeed a good criteria used for designing HY-80 pressure hulls, so when we went into the 593 design using these equations, we were quite confident that we could realize the required collapse depths, using these equations. I have been privileged to go down on the deep submergence trials of most of the recent submarines, since TANG, and I never, at any time, have had any qualms, any doubts whatsoever about the ability of the THRESHER to withstand pressures at top rated depths. I went down on THRESHER on her deep sea trials and had actually no thought whatsoever of the depth. I didn't worry about the strength of construction at any time, and I'm sure that anyone that has worked on the structural design of THRESHER feels the same way.

REEXAMINATION BY THE COURT

Questipns by the President:

Q. Now, Mr. (b)(6) do you have the same confidence that you have expressed with respect to the pressure hull, in the systems, the piping systems in the ship, which are subjected to outside pressure?
A. Well, I will have to admit that I do not, sir.

Neither counsel for the court, the court, nor the counsel for RADM Palmer desired to examine this witness further.

The witness was cautioned concerning his testimony and withdrew from the courtroom.

The court recessed at 1410 hours, 24 April 1963.

The court opened at 1415 hours, 24 April 1963.

All parties to the inquiry who were present when the court recessed are again present in court.

Raymond Eugene Bemis, was called as a witness for the court, was informed of the subject matter of the inquiry, advised of his rights against self-incrimination, was duly sworn, and examined as follows:

The witness was informed that the court was sitting with closed doors and that classified information could be divulged.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and occupation.
A. My name is Raymond Eugene Bemis, (b)(6) New Hampshire. I'm a GS-11, engineering technician, assigned to the service piping section of the Service Piping Branch.

Q. That is in the Portsmouth Naval Shipyard?
A. Yes.

Q. What is your code designation?
A. 263B.

Q. What is the general nature of your duties here at the Shipyard?
A. I'm an engineering technician in charge of preparing drawings, developing drawings, designing components for the trim and drain systems on submarines.

Q. And did you do that work in the case of the U.S.S. THRESHER?
A. Yes, sir.

Q. State briefly your educational and professional background?
A. I have no professional background. I am not a college graduate. I am a technician. I served an apprenticeship in the Shipyard as a coppersmith. I went up through the Leadingman Coppersmith, which grade I retained for five

years during the war, World War II. After the war I took a position in the Design Division in 1947, in the same section which I am in now working.

Q. Have you been there continuously ever since?
A. I have been in the Shipyard almost thirty-four years. I have been in the Design Division since 1947.

Q. Will you give us a summary of the contract plans, detail specifications and design philosophy and concept which led to the design of the trim and drain system in THRESHER?
A. If I may separate this in three different parts. The first part will be the trim system; the second part the drain system, and the third part according to the schedule in which you are interested, the water hammer test conducted on the THRESHER. May I conduct these in three parts?

Q. By all means, do so.
A. I will not try to separate this and compare the plans as they came out of the Design Division with the contract plans. I have many letters between the Bureau of Ships and the Portsmouth Naval Shipyard pertaining to the development of the diagrams of the trim and drain system; they are quite lengthy and they finally developed into the system which was installed in the THRESHER. Now if I may, I will go through these systems.

Q. Proceed.
A. May I use notes?

Q. You may refer to notes, but it must be understood that you will testify from your own knowledge.
A. Right. The trim system as required by the contract plans and detailed specs of the 593 class, THRESHER, consist of a trim pump, a priming pump, a (b)(1)(A) suction main, a (b)(1)(A) discharge main, with (b)(1)(A) and (b)(1)(A) branches extending from these mains to the various and variable ballast tanks. There is a sea valve and backup valve to permit transfer of water to and from the sea from these variable tanks. Each branch from the main to the tank has a stop valve. All of the aforementioned valves are hydraulically operated by means of solenoid valves from the ballast control panel in the control room. The trim pump is a six stage vertical centrifugal pump manufactured by Warren Pump Company, Warren, Massachusetts. The rated capacity of the pump was from (b)(1)(A) gallons per minute, depending on the depth pressure. It was driven by a 125 horsepower 250 volt DC directly connected motor. The motor was started, stopped and controlled on the ballast control panel in the control room. The priming pump is a Nash wet vacuum pump, rated capacity of 16 cubic feet a minute. It was driven by a one and a half horsepower motor, 440 volts, 60 cycles, three-phase. This was controlled from the ballast control panel. These two pumps are located in the auxiliary machinery space on the lower level. The various pressure gauges and the vacuum gauge for the priming pump are located in the ballast control panel, and another set in the upper level of the AMS. A flow meter totalizer was installed in the ballast control panel, controlled from two flow meters in the AMS. One flow meter indicates amount of water or pounds of water, I should say, transferred from tank to tank or from tank to sea. The other flow meter registered the amount of water, pounds of water, transferred from sea to a tank. This last flow meter was installed at the latest availability.

Q. When you say AMS, what do you mean?
A. Auxiliary machinery space. I'm sorry; I may say letters instead of names of compartments. If I do, please stop me. The tanks serviced by the trim system are the forward and aft trim tanks, numbers 1 and 2 auxiliary tanks, the negative tank, WRT tanks and the two torpedo impulse tanks.

The trim tanks, auxiliary tanks and negative tanks are controlled from the ballast control panel through these aforementioned valves. The WRT, the two WRT tanks, two impulse tanks -- excuse me, WRT, water around torpedo, this is the water that is flooded up around the torpedo prior to firing the fish, the torpedo. The impulse tanks, may I explain that, are tanks that transfer the pressure of the impulse cylinder to the torpedo tube, which fires the fish. This is used in lieu of the impulse air system that was formerly used. It was a high pressure system of water directly behind the fish. These two tanks are serviced from a manifold in the torpedo room and this manifold was manually operated. The priming pump is utilized to remove air from the system prior to startup of the trim pump. This is accomplished by taking a suction from three priming valves, one of which was located in the auxiliary machinery space, one in the after end of the midships compartment, and one in the forward end of the midships compartment. The trim system is cross-connected with the drain system via a manifold in the upper level of the engineroom. This enables either pump to perform the function of the other pump at any time they choose to change the manifold in the engineroom. The priming pumps are similarly cross-connected, so that one priming pump can serve either of the trim or drain pumps. The drain system -- do you want me to continue with the drain system?

Q. Please do.

A. The drain system is comprised of a drain pump and a priming pump identical to the trim pump and the trim priming pump. These two pumps are located in the lower level of the engineroom. It is also comprised of a (b)(1)(A) drain main extending the length of the ship, with branches extending to the various bilges in each compartment. There are two (b)(1)(A) drains in the sonar equipment room at the forward end of the vessel, one (b)(1)(A) and two (b)(1)(A) drains in the deisel engineroom, two (b)(1)(A) and three (b)(1)(A) in the midships compartment, four (b)(1)(A) drains in the reactor compartment, two (b)(1)(A) in the auxiliary machinery space, two (b)(1)(A) and six (b)(1)(A) in the engineroom. The reason for the large number of (b)(1)(A) in the engineroom was due to the bilges formed by the various lube oil tanks, sea water tanks, etc. They made bilges which could not be drained to another bilge, so therefore we had to install more drains in the engineroom than seem necessary. The drain pump takes a suction through the manifold in the upper level of the engineroom, through a dual McComb strainer. This dual McComb strainer is a two-sided strainer, so that when one side gets plugged up with bilge water, debris from the bilges, the strainer can be diverted so that the water goes through the other side of the strainer and the first side can be cleaned while still operating. This strainer was located in the lower level of the engineroom. The drain pump discharges through the same manifold to either overboard, to the trim system or to the waste oil tank. It is normally set up to discharge to the waste oil tank by leaving the valve in the manifold open, so that all that is necessary to do is to start up the priming pump, start the drain pump, open the waste oil valve, the waste oil tank valve, which is hydraulically operated, open the necessary bilge that requires emptying, and that is it. The waste oil tank is a soft tank located outside the pressure hull, within the ballast tank, outside of the forward port side of the engineroom. It is directly compensated through a reinforced hole in the bottom of the tank. This tank is to -- some of you probably -- are probably thinking of the old expansion tanks that separated the oil from the water; the oil floated to the top and would not be discharged overboard through the head loop in the fairwater. On these vessels, the waste oil tank takes the place of the expansion tank. We do not discharge bilge water to the tank; it is discharged to the waste oil tank. The oil is separated expansion in the waste oil tank, clean water is discharged overboard through this hole at the bottom of the tank. The controls for the drain pumps are located in the upper level of the engineroom with a control at this station for the hydraulic operation

Unclassified

of the hull valve to the waste oil tank. The pump has a (b) (1) (A) suction and a (b) (1) (A) discharge, rated capacity the same as the trim pump. The priming pump for the drain pump, as with the drain pump draining pump takes a suction from three priming valves, one located in the engineroom, one in the after end of the midships compartment, and one in the forward end of the midships compartment. The bilge suctions are comprised of a tail pipe and a strainer, located in the bilge, with a check valve and a stop valve in each connection to the drain main. For easier control of one suction in each main compartment of the THRESHER, we provided a hydraulic operation of a (b) (1) (A) suction valve in each main compartment, operated from the upper level of the compartment in which the stop valve is located. There was one in the deisel generator room, one in the port wet bilge amidships, one in the forward end of the auxiliary machinery space, and one in the forward end of the engineroom. Also in each bilge we have bilge level alarms that indicate in the compartment above the bilge both visible, visual and audible, that there is an amount of water in the bilge. These bilge level alarms are located, one in the sonar room, two in the deisel generator room, one in the pump room amidships, one in the periscope well amidships, two in the wet bilges midships, two in the auxiliary machinery space, three in the reactor compartment, and seven in the engine room. This is all I have on the trim and drain system. My next discourse will be on the water hammer. Shall I continue with that, or are there questions on the trim and drain system?

PRESIDENT: I think you might continue and we will reserve the questions until you are finished.

WITNESS: Yes, sir. During the second sea trials of the THRESHER severe water hammer was observed while operating the trim suction main at test depths, b(1) feet. This was caused by suddenly opening the sea valve to the trim suction main, or by suddenly shutting the tank valve while water was flowing at full pressure, b(1) through the trim suction main to a tank. We found out later this was the forward trim tank. The water hammer effect will cause peak pressures in excess of the system test pressure which was (b) (1) (A) pounds. At this time the Shipyard was requested by the Bureau of Ships to conduct a series of tests to determine these peak pressures, both to give the ship's force and the operators that there was good quality workmanship in this system, and to find the means of overcoming water hammer. This water hammer had never been experienced, to our knowledge, in vessels prior to this, because this is the first vessel that operated at this depth. The testing was accomplished by utilizing a large tank which was formerly a conning tower on an old type vessel. This was utilized as an accumulator, and was set up in Drydock No. 2. We filled this tank about seventy-five percent full of water, and charged it above the water with a set pressure of air. This was connected to the ship's system. By the way, if you have any questions afterwards, I have a complete set of pictures of the setup in the drydock as it was accomplished, and OSC silographs of the peaks. This was connected with six system by a hydraulically operated valve external to the ship. The valve could be controlled from outside the ship in the drydock. It could be controlled as to the time of operation of this valve. Hydrauloscopes were installed at the extremities of the trim discharge mains upstream of the valve to the forward trim tank, and we had two hydrauloscopes one on each side of the trim discharge backup valve to the sea. The system was first, this is on the trim discharge system, the first one they tested, the system was hydrostatically tested, first to (b) (1) (A) pounds for six hours, prior to the water hammer test. There was a pressure drop of approximately 44 pounds. This was temperature corrected. The tank was then charged to 150 PSI. It was decided to start at low

pressure and gradually work up so that we would not exceed the elastic limit of the piping in the system, so we started at 150 pounds on the accumulator. The test valve was suddenly opened with this pressure behind it, and a peak pressure of (b)(1) (A) pounds was recorded at the extreme hydrauloscope in the main discharge line. The test and the peak pressure of (b)(1) (A) pounds was recorded at the extreme hydrauloscope. This is the hydrauloscope upstream of the forward trim tank discharge valve. The tests valves were then cycled one hundred times. That was with a hundred and fifty pounds pressure on the tank. The tank was then charged to various pressures and I won't bother to go over them all because there's quite a few of them, and a combination of these valves was cycled to determine which valve should be slowed down and which could be operated at standard speed, and some peak pressures reached to (b)(1) (A) pounds. At the completion of the impulse tests the trim discharge main was again hydrostatically tested to (b)(1) (A) pounds and held for six hours, and it had a forty-five pound pressure drop, which was one pound more than the one previous to the impulse test. The drain system and the trim suction main were similarly tested. Each was impulsed one hundred cycles and retested with no failures. The results of these tests were slowing down the operation of all hydraulically operated valves that enabled sea pressure to reach the trim mains. Operating procedures were recommended for the trim system: (a) In flooding from sea, open the tank valve first, then the hull and/or backup valve; (b) always flood through the trim discharge lines, which might raise the question in your minds, in flooding from sea we determined that we would have to flood through the trim discharge main to protect the trim suction main, which could be under a vacuum pressure; to secure shut the hull valves first, then the tank valves. In pumping to sea (1) Open the tank valves to pump suction; start the pump, when the pressure differential approaches 50 PSI between the pump discharge pressure and sea pressure, then open the hull and/or backup valve. Shut down, stop the pump, observe a no-flow condition and shut the backup and/or hull valves. (3) A pressure switch was installed to prevent opening the backup valves to the main suction main below periscope depths. It opened the circuit to the buttons on the ballast control panel. As all of this came about subsequent to the 593 training lectures, the THRESHER received this information by a letter from the Shipyard Commander addressed to the Officer in Charge of the THRESHER on the 30th of June, 1961. This information has been incorporated in all subsequent crew training letters and in the ship's information books, and lectures. That's it gentlemen.

Questions by counsel for the court:

Q. What major items of design of the trim and drain system were accomplished at Portsmouth for reasons of damage control or safety?

A. I might say that the trim and drain pumps were not capable of damage control at test depths. The pumps would pump (b)(1) (A) gallons per minute at test depths, which is approximately (b)(1)(A) pounds a second, and if a hole came through the hull 1/8 inch in diameter, approximately, this would be (b)(1) (A) pounds a second at test depth. We installed these hydraulically operated bilge suction valves as an attempt to help in damage control because prior to installation of these hydraulically operated on the bilge suction valves, if a compartment became flooded it meant a man would have to dive to get to the valve to open it. We also disagreed with the Bureau in some cases where they showed stop check valves in bilge suction lines or other lines. We've had troubles with these stop check valves. We only have one means of protection to the system with a stop check valve. If a match or a piece of debris from the bilge gets caught under the seat of the stop check valve you cannot close it. With a check valve and a stop valve we have two means of protection. The check valve also, if the stop valve was inadvertently left open, will protect the compartment from flooding

Q. You mentioned in your testimony the "593 training lectures," I believe. What special instructions were issued to THRESHER's ship's company regarding safe operation of the trim and drain system in THRESHER?

A. This was issued via the ship's lectures, which I gave myself, on the trim and drain system. It is in the ship's information book, the hydraulic systems of the vessel, technical manuals of all of the components. This letter that I mentioned pertaining to water hammer on the operations of the system, the operation of the valves to prevent water hammer.

EXAMINATION BY THE COURT

Questions by a member, CAPT Nash:

Q. What type of joints are used in the trim and drain system?

A. We have both welded and sil-brazed joints. The 580, BARBEL trouble, came in about the middle of the design and the building of the 593. At the conclusion of the 580 hearing it was determined at that time to attempt to make everything between hull and backup valves, regardless of size, welded. The Bureau of Ships had imposed a restriction on fillet welding tubing at two inch, so this means that everything over two inches would have to be butt welded with a backing ring, and I'm talking about copper nickel tubing now, which is a little bit different in welding than in steel. I don't think we have at this time the consumable inserts for the copper nickel. If we have I have not heard about it, but we did use backing rings. The (b)(1)(A) mains were all butt welded. The (b)(1)(A) , due to the fact that this came about in the middle of the design and building of the boat, some of them are welded, some of them are sil-brazed. I would say that most of them in my system, the three inch size and below are sil-brazed.

Q. Are you acquainted with the quality assurance tests that were conducted on this system, in these two systems?

A. Not too well, no, sir. I do know that prior to the failure of these two joints on the second sea trial, I believe this is what you are probably leading up to, that these joints were visually inspected by the Leadingman and then by an inspector, I believe. At that time we did not have the facilities of ultrasonic inspection of the joints, prior to this, but to my knowledge they were inspected visually only and hydrostatically tested. The lines were flushed out to remove all the flux from the inside of the line. They were flushed with warm water, which removed the flux so the flux will not hold the pressure. They were then hydrostatically tested, so far as my system was concerned, to (b)(1)(A) pounds, and the joints were visually inspected.

Q. Do you have any responsibility so far as the installation of this system?

A. No, sir.

Questions by a member, CAPT Hushing:

Q. What materials are used in the trim system?

A. Copper nickel tubing, bronze, and copper nickel fittings. Copper nickel fittings are the welded fittings, and flanges, and bronze fittings for sil-brazing.

Q. Was any aluminum bronze used anywhere in this system?

A. No, sir.

Q. How about the drain system?

A. The same thing: the same material.

Q. You mentioned slowing down the valve operating times in the trim system. Can you give us a feel for their initial settings as regards time and then their retarded or slowed down settings?

