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VOLUME IV 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

Unclassified

Page 847 to 1173

Unclassified

Unclassified

SIXTEENTH DAY

Portsmouth Naval Shipyard
Portsmouth, New Hampshire
Wednesday, 1 May 1963

The court met with closed doors at 0945 hours.

All persons connected with the inquiry who were present when the court adjourned were again present in court, with the exception of (b) (6), who was relieved by (b) (6) as reporter. RADM Palmer, a party, and LCDR Hecker, a party, and his counsel waived their right to be present. Counsel for RADM Palmer was present.

No persons not otherwise connected with the inquiry were present.

Dean L. Axene, Commander, U. S. Navy, was recalled as a witness for the court, was reminded that his oath previously taken was still binding, and examined as follows:

COUNSEL FOR THE COURT: Commander Axene, this is a closed session of the court, and classified information may be revealed. I shall ask you at the conclusion of your testimony what classification you would accord to it as a whole.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Do you desire to clarify testimony you have previously given to this court with regard to the number and normal rig of air banks in THRESHER?

A. Yes, sir, if I may. At the end of my previous testimony, it is quite apparent that I became very confused relative to the number of air banks and the way they were normally rigged. I have thought about this and have, in fact, consulted with my former executive officer, Lieutenant Commander Raymond E. Engle, on this. THRESHER had four air banks. Our normal rig-for-dive procedure was to have two of these banks on service, two other than Bank No. 1. In our Rig-for-Deep Submergence Bill we placed a third bank on service, again other than No. 1, so that at rig-for-deep submergence Banks 2 and 4 would have been on service, and No. 1 was secured. I believe it to be true also, although it is probably not pertinent, we had no bank on service while rigged for service in port other than No. 1.

Q. Can you tell us anything further with regard to the operation of the main coolant pumps at battle stations?

A. Yes. When we wrote our original systems organization for THRESHER our battle bill provided for the main coolant pumps in fast speed. Some time after the ship started operating, and to the best of my recollection this was immediately following our shakedown training, we realized that for ASW type work which THRESHER was particularly fit to do, it might not be desirable to have the pumps in fast speed from a noise standpoint. We never proceeded other than with the pumps in slow speed unless ordered otherwise or unless an engine order was given which required shifting the pumps to fast speed. At least up to the time I was relieved, our ship's organization would not have required them to operate at

Unclassified

fast speed at battle stations.

Q. After your detachment from THRESHER, did you ever discuss the mode of operation of the coolant pumps with either Captain Harvey or anyone else from THRESHER?
A. No, sir, I did not.

Q. In your previous testimony, you referred to a report of THRESHER's first year of operations which you submitted to the Chief of the Bureau of Ships. Can you now produce that report?
A. Yes, sir, I have a copy here. (The witness produced said report.) Would you like me to identify it?

Q. Yes, please do.
A. This is a letter from the Commanding Officer of THRESHER dated 16 November 1962, a confidential letter, Serial 086, addressed to the Chief of the Bureau of Ships. I would like to point out that I reproduced this from the Shipyard's copy, which was annotated in various places throughout. This handwriting is not mine. I don't know whose it is.

Q. Apart from the handwriting on the pages, is this a true and correct copy of the report which you submitted to the Bureau of Ships?
A. To the best of my knowledge, yes.

The said report was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court. There being no objection, it was received in evidence and marked "Exhibit 111."

Counsel for the party waived the reading of Exhibit 111.

Q. (By counsel for the court) Captain Axene, you were requested by the court to review in your mind all that you could recall about THRESHER which you believe to be pertinent to this inquiry. Can you think of anything else you would like to offer at this time before we question you further?
A. No, sir.

EXAMINATION BY THE COURT

Questions by a court member, CAPT OSBORN:

Q. Commander Axene, with respect to your review of specific areas with respect to margin of safety, blowing capacity, flooding, would you at the present time, were you commanding a THRESHER class submarine, revise any of the procedures that you had in effect when you were Commanding Officer of THRESHER?
A. Yes; in at least one instance I know that I would. In the case of a salt water leak in the engineering spaces, my policy would provide for immediate isolation of the system, followed by attempting to isolate the specific leak and return the system to operation.

Q. What are your present thoughts with respect to the necessity or essentiality in terms of the constant vent system on THRESHER?
A. I believe that a constant vent system is necessary for continued uninterrupted operation of the main propulsion plant. Whether as elaborate a system as

Unclassified

THRESHER had is necessary or not, I do not know. I am inclined to think that some tests might be run to demonstrate this. There might be some components in the system that do not require constant vents; whereas, others do.

Q. Do you think it is necessary for a ship of the THRESHER class to go into an advanced readiness condition when proceeding below certain depths?

A. I do, yes. This was standard procedure while I had command of THRESHER. We did have a deep submergence bill which we invariably used when the ship was to proceed below b(1)

Q. Do you still think that the cut-off point, or the position at which you would go into advanced readiness condition, would still be about b(1) or would it be shallower?

A. In light of the loss of THRESHER, I am inclined to set that depth at b(1) feet. The depth, of course, is arbitrary, but I do believe that operation at or near deep submergence requires somewhat a special evolution.

Q. Do you think the primary advantage of deep submergence of a b(1) depth submarine is an additional safety factor gained in time with respect to handling of plane casualties at shallower depths?

A. No. I would say that the principal advantage of b(1) depth capacity, insofar as I have knowledge of what would be the additional advantage given the submarine in evasion. As you well know, of course, we had hoped to derive some advantage of operating at these depths in the area of sonar detection. However, this was never observed by me during the year I operated THRESHER.

Q. Do you think that we should come up with some type of procedure that, in operating at deep depths, we operate the speeds, on one hand, that protect us from a plane casualty; and on the other hand we don't go too slow to protect us from a flooding casualty?

A. I most assuredly do. For routine operation at deep depths, I believe a medium speed in the neighborhood of (b)(1) is probably optimum.

Questions by a court member, RADM DASPIT:

Q. Captain Axene, have you ever served on a nuclear submarine on which the main coolant pumps operated at high speed would be automatically switched to the motor generator sets if the ship's power supply failed and slowed down to half speed?

b(3) 10 USC 130

Q. Do you know any reason why this should not be applied to the S5W plant?

A. I know of none, sir. I have been advised, however, that the S3W plant, the one put into the SKATE class of ships, would have this provision, that the necessary contacts are there to do exactly the same thing, and with some minor wiring provisions, this could be applied to the S5W system.

Q. Can you think of any drawbacks which such an alteration would produce?

A. No, sir, I cannot. It seems very desirable to me, if it is as simple to do as I am led to believe.

Questions by the president, VADM AUSTIN:

Unclassified

Unclassified

Q. Commander Axene, how long does it take on THRESHER to shift from high speed to low speed coolant pump operation?

A. From the time the man starts the switch at the first pump until the final pump is switched, I would estimate b(3) 10 USC 130 It is certainly in the vicinity of b(3) 10 USC 130

Q. So that if personnel are available and not unable to perform their assigned functions, the automatic shifting would give you only roughly b(3) 10 USC 130 more?

A. Well, excluded from my previous answer was the time that would be involved in the man's recognizing the need to switch. If you include that time, it would depend a lot on the situation at hand, of course, but I think the time interval would extend to something more like b(3) 10 USC 130

Q. b(3) 10 USC 130

A. Yes, sir. In this case, and keeping in mind the type of casualty that we have considered, I do think you might realize some substantial saving by automatic switch-down of pump speed.

Q. Yes, because it is quite conceivable that when you need the automatic switch-down, the attention of those who would normally perform the functions necessary for that switch-down would be directed in other areas.

A. Yes, sir.

Q. Commander Axene, do you have any other observations regarding the loss of THRESHER or the operating procedures for nuclear submarines in general which you would like to give us at this time?

A. I have nothing new, Mr. President. I could reiterate some of the things which I know this court is well aware of and has been considering fully. If this would help, I would be glad to do so. I am not sure it would be worth the time it would take.

Q. If you are sure that the spectrum of our knowledge would not be enhanced, then it would not be necessary.

A. No, sir, I am sure it would not.

REDIRECT EXAMINATION

Question by counsel for the court:

Q. From all that you have been able to learn about THRESHER as a Commanding Officer, do you consider it highly desirable to provide a greater blowing capacity into deep-diving submarines than was designed into THRESHER?

A. Most assuredly, and this is one of the points I could discuss, but I know the court is already aware of this.

REEXAMINATION BY THE COURT

Questions by a court member, CAPT HUSHING:

Q. Commander Axene, postulating a ship like THRESHER moving at 10 knots with the main coolant pumps in slow, we receive in the Maneuvering Room a flank speed bell; how long would it take to shift the main coolants to fast to be able to answer that bell?