A. The initial operating time of the valves were a fraction of a second. This was assuming that we had twenty-five hundred pounds hydraulic pressure in the hydraulic system. May I read from these notes?

Q. Please do.

A. It's quite hard to remember all of the valves. The trim hull valves were slowed down, time to open six to nine seconds, time to close two to three seconds. The two backup valves to the hull valves, the trim suction and discharge from sea was slowed to six to nine seconds to open, and two to three seconds to close. The other valves in the system would service the tanks. The opening time was not important, the shutting time we slowed to from three to five seconds, and this pertains through the trim system. Manually operated valves, they had instructions to open and shut them slowly. I have a copy of this letter if anybody cares to have it.

PRESIDENT: No, I don't think we need it.

Q. You mentioned that in your tests in the drydock, using the old conning tower as an accumulator, you found substantial increases in instantaneous pressures when you opened the valves quickly?

A. Yes, sir, under the original setup.

Q. Did you take measurements after you slowed down the valves in the trim system, as regards peak pressures?

A. Yes, with the tank pressure at (b)(1) (A) pounds, slowing the valves down to seven seconds open, this is the backup valve to the hull valve, the peak pressure recorded at the extremity of the line was (b)(1) (A) pounds.

Q. You indicated that the trim system uprating instructions were contained in a letter to the ship; were they not?

A. Yes, sir.

Q. You say they were also included in the ship's information book?

A. That is right.

Q. When was the ship's information book delivered to the ship?

A. This I don't know.

Q. Do you know if it has in fact been delivered to the ship?

A. No, sir, this was out of my line.

Questions by a member, RADM Daspit:

Q. You indicated, I believe, that all joints in the trim system were welded, or brazed; are there any mechanical joints?

A. Oh yes, flange joints and some high pressure unions.

CROSS EXAMINATION

Questions by counsel for RADM Palmer:

Q. Mr. Bemis, I think you said one of the instructions, one of the procedures that you developed was the manner in which the trim system was opened. My question is, what might happen if you flooded the trim system then the trim suction line under a vacuum?

A. You mean suddenly, under high pressure?

Q. Yes.

A. We think we know what happened here. We think this is what happened, but we can't prove it. During the second sea trials with THRESHER, the trim suction main was flooded suddenly from sea with a vacuum in the suction main. The trim system is a little different than the drain system, in that it can retain a vacuum in the main, because very, very seldom do you empty a tank with the trim system, as you do with the drain system. The drain system, as soon as you empty your bilge you load the system with air and you lose your vacuum. In the trim suction system you very seldom empty your tanks so that you retain the prime or the vacuum in the main. We think what happened on the THRESHER was that when they suddenly admitted this b(1) pressure to the trim suction main, it collapsed, all three floats in the priming valve. These floats are made of inconel and I saw every one of them; they were crushed right up.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. You testified that on the second sea trials of THRESHER two joints failed in the system. Can you describe the two failures to which you refer and tell us the type of joints as well.

A. Yes, sir, one of them was a three-quarter inch joint from the suction main. These are both in the suction main, too, which leads us to the same thing that I just said. One was a three-quarter inch line from a boss in the suction main to the priming valve, and was in forward end of the midships compartment. This completely blew out of the boss. The other one was in a coupling, a slip coupling that was installed in the diesel generator room in the (b) (1) suction main, and sil-brazed in place. This did not completely let (A) go; it opened up at the top of the coupling and held at the bottom. This joint was brazed with Grade 4 silver.

Q. What type was the first joint and what was the type of failure?

A. The three-quarter inch was a sil-brazed joint; the union was a male-tail piece of the union in a boss, it was sil-brazed into a boss, and it blew out.

Q. With regard to the failure of those joints, were there any problems encountered in obtaining rapid closure of the sea valves to secure the system from the ballast control panel?

A. I don't know, sir. I understand they had quite a job getting at the three-quarter inch one. It was in behind the crew's head.

Q. You are referring to the sea valve?

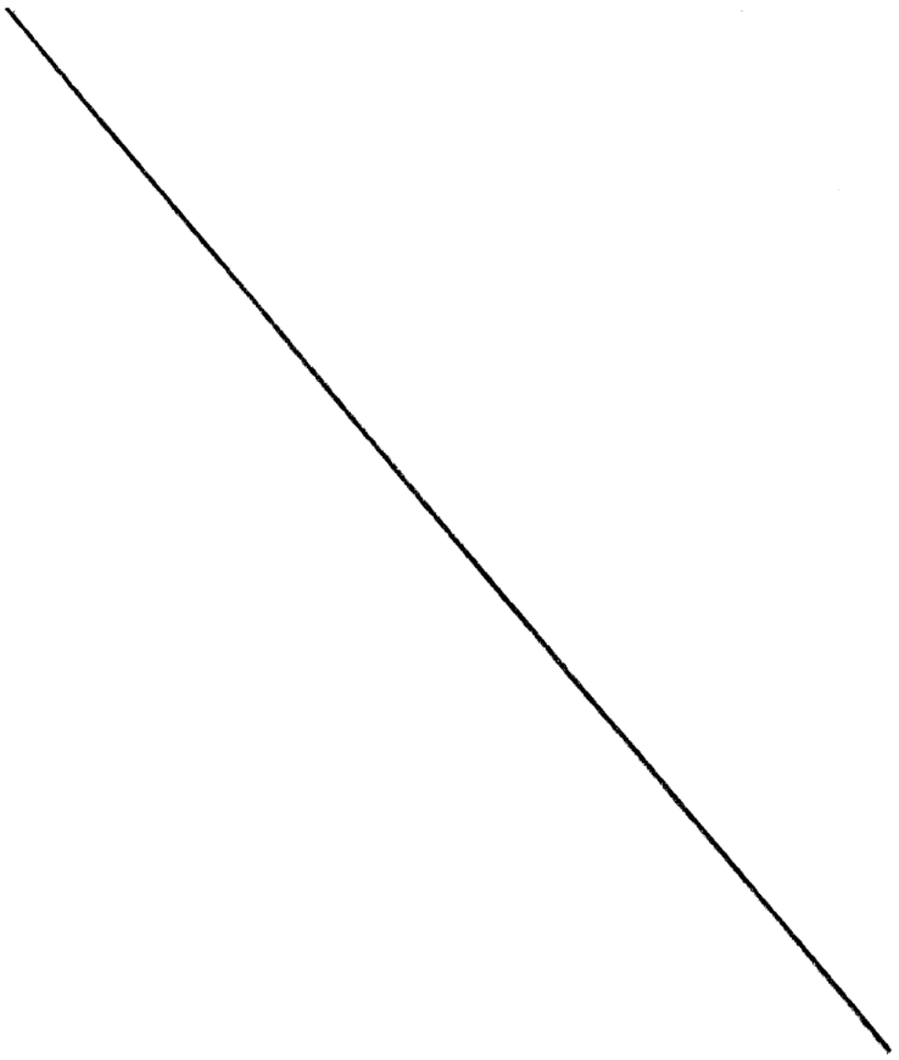
A. No, the joint that broke apart.

REEXAMINATION BY THE COURT

Questions by the President:

Q. Mr. Bemis, having been intimately connected with the design, redesign and testing of these lines, that you have just described, do you think that they are susceptible to simplification, or reduction in size without detriment to their serving their purpose?

A. I don't think they could be reduced in size, because the size of the trim main, both the suction main and the drain main, are sized to suit the capacity of the pump. If you reduce these sizes, you lose the capacity of the pump. It decreases very sharply. We have undergone a program of trying to reduce the number of joints in the system. I believe this was accomplished on the 605, and the latest ballistic missile boat; I don't know the number of it.



Q. There does, then, seem to be some feeling in design circles, that a simpler trim and drain system can be designed; one with less joints in it?
A. This doesn't only apply to the trim system, sir, it refers to every piping system in the vessel. Any time you can reduce the number of joints you reduce the possibility of leaks.

Q. Yes, I'm cognizant of that, but I wanted your estimate of the practicability of simplifying these systems with which you are most familiar. If you could start all over in the THRESHER, couldn't you design a simpler system?
A. I think that we possibly might, because we are now designing the 555, which has a low pressure trim system throughout the vessel, trim and drain system throughout the vessel. The only high pressure part of this system is located in one area; the rest of the system is low pressure. One thing I have been firmly convinced of is that if we could control all of the bilge functions from one central point, such as the ballast control panel, or a station in the engineroom, say, where the drain pump is located, if we could control all of the bilge functions in this one area, have bilge level alarms in this area, this could simplify the operation of the system. I won't say that it will simplify the system, because it would mean introducing remotely operated valves.

RECROSS EXAMINATION

Questions by counsel for RADM Palmer:

Q. Mr. Bemis, with regard to the letter that you said was sent to the ship, after your tests to get rid of that water hammer, do you have any identification of that letter?
A. I have that letter right here.

Q. Will you give us the date and identification?
A. From the Commander, Portsmouth Naval Shipyard, to the Officer in Charge of the THRESHER, letter number 240/SSN593/9480 of 30 June 1961.

Neither the counsel for the court, the court, nor the counsel for RADM Palmer wished to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

I do have a statement that I would like to make; can I make it as my opinion?

PRESIDENT: Absolutely.

WITNESS: In my opinion the THRESHER underwent the most thorough testing program of any submarine to leave this Shipyard. I was a member of a team from the Design Division, working with Commander Allen and Lieutenant Mahoney to instruct and work with Code 303, the test code, to provide methods for testing the various systems to agree with the test memos issued by Code 246.

This entailed giving lectures to the crew, shop representatives and to Code 303, setting up all the prerequisites for testing and the actual testing program of the vessel. Also, this was the first submarine to undergo such an extensive impulse testing of sea water systems, and measuring the impulse shock waves imposed on the system. It was my belief that this impulse testing could prove beyond a doubt the adequacy of the sil-brazed joints and the installations of these systems as a whole.

PRESIDENT: And yet we lost the THRESHER.

WITNESS: No comment.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

The court recessed at 1503 hours, 24 April 1963.

The court opened at 1510, 24 April 1963.

All persons connected with the inquiry who were present when the court recessed were again present, except (b) (6) , who was relieved by (b) (6) as reporter.

No witnesses not otherwise connected with the inquiry were present.

Eldridge B. Woods, a civilian, was called as a witness for the court, was informed of the subject matter of the inquiry, was advised of his rights against self-incrimination, was duly sworn, and examined as follows:

COUNSEL FOR THE COURT: Mr. Woods, this is a closed session of the court, and classified information may be given here. At the end of your testimony, I shall ask you what classification you would accord to your testimony.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address, and present occupation.

A. Eldridge B. Woods, (b) (6) Maine. I am a Supervising Naval Architect. I head the section called Hydronamic and Launching, Code 251-B, of the Design Division. My work--

Q. That is at the Portsmouth Naval Shipyard, is it not?

A. At the Portsmouth Naval Shipyard.

Q. Can you briefly describe the nature of the work that you do?

A. The hydronamic phase of the work includes determining forces and where they act on primary control surfaces, and relaying this information to Design codes. The basic data on control surfaces come to us from contract plans and specifications, and they are related to the hydronamics and shield applications as we can, upon request, relative to speed and power, resistance, drag, and some motion analyses, using Model Basin reports as our bible. The launching phase consists of the naval architecture of the launching of the ship. Here we deal with buoyancy and moments, stability, trim, stepping, pivoting, and pressures on the ways and cradle.

Q. Did your work include work on the ship control system of THRESHER?

A. Yes, sir.

Q. Briefly state, if you will, your background and experience in this job.

A. I have a B. S. degree in Civil Engineering from the University of Maine in 1936. In 1941 I went to this four-month course, an engineering training course at the Massachusetts Institute of Technology to study Naval Architecture. Following that I worked at the Boston Naval Shipyard for a few months; then at Bath, Maine, in the office of the Supervisor of Shipbuilding, until April of 1946, I believe it was; then a two year period in Civil Engineering work. In May of 1948 I came to this Shipyard. I was in the Arrangements Branch for approximately two years. I believe it was in the fall of 1951 or the fall of 1950 that I went into the so-called Scientific Section. It was more recent than that that I was involved on

control surfaces as a GS-11 unit head. I was involved with the BARBEL design prior to the THRESHER design. At the time of THRESHER, I was directed to go to the Bureau of Ships for a two-day visit relative to calculations, hydronamics, forces and moments. So I brought back from there the procedure to use in calculations. The contract plans--

Q. Is that your complete background in this field?
A. I was on the subject of background and training.

Q. Does that complete your background account?
A. No. I think I could add a little to that. I took some special courses. I attended a six-week course in Advance Naval Architecture at the University of California, a Government-sponsored program. I think that was prior to the THRESHER design. That's about all my background on control surfaces. I, of course, have read many David Taylor Model Basin reports, and I've had two trips to the Bureau of Ships on the subject, and at one time visited the Model Basin, and I've had one of my men go to the Model Basin and to the Bureau for similar instructions and experience on how these control surfaces should be calculated.

Q. Please give us a summary of the contract plans, detail specifications, and design philosophy which was aimed at providing adequate ship control in THRESHER.
A. I have here a drawing entitled, "Rudders and Diving Plans and Stern Arrangements", a Contract Plan approved by the Bureau. And we use this as our guide. The only deviation from this particular drawing of any magnitude is covered by a change order which added one foot to the bottom of the rudders.

Q. Please identify that drawing by number.
A. It has a BUSHIPS number 1437205. Is there any other information from this that you want?

Q. No, thank you.
A. Our work, rather than merely taking this for granted, consisted of recalculating forces and coming up with essentially the same answers. A minor change of one-half inch in magnitude - Just a moment. I can check that. (The witness examined some papers in his possession.) A three-quarter inch shift in the location of the center line of stock in order to optimize the balance of torques. This shift was made and approved by the Bureau, and its magnitude was just three-quarters of an inch. We, in turn, passed along the results of the calculations to the Design codes who are designing the stocks of control surfaces and the steering and diving gear. Essentially there was no departure from the contract plan.

Q. Had the David Taylor Model Basin previously established the adequacy of controls through the use of pressure class models?
A. Yes, sir. During contract plan stage we were aware that a change was made right then, because of model tests. The results had suddenly become available, so a change was made. Some time subsequent to that one foot change-- The contract had been assigned the alteration adding one foot to the rudder. During the contract plan stage and development, the stern planes were made the flap type rather than multiple. That was recommended by the Model Basin and incorporated in the contract plan. There is a Model Basin report which--

Q. Would you identify that for us, please?
A. The one I have right here (the witness produced a paper in his possession) is identified by their report number C-1550. It is dated March, 1963. Do you want the title?

Q. Please.

A. It is a three-line title: "Model Investigation of the Stability and Control Characteristics of U.S.S. THRESHER (SSN-593) and Deep Submergence." In this report there are conclusions which weren't availabile to us in writing. This report obviously wasn't in our hands until just recently. However, advance correspondence and communication between the Model Basin and Bureau of Ships had essentially concluded this same thing, which now appears in writing. "The degree of dynamic stability and the degree of plane or motion is adequate." The last clause from that same quote was not available back in 1958 or 1959, probably, but significantly less than that is now being advocated for new submarines of this type. This information and their criteria we do not have here. They make a comparison with ALBACORE. They say, "The control effectiveness in the vertical plane is somewhat less than with ALBACORE." I think control effectiveness is essentially self-designing. How effective are these controls? Well, the third conclusion is, "The submarine will be marginally stable in the horizontal plane of motion." The fourth conclusion: "The control effectiveness in the horizontal plane is reasonably good, although slightly less than indicated for ALBACORE II." A reference in this report, which I have previously seen and which I did not attempt to bring with me, is limited to horizontal maneuvering. I can get it for you if you feel it's required. It's upstairs in Captain Heller's office. In that report they gave the background for their recommendations for enlarging the rudder, and I presume that at that same time they concluded that stern planes would have to be enlarged. This was done in the development stage and prior to contract plans. They were issued at the time that these enlarged surfaces appeared on the contract plans as adequate.

Q. What is your best judgment then as to whether the design of THRESHER provided adequate ship control for her?

A. Would you mind repeating that question, please?

Q. What is your best judgment then as to whether the design of THRESHER provided adequate ship control for her?

A. My opinion is that the design did provide adequate control.

COUNSEL FOR THE COURT: No further questions.

EXAMINATION BY THE COURT

Questions by a court member, CAPT Nash:

Q. I have not had an opportunity to study the specifications to which you have recently referred, and I would--

A. This one (indicating a paper in his possession)?

Q. Yes. After studying that, do you find it in consonance with the statement you made about the capacity of THRESHER?

A. As to the adequacy of control?

Q. Yes.

A. Yes, because - and I am relying on my memory - I recall reading reports on ALBACORE I, which had less stability than ALBACORE II and less than THRESHER. It essentially resulted in a more active steering gear, a more active diving gear, in order to control it. It meant that they weren't able to operate "hands off." They had to be continually steering, operating the planes somewhat more than they do now.

Q. Changing the subject a little now, does your work involve you in the hydraulic operating system as well as the control surfaces?
A. No, sir, only that we furnish the torque, the mechanical linkages and leverages, and determine what hydraulic force and volume is required to operate against that torque.