Unclassified

Unclassified

A. The throttleman would, of course, immediately start to open his throttle and wait for the pumps to be shifted. The pumps would be shifted as the throttle was opened, and I think there would be no more delay in flank speed shaft RPM than it would take to open the throttle. My recollection is that this would be something on the order of b(3) 10 USC 130

Q. Would your answer be the same if we postulated the ship was moving at 20 knots when the order was given?

A. No, sir. Of course, as you approach b(3) 10 USC 1 reactor power, you then would have to be more careful to insure that your reactor flow is increased to prevent b(3) 10 USC 130 and I think the throttleman would delay until his pumps were shifted and had 100 percent flow before reactor power was allowed to exceed b(3) 10 USC 13(There would have to be some leeway, but not a whole lot.

Q. Let us say that the throttleman decided he would shift the main coolants before opening his throttle; how long would it delay opening the throttle if he immediately shifted the main coolants from slow to fast?

A. Approximately b(3) 10 USC 130 something in that neighborhood.

Questions by a court member, CAPT OSBORN:

Q. In your discussions at Bettis, when you were there prior to coming to the THRESHER, on the detailed instructions in the S5W plant, do you remember discussing the specific reasons why the automatic shift-down in pumps was not conceived in the S5W plant?

A. I do not recall this subject's being discussed at all in that Bettis course. It was some time ago; nearly four years. But I do not recollect the subject's being discussed.

Q. There are specific technical reasons why this was not done. Whether those technical reasons prevail under the assumptions we are talking about. I am not sure, but there is a good technical reason why the SKATE system was not incorporated in the S5W system. Now, bearing that in mind, do you think you could simultaneously shift b(3) 10 main coolant pumps in slow on the MG bus?

A. I think I could answer your question a lot more intelligently if I knew what the reasons are why the automatic shift-down was not provided. Perhaps overloading the MG sets. I just don't know without seeing this tried, however.

CROSS-EXAMINATION

Questions by counsel for RADM PALMER, a party:

Q. Commander, what event or condition would cause an automatic shift from fast to slow operation of the main coolant pumps b(3) 10 USC 130

A. Well, essentially loss of the b(3) 10 USC 130 The pumps were then put on the b(3) 10 USC motor generator which came off the battery. This low-speed power supply backed up the b(3) 10 USC 130 of supply. My recollection of the details of that plant is not very good. That's about all I really remember about them.

Q. Changing the subject for a moment, what is your appraisal of THRESHER's engine room arrangement as compared with SKIPJACK class as regards access of equipment for maintenance?

Unclassified

Unclassified

A. In general, I was always most pleased with the arrangement of the engine room equipment in particular on THRESHER. There is no doubt but what the access to components was generally better than it was in the SKIPJACK class of submarine. There is no doubt in my mind about that.

Q. THRESHER provided an increase in remote operation of equipment such as sea valves. What are your opinions in this area?

A. Well, my understanding is that a remote operation of sea valves was provided as one of the features to make her a safer ship at this new depth. I was never satisfied with the location of controls for some of those sea valves in that they were not centralized in one area, and I have since - I don't mean just since the loss of the ship - but after having operated her for a while, I had become quite leery of the fact that electricity was required to actuate those controls. We did, from time to time, have trouble with the control circuits and particularly the indicating circuits on these remotely operated valves. Electro-hydraulic operation was required, and this is complicated. There is an assortment of things that can go wrong to deny you the ability to operate those valves. I think something simpler would be better.

Q. Commander, were the main sea valves operated strictly by hydraulics rather than electricity?

A. This is correct, yes.

REEXAMINATION BY THE COURT

Questions by a court member, CAPT OSBORN:

Q. Let me clear up a question with respect to my understanding of the ASW system and the air conditioning circulating water system. Is this a complete hydraulic system?

A. Not unto itself, no.

Q. I mean, is it completely hydraulic in the respect that you throw a lever in the engine room and this operates the valve?

A. You are correct. Insofar as the ASW sea valves, the main salt water valves, no electrical operation was involved. This was operated hydraulically from a lever. I was speaking generally.

Q. Did you ever have any trouble with the air conditioning system valves, inlet or outlet valves, being located on the transition bulkhead of the engine room?

A. No.

Questions by the president, VADM AUSTIN:

Q. Commander Axene, as I recall, the main ballast tank air blow system is normally dependent upon electrical power to operate it; is that correct?

A. Normal operation of the main ballast tank blow valves was electro-hydraulic, but the controls were electrically actuated.

Q. But with nearby overriding manually operated valves?

A. Exactly so, yes, sir.

Unclassified

Unclassified

Q. Now, Commander Axene, going back to your re-appraisal of how you would handle at deep submergence a leak or flooding from the salt water system, I believe you said that you would now immediately isolate the salt water system and seek to isolate the difficulty.

A. Yes, sir. Speaking only of auxiliary salt water, Admiral.

Q. Yes. You previously had thought and had reflected those thoughts in your indoctrination of your crew, that you would not immediately shut down your auxiliary salt water system but would first try to isolate the leak, is that correct?

A. No, sir, this is not quite correct. I believe what I said in my previous testimony - and this is the way it was operated while I had command of the ship - was not to attempt to isolate the individual leak or the entire system but to try to make a judgment based on the size of the leak, whichever was the judicious thing to do. In other words, if it were a big leak, you would isolate the system; and with a small leak, you would isolate the leak. I would now change this to isolate the system, having a better understanding of how long the reactor can be kept operational.

Q. Your previous hesitation to shut down your ASW system flow was occasioned by your concern for the reactor?

A. Yes, sir. Not the reactor per se, but the conponents b(3) 10 USC 130

PRESIDENT: Commander Axene, the court takes this occasion to express its appreciation for your assistance to this court as a technical advisor during a period when you were assigned normal leave between stations, and I feel that you have definitely contributed to the efforts of this court to enhance the future safe operation of nuclear submarines by so doing.

Neither counsel for the court, the court, nor counsel for RADM Palmer, a 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 made the following statement:

THE WITNESS: I would like only to express my appreciation to the court, Admiral, for having been accorded the opportunity to work with you during these past two weeks. It has been most beneficial to me personally. I am only sorry that I have been unable, through some flash of insight, to lead you quickly to a solution as to the loss of THRESHER. I have nothing further to add that is pertinent to the inquiry.

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

Willis D. Merrill, 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. Merrill, 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 assign to your own testimony taken as a whole.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address, and present occupation.
A. Willis D. Merrill, (b)(6) . I'm a leadingman pipefitter, Shop 56.

Q. Are you employed at the Portsmouth Naval Shipyard?
A. I am, sir.

Q. What is the nature of your duties?
A. Supervising a crew of pipefitters aboard submarines or whatever ship we happen to be working on.

Q. What duties did you perform in connection with the post shakedown availability of THRESHER?
A. The normal amount of piping overhaul, replacement, alterations.

Q. Were you the leadingman pipefitter on the day and afternoon shift during that period?
A. I was the leadingman on the ship in the afternoons regularly except for eight to ten weeks, when I was called on the day shift for special assignment.

Q. What is your background and experience in your line of work?
A. I have been with the Government -- I don't want to be stuck with these figures. Roughly twenty-eight years. About twenty-three years as a pipefitter and as a leadingman for ten or more years.

Q. How much of that work was at the Portsmouth Naval Shipyard?
A. All of it, sir.

Q. Turning your attention, then, to THRESHER during her post shakedown availability, and to the pipe work performed in her auxiliary sea water system; will you describe to us the work performed under your direction on flexible hoses and couplings in the auxiliary sea water system?
A. On the flexible hoses, they were installed in a hurry. Not all the men had been briefed too well in the installation of flexible hoses, but we immediately followed this up with a crew that was briefed and was familiar with that particular work, straightening out these hoses, fixing them up to be sure they were up to what they Navy requires. There are directives out on that. I can't give you numbers or names, but there are charts, and I'm familiar with those.

Q. When you said they had been installed in a hurry, were you referring to the installation of these fittings during the construction period?
A. No, sir. During the availability. We had trouble with some, and we were late getting started. We got a great amount of them down on the pier, and it took

time to get them in place on the boat where they belonged. Then we got a crew going to put the gaskets on them, straighten them up properly, and hung as necessary.

Q. How are your men instructed to install these flexible hoses and to recognize a poor installation job performed by someone else?
A. Mis-alignment of the hoses is a poor installation job.

Q. How were they instructed to align them?
A. Straighten them out and be sure there's no kinks. In three out of four of them have to be supported at the dog lag. This is a 90 degree bend.

Q. How much of this mis-alignment were your men instructed to regard as non-acceptable?
A. None, wherever possible. However, in the case of the single hoses, they are of extended length, and we are allowed a bend in them. And that is often necessary. In this case I don't recall specifically what the figure was, but depending on the size of the hole, you're allowed so much radius to the bend. In a very few instances this can't quite be lived up to, but we come pretty close.

Q. Did you have responsibility for the correction of deficiencies, such as leaks in the piping, alignment and installation of additional supports?
A. That is part of my job, yes, sir.