Q. We have heard indications that the rather complicated system could perhaps be simplified and to the general advantage of safety. Would you care to comment on this statement?
A. I am not familiar with the details of the system, sir.

Questions by a court member, CAPT OSBORN:

Q. Mr. Woods, in your design do you tend to concentrate on the high speed rather than low speed in dynamic propulsion?
A. For design of control surfaces we design for a capability to full speed. In other words, we were after the greatest rotation and torques and moments. At our end of the job we provide the Design codes with the information, the forces and where they act, and at that stage we are not involved with the controllability, which could become a problem at lower speeds.

Q. Who is responsible for the controllability of a submarine at periscope depth, for instance?
A. I feel the Bureau of Ships.

Q. Have you been cognizant of the large number of reports from the standpoint of THRESHER with respect to its ability to be controlled at periscope depth?
A. Yes, sir.

Q. Who do you think was responsible for this design?
A. For this design?

Q. For this design feature.
A. The Bureau of Ships.

Q. Do you think ship control with lack of power is just as important an aspect as ship control at maximum speed?
A. No, because at slower speeds it doesn't seem to me you could get into trouble as fast.

Q. Did you assume in your analysis that trouble at slower speeds -- that you had the capability of putting the power on the ship?
A. The analyses that we did, sir, were not involved with the controllability of the ship. We were given the control surfaces and locations, sizes.

Q. This is the exact point I am trying to establish, Mr. Woods, is that the design analyses you did was for determining maximum torques, the maximum turning radius, the maximum plane deflections, rather than the controllability of the ship and the way it operated?
A. Yes, sir.

Q. Who do you think is responsible for answering the design questions in that area?
A. You mean who in the Bureau of Ships?

Q. I mean who in the world.
A. Who in the world? If you want my opinion as to who it is in the Bureau of Ships --

Q. Well, that's fine. That's sufficient.
A. If I may add a comment on the subject of controllability at periscope depth, I was never involved with the military mission of this submarine, but I understand that the original concept of its operations would not involve their having to operate under those conditions.

Neither the counsel for the court, the court, nor counsel for RADM PALMER, a party, desired further to examine this witness.

The president of the court informed the witness that he was privileged to make any further statement covering anything relating to the subject matter of the inquiry in connection therewith, which had not been fully brought out by the previous questioning.

The witness made the following statement:

THE WITNESS: No mention has been made today of the so-called critical speed. As I have learned, the critical speed is that speed below which you get a reversal effect from the stern planes. If a submarine were at or below this critical speed, they put the planes on rise and, as I understand it, the ship would go into a dive angle. I can't visualize that at that speed there would be a very quick response. However, it would be in the wrong direction. I have not experienced that myself, however. I have only read about it.

REDIRECT EXAMINATION

Question by counsel for the court:

Q. Do you know whether THRESHER personnel were aware of this phenomenon-this property?
A. Oh, I believe so. I don't know that for a fact. I think there has been information in a letter in advance of Model Basin reports, or accompanying the Model Basin reports, distributed to the parties concerned. I don't have that information with me, but I think I have seen it in a letter or report, and the THRESHER would receive a copy of that, I believe.

Neither the counsel for the court, the court, nor counsel for RADM PALMER, a party desired further to examine this witness.

The witness indicated that portions of his testimony were classified as ~~confidential~~. UNCLASSIFIED

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

(b) (6) relieved (b) (6) as reporter at this point.

Leo Bosse, (b) (6) New Hampshire, was called as a witness for the court, was informed of the subject matter of the inquiry, was advised of his rights against self-incrimination, was duly sworn, and examined as follows:

COUNSEL FOR THE COURT: Mr. Bosse, this is a closed session of the court and classified information may be given here. At the end of your testimony I will ask you what classification you would attach to your testimony.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation?
A. My name is Leo Bosse. My address is (b) (6)

Q. And your occupation?
A. Occupation, Mechanical Engineer.

Q. Are you employed by the Portsmouth Naval Shipyard?
A. Employed by Portsmouth Naval Shipyard.

Q. What is your Shipyard Code Number?
A. My Code Number is 264-B.

Q. Can you describe briefly your duties at the Shipyard?
A. My primary duty is to design high pressure air systems for all air systems, in accordance with specifications.

Q. Did you, in fact, work on the design of the high pressure air system in THRESHER?
A. Yes, sir. I did.

Q. What is your background and experience in this field?
A. I have been employed at the Shipyard for twenty-four years, and I have been in the piping group for the last thirteen or fourteen years.

Q. Would you give us a summary of the contract plans, detail specifications, design philosophy and concepts, including damage control, which led to the design of THRESHER's high pressure air system?
A. The 593's high pressure air system was conceived in the latter part of 1957. We were requested by the Bureau to produce high pressure air diagrams. We have produced three of these; one was a b(1) pound systsm; the other was a b(1) pound system with the capabilities of charging b(1) pound missiles; the third sketch sent to the Bureau depicted a straight b(1) pound system. The detail specs, dated March, 1958, required a capacity of 765 cubic feet of b(1) pounds of air. The specs of July, 1958 changed this from a b(1) pounds system to a b(1) pounds system and the capacity to 400 cubic feet. The high pressure design for the 593 can be called an automatic air system. The system itself has four banks, one located forward, two in the auxiliary space area, and one aft in the engine room area. All of these banks lead to their individual headers to a b(1) pound manifold in the air regenerating space. From the b(1) pound manifold we lead our air to the b(1) pound reducers, thence to a b(1) pound header. On this system we do not use b(1) pound air except for storage.

The highest pressure used in b(1) pounds. Then a b(1) pound service feeds all other services, which include a 700 pound service air, 250 pound air, engine starting air, blowing sanitary tanks, fresh water tanks, and so forth and so on. Originally the bank stop control valves were of the quick opening type. Each one of these valves has a switch on the ballast control panel. These valves are not only operated from the panel itself, but they can also be operated at the bank outlet manually. Some time later the specs were changed to incorporate a twenty second delay in the opening time of these valves, the reason being to prevent auto-ignition. Later they were changed from twenty second operating time to thirty second operating time, plus or minus three seconds. The high pressure blow system derives its source of air from the b(1) pound header, Air Bank #1, forward group ballast tanks, after group ballast tanks, negative tank, have separate blow valves of the solenoid quick opening type which are located forward of the ballast control panel. These valves can be electrically operated at the ballast control panel. In the event of electrical failure, these valves can be manually operated in any sequence. In the event of casualties to high pressure air reducers, we have a method of by-passing the reducers. The by-pass is located in the air regenerating space, allowing us to charge the b(1) pound header by opening this by-pass valve. Another source of air to the b(1) pound header is located in the crew's head forward; a b(1) pound to b(1) pound regulator is located there; and this allows us to derive our air from any of the banks through this reducer to the b(1) pound header, insuring b(1) pounds pressure on our header. In the event that the ballast tanks cannot be blown with high pressure air at the BCP we have a by-pass valve from the banks in each escape compartment to the blow headers. That, in essence, covers just about the b(1) pound system.

Q. Were any requirements on the rate of blow submitted to this Shipyard by the Bureau of Ships?

A. No blow rate or rate of blow was forwarded to the Shipyard from the Bureau, nor any were requested from the Shipyard.

Q. Can you tell us what you did to design safety features into the system and what you did in addition to the specifications submitted to you or in change of them?

A. Well, as previously mentioned, we have four methods of supplying air to our b(1) pound header -- two b(1) pounds reducers located in the air regenerating space, one in the forward space, and a by-pass off the b(1) pound manifold. We have experienced some difficulties with some of the components that we had purchased, and we required modifications to these components to satisfy our system requirements and to insure that we would have a better system. The MV-200, so called, are the bank control stop valves. The original design incorporated a one spool design, one piece poppet, which was coated with a plastic called KORVEL. This plastic material, after some use, disintegrated, cracked. Since we had had previous experience with high pressure solenoid valves, we recommended to the vendor that the poppet be made into a so-called three piece poppet, two metal pieces screwed into each other, and a piece of nylon sandwiched between these two pieces, which was actually our seat. With this type of a seat, we have experienced very few problems and very little trouble with it; and this is the type poppet that the MV-200, or the bank stop control valve, now has. This type coating was not only used in the solenoid control valve; it was also used in the high pressure reducers. Here we had a problem of peeling similar to that which took place on the back stop valves. The original poppets were made of brass and coated with plastic -- I believe the name is KORVEL. We had chipping, or peeling off. So to insure a better bond between the two materials, the manufacturer changed the material of the poppet from brass to stainless steel, using the same type of coating. By the way, the coating was to insure dead tightness. We

realized that with two hard seats it is difficult to get a proper seal, a dead tight seal, at that pressure. The results here were much better than had been experienced with the brass poppet; however, we still were plagues with leakage, so the supply poppet, or the inlet poppet of the regulator was changed to a three piece design. The three piece design was incorporated by modifying the body of the valve itself. The seat was a nylon disc, retained by two pieces of stainless steel. The poppet itself remained stainless. We also experienced another problem on the regulators. Since the regulators are located in the air regenerating space, the ambient temperature varied considerably. While the compressors were operating, the temperature in the air regenerating space was pretty high and the regulators would not give us the regulated pressure, assuming that the regulated pressure had been set while the temperature in the compartment was low. The dome on the regulator was modified to incorporate a pilot regulator. This pilot regulator had the capabilities of maintaining a uniform downstream pressure, regardless of ambient temperature. In the event that the room was cold, this pilot regulator would allow air to enter the dome to allow desired or set downstream pressure. On the other hand, if a high temperature was existing in the air regenerating room, the pilot would dump air out of the dome into the compartment, thereby maintaining the desired pressure. During the course of our troubles we incorporated many filters in our system. We had not planned on doing this on the original design. We had one filter failure in one of the trials. This filter was an aluminum body filter. After this failure all of the aluminum filters were removed from the ship and replaced with filters which had a minimum burst of 20,000 PSI, and this is the type filter that the ship had upon completion. Our filtration was rated at about ninety micron absolute. That is all I have, sir.

Q. Were you aware that continuing difficulties were experienced by THRESHER during her post shakedown availability with respect to the high pressure air system?

A. The problem that was brought to my attention was that we had leaky pressure reducers. I observed many of these pressure reducers, both on the ship, and in the shop after having been removed from the ship. Those that I have observed certainly were of the minor nature. I would describe them as equal to a leaking faucet in a house. We have made some checks in the shops on some of these regulators, -- as installed on board with the rate of flow that was coming out of the regulators; there was some escape, but at no time on checking on these regulators did we have an escape of more than ten cc's per second.

Q. Did you consider the leakiness of these regulators to be the results of design deficiencies or improper manufacture?

A. I don't believe it was design deficiencies, because many times I was called to the shop to look at these pressure reducers. They were repaired in the shop by removing a poppet or replacing a new seat, and oftentimes the leakage was rather minute. It could be irritable to someone, but really minute. I mean oftentimes you could feel the air coming out but you couldn't hear it, and that's a real small amount of air to be escaping from a regulator. Actually the escape was through a relief valve because each one of these regulators has its own built-in relief valve.

Q. If you don't attribute it to design, do you attribute it to improper manufacture?

A. No, I don't believe so because in all the cases that I had anything to do with, once these regulators left Shop 31 and were installed on the boat, they were in working condition.

Q. Did you find out for how long they remained in working condition?

A. It was varied -- perhaps a week, perhaps a day, perhaps three weeks.

Q. Did you consider this an unsatisfactory condition?

A. Well, it was unsatisfactory in the sense that it was irritable to the crew, but it certainly would not lead to any major catastrophe -- this is, something as I said before -- I mean, you have a dripping faucet in your house, you can tolerate it; but how long can you tolerate it? It's just aggravating.

Q. Were factory or shipyard acceptance tests made on these valves?

A. Factory acceptance tests were made on these valves and were witnessed by Air Force inspectors at the factory.

Q. Were there any shipyard tests on the seats of the valves prior to ship installation?

A. No.

Q. As the result of a history of complaints with respect to these valves, do you know whether any steps were taken to correct the situation by changing the nature of the valve?

A. The steps that the yard took were to have the poppets and the seat and the valve itself modified; and this is what the THRESHER had, modified seat and modified poppets.

Q. What were the factory tests criteria -- no leakage or some leakage?

A. We specified "No leakage," but -- as I remember we specified, " No leakage." If leakage had been specified it would be in the order of about perhaps 2 cc's per minute.

Q. There has been a report of finding a spike in a filter of the high pressure air system in THRESHER. Were you aware that this condition was found during the post shakedown availability period?

A. No, the first I heard of it was in the newspaper.

Q. From what you learned of it, what possible derangement of the system could be caused by a spike in a high pressure air filter?

A. First of all, I can't believe that a spike could be in a system, in a piping system. With all of the elbows and configurations that we have I can't understand how it could have been in a piping system and have been driven into a filter. I believe that the configuration of the filter itself, its port entrances would not allow a spike to enter it. Now I don't know how long the spike was -- you mentioned a spike; it could be four or five or three inches long; I don't know.

Q. The newspaper account was erroneous in that there was no testimony, I believe, that the spike was driven into the filter. Would that change your evaluation of the problem any?

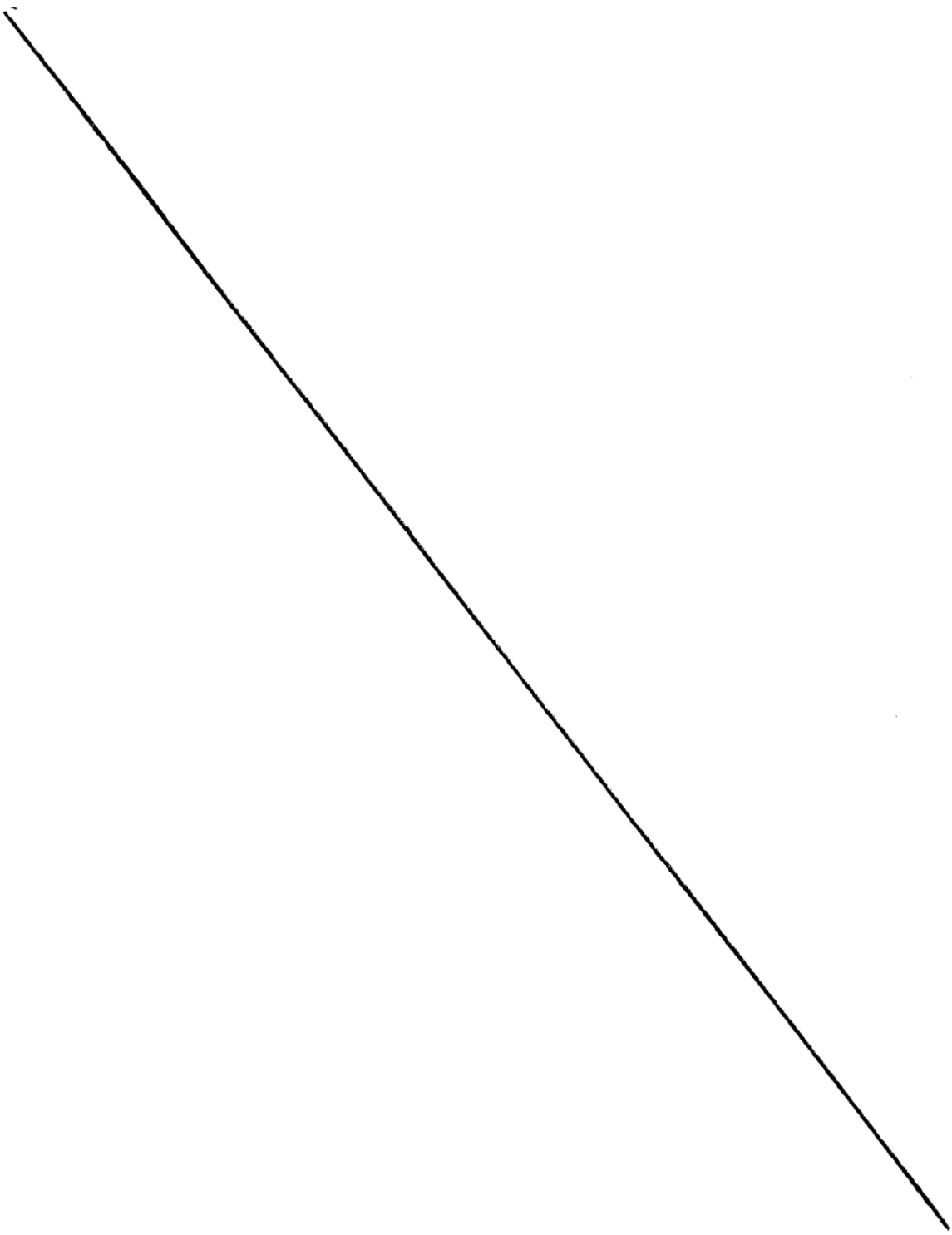
A. Well, I believe the only way that you could put a spike in a filter is to remove the bowl, remove the filter element, and place the spike in the element.

Q. Or it could be dropped in, could it not, while the filter element was exposed?

A. The filter element could have-- It could have been placed in the filter element, that's the only way, before placing the element into the filter body.

Q. I would want to make sure that your testimony is exact on this point. When you say "place," do you necessarily mean only intentionally or could it have been inadvertently dropped?