Q. Please tell us what was done in that area under your supervision.
A. When valves leak on the system on test, we call Shop 38 in to overhaul. If it is beyond their capacity, then, depending on the location and duty of the valve, it is sent to Shop 31 for overhaul, if necessary.

Q. Can you speak from memory as to what work was done in this area?
A. I believe, with very few exceptions, all the valves, back-up valves were removed from the ship and sent to Shop 31, and they received some sort of a coating. That's out of my jurisdiction, however. We were involved in the replacement of them back in the boat.

Q. Did you have any difficulty with the 8,000-gallon-per-day distiller and the piping associated with it?
A. Not to my knowledge. There were some alterations and additions. We did have one cylinder let go on the low-pressure side. This was removed on the boat, taken over to 31, repaired, and replaced.

Q. Did you check the silver-brazed joints in the ASW system?
A. Any that I made I checked, yes, sir - any made under my supervision.

Q. Did you check any in addition to those that were made by you?
A. I probably looked over a few out of curiosity. This boat was not under control during construction.

Q. Was not under control?
A. Under silver-brazing control. This came after the boat was built.

Q. Is that why you looked over other silver-brazed joints than those that were made by you?
A. Out of curiosity, yes, sir.

Q. What were you looking for?
A. Poor joints, mis-alignment.

Q. Did you find any?

A. I don't recall that I did, although U. T. showed up a few. They looked good on the surface, but the bond was nor good inside. Whenever that condition was found, they were changed.

Q. With reference to the ultrasonic tests which you mentioned, were those tests performed on the joints made during the post shakedown availability or on others besides?

A. I can't answer that actually, but I believe any joint that had the lagging removed were ultrasonically tested from two inches up.

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

Q. What percentage of them were found to be bad from your recollection?
A. Very minor, but I wasn't involved especially in the salt water system.

Q. Of the ones made by you and your people, how many turned out badly?
A. I believe we had a "T" which I tried to repair from old installation. It looked so good that I thought there might be a possibility. We didn't make out on the repair. I removed it. We wound up with a new "T", new couplings added as necessary, to replace the piping; and then we had the misfortune on one coupling that we had to change it twice. This was new installation.

Q. Apart from these two items, were there any others?
A. I don't recall any others specifically.

Q. How competent do you think your people are to put a silver-brazed joint in right the first time?
A. Very.

Q. What training do they have?
A. I do not know how long the school lasts. I believe that depends somewhat on their ability and competence, on whether it lasts a week, a week and a half, or something of that sort; but I'm sure it's at least a week on silver brazing, and usually they go back to qualify on other alloys and so forth.

Q. Have you ever had a man who wasn't good at silver brazing joints that you had to get rid of?
A. I had one that wasn't doing too well. I spoke to him about it, tried to help him with it. He improved somewhat. I was keeping him on low-pressure copper and brass fittings, and he did show improvement. And then the man was transferred due to the workload going down on the ship.

Q. Can you tell us about the work done on the ball valves of the auxiliary salt water system?
A. As I said, they were for the most part -- I don't know whether in their entirety or not -- removed from the ship and sent to 31 for Plastisol or some other sort of coating on the balls, I believe. Then they were tested and returned to us, or returned to 38 and installed.

Q. Did you have any problems in connection with them, or the "O" rings, seals and flanges of the ASW pumps?
A. On pumps and valves, when the piping is large especially, every once in a while you will cut an "O" ring on replacing it, and that's why we test. We find these leaks and correct them. We know when we've cut one that we've got a tight joint or a misaligned joint. Then we send a top mechanic down who finds out what's wrong and why.

Q. But you do make these tests?
A. Oh, yes.

Q. What tests were conducted under your supervision on the auxiliary sea water system aft?
A. To my recollection, I believe I wasn't involved in the salt water aft at all on testing.

Q. Not even partial testing of components?
A. I had partial tests, yes, sir.

Q. Well my question was, "What tests did you perform?"
A. I performed -- no, I didn't perform that either. I don't believe any, sir.

Q. But because you were supervising work on the auxiliary sea water system, piping work, you were interested to know when the test of the system aft was sold, were you not?
A. I was.

Q. It's a matter of some interest to a leadingman working on it; is that correct?
A. That is one of our harder tests.

Q. You say the test was not performed under your supervision?
A. No, sir.

Q. Can you recall whether you learned whether or not a final test had been performed and sold on the auxiliary sea water system aft in THRESHER?
A. Yes, sir. They were quite elated about it. The day shift had sold the system. I came in one afternoon and everyone was quite happy about getting rid of it.

Q. Can you recall the approximate date that you were told the test of the system had been completed and sold?
A. Approximately March 6th or 7th.

Q. How do you fix that date in your mind, Mr. Merrill?
A. I looked through one of our log books this morning.

Q. I show you Exhibit 106 before this court. Do you recognize it?
A. Yes, sir.

Q. Is this the book through which you looked this morning?
A. Yes, sir.

Q. Is your recollection of the date based on what you read in here, or did this remind you of the date so that you are speaking from your own recollection?
A. May I look at the book again?

Q. Surely. Do you understand my question, Mr. Merrill?
A. I understood your question; that's why I wanted to look at the book.

(The witness studied Exhibit 106)

WITNESS: I'm trying to read between the lines, I'm sorry.

COUNSEL FOR THE COURT: Take all the time that you need to give a really careful answer.

WITNESS: The book does not state definitely the auxiliary salt water system was sold.

Q. Would you like to change your testimony then as to the date when the test was completed?

A. Change the date to the early part of March, rather than a definite figure. There is a Test Slip somewhere that gives this information.

Q. Do you know where that Test Slip is?
A. I presume under your jurisdiction, possibly.

Q. You don't know then?
A. I do not know. I have seen it.

Q. Mr. Merrill, did you hear about a casualty to the reserve feed tank in THRESHER?
A. Yes, sir.

Q. You weren't at work during the time the casualty occurred, were you?
A. I wasn't, sir.

Q. Do you recall whether you learned of the completion of the test to the auxiliary sea water system before or after the occurrence of that casualty to the reserve feed tank?
A. No, sir, I can't give a date.

Q. With regard to the auxiliary sea water system forward in THRESHER, will you give us a general description of the work done under your supervision?
A. This is part of the reason why I was called onto the day shift. I installed comparatively all of it new due to alterations on Bulkhead 52 and the installation of a different type of Carver pump on the electronics schooling system.

Q. And what other work was done under your supervision?
A. Installation of piping on the air compressor, high-pressure air compressor; on the manifold in the air regenerating room, high and low-pressure manifold, complete job.

Q. Was there any other work?
A. A minor amount of pick-up here and there, drain lines, I was in on a little of it. Most of it I didn't have to bother with on that system.

Q. What tests of the system on which you worked forward were conducted under your supervision?
A. I conducted a test on the auxiliary salt water with the exception of the flushing lines in the crew's and officers' heads. At the time the work up there had not been completed. That also was under my jurisdiction. I hooked into a convenient spot in the air regenerating room and sold the rest of the system.

Q. When did you test the system?
A. I can't give you the date, sir.

Q. Would it have been at the end of February or early in March?
A. I don't recall, sir, not honestly.

Q. Do you know of your own knowledge whether a complete and final test of the auxiliary sea water system forward was conducted?
A. I cannot honestly answer that it was. That would be a presumption on my part.

EXAMINATION BY THE COURT

Questions by a member, CAPT Nash:

Q. As the leadingman was it your responsibility to designate which man would work on a certain sil-brazed joint?
A. We have qualified brazers, sir. It has to be a qualified brazer to braze the joint. It would be up to me to name the man if I had a choice of more than one in the crew, and also who would assemble the joint.

Q. How would you determine which man to assign? How would you select a man?
A. Normally if I have a job that's going on for days or a week, I assign a man to it and he stays there. I have the good fortune to have a fairly experienced crew, most of whom have been with me two years. When I was on the day shift in this particular job, I had two apprentice boys, I believe, and three men who had done the tear-off down there that were familiar with various parts of the system. I re-assigned those to those systems. I watched fairly close a day or two; they seemed to know what they were doing once they got started, so I left them right with the work they were doing.

Q. How do you determine specifically that a man is or is not a qualified sil-brazer?
A. They have identification cards stating their qualifications for brazing on them. It used to be that some were qualified for Number Three Solder only; some for Three, Four and Five; some unlimited; some were specifically detailed for just one or two items.

Q. When you assign a man to a job, do you check his qualifications?
A. If I don't know the man or he hasn't been with me for quite a while, definitely. It's my job if I don't, or can be.

Q. If a man's qualifications change, how would you become aware of that?
A. I am supposed to be told.

Q. By whom? Who would tell you that this qualification had changed?
A. Someone would have picked up his brazing card or would have recommended that he go back to school. The quarterman would probably inform me of that fact as soon as it was found out. If he's under my jurisdiction I would know, because I'm the one that can pick up his card.