A. It could have been dropped. Now the filter element is probably six inches long. It has an entrance port of perhaps an inch and a half. Either it could have been placed or could have been dropped while the element was setting on the floor, table, or what have you. But I believe it had to be placed in there manually.



Q. But not necessarily intentionally?
A. Not necessarily intentionally.

Q. Have you recently completed a casualty study at the direction of this court relating to THRESHER's high pressure air system?
A. May I have your question again, please?

Q. Have you recently completed a casualty study at the direction of the court relating to THRESHER's high pressure air system?
A. Yes, we have. This is relative to the high pressure blow system -- or high pressure main ballast blow system. On April 19th, my supervisor and myself went to the TINOSA, the 606. We had been told that the bank stop solenoid valves opened in a greater time than specified in the specifications. The range that they had, ranged anywhere between sixty seconds to ninety-eight seconds. Since I had conducted this test on the 593, it was simple to rerun this same test on the 606. We contacted Mr. Pate, made arrangements for him to have telephone service between -- communications service between the ballast control panel and the air regenerating space. The reason we specified the air regenerating space is because in that area we have straight pressure gauges. We have one pressure gauge for Air Bank #1, Air Bank #3, which eventually tie into a common header, and the same holds true for No. 2 and No. 4 Banks, giving us two gauges in the air regenerating space, one on which we can read Air Bank #1 and #3 and the other Air Banks #2 and #4. After we had our communications set up to the BCP in the air regenerating room, Mr. Pate informed the operator of the BCP to energize Bank #1. I'm sorry. Prior to this we had been given stop watches so that we could watch the pressure gauge in the air regenerating space. After we were all settled and had all of our equipment, the operator at the BCP was instructed to energize #1 and at the same time give us a mark. Upon getting the mark we clicked our stop watches and checked our Air Bank #1. Air Bank #1, as I remember, opened in 26½ seconds. Excuse me, I have the actual information here; perhaps I'd do better to --

COUNSEL FOR THE COURT: You may refer to it, but it is understood you will be testifying from your own knowledge.

The witness continued his answer as follows:

A. Air Bank #1. The gauge in the air regenerating space indicated that the bank had equalized with the bank header in thirty-two seconds and the time for the light was seventy-eight seconds. Bank #2, we conducted the same test. The gauge in the air regenerating space indicated that we had equalized downstream with upstream in twenty-eight and a quarter seconds and a light in fifty seconds. Air Bank #3 was also tried and, in fact, since we could not use Bank #4, we ran two runs on Bank #3. One gave us a reading of twenty-six seconds, the other a reading of twenty-six and a half seconds; and the light on BCP, one was sixty-one and the other was sixty-two. This indicated to us that the bank stop solenoid valve was actually doing its job and equalizing downstream with upstream pressure within plus or minus three seconds.

Questions by a member, VADM Daspit:

Q. Plus or minus what?
A. Three seconds.

Q. Three seconds, or thirty seconds plus or minus three seconds?
A. Thirty seconds, plus or minus three seconds.

Questions by counsel for the court:

Q. Was there anything further on the casualty control study?
A. Yes, we did make another study, and I have it charted out here. Assuming that we lost AC power, which meant that we lost power to Air Banks #2 and #3 and #4, it means that these bank stop control valves would shut within one hundred to five hundred milliseconds.

Q. Would you describe the loss of power as momentary or continuing?
A. This would be a fraction of a second. This valve would shut in a tenth to a half a second, and once it has shut, you have to repeat this opening cycle all over again. So if 2, 3 and 4 bank solenoid valves shut, Air Bank #1 automatically came onto the b(1) pound manifold, eventually leading to the b(1) pound header. Now in the event that this occurred and you wanted to blow ballast, since you had no electrical power available at the BCP, it would be necessary for someone to go to the blow valves, which are located on the same side as the BCP, just forward of it, open an access door, and manually override these valves. At the same time the word would have to be passed to manually override solenoids 2, 3 and 4 in order to put these solenoid valves back on service. Whether you put these valves back on service electrically or manually, it still requires in the vicinity of thirty seconds to fully equalize downstream with upstream pressures. Now this reasoning here was total loss of power. In the event that you lost power for half a second or longer, this means that Bank #1 solenoid control valve, or Air Bank #1, would come on to the header. Two, three and four would become shut a half a second later. Number 1 would shut; 2, 3 and 4 would come on to the header but still require that thirty second time to equalize upstream with downstream. Had you lost power at the BCP, which also means that you lost power at the automatic ballast blow valves, the ballast tank operator could have become panicky and started to operate or jiggle his switches to 2, 3 and 4, and it is conceivable that he could have left those in a SHUT position, shut by switch at the BCP; and it's quite possible, if this occurred, that it would be possible for no air to be available to the ship.

Q. Your continued references to "BCP" are intended to mean what?
A. Ballast Control Panel. So here again, in the event that he had electrical power returned to him by switch, he could have cut off Banks 2, 3 and 4, and at the same time he could have energized Air Bank #1. Shut with power on, it is quite possible that you would have -- in fact, it is possible that you would have no air available to blow the ballast tanks.

Questions by a member, CAPT Hushing:

Q. You mean no air for thirty seconds after that time, or no air until the set-up was changed.
A. Now you are talking about several casualties here; which one are you referring to, sir?

Q. The last one.
A. If he had shut the solenoid air valves at the BCP inadvertently in a panic by switch and left them in a SHUT position, he has no air available to the b(1) pound manifold; hence, no air to the b(1) pound header.

Questions by the president, VADM Austin:

Q. But if you still had power, all he has to do to get air is to open the valves?

A. Well, if he has power, all he has to do at the ballast control panel is to flip the switch in the right position. Then, it will require thirty seconds to equalize downstream with upstream. This does not mean that the valve is shut for a period of thirty seconds. From the time you actuate the switch, the valve is in an open cycle.

Questions by counsel for the court:

Q. Do you have more to give us on the results of your study?

A. I believe this is fully covered. I could bring time in, but since we do know now that anything beyond a half a second means that the valve is shut, and you have to start cycling all over, - I mean, say, ten, fifteen seconds, twenty minutes, or an hour, it wouldn't make any difference as long as it's over a half a second.

Q. We have gone for years without reducing valves on main ballast tank blow systems. Can you explain why and how they became part of THRESHER's blow system?

A. On fleet type ships we did not use regulators, as such, but we did use relief valves. On the THRESHER class -- to begin with, the first class that used -- the 569 was the first boat to blow from the b(1) pound header with a solenoid valve. The 580 utilized b(1) pound air to blow its ballast tanks. Since the 593 had a b(1) pound storage system only, and since we had no experience to blow tanks at b(1) PSI, it was determined -- I don't know who or what -- but it was determined by the Shipyard or the Bureau to utilize b(1) air. At the moment I can't determine this.

Q. What was the purpose of going to the b(1) pounds per square inch storage system in the THRESHER?

A. Well, the reason for going to the b(1) pound system was that we could save considerable weight and considerable space. What I mean by that is that the 21 cubic foot flask could store approximately -- the 21 cubic foot flask utilized, with a b(1) pound system, its same outline except for the wall thickness; we could carry a capacity of 19.3 cubic feet per flask. So this allowed us considerable weight saving and space conservation.

Q. Can you furnish any additional information as to the particular specifications and tests which pertain to the purchase of the b(1) pound reducing valve?

A. The spec number was 253B-593-315.

Q. Would you repeat that, please?

A. 253B-593-315. That was the number of our purchase specification.

Q. Can you give us any particulars of it?

A. This specification covered high pressure range from (b)(1) PSI down to 20 PSI. The spec required that we maintain a certain downstream pressure in relation to the decay of the inlet pressure. We were asking for something better than what we had been able to get previously on the dome type, the other dome type regulators. The regulator had to withstand high shock, cycling tests, temperature tests, flow under different conditions, ease of maintenance, accessibility of adjusting components. This about covers it.

Q. What was the name of the manufacturer of the valve?

A. Marotta Valve Corporation, Boonton, New Jersey.

Question by the president, VADM Austin:

Q. Say that again?
A. MAROTTA Valve Corporation, Boonton, New Jersey.

Questions by counsel for the court:

Q. Did the shipyard ever give such valves a test which was equivalent to a full scale blow down of the main ballast tanks?
A. This was never accomplished in the shop, to the best of my knowledge, although it was performed on the 593, blowing ballast tanks on the surface.

Questions by a member, CAPT Osborn:

Q. Complete blow-down of the tanks?
A. Of the banks. No. We did perform a test here on the TINOSA on April 19th. I can indicate to you what happened there.

Questions by the President, VADM Austin:

Q. Same kind of valves?
A. Yes.

Questions by counsel for the court:

Q. Essentially, the same kind of system?
A. Yes, sir.

Q. Please go ahead, then?
A. Operational Test of TINOSA's main ballast tank blow system on 19 April 1963. Test 1 - initial conditions: Bank #2 on service at b(1) PSI, all other banks isolated. Commenced blowing the forward group main ballast tanks. b(1) PSI header pressure settled out at (b)(1) (A) PSI. De-energized the #2 air bank solenoid, then quickly re-energized. Now this de-energized period, was for a few seconds. This was to insure that the valve was completely shut, the valve at the bank. Initially b(1) PSI header pressure dropped to zero. Now, zero is not a true pressure because this is the best that the man can read at the BCP. He may have had a couple of hundred pounds. We didn't check from the air regenerating space. After ten seconds, pressure began to increase. It reached (b)(1) (A) PSI after twenty seconds and was steady at (b)(1) (A) PSI after thirty seconds. Pressure then began to drop as the bank pressure dropped. The air bank stop open light came on after one minute and ten seconds. The second test that we conducted --

Q. With reference to the first test, were two reducers installed for that test?
A. We were only running through one reducer. We only run through one reducer at any one time. Test Number Two: Bank #3 on service at b(1) PSI, all other banks isolated. Commenced blowing main ballast tank #1. b(1) PSI header pressure settled out at (b)(1) (A) PSI. De-energized air bank #3 solenoid, then quickly re-energized. Initially b(1) PSI header pressure dropped to zero. After ten seconds pressure began to increase; reached (b)(1) (A) PSI after twenty seconds; and was steady at (b)(1) (A) PSI after thirty seconds Pressure then began to drop as bank pressure dropped. The air bank stop open light came on after sixty seconds.

Q. Earlier in your testimony you described the consequences which would follow if a crew member in a moment of panic left a switch in closed position inadvertently. Had you given any instructions to ship's company with respect to this system and its operation?

A. Yes. During our lectures we explained to them how the bank stops operated, the time lag in the bank stops for equalization, and how you could operate them either manually at the valve itself or at the ballast control panel electrically.

Q. Did you form any judgment as to whether ship's company absorbed your lectures and was familiar with the operation?

A. I worked with the first crew of the THRESHER, because as of September, 1961, I was transferred from the THRESHER project to the 555 project, and I worked with this crew very closely; they were very enthusiastic and very cooperative and they were well founded in the operation of the air system. I had a lot of dealings with Lieutenant MacNish and Chief Stockel, Chief Johnson, and many of the other crew members who were auxiliarymen related to the system. They were well aware of the system and knew it perfectly.

EXAMINATION BY THE COURT

Questions by a member, CAPT Nash:

Q. Are you aware of any tests that have been conducted to explore the effects of flooded high pressure air lines?

A. Flooded high pressure air lines?

Q. Yes. I am especially interested in the possible piston effect of the water, which would then be in the air line?

A. There was some water in our system. Not as much water as on previous boats. On some of them you could hear the water gurgle through the lines, but not on the 593. However, I have evidenced this in Shop 31. The regulator had been returned to the shop for repair; there was water in the regulator on the inlet side of the poppet. There was also water in the dome, a minute quantity, however. Water in a dome loader will not affect the operation of a valve since the dome is controlled by a pilot and since it allows air to escape or air to enter it, depending on the ambient temperature of the compartment, which insures the proper downstream pressure of the system. Water in a dome will not lodge in there, but under pressure would escape through the pilot valve.

Q. Suppose, however, there had been an accumulation of a large amount of water in the line itself and you hit this with high pressure air?

A. The regulator will regulate a certain amount of water. I believe you are referring to water hammer, and due to the design of this regulator, with the inlet pressure being under the -- above the poppet, no; I can't see that a water slug would affect the regulator.

Questions by a member, CAPT Osborn:

Q. Mr. Bosse, I don't think he is referring to that at all. I think he is referring to water between the hull regulator and the Marotta valve and where you hit that with high pressure air, and if you've had any experience with this on a ship?

A. We are talking about the high pressure air system?

CAPTAIN NASH: Right, right.

WITNESS: I'm sorry. I was talking in regulators, pressure reducers.

The witness continued his answer as follows:

A. The valve that we have on the 593 is not a stop check regulator type valve, as some boats have. We have divorced the check from our hull valve so we have a check valve in our line and also a regulator valve, so called, at the tank connection itself, the tank penetration. A slug of water -- I don't believe so.

Q. Are you aware of any of the tests that were actually conducted to determine this?

A. We have conducted some tests, but not on the same type check valve, with no bad effects.

Q. Can you think of any other stoppages which might occur once you had actually started to blow the tanks? You have mentioned momentary power failure; can you think of anything else that might cause a stoppage in the system?

A. No, unless a tank was manually shut off, which I don't believe could have happened at this time.

Q. Could there be a freezing in the system that would cause a stoppage?

A. A freezing wouldn't have occurred at the bank stop valves, and the regulators were designed to operate at freezing temperatures; so I doubt very much if the regulator would have frozen up; and, if there had been any freezing occurring, it would have occurred -- well, could have occurred downstream. I doubt it very much on the pressure reducer. I doubt it very much, and the reason I say this is I witnessed tests conducted during the torpedo firing tests and here we used a great amount of air, a tremendous amount of air, and I have yet to see a pressure reducer frozen up. They get cold and sweat, but I've never seen them frosted up.

Q. You've never seen a similar air system freeze up?

A. No, I have not.

Questions by a member, CAPT Hushing:

Q. You advised of tests on TINOSA on which you tested one bank at a time, and as I understand your report, you did exhaust one bank at a time?

A. Yes.

Q. Have there been any tests in this shipyard or anywhere else to your knowledge, in which there was a total discharge of all four air banks?

A. Not to my knowledge.

(b) (6) relieved (b) (6) as reporter at this point.

Q. Are you familiar with the original air compressors for this ship?
A. I must say no to this question because the compressors were not under my jurisdiction.

Q. Do you happen to know what lubricant was used in the air compressors originally?
A. Originally, I believe we started out with mineral oil and it was just changed to phosphate ester based fluid.

Q. Cellulube?
A. Cellulube.

Q. Did the ship operate with cellulube lubrication in the air compressor for some little time?
A. Yes, it did.

Q. Are you aware of the characteristics of emulsion of cellulube and water?
A. (No answer from witness)

Q. Is there any chance that these emulsions could have effected the operation of the original Marotta valves?
A. No, I say no because all the Marotta valves, all of the cellulube operated valves, all of the operating valves in the system received a complete changeover of packing and in order to do this the valves had to be completely disassembled, washed and repacked with new "O" ring seals.

Q. When was this done?
A. This, I'm not too sure now because as I say I got off the 593 project in 1961. It has been done. Exactly when, I cannot tell you, but those are in the files.

Q. Would you happen to know whether the air banks in the high pressure air system were completely flushed and cleaned out at the same time when the conversion of the high pressures from cellulube to 2990 took place?
A. I am not too sure of that, sir; I cannot answer.

Q. Going back to the loss of power situation and automatic transfer from the normal condition with three banks on the line, and losing those three banks going to the automatic closing off, would it be difficult to modify this system so that loss of power did not result in a shift of the air banks?
A. You are referring to a modification of the banks stop control valve. We have already looked into that. We believe we have the solution. However, the vendor must be consulted to see whether this is feasible or not. We would like to do this on the existing valves if at all possible. This would prevent us from cutting into the high pressure air system and it would make a much simpler job if we could do that. We believe we can; we are not sure.

Q. What is the reason for the transfer of the air banks on loss of power?
A. The reason for this is that in the event that you had a ruptured header, and we assume that an electrical failure would have occurred at the same time of a ruptured header, we wanted to remove banks two and three and four off the

header and only cut in Number 1; if we lose our bank we would only lose one and not three. And this is incorporated in the THRESHER class as specified in the detailed specifications.

Q. So it was in accordance with the specifications that you did this?
A. That is right.

Q. Do you have copies of this report of the tests which you performed on TINOSA on 19 April?
A. Yes, I have. (Hands two documents to counsel for the court)

The court then examined the documents which were offered in evidence by counsel for the court. There being no objection by the court or counsel for the party, RADM Palmer, the documents were received in evidence and marked as Exhibits 75 and 76. Counsel for the party, RADM Palmer, waived reading the documents at this time.

Q. Do you have a record of the casualty control study to which you referred in your testimony?
A. Yes, sir. (Hands document to counsel for the court)

The court then examined the cited document, which was offered in evidence by counsel for the court. There being no objection by the court or counsel for the party, RADM Palmer, the document was received in evidence and marked as Exhibit 77. Counsel for the party, RADM Palmer, waived reading the document at this time.

Q. Can you tell us how the 30-second equalizing system was arrived at?
A. I can say this much. The original specs on the 593 stated no time. The Shipyard had bought quick-opening valves. In the meantime, it was realized that auto-ignition was taking place in high pressure air systems. Change Order 153 changed this type of valve from a quick opening valve to a valve that would equalize downstream with upstream in 20 seconds plus or minus two seconds. Later on, Change Order 213 came into being and it changed the time from 20 seconds to 30 seconds plus or minus three seconds.

Q. Do you have any knowledge of how the 20 second or 30 second number was arrived at?
A. No, I do not, except that we have information stating that pressure in a dead end will not be increased by more than 200 PSI per second.

Q. More than two hundred PSI per second?
A. Per second, yes, sir.

Questions by a court member, Captain Osborn:

Q. Mr. Bosse, on your operation with the ship and ordinarily proceeding along at shallow depths, what usually do you have cut in on the air banks?
A. They would operate with banks 2, 3 and 4.

Q. Was that the instructions that you covered with them with respect to rigging for deep submergence?
A. During the lectures, we stated that banks 2, 3 and 4 would be on the header at all times and bank Number 1 would be shut.

Q. Did you ever discuss with the crew margins of reserve buoyancy, margins with respect to covering flooding by blowing the main ballast tanks?
A. With the crew, we indicated to the crew how to blow ballast. In an emergency they had a source of air from each escape compartment forward and aft. They could blow the ballast tanks manually and they could blow them manually in the event they lost their b(1) pound header so-called. It could be isolated from each end compartment. They would have a direct source of air from Number 1 bank forward and after banks aft to blow.

Q. Did the crew realize the significance of having say a ten percent capacity of blow at deep depths?
A. I don't know. I wouldn't know. I can't answer that question.

Q. Did you discuss this problem with them?
A. Buoyancy problem?

Q. Yes.
A. No.

Q. Then the way I understand it, all you discussed was the capabilities to blow tanks. You did not discuss the degree?
A. I did not. That wasn't in the realm of my job.

Questions by a court member, RADM Daspit:

Q. Mr. Bosse, referring to the leakage from the regulators into the hull of the ship at atmospheric pressure, are you aware that the atmospheric pressure buildup can cause mal-operation of the evaporator?
A. I am aware that the pressured hull can cause mal-operation to some of the equipment on the vessel, yes.

Question by the court president:

Q. Mr. Bosse, I understand that you were taken off the THRESHER project in 1961.
A. The end of August, 1961.

Q. You have had no responsibility with respect to the THRESHER air system since that time?
A. That's correct. I have done nothing on the THRESHER since that time.

Q. Who has had cognizance--who relieved you of this?
A. Mr. St. Pierre.

Q. Mr. Bosse, you stated that you instructed the crew, gave them lectures with respect to the operation of their high pressure air system, is that correct?
A. Yes, sir.

Q. Showing them how to use it to blow ballast out of the ship?
A. That is correct, sir.

Q. And yet when you were asked the question, did you discuss with them the fact that they could only blow roughly ten per cent of their ballast out at deep submergence, you said that buoyancy was no part of your area of responsibility. Why do you have a high pressure blow system on a submarine?
A. Well, I didn't discuss buoyancy as such with anyone. I realize that I do not have the high pressure air and the method of blowing was explained to them, how they could do it electrically or manually.

Q. Whether it did any good or not, you told them how to do it, is that right?
A. We have calculations stating and showing that we can blow, with our air banks, from three banks 2, 3, and 4--equivalent to test depth pressure approximately (b) (1) (A) of water, blow approximately (b) (1) (A) with air bank Number 1 alone. This should provide you with positive buoyancy.

Q. Were these figures given to the ship in any instructions that was given to them?
A. Not to my knowledge.

Q. Now going back to these valves which reduced the air from b(1) pounds, is the Marotta Valve Corporation the only source of these valves?
A. No, there are other sources on the market. Grove Regulator for instance is another source. They do not have the same configuration however, but it is another company that supplies regulators.

Q. When it became necessary to make changes to these valves as described by you, did the Marotta Valve Corporation lend scientific assistance in making their valves do the job for which intended or did the Yard Design Division carry the entire load in this respect?
A. No, we received very good cooperation from the Marotta Valve Company. They modified their valves. I feel that they have done all possible to provide us with a good regulator, but one thing that we must take into consideration, this is a high pressure piece of equipment, and the system must be maintained clean in order for it to operate the way it was designed to operate. A regulator is not like a hand valve. If you have a leak you can turn your handwheel, turn your handle in- tighten it down on the seat. You cannot do this with a regulator. This is fully automatic. Never a human hand can touch it as far as obtaining tightness integrity.

Q. Now with respect to the inspection of these valves, you said they were inspected by Air Force inspectors; that is, at the plant?
A. That is at the plant, sir.

Q. Now, weren't these valves reinspected on receipt here?
A. Yes. We have an inspection department.

Q. And did they, in general, meet specifications when inspected here?
A. I would say so. I am not an inspector but we have an inspection department.

Q. But you have no indication that these valves were receiving other than good inspection?

A. You are right. I believe they were inspected properly.

Q. Now, Mr. Bosse, I realize that you were not responsible for the 593 air system during this recent overhaul, but you have been reading in the paper what has been said about it, I presume?

A. That is right, I have.

Q. And can you explain to this court why they had so much trouble with various foreign particles in that system, up to and including a spike?

A. Well, we went back, from the very beginning if you don't mind, as we all realize and agree that we did have trouble with our regulators and there is a continuous problem. As time went on they seemed to stay longer in the system and my last conversation with Chief Johnson upon his return from the tests down at Key West, his regulators were in good order. Modifications, as I understand it, were made in the air system, cutting into the lines and so forth and so on. When you cut a line and incorporate fittings into a system, you also incorporate contaminants,--weld spots, slivers of metal, chips; they get in there. Shop 56 can flush and flush and still not get all the contaminants out of the system.

Q. They stick up behind shoulders and in bins.

A. That is right. They can stick up behind shoulders between a fitting. A fitting normally--a welded fitting--has a socket in which we place a pipe in a particular socket, leave a gap of a 32nd or 16th, whatever the case may be, and these are collecting points. They do collect dirt and particles. You can get out so much from flushing; then I think your system is a self-cleaning system. Over a period of time you have surges in your system and contaminants are collected in your filters. Some of the, the smaller particles may pass through the metallic cloth filter, but eventually these contaminants come out of your system. However, it takes a long time.

Q. Would it help, if during the flushing process you had some way to vibrate that system to simulate the vibration it gets in operation?

A. If someone could devise such a system that would be a wonderful thing, but I don't know how it could ever be done.

CROSS-EXAMINATION

Questions by counsel for the party, RADM Palmer:

Q. Mr. Bosse, what are the possible consequences of a spike in a filter element?

A. I don't think anything would happen. It is just like a chip in a system; it is just lying there and air is passing by it, that is all. I was going to say the filter is there to protect the system and naturally it is the job of the filter to pick up whatever contaminants are in it, even if it is a spike.

Q. Now changing the subject on you, why does the system cease to be equalized just because the bank stops close if the tank blow valves are shut?

A. You are stating that the tank blow valves are shut. We have no requirement of air in our system. I'm trying to read myself your question--would you repeat please?

Q. Yes. Why does the system cease to be equalized just because the bank

stops close if the tank blow valves are shut?

A. Well. your tank valves are shut. The valve is open to the header and it requires 30 seconds to do this. This is the function of the valve; it is a slow opening valve to equalize--actually a slow equalizing valve. In other words it equalizes the upstream pressure with the downstream pressure over a period of 30 seconds. It is an equalization process that the valve does.

Q. Well, does it still take 30 seconds for the bank stops to open even if the system is equalized?

A. Yes, it does. Once you de-energize the system and re-energize it again, it still requires 30 seconds.

RE-EXAMINATION BY THE COURT

Questions by a court member, RADM Daspit:

Q. In regard to the sensitivity of the regulators to dirt, I am not familiar with this system. Do you have strainers installed between the air banks and the regulators?

A. We have strainers installed between each bank control valve, one on either side. The reason we did this is to collect or prevent the contaminants in the banks themselves from coming through the valves, and when we are charging the system, to prevent the valves receiving contaminants. We have filters upstream of our pressure reducers. They are not located ideally but this is the best we could do under the conditions that existed. It is much better to locate the filters as close to the equipment as you possible can. We attempted to do this; the closer the better.

Q. Thank you. That is what I wanted. Now, one more subject. Referring back to the amount of water that the banks can blow out at test pressure, when were these calculations made?-Can you tell me approximately?

A. I beg your pardon, sir.

Q. You stated at test pressure, test depth, calculations indicated that banks 2, 3, and 4 could blow out (b) (1) (A) of water. At about what date were these calculations made?

A. Well, we made some calculations back in 1958.

Q. All right, thank you. They are not new.

A. No, they are not.

Questions by a court member, Captain Osborn:

Q. I would like to ask one. Is that isothermal or **idiabatic** computation?

A. I don't recall.

Q. Was it **isothermal**?

A. I believe so.

Q. Would an isothermal calculation make your reserve buoyancy look better?

A. It probably does.

RE-DIRECT EXAMINATION

Questions by the counsel for the court:

Q. We have had evidence before this court that one of the last messages received from THRESHER was in the tenor as follows: "Experiencing minor difficulties, have positive up angle; am attempting to blow." From all that you have said up to now, have you been able, in your own mind, to reach any reasonable explanation for the word "attempting" in the phrase "am attempting to blow"?

A. I have thought about it. It would indicate to me that he lost power, lost power to the BCP and no air energy from 2,3, and 4, and in the process Number 1 was coming off of the header. That's what I believe happened.

Questions by a court member, Captain Osborn:

Q. Is it possible, would it be natural to put 1, 2, 3 and 4 on the air bank or on service and be in a position where you had no air?

A. Yes, I have already stated this.

Q. Well, I mean they were all going shut so there was nothing else to come on.

A. You could arrange at the BCP switches, in the event your electrical power came back on your system that you could have banks 1, 2, 3 and 4 shut at the Ballast Control Panel.

Q. That involves a mal-operation?

A. That involves a mal-operation, yes, sir.

Neither counsel for the court, the court, nor counsel for the party, RADM Palmer, desired to further examine this witness.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out be the previous questioning.

The witness made the following statement:

WITNESS: The 593 design actually is perhaps now about five years old. Since then, we have learned many things. We have discovered many things and in fact, the 555 has helped us to rework our high pressure air system to permit greater blow rate. I would say that a submarine should carry as much air as possible, even sacrificing other systems such as an oxygen system. The air to blow ballast tanks should come directly off the banks, not through regulators or any other valves. The electrical system is satisfactory but you should have a straight mechanical method--a panic button--to blow ballast. That's about all I have to say.

RE-EXAMINATION BY THE COURT

Questions by court president:

Q. On much earlier boats there was a mechanical way to blow your tanks with high pressure air and it was located within reach of the diving officer or commanding officer. Submarines have gotten much more complicated now, and if your

present day system has to be blown manually, you cannot do it from the control room, isn't that correct?

A. No, sir. We can blow manually from the control room. For instance we could have a blow valve in any compartment or adjacent to any group of tanks. This valve could be a ball valve or any kind of a valve.

Q. You say what could be but, as it is on the 593.
A. I am sorry.

Q. As it is on the 593, you've got to go forward.
A. You have to go either forward or aft, that is right.

Q. Either one.
A. That is right.

Q. And if doors are closed as for a deep dive situation, it might take some time to do that.
A. That is right.

Q. If a man in the compartment is not able to be communicated with or he doesn't know just what to do--
A. Yes.

Q. But you were about to tell us that you could, with modern submarines have a manual blow in the control room, weren't you?
A. Well, I was going to say, yes, you could have a manual blow which would be a panic button, you might say, which would actuate valves in different compartments.

Q. Actuatated by what though?
A. By air. You are deriving the source of air from the bank itself.

Q. In other words, as long as you had air you could use air with such a system?
A. That is right, quite correct.

Q. Is such a system in process of being designed?
A. Are we still talking 593, sir?

Q. No, I mean for any submarine.
A. For 555 we are in the process of doing that, yes.

Q. Designing that very sort of system?
A. Yes. We have taken that into consideration and this is what we are doing.

Questions by a court member, RADM Daspit:

Q. Captain Harvey was attached to the TULLIBEE and the SEA DRAGON immediately before being assigned to THRESHER. Were their air ranks arranged to Fail-safe the way they were on THRESHER?
A. All ships to my knowledge are, and the specs read in this regard the same as they do on the 593. I speak for the 580 class with which I am familiar--three banks on and one off.

RE-DIRECT EXAMINATION

Questions by counsel for the court:

Q. If you used your main ballast blow override next to the ballast control panel would any electricity be involved in this operation?
A. When you operate manually, you are totally divorced from electricity.

Q. But aren't these valves located in the control room?
A. The blow valves are located in the control room just before the ballast control bank and you are doing manually what the electricity actually would do for you in the event that you had it.

Q. You are manually blowing main ballast tanks from the control room.
A. Yes, sir.

Neither counsel for the court, the court, nor counsel for the party, RADM Palmer, desired to examine the witness further.

WITNESS: I would classify my testimony as ~~confidential.~~ UNCLASSIFIED

The witness was duly cautioned regarding the testimony he had given, was excused, and withdrew from the courtroom.

The court then recessed at 1517 hours, Wednesday, 24 April 1963.

The court opened at 1528 hours, Wednesday, 24 April 1963.

(b) (6) civilian, was called as a witness for the court, was informed of the subject matter of the inquiry, advised of his rights against self-incrimination, was duly sworn, and examined as follows:

The witness was advised that the court was sitting with closed doors, that classified information could be divulged, and at the conclusion of his testimony he would be asked to place a classification on the testimony he had given.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation?
A. (b) (6) (b) (6) York, Maine, presently employed as the head of the Shipboard and Development Test Section in the Design Division. I have worked in the Shipyard since July.

Q. Excuse me, (b) (6) I would prefer to question you concerning that. You are employed by the Portsmouth Naval Shipyard?
A. That is correct.

Q. And what is your Code designation?
A. 246B.

Q. Could you state, very briefly, the nature of the duties which you perform here?

A. I am head of the Shipboard & Development Test Section of the Design Division.

Q. And as head of that division, what is the general nature of the duties that you perform?

A. The Shipboard & Development Test Section prepares all test memorandum in accordance with detailed specifications for the ship on new construction and overhaul.

Q. And did you perform such duties in connection with the THRESHER?

A. Yes, sir.

Q. What is your background and experience in this field?

A. I was employed at the Shipyard in 1951 as a test engineer and have been such ever since, and promoted to my present position in August of 1962.

Q. How long in all have you been at this Shipyard then?

A. Twelve years.

Q. Since THRESHER was the first submarine designed to operate at her test depth, what special test features were employed to prove out her hull valves and damage control features during her first builder's trial?

A. Initially, we published builder's trials in accordance with specifications and BuShips Technical Manual Chapter 11. These, along with the list of trials, were forwarded to the Bureau of Ships two months in advance of first sea trials. Approximately one week in advance of the first sea trials the Bureau called the Assistant Design Superintendent and informed him of the forthcoming change order which would require cycling all sea valves and their backups at depths in hundred foot increments b(1) down to test depth.

Q. Did this involve only sea valves or were other appurtenances included?

A. No. This change order just affected sea valves, tests on all tubes, various tanks, trim pump, drain pump, specified in the initial deep dive memorandum as had been done previously.

Q. Then this last minute change, so to speak, added certain requirements on you. Were these additional requirements such that they had never been tried before in a deep dive of this sort?

A. To the best of my knowledge they had not. They had never been specified in a deep dive memorandum prepared by this Yard before.

Q. Were the tests actually performed to your knowledge?

A. Yes, they were.

Q. Were the results of the test considered to be satisfactory?

A. Not in all cases, no, sir.

Q. Will you report the results of the tests?

A. All the valves except the fuel oil valve, all of the fuel oil valves and the back-ups, and the brine overboard discharge back-up valve tests mentioned were cancelled by the Commanding Officer. The b(3) 10 USC 130 valves could not be reopened after shutting them at depths in excess of b(1) . These valves are designed so that there is an area differential and sea pressure assists in shutting the valve and the tolerances for installing the operating mechanism

Unclassified

were such that on trying to reopen these valves, b(3) 10 USC 130
This has since been corrected by more rigid tolerances and installing guides in the valves b(3) 10 USC 130 at all times.

Q. With reference to the cancellation of certain valve tests, was this due to direction of the commanding officer rather than to any problem?
A. To the best of my knowledge, yes.

Q. You were telling us now about the results of some tests. Are those results recorded in a report?
A. Yes, sir.

Q. Will you designate the report for our record please?
A. The record of shipboard test, test memorandum SSN 593-S0801011(Rev.B).

Q. That is "Revision B"?
A. Revision B.

Q. What is the date of that report?
A. This memorandum was sent in by the Quality Assurance Division as being complete on 18 August 1961. It was issued for accomplishment on 27 April 1961.

Q. You have told us that satisfactory corrective action was taken as a result of the reported deficiencies, is that correct?
A. Yes, sir.

Q. Now, directing your attention to the most recent sea trials of THRESHER, when Captain Harvey was preparing his sea trials, did he have a copy of the published results of the original sea tests to your knowledge?
A. Yes, he did.