Questions by a member, CAPT Hushing:

Q. How many men do you have in your gang now, Mr. Merrill?
A. Seventeen, I believe, sir.

Q. How many of them carry brazer's cards?
A. I have two brazers in my crew at the moment.

Q. When did you last look at their cards?
A. I checked the new brazer who I just picked up approximately two weeks ago, possibly three. The other man has been with me two years. His work has always been very satisfactory and he has been out on loan for only a week or two.

Q. When did you last look at his card?
A. I can't answer that. A long, long time ago.

Q. How long are the cards valid?
A. You have me stuck there; I don't know. I believe we get a questionnaire from the shop -- can't tell you which man for sure, Mr. DesRosiers, I believe -- once or twice a year, asking if we are satisfied with the brazer's work, do we recommend his going to school for retraining, or one or two other similar questions.

Q. When did you last fill out such a questionnaire?
A. I would say about the first of the year.

Q. The first of January of this year, or thereabouts?
A. Yes, the last of December, first of January.

Q. Let's go back to your testimony about a man who was weak and you put him on plumbing systems or low-pressure systems. Was he a card carrying brazer?
A. Yes, sir.

Q. Did you take away his card?
A. I did not.

Q. Did you notify the shop that he was weak?
A. I watched his work, discussed with him what I thought was wrong, and it did improve some. If he had stayed with me long enough I would have recommended that he go back to school.

Q. But you did not notify management that a card carrying brazer was weak?
A. I did not.

Q. Suppose you had been taken off the job through illness or for some other reason shortly after you discovered he was weak. How could anyone being assigned that man know that he was weak on pressure systems?
A. We are supposed to look at all this brazing work and it would soon be discovered before any harm was done, I'd say. We are supposed to look at one hundred percent of these joints, fit-up and finished product both.

Q. Would you say that your action in this regard is typical of what the other supervisors would do in the Pipe Shop in this kind of situation?
A. I don't think I could qualify anyone that way.

Q. Do you know of any weak brazers at the present time who carry cards?
A. I do not, sir.

Q. Is the man to whom you referred currently a card carrying brazer?
A. I can't answer that. I haven't seen him since I went back onto the afternoon shift.

Questions by a member, CAPT Osborn:

Q. You said you were supposed to look at each joint, Mr. Merrill. Did you actually look at each joint that was brazed on your shift?
A. I am quite certain I have looked at all of them.

Q. You personally inspected each one of them?
A. Yes, sir.

Questions by a member, RADM Daspit:

Q. I have one more question with regard to the man that you thought was a weak man. As I understood, he was taken off your gang and sent to some other gang?
A. Either that, or I was moved back to the afternoon shift. One way or the other, we were separated.

Q. Well, when he began to work for a new leadingman, did you advise the new leadingman that you thought he was a little weak on some of his work?
A. I advised my quarterman that he wasn't quite as good as I thought he should be and what I had been doing with him.

Q. Now to go back to the after auxiliary salt water system. I know that this is a long time ago and you're trying to remember, but you do definitely remember that the day gang was quite elated at having completed the test and sold the system?
A. Yes, sir.

Q. It's just the date that you don't recall?
A. I don't recall dates and names, sir.

Q. Now is it possible that on this day that they were so elated something else happened that you might recollect that we could fix the date that way -- the weekend before St. Patrick's Day, the day of the first baseball game, or something of that nature?
A. I don't think it would work, sir.

Q. I thought I'd try it.
A. I'm sorry. We do have a test slip; it's around somewhere.

Q. The Test Slip is not dated.
A. Oh, no!

Questions by the president, VADM Austin:

Q. Mr. Merrill, referring to Exhibit 106, will you identify your handwriting in that book?
A. Yes, sir.

COUNSEL FOR THE COURT: Let the record show that Mr. Merrill has indicated entries made on March 18th, 1963, which start off: "Merrill to day shift."

WITNESS: All the caustic comments will be under that heading.

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 made the following statement:

WITNESS: To my mind the THRESHER looked and seemed to be as good a boat as ever went out of here when she left for sea trials. That's how I feel about it. As for

the reserve feed tank, I am quite sure that that could in no way affect the auxiliary salt water system. It doesn't come that close to the 8,000 gallon still that was involved. To the best of my knowledge and recollection there is one drain line only that is even close to that, and that is way outboard on the frame. I think she was a good ship. I know she was.

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

The court recessed at 1056 hours, 1 May 1963.

The court opened at 1144 hours, 1 May 1963.

All persons connected with the inquiry who were present when the court recessed were again present in court.

No witnesses not otherwise connected with the inquiry were present.

(b)(6) , a former witness for the court, was recalled as a witness for the court and reminded that the oath he had previously taken was still binding.

COUNSEL FOR THE COURT: Mr. (b)(6) , this is a closed session of the court and classified information may be given here. Feel free to make your answers complete if they require inclusion of classified matter.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. During the later stages of THRESHER's post shakedown availability were you the leadingman pipefitter in the afternoon shift?
A. Yes, sir.

Q. Did you hold that position until the end of her post shakedown availability?
A. Well, no. I was transferred to the 620 about the last two weeks of it, sir.

Q. The last two weeks of her availability?
A. About that, approximately, yes.

Q. Can you describe the work accomplished during the afternoon shift in THRESHER's auxiliary sea water piping system?
A. Well I had the job of starting to fit up b(3) 10 USC 130 auxiliary salt water pumps. The piping going to them had been put together for the new shock mounts to get the boat out of dock. And after the boat was out of dock and we were at dockside, we took the piping all off and re-aligned it all up so there would be no pull whatsoever on the pumps.

Q. What work did you do with respect to the check valves and the constant vent piping system?
A. On the constant vent piping we put in check valves. These check valves were put in to vent off the system at different portions of the auxiliary salt water down in the lower level in the AMS space.

Q. Do you know of any check valves that were installed backwards in that system?
A. Yes, sir. There were some check valves installed backwards so the crew could run the EVA's and I believe with the reactor fresh water.

Q. How many valves were so installed?
A. Oh, approximately four, possibly five.

Q. Do you know of any valves which required re-installation because they were installed backwards, and the trouble wasn't found until the tests?
A. Well now, what do you mean, "until tests"? You mean that we started testing the system out or they started their operational tests?

Q. I mean after the valves were intentionally installed backwards for assistance in the work being done, they should later have been installed properly, should they not?
A. That is right, sir.

Q. I would like to know whether anyone inadvertently failed to install one properly that should have been installed properly, and that the failure was not revealed until a test revealed it?
A. Well, that's quite possible; it could happen, sir.

Q. Well my question is, "Did it happen to your knowledge?"
A. Not to my knowledge, sir.

Q. Have you fully described to us all the piping work that was done in the constant vent system? Were there check valves installed in that system and piping modifications?
A. Yes. Well, these check valves are all put in on a DMI, and the day shift were putting them in --

Q. Design Memo [illegible] hat does DMI mean?
A. You shouldn't have asked me that.

Q. Direct Material Inventory?
A. Well, no. DM is a plan that we get from Design -- Design Memo -- there, I got it after a while. Design Memo telling us what these changes are, and these here are something new that was put into this boat that we hadn't had in previous boats.

Q. What was that work; please tell us about it?
A. It was installing check valves in the vent system off of various components throughout the ship.

Q. Do you know of any other valves which were installed besides the ones you have told us about?
A. Well you mean in the whole system, sir? The vent valves?

Q. Yes, under your supervision in the ASW system?
A. That is quite hard to get to because we may have continued on finishing piping that somebody on the day shift had started, and we either had to braze for them -- there was, in the interim, I know we had some brazing down there from the day shift because there was a shortage of brazers and when I had an opportunity at night I would braze them up for them to progress their job.

Q. What shortage of brazers was there?
A. Well all these brazers are qualified people and it takes a certain amount of time for each brazer to get a joint done and get it done properly; and, therefore, it takes longer to do a joint under this new system than we used to do under the old system, because as a rule a leadingman goes around and he checks these joints to make sure that they are right, and there are times when the brazer has to stand by a few minutes to wait for a leadingman to get there.

Q. How big was the group which worked under your supervision?
A. Oh, approximately ten men, I would say.

Q. How many brazers did you have in that group?
A. Well, there was approximately three, sir.

Q. Was that enough for you to get all the brazing work required to be done on your shift done properly and well?
A. Well, it would be enough brazers to get the work done properly, but it wouldn't be enough brazers to get all the work that you may want to get done. Some of your work you'd have to lay over for the next day or have the other brazers on the day shift take it over.

Q. Can you give us a feel, then, for the brazer's situation with regard to the work done on the shift? Was all the work that needed to be done done by a properly qualified brazer despite the limited number of brazers?
A. Yes, sir. Nobody is allowed to braze whatsoever unless they're qualified and the leadingman, therefore, knows they're qualified, and every thirty days or so we sign a card if we're not satisfied with the brazer's work and will send him back to school and have him requalified.