Q. How do you know that?
A. He referenced them in sea trial agenda which he prepared on 2 April prior to going to sea.

Q. Were the same special requirements which you described before, made a part of the sea trial tests conducted by THRESHER after her recent post shake-down availability?
A. Only with respect to the main sea water valves and the auxiliary sea water valves. On a second deep valve he had planned to open these at one-half test depth and test depth.

Q. His plans are known to you because of his published agenda, is that correct?
A. Yes, sir.

Q. Can you say what he intended to do with respect to any of the other valves?
A. They are not specifically referred to in the agenda.

EXAMINATION BY THE COURT

Questions by a court member, Captain Nash:

Q. You may have said this. I'd like to clarify in my own mind. At what stage of his sea trials did he intend to conduct the operation of the sea valves?
A. On the second deep dive.

Questions by a court member, RADM Daspit:

Q. Did you have any discussion with him as to why he waited to conduct these tests on the second deep dive instead of on the first one?
A. No, sir.

Neither counsel for the court, the court, nor counsel for the party, RADM Palmer, desired to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing to say, and he would classify his testimony as ~~confidential~~. UNCLASSIFIED

The witness was duly cautioned concerning his testimony, and withdrew from the courtroom.

(b) (6) , civilian, was called as a witness for the court, was informed of the subject matter of the inquiry, was advised of his rights against self-incrimination, was duly sworn, and examined as follows:

COUNSEL FOR THE COURT: Mr. (b) (6) , this is a closed session of the court and classified information may be taken here. At the close of your testimony I shall ask you what the highest classification you would attach to your entire testimony taken as a whole.

DIRECT EXAMINATION

Questions by counsel for the court.

Q. State your name, address and present occupation?
A. My name is (b) (6) . I live at (b) (6) , New Hampshire. and my present occupation is project engineer in the Ordnance, Hydraulics and Penumatics Branch of the Design Division. The code is 264B.

Q. And that is in Portsmouth, New Hampshire?
A. Yes, sir.

Q. How do you spell your last name?
A. (b) (6)

Q. Will you describe, briefly, the nature of your duties at the Shipyard?
A. I am a project engineer in the Hydraulics and Pneumatics Section, and I am assigned duties in the group related generally to submarine hydraulic systems and design development tests and most anything to do with submarine hydraulics.

Q. In that connection you worked with the hydraulic system in THRESHER, is that correct?
A. Yes, sir.

Q. What is your background and experience in this field?
A. Actually I came to the Shipyard in 1952 and served in trim and drain systems for two years and then went into the service. I served in the United States Army. Most of my two years in the service was spent at the Aberdeen Proving Grounds at the Ballistics Research Laboratory in Ordnance Research. After I left the service I returned to the Shipyard. This was in the end of 1956. Since that time, I've been in the code that I previously mentioned, the Pneumatic and Hydraulic Group, and worked as a junior engineer and three years from then I was advanced to a project engineer.

Q. Please give us a summary of the contract plans, detailed specifications, design philosophy and concepts which led to the design of THRESHER's hydraulic system.
A. Could I refer to my notes?

Q. You may refer to notes provided your testimony is your own knowledge - reflects your own knowledge.

At this point (b) (6) relieved (b) (6) as reporter.

A. The THRESHER Class submarine hydraulic system started out as a central plan concept, where we have four pumps supplying a common header. In addition to the four pumps supplying a common header we had three accumulators. The basic principle that was involved was to provide a two system operation for ship's control, one to back up the other. To achieve this the four plant setup was isolated by check valves in this header line, making it into a main and vital system, so-called. One of the four pumps pumped exclusively into the vital system, and was separated from the entire rest of the system by a check and stop valve. The opposite side, or one of the other pumps, namely the steering pump, pumped directly to the main system and in itself couldn't pump into the opposite system. In like manner, the same type of isolation was conceived in the normal supply tank, so our system then consisted of a central system with a capability of isolating the main from the vital system. In addition to this basic concept of having a main and vital system, we also had capabilities of switching three of the pumps to a pressure demand system. This involves switching three of the four pumps to operate only their respective systems, namely the fairwater, stern and steering systems. In this case, when the THRESHER did go to sea it had two of the pumps with this capability. The pressure demand system for the fairwater planes was removed. The concept of the entire system was to be able to operate and have at the same time the capacity to overcome any casualty. The main system as we call it, is similar to a general service system. It supplied hydraulic power, for your normal steering and diving system. It supplied power for general sea water systems, hull valves, torpedo sytems; all of the operations of the muzzle doors, the long vent valves, all of the remote control miscellaneous devices. The vital hydraulic system supplied power only for those components that effected emergency steering and diving. Now these components are emergency steering and diving, the main ballast tank vent valves, negative tank outer door flood valve, and in addition to that, supplied power to operate the induction hull and exhaust valves, both inboard and outboard and hull ventilation valve and backup. I believe in addition to that we had also the torpedo leading hatch was powered from the vital system. This is generally the picture of the entire system. The system concept from the contract plans changed somewhat as we developed the system and because of the complexity of adding additional duties to the hydraulic pumps, we had additional complexities in our piping system. From the time the contract plans were made up until the working plans were accomplished we simplified and tried to continue with our split concept system of having one system available all of the time after a casualty.

Q. What particular damage control features were provided in THRESHER's hydraulic systems as relates to ship control?

A. As I mentioned before, the normal power to operate your control surfaces is from the main system. In the event of main system failure there is a pressure switch which automatically shifts your transfer valve and you work off your opposite system, in this case the vital system. This system provides direct hydraulic power from the vital system through a manual control valve at the diving station and back directly to your RAM. There are a number of safety features in ship's control. The safety features are, loss of sixty cycle power, b(3) cycle power, main pressure or amplifier failure. If the operator at the pilot control panel just switches to emergency, all these cases will automatically transfer your normal power to emergency power. When you are on emergency power your control surfaces will now be operated directly from the pilot control station. Individually, the outboard station operates stern diving directly from the stick to a manual control valve. Hydraulic

power is available from the vital hydraulic system through this manual hydraulic valve and back through the ship to your control surfaces or to your fairwater, or to your steering. In all of these cases we have direct manual emergency operation. If an additional casualty occurs we have still an additional backup system. This is what we call DC emergency. This involves operating four valves in each system, steering, stern diving and fairwater to be able to valve off the system and to put an entirely new system into operation. This system is limited in speed. It could operate your stern diving planes at about one degree a second instead of say approximately on an average of seven degrees a second on your normal systems. This operation takes a matter of seconds to switch from your normal or your emergency position to DC electric driven pump operations, and just to repeat again, the system could be put in effect by opening two stops and closing two others for any particular circuit, and starting your pumps and positioning locally with a manual control valve.

Q. If THRESHER lost all electric power, could the planes still be put on zero degrees or on an up angle?

A. Yes. If you lost all electrical power you would automatically go to emergency and you would have your vital accumulator used to correct your planes and, if necessary, other equipment on your vital system. The accumulator capacity is capable of bringing the stern planes from a hard dive to a hard rise position. Actually, the accumulator volume in the vital system, is 2400 cubic inches and to move your planes from hard dive to hard rise takes about 1400 cubic inches, so in addition to this, there is some reserve available.

Q. During the period of THRESHER's post shakedown availability, were there any major modifications to the hydraulic system?

A. The only major modification that I can think of was the deletion of the fairwater planes pressure demand system. Actually, by eliminating this extra mode, reliability was increased due to removal of additional components.

Q. Was not that the period where you took the cellulube out of the system also?

A. Yes. I made that previous statement as a system change. The cellulube was removed in favor of a proven petroleum base oil which I'm sure added additional reliability to the system.

Q. I know that you have given this subject a great deal of thought, Mr. (b) (6) . Is there any question in your mind as to the soundness of THRESHER's hydraulic system from the standpoint of design?

A. All I could say is that I went to sea with her the first two times, and took the first two dives with her, and I had complete confidence in the hydraulic system.

EXAMINATION BY THE COURT

Questions by a member, CAPT Hushing:

Q. Relative to the switch-over to the hydraulic system from cellulube to petroleum base oil, did it require essentially disassembly of the system?

A. Yes, it did, sir.

Q. Can you describe it a little bit?

A. The changeover consisted, first of all, of draining the oil supply tank filling with cellulube 220. Each operating gear was cycled and then drained down. The next process was to add your new petroleum based oil, cycle everything again, then take a reading at certain specific areas, at strategic points in the boat, to see how much cellulube content remained.

The process of flushing and cycling was repeated until the content was reduced to less than 2%. After this phase was completed all of the equipment containing any packings were removed from the ship, repacked, retested and replaced.

Q. How about the test of the system after it was reassembled? Were they essentially the routine tests of a hydraulic system, or were they extensive?
A. Well, most of the tests were repeated, like I said. Each circuit was checked out again and cycled and timed. Every pump was given its normal check, you might say. Every system was given its normal check, as you would in a new system.

Q. You gave it the same sort of test as you would in a new system; is that right?
A. I would say that, yes.

Neither counsel for the court, the court, nor the counsel for RADM Palmer wished to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing else to add at this time.

The witness was duly cautioned concerning his testimony and withdrew from the courtroom.

Philip Hoyt was called as a witness for the court, was informed of the subject matter of the inquiry, advised as to his rights against self-incrimination, was duly sworn and examined as follows:

The witness was informed that the court was sitting with closed doors and that classified information could be divulged.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation.
A. I'm Philip Hoyt; I live at (b) (6) New Hampshire. I am presently a program manager, Design Division at the Portsmouth Naval Shipyard.

Q. What is your code number?
A. My code is 243.

Q. Can you state briefly the nature of your duties?
A. Yes, sir, as program manager I directly supervise a group of project managers who have the responsibility for the coordination of the various new construction and repair projects for which Design Division has cognizance.

Q. What is your background and experience, Mr. Hoyt?
A. I have been associated with the Shipyard since July of 1934, in one form or another. Until 1948 I was in Production. In 1948 I took leave of absence to attend school. Since 1952 I have been back with Design and I spent five years down in Nuclear Power. Following my experience in Nuclear Power I returned to the Design Division.

Q. During the period of construction of THRESHER, was there a Shipyard program in effect for submarine crew training in the ship's systems?
A. Yes, there was.

Q. Who was in charge of it?
A. We have a Design Division coordinator who sees that these training programs are done, and actually makes sure that the various codes prepare the material and presents it. The coordinator is generally in charge of the civilian training. However, at this time, since this was a relatively new program, he also worked on the crew training for THRESHER under the direct supervision, or guidance, if you will, of Commander John Woolston, who was here in the capacity of assistant design superintendent.

Q. Did his duties include much the same areas as yours presently do?
A. Very similar.

Q. He is now serving in the Bureau of Ships; is that correct?
A. It is correct, in Code 525.

Q. In his absence do you have some personal familiarity with the program, and are you in possession of a lecture schedule used in the case of THRESHER's ship's company?
A. Yes, I am.

Q. Do you have the lecture outline for the high pressure air systems?
A. Yes, I do.

Q. Auxiliary sea water system and the hydraulic system?
A. Yes.

Q. Please produce them.
A. These are the lecture outlines that were given. I would like to emphasize that these are outlines only, and are supplemented by many side things. This is a copy of the group training program.

Q. Is there available the entire lecture program if the court were interested?
A. Yes, sir.

COUNSEL FOR THE COURT: The first one is entitled "Lecture No. 15 - Steering and Hydraulic Systems"; the second one is entitled "Lecture No. 6 - High Pressure Air System"; the last is "Lecture No. 19 - Main and Auxiliary Sea Water System."

The above described documents were offered in evidence and there being no objection they were so received as Exhibits (78), (79) and (80).

Q. This other document that you have handed me is entitled,"Crew Training Plan; Initiation of"; is that correct?
A. Yes, sir.

"Crew Training Plan; Initiation of" was offered in evidence and there being no objection it was accepted in evidence as Exhibit (81).

Q. Were there any formal instructions governing the training of crews during THRESHER's construction period?
A. Yes, we were given the authority to proceed with the crew training by change Order 78 from the Bureau. This came out shortly before the proper time for initiation of the training actions for 593, and Change Order 78 enumerated the various systems that should be covered. It also indicated that we should prepare the lectures, prepare notes, visual aids, ships'

information books, etc., and present these to the crew in advance of the lectures, whenever possible, in order to allow the ship's force to study these items and be able to ask questions of the lecturer when the lecture was given. This is the general procedure that was followed. It has worked rather well and we are still following it.

Q. How was the program funded?
A. The program is funded from general basic ships' construction fund.

Q. Did you have enough funds to do the job without skimping on the training?
A. Yes, sir.

Q. To whom, precisely, was this training given?
A. This training was given, or at least was offered, to the entire ship's company. There are certain lectures that obviously the entire company would not be interested in or would not need. This was left up to the discretion of the men's prospective commanding officer to decide.

Q. Can you tell me the method of presentation that was employed?
A. The presentation, as I have indicated, was in the form of lecture notes, training aids, diagrams, etc., presented to the crew in advance of the lecture. The lectures usually took three hours. They consisted of a formal lecture and a question and answer period at the end.

Q. There are certain elements of casualty control concerning which I will question you. The same question will apply to each. I will now state the question: What information was given to the ship's company regarding the capabilities and limitations of the ship, specifically in regard to casualty control? The first deals with flood rates.
A. Flood rates, as far as the formal presentation, there was none that I know of. There may very well have been some questions that came up during the course of the lectures, that were answered.

Q. The same question applied to pumping rates.
A. Pumping rates; any time a pump was mentioned the pumping rates were given. I believe you will not, for example, in the auxiliary sea water lecture outlines, pumping rates are given.

Q. The same question with regard to main ballast tank blowing.
A. Main ballast tank blow, in the lecture outline this is not mentioned. However, I have questioned the man who gave the lecture and he said that he did go into this slightly as a result of questioning at the time.

Q. What was that man's name, please?
A. That was Mr. Bosse.

Q. The same question with regard to capabilities for recovery of the main propulsion.
A. This, again, was mentioned in the outline, what could be done, what the plant was capable of, and the various methods of starting up following a shutdown. I would like to emphasize that we present the lectures as a systematic description, and not really as a mode of operation. It is the feeling here that as far as the operation is concerned, that is strictly under the commanding officer's jurisdiction. This, I believe, would apply very strongly here in the case of the propulsion power systems.

Q. The same question with regard to control surfaces.

A. Control surfaces were mentioned in the steering and diving outline which I have presented. There were certain admonitions at the end of this, precautions to be observed. In addition to that, a letter was sent to the Officer in Charge of the THRESHER at the Portsmouth Naval Shipyard. The subject was "SSN-593 Past Performance Data" on the date of April 4, 1961.

The counsel for the party, RADM Palmer waived the reading of the letter.

The letter from the Portsmouth Naval Shipyard to the Officer in Charge of the THRESHER, dated April 4, 1961, was offered in evidence, and there being no objection it was so received as Exhibit 82.

Q. Was any formal organized training of ship's company conducted by the Shipyard during the post shakedown availability period, in THRESHER's case?

A. It was not by Design Division, and to the best of my knowledge, by any other group.

Q. How do your present training procedures differ from what you have described during THRESHER's construction period?

A. Generally they are the same. We have, I feel, become a little more sophisticated in our procedures; our lecture notes are a little better, a little more complete. We have invited the ship's company to come up and work with our people now during the preparation of the lectures, so that we will eliminate that portion that they are not interested in, and concentrate on the portion that they are. Otherwise than that they are essentially the same.

EXAMINATION BY THE COURT

Questions by a member, CAPT Hushing;

Q. In connection with the FBM program, did you contract with the Electric Boat Division of the General Dynamics Corporation to deliver certain of the lectures for you; do you know?

A. Do you mean me?

Q. No, the Shipyard?

A. Yes, I believe we did, sir.

Q. Did you get copies of those lectures?

A. I haven't seen these, but I'm under the impression that we did.

Q. Do you know whether or not the Shipyard included certain of the information from those lectures in lectures for new construction given after that time?

A. I'm sorry, but I wouldn't know this.

Questions by the President:

Q. Mr. Hoyt, I noted in the letter regarding ship control surfaces and the characteristics thereof, at various speeds, I noticed a paragraph which spoke of the unstable condition of the ship when backing. Now this is an operational observation; is it not?

A. Yes, sir.

Q. Would it not have been just as pertinent to point out with respect to the main ballast blowing rates and flow rates of your trim system, and all, that at test depths there would be very little time to correct negative buoyancy that was coming in if you got a SCRAM at that point?

A. In retrospect, sir, I certainly agree with you.

Q. In the future lectures you probably will include this type of information; will you not?

A. We are right now examining all of our lectures, to include as much information of this nature as we can.

Neither the counsel for the court, the court, nor the counsel for RADM Palmer wished to examine this witness further.

The president of the court informed the witness that he was privileged to make any further statement covering anything related to the subject matter of the inquiry that he thought should be a matter of record in connection therewith, which had not been fully brought out by the previous questioning.

The witness stated that he had nothing further to say.

The witness was cautioned concerning his testimony and withdrew from the courtroom.

The court then, at 1825 hours, 24 April 1963, adjourned.

ELEVENTH DAY

Portsmouth Naval Shipyard
Portsmouth, New Hampshire
Thursday, 25 April 1963

The court met at 1015 behind closed doors.