Q. Did you have to sign any of those cards on brazers that worked for you in THRESHER?
A. Yes, I'm quite sure I did, sir.

Q. Tell us the instances to which you refer; tell us about them. Did you sign a card saying that a brazer who worked for you needed to go back to school because of the poor quality of his work?
A. No, I've never had one, sir. All the brazers that worked for me, I checked their work and I was perfectly satisfied they were doing it properly and they got their joints, to the best of my knowledge, that they were perfect -- as near perfect as humanly possible.

Q. How do you check a silver brazed joint?
A. Well, before it is brazed you go down and you make sure it is fitted properly. And after it's fitted properly you go back again and you look to see if the silver ring -- you can look around your fitting and you can see a small silver all the way around it; and if it shows good and clear and no small holes or bubbles in it, then you're satisfied that it is a good joint.

Q. How do you tell when it is fitted properly to begin with?
A. Well, you have the depth, and you can take a pencil or a scribe mark and put it on the joint on the pipe and take it apart and look at it and see if it's got the proper depth. Then after the proper depth, you will take a gauge and you'll put it into the side of the pipe. An eight thousandths feeler gauge should not go into the pipe. And if it's fitted up that closely, you know it's been properly sized and it's ready for brazing.

Q. What inspections are conducted while the work on the silver brazed joint is in process?

A. Well, the leadingman, if he is there at the time that the brazing is being done, he will stop and watch the man to make sure that he's using proper heat, to see that he isn't getting the fitting too hot, make sure that you're satisfied with his brazing.

Q. Is that all that goes on during the in-process part of the brazing process?

A. Yes, sir.

Q. Is there a requirement for a second brazer to stand by and watch the operation?

A. There has been in the past, but since they've been using UT, there hasn't been so much of that down there lately. The UT, it tells you whether the joint is a good joint or a poor joint, and if it shows a poor joint you either repair it or you pull it and eliminate it and put in a new fitting and start all over again.

Q. You refer to ultrasonic tests?

A. That's right, sir.

Q. With regard to the work done on THRESHER, was there or was there not at that time a requirement that a second brazer stand by when a brazer was doing his work?

A. No, I don't believe there was.

Q. How many of the joints made under your supervision were subjected to ultrasonic testing?

A. I would say most anything two inches or over. The bigger joints are the ones that were ultrasonically tested. I would say two inches or over.

Q. Who was responsible for this, for conducting these tests?

A. The UT people.

Q. In the Quality Assurance Division?

A. That's right, sir.

Q. Do you know whether any of the silver brazed joints made by your people failed to pass such tests?

A. Yes, I believe there was.

Q. What percentage of the joints made by your people were rejected as a result of those tests?

A. That's pretty hard to figure right down, but I would say the percentage would be very small, sir.

Q. On the order of ten percent?

A. No, I would say less than ten percent.

Q. Less than five percent? Between five and ten?

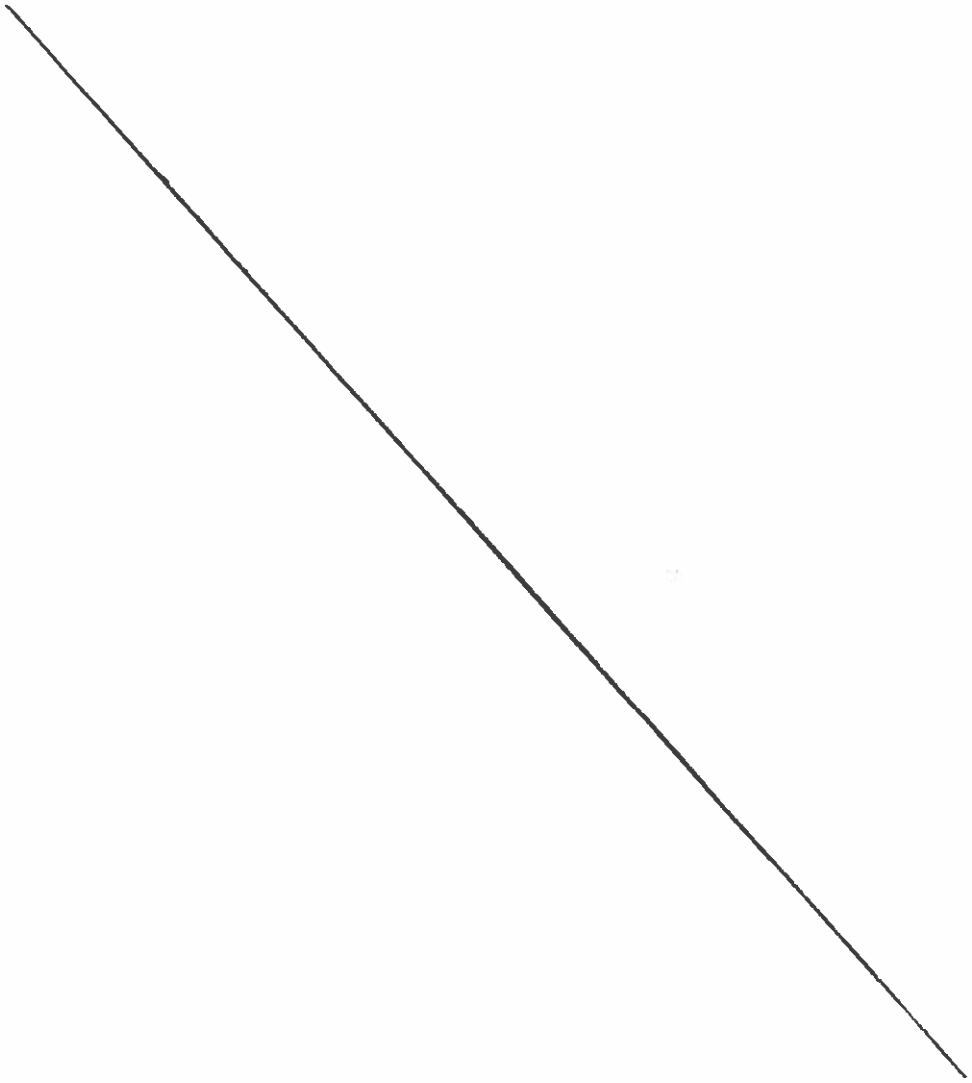
A. I would say around five.

Q. In addition to the silver brazed joints actually made during THRESHER's post shakedown availability, to your knowledge were any other silver brazed joints inspected and tested?

A. I believe that in the beginning that they went through the boat and they put a spot check on -- the inspectors put a spot check on the boat and anything that they figured that wasn't up to snuff, they tested it ultrasonic to make sure it was O. K.

Q. Did you notice any joints of this nature not made by your people during the post shakedown availability which, in your opinion, required that a test be performed on them?

A. I don't believe so.



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

Questions by counsel for the court (continued):

Q. If you did notice a joint that looked defective to you, would you consider it part of your responsibility to get it checked out?
A. Yes, sir.

Q. [illegible] n alignment checks of piping that were made on the installation of the auxiliary salt water pumps, what were the allowable limits applicable to the alignment of piping to the pumps?
A. Your piping should come up to your pumps and no drag whatsoever on your pump. Your bolts should slide back and forth freely between your flange on your last fitting and your pump, therefore having no strain, and you have a small clearance in between to make up for your "O" ring going in.

Q. Who checked it to see that that condition existed on the work performed under you?
A. Well, the leadingman would check it. The pipefitters and the machinists would check it to make sure there was no pull or nothing.

Q. Did you check it, Mr. (b)(6) ?
A. No, I don't believe I did have any checked. I have had some that were all fitted and left for the following day to continue with.

Q. Did you do any work on the flexible hoses and couplings in the auxiliary sea water system?
A. The only one on the auxiliary salt water system would be down on the CVA's, and I took one off the starboard side and put it on the port side so the ship could have their CVA's running. We were short one hose.

Q. Do you recall whether any test was performed afterwards on that?
A. Other than an operational test, was all that I know about on that, sir. They come from the shop. They've been tested at the hose department in Shop 56 and they come to the boat and we install them, and it would be an operational test on that particular one that I put in so they could have the system running.

Q. As a leadingman working on the piping in the auxiliary sea water system, you would naturally be interested, would you not, if a final test of the system aft, had been sold?
A. Right.

Q. Did you ever get the information that such a final test had been sold?
A. Yes, I received the information that this system had been sold.

Q. Was the test conducted on your shift?
A. Well, we would carry it over on our shift, but the final sale of it was not.

Q. Did you do any work in connection with that final sale?
A. Well, I would say, working up to the final test we did, because going through my book here I found down in the hydraulic system, down in the after end of the boat, we had an "O" ring leak down there that I had repaired.

Q. When you refer to the "book," you are referring to Exhibit 106, are you?
A. I imagine that is the book, sir.

Q. Satisfy yourself that it is the book. (Hands Exhibit 106 to witness)
A. Yes, sir. Well, on the 7th here, I see that on the pumps that had been installed there was "O" ring leaks on the auxiliary salt water b(3) 10 USC 130

Q. You are referring to an entry made on March 7, 1963?
A. I assume that is the date because it is my note to the previous date that I have on here. Now, there was another one in here that referred to the hydraulic system where I changed an "O" ring so that, apparently, would be on the same one. "Auxiliary salt water weeps complete on test at 830, can only have eight hours, plenty leaks turning to the midnight shift."

Q. You are reading an entry--
A. That I wrote myself, yes, sir.

Q. That is on what date?
A. March the 5th, 1963.

Q. It says, "ASW weeps complete on test at 830, can only have eight hours, plenty leaks turning to midnight shift."
A. It was apparently that the crew would only give us the auxiliary salt water for an eight-hour period. I remember, I think it was Chief Wise, or one of the chiefs, told me I could only have it for a certain length of time, and we were pushing it to try to get it completed.

Q. Are those entries under March 5th in your handwriting?
A. Yes, sir, my printing.

Q. Your printing?
A. Right.

Q. Can you recall the date that you were told that the final test on the auxiliary sea water system aft had been completed and sold?
A. No, sir. I can't, and I have been wracking my brain all day trying to come up with it. I even asked my people who worked for me last night if they could remember when this had been sold. We got the word from one of the day people that they had sold it. Who it was, I can't remember that, either.

Q. With reference to the casualty to the reserve feed tank, can you definitely state whether it was before or after that date that you got the word?
A. No, sir, I can't. I can't for the world of me remember.

Q. Is there anything further you can tell us about the work done under your supervision during the post shakedown availability of THRESHER?
A. You mean pertaining to the auxiliary salt water system?

Q. Or anything else.
A. No. There's nothing that I can think of on the auxiliary salt water. Of course, trim and drain, which is another thing, I had that; and as I told them at the Legal Office, I couldn't remember selling anything; and I go through the book and I sold the whole thing. So that just goes to show you, when you get under pressure, you don't think quite right.

Q. What work did you do on the trim and drain system?
A. Well, we sold the complete system, the trim and drain, the main drain, the trim suction, and the trim discharge.

Q. You have a sizable crew working for you, Mr. (b)(6) . Do you feel you have enough power--disciplinary power--to make them do the job properly and do it right in accordance with instructions?
A. Yes, sir. The majority of my men, I don't think, have to be forced to do it. They are more than willing to do a good day's work, sir.

EXAMINATION BY THE COURT

Questions by a court member, Captain Hushing:

Q. How many brazers do you have in your gang now?
A. Well, on this particular boat I'm in now, sir, the brazers are all under one leadingman. He has charge of all the brazers and if I want a brazer, I go to him and he assigns me a brazer for the night; and, therefore, he takes care of all the brazing, but on my own work, I have had the brazer give me the cards, so I will sign them and I'll inspect the work and be responsible for it, rather than have another leadingman coming into my territory that might not have the same interest in the work that I got. I want to make sure it is signed by me and, if anything comes up, it is going to be me and not anybody else that takes the blame.

Q. Have you looked at the cards of these brazers that are assigned?
A. Yes, sir, I have had--the brazer I have had with me, went with me onto this 620 boat from the 593 boat.

Q. Do the cards have dates on them?
A. Yes, sir. All the joint cards have dates on them, yes, sir.

Q. Have you ever seen any expired cards?
A. You mean on my brazer--an expired card?

Q. Yes.
A. No, sir.

Q. Do you, as a regular matter, check the cards of the brazers assigned to you?
A. They are sent to us from the personnel office. These cards are sent out, I believe, it is every 30 days and we have the opportunity then--it is marked on the card that he be returned to school or whatever action we want to take against them. If you have a brazer with you and watch him, you know his type of work and, if you figure he is all right, you don't bother to send him to school; you know he is doing a good job. By the same token, if there is a brazer on another job and I see him and figure he isn't brazing right, I can immediately pick up his card and stop him from brazing whatsoever.

Q. You can pick up his card?
A. Yes, sir.

Q. Have you ever picked up anybody's card?
A. No, sir, but I recommended to another leadingman to have him pick up a card, but that was when this particular thing started, back maybe a year or so ago.

Q. About a year or so ago?
A. Yes.

Q. Do I understand that you do get a list about once a month of all the card-carrying brazers?
A. Yes, sir. We don't get a list; we get an individual card for each brazer.

Q. For each man?
A. Yes, sir.

Q. What kind of card is that?
A. That is a white card, maybe four by three, and on it, it says to have him requalified or send him back to school or are we satisfied with his brazing, and we mark it such and we sign it, and these cards should be all available at our shop.

Q. Each leadingman has that opportunity once a month?
A. About that, sir, yes.

Q. So, every month or two months, but it is a regular occurrence?
A. Yes, sir.

Q. Is it a regular requirement that the cards be returned even though you don't desire to take any action on the man?
A. Oh, yes. We send it back, and I imagine it is kept on file so as to show we are satisfied with this person that we got brazing.

Q. How many times have you done this in the last year?
A. Well, it is pretty hard to say, in the last year. But we'll say on the THRESHER boat, I've had two or three different cards that I signed on that boat at different times for different leadingmen--I mean, for different brazers.

Q. So, you have done it three--two or three times within the recent past--say, the last year?
A. Yes, sir, that is right, sir. When this was instituted, I just can't put my finger on it, but it comes to us in paperwork and we read it over and mark it up and send it back to the personnel office immediately. We have a boy that brings our mail around the first part of the shift and when he comes back on the next part of the shift, I either give it to him then or, if I talk to him a few minutes, I open my mail and give it to him to take back then, so I won't have it in my pocket and maybe have it get lost.

Q. You feel, then, you have adequate control over the abilities of the brazers who may be assigned to you?
A. Yes, sir, because any time I am not satisfied with them, I sure don't let them braze.

Q. But you have had no instance, in your own gang, of not being satisfied?
A. That is right, sir.

Q. Do you make it a habit, when you are down on the ship, to look at other work than the work with which you are currently employing your men?

A. Well, we're something like women; we're kind of nosy--we like to know what the other guy's doing. If you are in the midship compartment, you are checking your own work and you look around and there may be a hanger that you can put on--another person's work, but you just put it on and let it go at that, but you have a pretty good feel for what's going on.

Q. How did you feel about the flexible hose installation on THRESHER from the time they started doing it in this year until it was finished?--Did it look good to you?

A. The majority of it looked very good, sir.

Q. Well, what didn't look good?

A. Well, there was one or two instances where we just had one hose and you could have a certain degree of bend in it, but I didn't like it; but it was the way that they were designed and you are allowed to have this bend in it, so they were put in this way.

Q. Within the specifications, but you personally didn't like it?

A. That is right, sir, because most anything I see--and my men are a little cautious of it, too, because if I see something that isn't straight, I start squawking about it and they are pretty well hep to me now that when I come down, that I got a pretty good eye, and if it isn't straight I am going to squawk about it, and they try their best to have things square.

Q. Did you see anything that went beyond the specifications, that was outside of the specifications, a deficiency in the specifications?

A. No, sir, I didn't.

Q. You feel the hose installation was within specifications from what you saw of it?

A. Yes, sir.

Q. Although your personal standards in this regard might be a little bit higher?

A. That is right.

Q. How about the alignment of piping with connections--of flexible hose connections--were you satisfied with the alignment of piping?--Did you see any hoses that were offset in straight connections, for example?

A. Well, you mean--

Q. Where the pipes were offset and taken up by the hose?

A. Yes. That is the one I was referring to, sir. I think it was down--I think it was on your constant vent system down in the engine room. There was one down there that showed the hose coming up and making an off angle, in other words, an offset; and I kind of squawked about it and the men got the print and showed it to me, that they were coming off right, so there was nothing I could do about it. That is the way it was designed to be.

Q. From your knowledge of hoses, would it be possible to excessively twist the hose during installation and then correct the twist simply by backing off and have the hose show no signs of having been twisted?
A. I don't think so.

Q. Well, how would you know that a hose had been excessively twisted during installation under those circumstances?
A. Well, I don't think it's possible that you could twist this hose. You could throw it out of alignment where one would be off from the other but, as far as twisting the hose, I don't believe you could, sir, because those are made up in the shop, sir, and there is tremendous pressure put on those hoses to make them rigid on each end, and I don't believe you could twist the hose.

Q. You don't believe it is possible to twist the hose during installation?
A. I don't think so because if you got your two ends and were going to hold this end solid and twist that hose so it turns around, it is going to take a tremendous amount of pressure to do it because those are really set up there, and the majority of hose I am talking about is not light--it is heavy, and it usually has a wire or cable of metal on the inside.

Q. Your opinion, then, might be that any twist that shows in the hose was put in during the initial fabrication of the fitting itself, the hose fitting?
A. I don't see how that is possible, sir.

Q. Have you ever seen a twisted hose?
A. No, sir, not in the manner that I think you are talking about--nine inches of clear hose that we got with a fitting on each end. No, sir, I can't say that I know of any that have been twisted or I've seen twisted.

Questions by a court member, Captain Osborn:

Q. Mr. (b)(6) , you seem to have a high regard for the people who work for you. What do you think of the people that supervise you?
A. I believe that they are about the best there is, sir. I am very well satisfied with them and I think they are well qualified for their jobs.

Q. Is this just based on technical competency of the individuals, or more or less a personal admiration?
A. No, sir, this here is strictly on their ability for the work, sir.

Q. How long has it been since your supervisors have been in an actual work capacity on the ship?
A. How long has it been since they actually used the tools?

Q. Yes.
A. A good many years. Mr. Smith, which is my immediate supervisor--or was at that time--was quite a few years since he has actually worked with the tools, but I knew him when he come out of his apprenticeship and I knew him when he worked on the boats. I was an apprentice.

Q. Did he ever work, personally, on a nuclear submarine in a working capacity?
A. No, sir, I don't believe he has.

Q. How about Mr. Collins?
A. No, I don't believe Mr. Collins has worked in a working capacity on a nuclear-powered submarine because he was leadingman--no, I don't believe he ever did, to my knowledge.

Q. Are these people pretty familiar with the technical details of the work that you and your men are doing?
A. Yes, sir, because if I get in any difficulty, he is the one that I go to for my assistance for anything that is buffaloing me or anything over my head, and I go to them; and if they can't find out, we go to an engineer to make sure we are squared away.

Q. Is this assistance usually vocal assistance, or actual help?
A. Well, it is usually vocal assistance is all that is necessary. If there is something bothering me, I go to him for the technical end of it.

Q. What date was the drain system in the engine room completed?
A. The trim and drain?

Q. Yes.
A. That I couldn't tell you, sir, without checking.

Q. Do you remember any approximate date?
A. No, sir.

Q. Did you put a test on the drain system after the reserve feed tank casualty?
A. I believe it was before, sir; I wouldn't want to state it without knowing for a fact.

Q. You stated that the ship was putting a lot of pressure on you around the 5th of March to get the ASW system completed. Why was this?
A. Because they wanted to run their systems, the systems that they were running, and they shut it down and give me the system for a specified length of time to do the work. In other words, they had a lull where they could give me time to go in and try to accomplish something while they were still using the vent system. I think the reactor fresh water was one of the reasons that they could only tie it up for a certain length of time on account of heat. Now, this reactor heat is getting away from me; I am not even going to say anything about it because I don't know the first thing about reactors, but I believe that was the reason we could only have the system for a certain length of time because they had gauges that they watched in the maneuvering room and they would tell us that we could either have it for a specified length of time, or we couldn't have it.

Questions by the court president:

Q. Mr. (b)(6) , in your testimony, I believe you have stated that you are one who likes things to be shipshape.
A. Yes, sir, I do.

Q. A submarine is a fairly crowded place in which to work, is it not?
A. That is right, sir.

Q. When you get many electrical leads and air hoses, and things for various people to do, various jobs on a submarine, it becomes rather difficult to keep things very shipshape, doesn't it?
A. That's right, sir.

Q. Do you feel that the congestion, or the difficulty of keeping things shipshape in the crowded spaces of a submarine, makes difficult meticulous inspection and high quality work at times?
A. Well, it does; it makes it difficult lots of times to get at your work to do it, but there's places, of course, on a submarine that you would never find any place that I have ever been, that you would have the trouble of getting in to do a job, that you have on a submarine.

Q. Sometimes you even need smaller men--
A. That is right, sir, yes.

Q. —to get into inaccessible spaces.
A. On the 593 boat, I had to take one of the apprentices and lower him down in the spray ring in there. He was the only man that was able to get in there to try to help the ship out. Although it wasn't my work--it was machinists' work--I volunteered to try to let the man go down in to accomplish the work to be done.

Q. And this was an apprentice and not a machinist, was it not?
A. That is right, sir.

Q. And yet, he was doing machinists' work, was he not?
A. Well, I presume you could call it that, but the crewman wasn't small enough to get in and they didn't have a machinist that was small enough, so I volunteered to let my man get in to see if the spray ring--if they could put something in to dislodge it, which it was proved that they couldn't, and later the machine shop had to use one of their own leadingmen to actually do the work. He was the smallest man that could get in, but when it come to the technical part, they used my help for it to try to bring the ship along and, well, in other words, we try to work with the crew as much as we possibly can.

Q. In view of the crowded conditions and the clutter of air hoses and manifolds and electrical leads et cetera, there is a tendency sometimes to take, shall we say, a practical short cut, is there not?
A. Well, I don't--in what way do you mean, sir?

Q. Well, I mean, Mr. (b)(6) , just in the way that you just described, where a man who is an apprentice was used to do a job that normally, had you had a machinist who was small enough, you would have used a machinist.
A. That is right. You'll just use whoever you can get to get into the smaller part, but if you have an apprentice or a helper doing the job, you watch the work very close to make sure that it's under proper supervision, to make sure that it is done correctly.

Q. The silver brazing work has come under more and more careful supervision during the last 18 months, has it not?
A. Yes, sir.

Q. How much do you estimate this greater supervision has added to the reliability of silver-brazed joints?--In other words, I am asking you now for an estimate. I recognize it cannot be accurate to a decimal point, or anything of that sort, but I am asking you, as an experienced leadingman, to give us just an estimate of how much more you would rely on a silver-brazed joint that goes out of this yard today than you would have 18 months ago.
A. Roughly, I'd say 75 per cent.

Q. Better?
A. Much better, right, sir.

Neither counsel for the court, the court, nor counsel for RADM Palmer, party, 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 by the previous questioning.

The witness stated that he had nothing further to add.

The witness stated that his testimony was not classified.

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

Mr. Robert E. Boutet, 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:

The witness was informed that he was privileged to divulge classified information, and at the conclusion of his testimony he would be requested to assign the highest classification he felt was applicable to his testimony.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation.
A. Robert E. Boutet, (b) (6) . Right now, I am on six months' detail to the Production Engineering Division, classified as an equipment specialist.

Q. And that is at the Portsmouth Naval Shipyard?
A. At the Portsmouth Naval Shipyard.

Q. What is your background in the field in which you work, Mr. Boutet?
A. I have served a four-year apprenticeship and I have had 23 years as a machinist, 12 of this as a supervisor leadingman machinist.

Q. How much of that work was done at the Portsmouth Naval Shipyard?
A. I will have 22 years at the Portsmouth Naval Shipyard this coming July.

Q. Until about the first day of April 1963, you were a leadingman machinist in Shop 31, were you not?
A. Yes, sir.

Q. And did you have the day shift in THRESHER during her post shakedown availability period?
A. Yes, sir.

Q. [illegible] the day shift [illegible] leading shift on the work that was being done on THRESHER?
A. Yes, sir.

Q. Would you explain that to us? What does it mean to be the leading shift?
A. The leading shift sets up, for the afternoon shift and the midnight shift, the work that is to be done. The jobs are set and assigned to the men on the afternoon shift and the midnight shift. This is done through a roster with a job order signed, and a little notation after the job order to signify the job that the man is to work on.

Q. Now, would you describe the shop work done on the ball valves in THRESHER's auxiliary sea water system?
A. Yes, sir. The ball valves on the THRESHER were removed from the ship and they came into Shop 31 on a design memo. This design memo called for Shop 31 to take apart and inspect for corrosion and pit marks and to make notations--or what is known as a "condition report"--and to confer with Mr. Lanzillo of Design. These valves came into the shop; they were disassembled. Any ball that was salvageable, which means that we could polish it to take any small nicks or scratches out, we did that. We reassembled the valve and ran a hydrostatic test on it. Then, the valve was disassembled, taken apart and the ball was shipped to Shop 37 for a Teflon coat.

Q. [illegible] an you describe the condition of the valves from THRESHER when they were delivered to Shop 31?
A. Yes, sir. May I look at my notes?

Q. Please refresh your recollection, if you will, but testify from your own knowledge.
A. The ball valves, themselves, as they were disassembled, they showed a slight corrosion on the ball, itself. Some of them had nicks and there was a few that had extreme corrosion, a few with extreme corrosion due to barnacles. These balls were replaced. The ones that had a slight corrosion, we skin-machined the ball, and if the seat cavity in the body, itself, had extreme corrosion on this we were allowed a minimum of 20 thousandths which we could take off to save the valve body and reuse it. This had to be done in two operations because we had to skin-chip the seat surface and we had to skin-chip the mating flange surface where the bonnet--which we call the bonnet--was to allow for the same differential which we took off the seat so the valve would come back to its original position. I hope that is clear.