All persons connected with the court who were present when the court adjourned were again present, except (b) (6) , who was relieved by (b) (6) as reporter. Rear Admiral Palmer and Lieutenant Commander Hecker, parties, and counsel for Lieutenant Commander Hecker waived their right to be present. Counsel for Rear Admiral Palmer was present.

No witnesses not otherwise connected with the inquiry were present.

Raymond H. St. Pierre, a civilian, was called as a witness for the court, was informed of the subject matter of the inquiry, was advised of his rights against self-incrimination, was duly sworn, and examined as follows:

COUNSEL FOR THE COURT: Mr. St. Pierre, this is a closed session of the court. Classified information may be divulged here. At the end of your testimony, I shall ask you what classification you would attach to your entire testimony.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address, and present occupation.
A. Raymond H. St. Pierre, (b) (6) New Hampshire. Mechanical Engineer, Portsmouth Naval Shipyard. I am Project Engineer, Pneumatic Systems.

Q. And what is your code number, Mr. St. Pierre?
A. Code 264-B.

Q. Describe briefly the nature of your duties at the Portsmouth Naval Shipyard.
A. With the concurrence of my immediate supervisor, I am responsible for the design of the installations on the THRESHER type boats of the class. That would include new systems that are being put into service, alterations to present systems, work accomplished because of ship's deficiencies, work list items, and the like.

Q. Can you give us a brief description of your background and experience in such a field?
A. I came to work in the Shipyard on August 5th, 1952. At that particular time I was assigned to the Hydraulic Systems. My chief duties were working on the hydraulic system for the 567 boat, then on through the 569, 572, and 573, 580 class, and into the 593 class. It was either March or April of 1960 that I transferred from the Hydraulic Systems to the Pneumatic Systems at the request of the Shipyard. Upon entering the services of the pneumatic systems, I worked on the BARBEL, the 580, and the NAUTILUS, 571, and several other boats on pneumatics. I did not get into the design of the 593 class systems until approximately May of 1961.

Q. When did you assume cognizance of the design of THRESHER's high-pressure air system?
A. Approximately a year and a half ago.

Q. Can you recall the month?
A. I would assume about October or November of 1961.

Q. You then had an interest in the design changes or modifications made in THRESHER's high-pressure air system during the period of her post shakedown availability?
A. Yes, sir.

Q. Can you tell us of any changes made during that period?
A. Yes, sir.

Q. Please do so.
A. The biggest change that occurred on THRESHER during her post shakedown availability was the installation of the air system to the ANB -- well, it's the PUFFS hydrophone. I don't know the number of it. This was a new system installed on THRESHER to eliminate in-board hull in-rush transferring through the hull to the PUFFS hydrophone, so that the PUFFS hydrophone could give a more accurate bearing, as I understand it. This system consisted of what we term as an air blanket between the hydrophone itself and the pressure hull. The hull was modified to accept this blanket and hydrophone. The system works as follows: Air is taken from a 700-pound service air system and it passes through a pressure-reducing valve. This pressure-reducing valve is an automatic reducer. There is a sea-sensing line that admits sea pressure to the top of the regulator, and for an example, if the sea pressure were 100 PSI, the pressure reducer would allow on the average of 5 pounds higher than sea pressure to the air blanket, so that at all times the air in the blanket was more than the sea pressure. This system had two relief valves for each position. There are three positions on the boat. No. 1 position is forward; Number 2 position is in the auxiliary machinery spaces; and Number 3 position was the stabilizers aft. As I said, relief valves were provided - separate relief valves. The pressure regulator also had a built-in relief valve, and under ordinary operations the relief valve in the pressure regulator would be the only relief operating between the depths of approximately 100 to 200 feet, when the largest amount of air was being expelled from the blankets, and the second relief valve would operate, this being so that the air blankets themselves would not rupture. In the cases of air blanket ruptures, the boat would have to be drydocked in order to make the repairs. In this system we also installed manual relief valves. These manual reliefs served as a relief valve and also as a vent valve in the event that that portion of the system needed to be vented. We also furnished, in the initial design of the system, a pressure gauge for the air pressure and a pressure gauge for sea pressure, but the graduations were such that it was a little hard to read the differential in pressure, because the differential was so slight. So we installed a pressure differential gauge with larger graduations so that it would be more easily readable. The next work that we did on THRESHER was eliminating the high-pressure air-reducing station that we had on her when she came in. That was the system that she had on her which was a series of ball valves and piping. The area in which this had to be piped was very small. Consequently, the piping turned out to be short nipples. The system being a b(1) pound system, these short nipples required welding, and in the process of welding, the pipes would pull somewhat because of the heat, and THRESHER asked if we couldn't do something about that. We issued some design memos to introduce more flexibility into the system so that they could not have as much trouble as they were having. The trouble they were having was with O-rings leaking in the reducing station. We found this not to be a great help, so we designed a system

and put the whole high-pressure side of the reducing station into copper-nickel manifolds. We manifolded all the ball valves into the cartridge type stops and isolation valves. They proved out as far as operation was concerned and, as far as I know, they were satisfactory -- very satisfactory. There was one deficiency that the ship requested that we take care of, and that was one of the cartridges in the b(1) -- I don't know whether it was the b(1) or b(1) to 700 reducing section. The b(1) pound operation was such that it made the operation of that particular cartridge very hard to operate. The torque on the valve handle, I would say, was more than 120-foot pounds, and consequently for the operation of this valve, the valve stem was twisted. This had no bearing on the operation of the system. These valves, mind you, were not operational valves. They were stop valves and isolation valves. We contacted the manufacturer of the manifold, the Republic Manufacturing Company of Cleveland, Ohio, I believe it was, and within a relatively short while, via a phone call, they told us of a fix that they had for this particular valve cartridge. They reduced the torque from 120-foot pounds to 75-foot pounds. A valve of that design with 75-foot pounds torque can be operated by hand. We issued a design memo to have this accomplished for THRESHER. It consisted of removing the valve cartridge from the manifold, transporting it to the machine shop, and having the seat portion of the valve, the I. D. portion of the valve, enlarged by ten thousandths of an inch. Another phase that we did on THRESHER was the installation of Rockwood bleeder conversion kits for the Rockwood ball valves. The conversion kits were installed on all the high-pressure valves from (b)(1) pounds and higher, the reason for this being so that the down-stream side of these ball valves could be pressurized before the on-rush of air would get downstream, so that when a valve was put to the open position, the downstream side of the valve would be equal in pressure to the upstream side. This conversion kit modified the ball in the valve by introducing a small minute hole only thousandths in diameter on a 15-degree angle so that when the valve had to be opened, the operator grabbed the handle of the valve and moved it to the open position, the valve handle would move only 15 degrees. Now, when that occurred, he was pressurizing his downstream side. Now, the safety features that we asked for in this kit were such that he had to use two hands in order to go past this 15-degree mark. There were two spring pins that recessed into two holes; so in order for the operator to go past the 15-degree mark, he had to pick up the two pins with two hands and move the valve to the full open position, which is 90 degrees.

Another phase was the cellulube conversion. THRESHER, prior to her post shakedown availability, had cellulube as a high-pressure compressor lubricant. The seals in the O-ring system were made of butyl rubber, which was MIL-G-22050. We removed the dynamic seals in the system from all the valves. The static seals actually had no consequence to the operation of the system because -- Well, let me say when we removed the seals, we installed a petroleum-base fluid. I believe it was MIL-SAE-2190, a petroleum-base oil. When this petroleum-base oil did act on the static O-rings that we did not remove from the system, the rings would swell, which would give us a better seal. In the event that these fittings or equipment that had static seals were removed from the system for a system alteration or a general overhaul of the equipment, at that particular time the static rings would be changed. All the valves in the system and vendor components were changed by the vendor either at this Shipyard or at the plant.

There were other smaller jobs that happened to THRESHER during the post shakedown availability: those resulting from work list items and shock items and 606 PCO

requests that the Review Board in this Shipyard felt that it was advantageous to install them on THRESHER. Now, I have a list of these, if you'd care to have me go over them.

Q. Can we take a look at them, please?
A. Yes, sir. I started here with the hydrophone, and the like.

(The witness submitted said list to counsel for the court.)

Q. (By counsel for the court) Would you provide us with a general discussion of each item? That's all that we require, and then a thorough discussion of the item marked with a check mark.

A. Yes, sir. In the b(1) pound discharge line from the compressors we installed a 2-foot section of pipe. We also provided a spare section, and this was provided for oil carry-over analysis. Periodically, a section in the system had to be removed and sent to the laboratory to have the oil carry-over analyzed. Shock Item SM-7: this entailed the installation of another union in the torpedo impulse air line. This particular union failed under shock. The threads, I believe, were stripped. We issued memos to have a new union installed and to have it seal-welded. We also redesigned the bolt of the secondary tank No. 3 charcoal filter. This resulted from the THRESHER's shock. We put on a flange, rather than having it bolted on the lips of the charcoal filter.

We also initiated a test to test the fittings and the hose for the PUFFS hydrophone air blanket. We modified the PUFFS air blanket piping system for Number 2 array, port and starboard. Now, this was done because at one of the meetings between the Design Division, the Production Shop and the Naval Ordnance Laboratory Design was instructed to pipe this to show the picture on a drawing mainly to show the components that would be necessary to install this. The air blankets, when they came from the Naval Ordnance Laboratory, would have short lengths of pipe protruding from the bottom. For this reason, this would all have to be installed to suit on the ship. Consequently, Design had no way of knowing how long a pipe was going to have to be in order to fit it together. When the Number 2 arrays were installed, Production asked for the assist if we would not show them an accurate description of how this would go in order to go with the rest of the system installed at the array outboard of the pressure hull, and this piece of paper was put out to do that.

As I mentioned before, we installed manual relief valves in the PUFFS hydrophone system and differential pressure gauges. We installed vent fittings upstream of the torpedo charging automatic stop valves. This was put on the boat by a 606 PCO request. It was discussed with the personnel of the 606, and it was also discussed with the personnel from THRESHER. This automatic stop valve is installed in the system because in that portion of the system, that is used as a blow connection or a charging connection, anywhere where a flex hose is utilized to take air from the high-pressure system or the service where the system would use it to charge or to blow sea chests, and the like. The reason for the automatic stop valve is that, in the event the system is hooked up with a flex hose, if the hose had a rupture, the air in the system would rush out of the rupture causing a 40 to 50 PSI back pressure in this automatic stop valve, and this valve would automatically shut. In order to get this system back in operation, the valve is designed with a vent in the side of the valve. This vent has to be manually operated with a small Allen set screw wrench, and if the valve is installed in the system so that this Allen set screw vent is not readily available to the ship's personnel, we thought

it would be quite a job to have to hunt around for the vent in order to vent this valve system. It has to be vented in order for that portion of the valve to come off the system so that the system can be put in operation again. So rather than have the ship's personnel go through this procedure and take the chance of backing this little vent out of the valve too far and dropping it in the bilge, we decided to put a vent fitting immediately upstream of the valve, which would serve the same purpose, and it would be a lot better.

We added a gauge to the b(1) pound by-pass. We had a gauge in the line, but the gauge was installed a distance from the by-pass valve, so that the personnel of 606 boat thought it would be a good idea to have another valve right there. This was a 606 PCO that we incorporated on THRESHER.

We removed and replaced fittings for a transmitter. THRESHER had trouble with one of the fittings on the transmitter. She could not stop the leak on the fittings where they were sil-brazed. When she came in, we removed all the old fittings and put in all new fittings.

We installed a stop valve in the high-pressure compressor discharge line downstream of the discharge valve. This is a requirement of the specifications. However, this was never done in our drawings. This happened years ago, before I was in the Pneumatic Systems. We wrote a letter to the Bureau of Ships asking if this could be waivered, and their reply was, "Install the stop valve." So we did so. That was to protect shop personnel who had to remove the flex hoses immediately coming from the compressors.

We installed shock-proof gauges on pressures. This is Shock Item SN-10. The gauges that failed under shock were replaced with a better gauge, a shock-proof gauge. We deleted all the piping to the periscope air jet box. This was done in accordance with Kollmorgen modification Number 0013. Initially, THRESHER had a periscope that required air for defogging the lenses, and at some time that periscope was removed and a periscope installed that had electric defogging. Consequently, the air pipe was no longer needed. We put out a rip-out plan, and deleted all that piping.

At the request of the Production Department, we put out a memo to fabricate a test fixture for testing the automatic stop valves that we just spoke about.

We installed torpedo test panels in the torpedo room. One was a control valve test panel. The other was a general use test panel.

Due to Change Order 273, we added a 20-pound air supply to the battery water tanks so that they could get their head. We revised two ball valve conversion kits so that they could be properly operated, this being the valves on the impulse flasks, where the valves are operated from the deck above. So instead of having the conversion kits on the valve, we had them up above on the next level.

Change Order 297 relocated the air system WR2T gauge outboard of the weapons control panel to the deck above the weapons control panel.

That's all, sir.

Q. Are you aware of the problems experienced by THRESHER--
A. Oh, I beg your pardon.

Q. You haven't discussed the big one yet, have you?
A. That's correct. We installed new Belville Spring Marotta valves RV24EA when THRESHER came in for her post shakedown availability. These Marotta pressure reducers were removed from the system and brought to Shop 31 for overhaul. When the valves were disassembled, it was found that the styrene foam, in which this Belville Spring was encased, had broken down after approximately eighteen months of use, and we immediately notified the company to provide us with Belville springs with a more durable cover. They are in the process now of doing that, but we also ordered more Belville springs with this styrene foam to use until we get the new springs with the new covering. That's all I have on this particular piece of work for the Belville springs.

Q. Are you aware that the problems experienced by THRESHER with reference to those reducing valves extended through the period of her post shakedown availability?
A. Prior to the PSA?

Q. Throughout the PSA, right up to the end.
A. Yes, I was aware that they had had trouble with the valve, with their pressure reducers, yes.

Q. Were you aware that the troubles continued, that they did not seem to be able to correct this problem for an extended period of time?
A. As far as I know the trouble continued, but it was intermittent. They had trouble as soon as the valve was installed on the ship. Sometimes they had trouble right away with the valve leaking; other times it was for longer periods of time.

Q. Did that raise any question in your mind as to the validity of its design or correctness of its manufacture?
A. No, sir. I believe that the trouble was with the contaminated air system.

Q. It was trouble with dirt in the filters of the system, was it not?
A. Yes, sir. That's why the filters are installed in the system, to collect this dirt.

Q. To your knowledge, did they ever try to correct the cause of the continual clogging of the filter?
A. No, sir, but these filters that we have installed, the high-pressure filters, they are designed with what we term a flag, and when the filter element gets to the point where it should be changed, this flag is raised to tell the personnel aboard ship that that element should be changed.

Q. You were aware of both of these facts, that there was continual difficulty with the valve and continuing dirt in the filters?
A. Yes, sir.

Q. Did this raise any question in your mind as to whether or not a good hard look ought to be taken at the system as a whole to find out why these troubles continued?

A. Very, very frequently Design personnel would go to the air cage in Shop 31, where these valves were being overhauled to see if we could find anything that might have been missed when these particular reducers were experiencing difficulty back in the initial stages of the THRESHER's construction. However, we did find scratches on the poppet which would indicate dirt in the system or a contaminant passing through a small opening between the poppet and the seat at a fast velocity. Even a minor scratch on these seats would cause a leak because of the b(1) pounds behind it.

Q. There is a boat with a similar system, is there not, which was using these valves?

A. Yes, sir.

Q. Did that boat experience similar difficulties with this system?

A. Not that I recall, sir.

Q. Then it was something about THRESHER you were unable to find?

A. Well, I wouldn't say that we were unable to find it. I personally feel it is not due to the design of the valve or due to the operation of the system. If the other boats that utilize these pressure reducers had the same type of trouble that we did, there would be no reason for them to inquire as to what to do. I imagine--

Q. Were there any special instructions given to the crew as to the operation of the system during the post shakedown availability?

A. Concerning what?

Q. The operation of the high pressure air system.

A. Not to my knowledge. The only instructions that were given to THRESHER were the operating instructions for the PUFFS hydrophone air blanket.

Q. Wholly apart from operating instructions, to your knowledge were any instructions given to the ship's company during her post shakedown period of availability as to the capabilities of high-pressure air system from the point of view of blowout of banks?

A. No, sir.

Q. What was the maximum size, internal diameter, of the piping installation for the PUFFS air blanket compensating system?

A. I'm not certain of the wall thickness of the largest pipe.

Q. Approximately.

A. All right. Slightly more than 900 thousandths of an inch.

(b) (6) relieved (b) (6) as reporter at this point.

Question by a member, CAPT Osborn:

Q. You are talking about diameter?

A. ID, inside diameter. Point nine zero plus

Questions by counsel for the court:

Q. Referring to the PUFFS air blanket system, what were the provisions for preventing back flooding of sea water in case of rupture in the air blanket?
A. In the event that the air blanket ruptured, water would flow in through the line going out of the hull to the blanket, and water would flow from the relief port of the regulators; and in the event that this happened, instructions that were given to the boat, the hull valve, which was adjacent to the regulator, would immediately be shut; the sea sensing hull valves would immediately be shut; and the seven hundred pound air supply would be shut.