Q. Do you have a list of the valves removed and worked on?
A. Yes, I have a list of the valves that were removed and worked on.

Q. Now, was there some difficulty on the hydraulically-activated valves when the THRESHER came in for post shakedown availability?
A. Yes, there was.

Q. Was that corrected?
A. This was corrected on the hydraulic conversion when we went from Cellulube to a mineral oil or TEP-2190 oil. This condition--would you like me to explain it?

Q. Yes.
A. This condition was due to the plumer or a leather cap that went on the end of the piston; the retaining screw had a tendency to back out in operation. Design put out a memo for us to put what is known as a nylon slug in the thread. This is an Allen head cap screw, and this acts as a locking agent when you screw it in; it binds up on the thread and locks the cap in right. After this was done, we had no previous trouble with the valve.

Q. You had no further trouble with it, is that right?
A. That is right, sir.

Q. Would you describe the Teflon coating work that was done?
A. I can briefly describe the Teflon coating from just knowledge. I had nothing to do with it as that is done in another shop, but it is a means of immersing the valve in a certain degree temperature of a Dupont Teflon that is cooked on there, I think, for 750 degrees; I think for one hour for each inch in regard to the size of the valve; and, then, as a distinguishing agent, mainly, they put an olive green coat of Teflon on it. That would visibly show that the valves have been Teflon coated.

Q. Can you describe the tests made in your shop on the auxiliary sea water valves and the results of those tests?
A. Yes, sir. When a valve is set up in Shop 31 for a hydrostatic test, we use the town water as a medium. The valve is first set on a test table and visually inspected for line of flow to indicate the arrow point with your indicator on your actuator, either hydraulic or manually operated.

Q. I would like you to describe the tests performed on THRESHER's valves, not your general procedure.
A. This was performed on THRESHER's valves. The THRESHER valve is a soft-seated type of valve, which means it has a Nylon seat and a CRES Teflon-coated ball valve. The valve is set on the table in the open position. We blank off one end of it and give it, mainly, first a body test by blanking off the other end and pumping the planned pressure to it. This test is run a minimum of ten minutes. If we see any sign of leakage, we usually sometimes go to a high hour and a half on a test like this to make sure it is not a slight weep we have found, or a splash of water that got on the valve in the test.

Q. Did you have any difficulty with THRESHER valves during their test?
A. No, sir. The valves are tested in a closed position from both ends of the valve.

Q. Were there any difficulties due to the nylon coating peeling?
A. The nylon coating on some of them had a tendency to peel; these valves were sent back and recoated with Teflon--pardon me, Teflon, not nylon.

Q. I meant Teflon, yes.
A. Yes, the Teflon coating was renewed on those.

Q. At the end, then, were all of the tests satisfactory on the shop tests of THRESHER's auxiliary sea water valves?
A. As you probably know, we have to sell every valve tested in the Shop to 303B Quality Assurance. They have a regular acceptance form, a pink slip they make out, which lists the ASW number of the valve, the plan; the pressure is confidential and is not listed. This is signed by the inspector. This is attached to the valve. When the valve is done, we take it off test and leave it in the open position, blank off both ends with corrugated cardboard, taped up tight.

Q. The tests were satisfactory?
A. The tests were satisfactory.

Q. You have been leadingman machinist for many years before your present position, have you not?
A. Yes, sir.

Q. Looking back on your experience now, did you feel that you had enough disciplinary authority as a leadingman machinist to insure that the people who worked for you did their work properly and responded to their orders?
A. Yes, sir.

Q. Did you ever have any difficulties with your disciplinary authority?
A. No, sir.

EXAMINATION BY THE COURT

Questions by a court member, Captain Osborn:

Q. Have you had any experience with the operation of THRESHER valves at sea in THRESHER?
A. Only as I get them as a component that comes into Shop 31.

Q. Have you ever noticed any tendency with respect to these valves to bind with increased pressure?
A. No, sir.

Q. Have there been any reports of this to you?
A. No, not to my knowledge.

Q. Would you be in a good position to receive all the detailed knowledge on these valves?
A. Yes, I have a very competent crew that worked for me.

Q. I mean, the results from the tests at sea.
A. No, sir. I have no availability to that at all.

Q. Have you ever had any occasion where you had a valve that worked pretty well on a ship prior to going to sea, and then didn't work too well when it came back?

A. I had a valve that came in off a weep, which would be a job order, and asked to be checked over in our shop, and we would take it apart and look it over, check the clearances and reassemble it, test it, and if it is hydraulically operated, we use a hydraulic power pack on it. If it is manually operated, we have a torque tolerance to work to.

Q. Do you check the torque tolerance on hydraulic valves, manually, prior to putting it on an actuator?

A. On a five and six inch hull valve, you have no way of doing it.

Questions by a court member, RADM Daspit:

Q. I have one point I'd like to clarify. You said that you had to sell every valve in the auxiliary salt water system to 303 Bravo in the shop?

A. Yes, sir.

Q. Is this because the coating was in the nature of an alteration?

A. No, sir. This is standard procedure on any component that is taken off a submarine and given any type of test in Shop 31. It has to be sold to 303B. It has to be inspected.

Q. But this is not the procedure carried out down in the ship?

A. I would not know, sir.

PRESIDENT: I would like to see a list of the valves.

(The court then examined a paper presented to them by counsel for the court)

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. Are the inspectors from 303B, who check the valves on the test stand in Shop 31, permanently assigned to duty in Shop 31?

A. Yes.

Q. Do they have office space located in Shop 31?

A. Yes.

Q. It is the same inspectors over and over again, then?

A. Yes.

Neither counsel for the court, the court, nor counsel for RADM Palmer, party, 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 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.

The court then recessed at 1248 hours, 1 May 1963.

The court opened at 1400 hours, 1 May 1963.

All persons connected with the inquiry who were present when the court recessed are again present in court, except (b) (6) , who was relieved as reporter by (b) (6) .

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

COUNSEL FOR THE COURT: This is a closed session of the court and classified information may be given here. You can include it in your answers to make them full and complete.

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) ; my occupation is Leadingman Machinist Marine.

Q. Are you employed at the Portsmouth Naval Shipyard?
A. I am.

Q. What is your background and experience in your line of work?
A. I have been on the Shipyard twenty-one years.

Q. Were you, at the time of THRESHER's post shakedown availability, the Project Quarterman, Outside Machinist, for THRESHER's auxiliary sea water valve work?
A. Yes, sir.

Q. Did you work with a Mr. Palmer in that respect?
A. Mr. Palmer worked under me.

Q. Was he directly concerned with the sea water hull fittings?
A. Yes, sir, he was the immediate supervisor.

Q. He was lost at sea in THRESHER, was he not?
A. Yes.

Q. Will you describe the work done under your supervision in THRESHER on the auxiliary sea water pumps?
A. On ASW pumps b(3) 10 USC 130 in the engineroom, Shop 38 removed them from the ship. Modification was made to the foundations, new two-speed motors; original pumps were returned as a unit and installed in the ship by 38.

Q. Will you tell us about the removal and reinstallation of the ball valves?
A. Ball valves were Teflon coated. Modification was being made to hull and backup valves on THRESHER. These too were removed, sent to Shop 31. They were Teflon coated, tested in 31 and sent back out for Shop 38 to install.

Q. Did Shop 38 inspect and test any of the valves in THRESHER's auxiliary sea water system?
A. Can I ask you what do you mean by test?

Q. If you had hydraulic actuator valves, would they have been tested in your shop before sending them back to the ship?
A. They went to 31 also; the actuators went to 31.

Q. What work was done under your supervision on the main sea water valves?
A. Main sea water valves, we installed roller guides; MS 5, 6, 16 and 17, I believe they are. This was a hardened roller way with a ball bearing roller installed to eliminate shaft deflection, I would say.

Q. Do you remember that No. 5 main sea water valve failed to operate due to a bent shaft?
A. Yes, sir.

Q. What work was done to correct that?
A. First we tried to straighten the shaft in place, and then it was decided to replace the shaft with a new one, which was done.

Q. Were you present when the valve was finally tested to insure its operation?
A. No, sir.

Q. Was Mr. Palmer the one who worked directly on that?
A. Yes, sir, he was, and the night shift supervisor, Mr. Scholtz. I did see the valves actually operate?

Q. You did?
A. Yes, sir.

Q. When the work was done did the valves operate properly or improperly?
A. Sir, they operated properly.

Q. Would you describe the work done on the installation of b(3) 10 USC new condensate pumps in THRESHER?
A. Yes, sir. It's the same thing with your condensates as it was with your ASW. We removed the old condensate pumps and installed new, on new foundations and bed plates and mounts.

Q. In your recollection, were there any significant problems encountered in the work done by your people on THRESHER's auxiliary sea water system and condensate system?
A. Significant?

Q. Anything of major importance that they ran into, that you think would be helpful to this court to know?