Q. So it couldn't enter the air system piping?
A. I would say that a small volume of water could enter the air system.

Q. What effect would that have on the air system?
A. That would have no effect on the air system.

Q. We have heard testimony that an object described as a spike was found in the filter; are you aware of that?
A. Yes, sir.

Q. Have you any explanation or possible theory of how it could have got there?
A. Well, we have issued instructions to the Production Department that whenever a system is broken down, immediately the lines involved shall be covered with this tape material. If this spike got into an air filter I can't imagine how it got there, unless the air filter that you are speaking of would be in the ventilation system where they have large, large filters.

Q. And then how could this have gotten in?
A. I don't know, sir.

Q. I am about to refer now to the changeover from cellulube to petroleum base lubricants in the air compressors and the change in air system seals which was required by this change?
A. Yes, sir.

Q. You indicated static seals were not changed unless a component was being removed from the system for some other reason; is that correct?
A. Not wholly, sir. The static seals contained in fittings, such as unions and the like -- the static seals and the dynamic seals of all valves, pressure reducers, soft seats in valves, were all replaced by the vendor, either at this shipyard or at his plant. When I speak of the static seals that were not removed, they were the static seals in fittings. This eliminated the breaking down of the whole system.

Q. Were tests made to determine that seal swelling was the only physical change which occurred in the static seals; that is, was the possibility of seal deterioration or cracking carefully checked to determine that seals would, in fact, be satisfactory if left in the system?
A. I believe so, yes. This was done, I believe by a PROJECT PRESSURE item.

Q. Taking into account your vast familiarity with the high pressure air system on the THRESHER, can you give us any explanation which you've arrived at

in your own mind for the following message, which was one of the last ones received from the THRESHER -- this was at or near her test depth: "Experiencing minor difficulties. Have positive up angle. Am attempting to blow." How can you explain the word "attempting"?

A. There are two positive procedures for blowing -- one being operating the toggle switches at the ballast control panel; and, with the loss of electrical power, to manually override the valve, which can be done from the same location on the ship. These valves are located immediately forward of the ballast control panel. "Attempting to blow," one could assume that there was an electrical failure; and in the event of an electrical failure the bank stop valves, the main stop valves for Banks 2, 3 and 4, would automatically shut and the bank stop valve for number one, the Captain's Bank, would be open. The capacity of the No. 1 bank is approximately one-quarter of the capacity of the b(1) pound air system. I don't think I would have anything other than that to say about the phrase "attempting to blow."

Q. What you told us is that 2, 3 and 4 automatically fail safe?

A. Yes, sir, that's true.

Q. Is there a way to override that situation so a man in command could say, "I am blowing."?

A. Yes, sir. Right at the ballast control panel these valves can be overridden and the poppet removed from the seat, which would put b(1) pounds down to your blow valves, the main ballast tank blow.

Q. We are referring to the bank stops.

A. All right, sir, would you give me the question again, please?

Q. Just give us, if you can, if you've given this any thought at all, your best explanation for the message that the ship was "attempting to blow."? Normally a ship experiencing minor difficulty, if it wishes to blow, would say, "I am blowing," would it not?

A. Yes, sir.

Q. And if it's a routine matter, upon electrical failure, for it to fail safe, and a routine matter to override that, the word would probably be, "I am blowing," would it not?

A. Yes, sir.

Q. Well, how do you account then, in your own mind, for the statement, "attempting to blow."? What sort of difficulties would cause a message of that sort?

A. I'm sorry, I wouldn't have an answer.

Q. Have you given this matter much thought prior to this date?

A. Yes, sir.

Q. And you can arrive at no reasonable explanation for that?

A. Well, like I said before, it could have been that he experienced electrical failure, which would give him only one-quarter of his capacity.

Q. How would he override the bank stop valve to open if he had an electrical failure?

A. These bank stop valves are enclosed by a door right adjacent to the ballast control panel. By turning three knobs, opening the door, he pulls a short arm, pulls it out so that it is in the lateral position to the valves; that opens the valves.

Q. Does that involve electrical power?
A. No, that's the manual override.

Q. Well, what is it that he actuates when he manually operates the knob?
A. He manually overrides the solenoid. The solenoid is dead; it has no electrical power. When he manually overrides the solenoid, he pulls the poppet off the seat to allow the air to pass through the valve.

Q. It is a purely physical operation then?
A. Yes, sir.

Q. Why were the bank stop valves enclosed behind a door?
A. I don't know, sir. I would believe just for habitability.

EXAMINATION BY THE COURT

Questions by a member, CAPT Nash:

Q. Mr. St. Pierre, assuming that the blow did commence, could the movement of contaminants in the high pressure air system have caused a stoppage?
A. I believe not, sir.

Q. Could it have affected the reducer valve in any way to cause this stoppage?
A. No, sir. It would just cause the pressure reducer to leak. You see there are two pressure reducers in parallel. In the event of the failure of one, the other one is cut into the system.

Q. In the event of failure of both, could it fail shut?
A. No, sir, this would have to be done manually by these cartridges in the manifolding of the high pressure reducing station.

Q. Will you explain to me the requirement to have the reducers in the system at that point?
A. These two reducers are immediately downstream of the b(1) PSI distribution manifold. b(1) pound air comes into the distribution manifold, either from the compressor or from the storage flasks, through the manifold into one or the other pressure reducers, which reduces the pressure from b(1) pounds. From there this b(1) pound air traverses the load to the b(1) pound header.

Q. My question was not clear. Why not leave these reducers out?
A. Because the system is not designed for an operating pressure of b(1) pounds.

Q. If there occurred a rupture in the PUFFS blanket system, what amount of leakage might occur into the submarine -- water leakage?
A. Amount? You're referring to gallons of water?

Q. Or size?

A. We have two different sizes of lines in each. I don't know if it is in one position or in the three positions. We utilize half inch IPS line and we utilize three-quarter IPS line. Without having the drawing here, it would be a little difficult -- but I believe that the only penetration that would utilize a three-quarter IPS line would be the #2 position. The line there is larger because it has double the amount of air blankets than Position No. 1 and Position No. 3. Positions No. 1 and 3 have two blankets, one port, one starboard; and Position No. 2 has two port and two starboard. So, consequently, the line size had to increase in order that sufficient flow got to the blanket and so that a proper size line was available so that it could vent when the vessel was surfacing.

Q. If there were a rupture, is it probable there would be leakage into the submarine at whatever size the line is?

A. Yes, sir. The water would flow from the vent port of the regulator vent release valve.

Questions by a member, CAPT Hushing:

Q. You mentioned a number of rather large jobs in connection with the high pressure air system, and quite a number of smaller ones, have you not?

A. Yes, sir.

Q. Would you say that these constitute extensive modifications to the high pressure air system?

A. Extensive modification would, of course, be the air piping for the PUFFS and blankets. As far as the high pressure air reducing station is concerned --

Q. I have not stated my question clearly enough for you. Do you think that the total amount of work on the high pressure system was a great deal of work, a normal amount of work on PSA availability, or a very small amount of work?

A. Normal.

Q. Can you tell us who was responsible for determining the tests to be prescribed upon completion of the PSA?

A. On the design memos that we put out for THRESHER, where required, we put out the test requirements. After we analyzed the whole situation we put it down on paper as to what lines should be tested, where they should be stopped, where the tests should come from, and so forth. We go over to the test people, Code 246, and they go over the test procedures and either they concur with us or they do not concur: but I can't think of an instance where they haven't concurred with us.

Q. Can you tell us whether the tests prescribed by Design for the high pressure air system after the PSA were extensive, nominal, or small in scope?

A. They were nominal. I say this because the extent of the redesign of the high pressure air system was in just one location on the ship. It was in the air regenerating room after bulkhead, sheet metal bulkhead, at Frame 47. It was localized in one area only.

Q. Do I understand that Design's analysis of the work did not lead to performing, say, the same kind of tests which are performed on new construction?

A. No, sir. It has the same tests.

Q. Same tests?
A. Yes, sir. Where applicable. There would be no reason to check a portion of the system that need not be tested.

Q. Do you know whether the tests were conducted on the THRESHER?
A. No, sir, I don't.

Q. Turning to the system contamination I believe you mentioned, was there any attempt to analyze the dirt and contaminants in the filter?
A. Yes, sir.

Q. What did you find on analysis?
A. At times we have found sandblasting grit, metal filings -- I say "metal filings;" that's a metal that probably got into the system from components in the system working, you understand. We have found wire, papier mache, matches. I can't think of anything else, sir.

Q. During the post shakedown availability, were the air banks charged from the ship's compressors or from the shipyard supply of air? Do you know?
A. I don't know, sir.

Q. Do you know what the normal procedure is during new construction for the providing of air to the air banks?
A. Usually as soon as the system is bought and the compressors are in operation, the charging operations would be done by the ship's compressors.

Q. Is there any attempt made to filter the intake to the compressors?
A. I don't know, sir. I do not have cognizance of the compressors at all.

Q. Is there any design direction to provide filtering for the intake of the compressor during the ship's construction period?
A. I would assume there is.

Q. But you don't know of any?
A. No, sir. That's out of my code.

Q. Let me turn to another subject. Suppose we wanted to, on TINOSA for example, not have the air banks 2, 3 and 4 valves close on loss of power. Could we defeat this automatic feature by removing power to the solenoid that you have discussed, and simply have manual operation all the way through?
A. Yes, sir, I think you would defeat it. I say this because if there were an air line rupture, the closing of these valves would have to be manual and you could lose quite a bit of your air in the event that you had a line rupture. With these valves operated electrically, when the toggle switch de-energizes the solenoid, the valve shuts in a minute portion of a second, which conserves your air.

Q. Are you saying then that in addition to loss of power, if you have a high velocity of air to the line that you also have the air bank stop shut automatically?
A. Yes, you can.

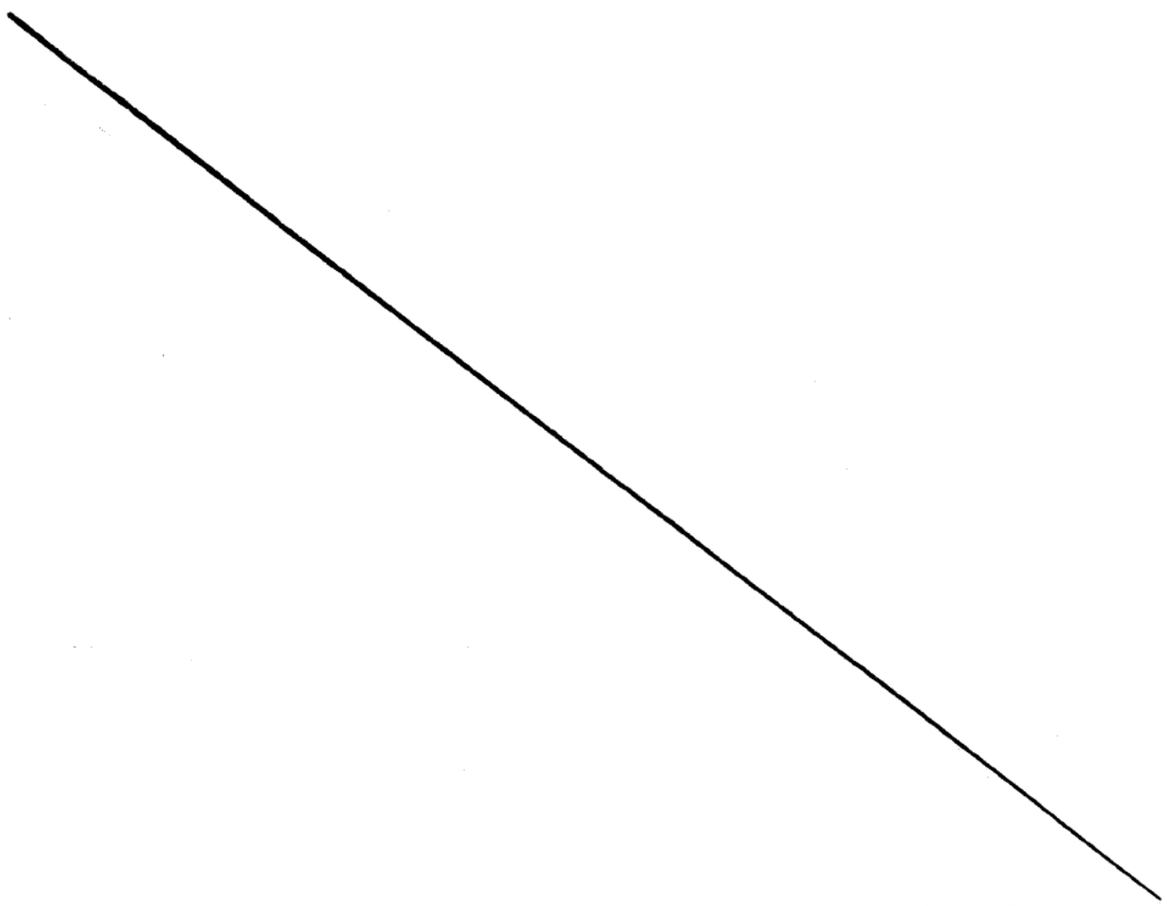
Q. I'm saying, does it shut automatically?
A. No, sir. That would have to be done by the personnel. They only shut automatically on the loss of electrical power.

Questions by a member, CAPT Osborn:

Q. The post shakedown availability work lists were minor in scope with respect to the blow capacity and blow rate of the main ballast tanks. Am I to assume that you were completely satisfied with respect to the air bank capacity and associated blow capacity of the THRESHER when operating at deep depths?
A. Yes, sir.

Q. In the design of the high pressure air system, had you ever been acquainted with flooding investigations or damage control with respect to the use of the air system?
A. No, sir.

Q. Then I take it that your approval of the system design was primarily based on just the ability to blow tanks and the flexibility involved, rather than any emergency action with respect to flooding?
A. Let me say, sir, that, as I stated before, I was not associated with the pneumatic systems at the time of this design, so the question that you just asked me I am sure that I am not capable of answering it.



Q. Would you give me an opinion now?
A. Yes, sir. I would say that nothing was taken into consideration at the time of the design of the air system for damage or casualty.

Q. Would you give me your opinion now with respect to handling casualties by blow rates?
A. Could you rephrase that, sir?

Q. Can you give me your opinion now with respect to handling casualties by blow rates, just using main ballast tanks blow?
A. Well, I feel that the system has enough capacity to handle minor casualties.

Q. What's a minor casualty?
A. Well, a rupture of an air line, for instance.

Q. With respect to a salt water line?
A. Well, there are so many different sizes of salt water lines that could rupture. I don't know how much water the ship would take from any salt water line being ruptured and at what depth.

Q. I am speaking with respect to test depth or so-called design limits. I just want to know what you would consider as a minor casualty?
A. In reference to sea water?

Q. And with respect to size, with respect to test depth, pressure?
A. Sir, I don't know.

Q. Were the yard cleanliness standards in air system repair, in supply, consistent with your design assumptions with respect to complicated high pressure air reducers?
A. Yes, sir.

Q. Did you inspect the quality of air being delivered from the yard to the ship to see if it were?
A. I don't know of any instance where the flasks were charged with yard air.

Q. Well, Mr. St. Pierre, we went through a major cellulube modification during this yard period, during which air compressors were one of the major items?
A. Yes, sir.

Q. They were bound to have been out of commission during the time. The ship was bound to have charged its banks with yard air.
A. Well, I know that on previous tests that we had run -- not concerning THRESHER or not concerning any boat -- and the only other source of air that I know of that's in the yard had filters in the discharge line. That was the air that was available over in Shop 31 for testing valves, and so forth.

Q. I am positive that you put filters on both sides of the reducer with respect to protecting them?
A. Yes, sir.

Q. Did you assume then that that would completely take care of any condition with respect to contaminating the system externally?
A. Yes, sir.

Q. Can you state under what conditions the electrical supply to the main ballast control panel for remote valve operation control would shift, say, from the b(3) 10 USC 130 electrical bus? If you want to be more specific, I want to know what conditions, in your mind, caused the ABC shift of electrical power to supply the main ballast control panel?

PRESIDENT: Do you understand the question, Mr. St. Pierre?

WITNESS: I understand the question, sir, but I'm not at all familiar with the electrical system. I do know that there are two sources, the b(3) 10 USC and they all eventually end up at the IC switchboard.

PRESIDENT: When you are asked a question and you do not feel that you are sufficiently informed or expert to answer it, it would be well to indicate that.

WITNESS: All right, I will, sir.

PRESIDENT: Don't try to answer something that you don't know how to answer.

WITNESS: All right, I will do that, sir.

The witness answered the last question in the following manner:

A. I can't answer that, sir.

Q. In retrospect, would you place a b(1) pound reducer in the main ballast blow system?
A. No, sir.

Q. In retrospect, would you design the hull stops to shut on power interruption the same way they do right now?
A. Yes, sir.

PRESIDENT: All stops or bank stops?

OSBORN: Those are the bank stops.

WITNESS: For the bank stops.

PRESIDENT: I think that should be brought out for the clarity of the record.

Q. I have one more unrelated question, and that has to do with the hull regulator valves where the ballast tank blow lines go into the main ballast tanks. Have you been cognizant of any flooding trouble with respect to these valves?
A. No, sir.

Questions by a member, VADM Daspit: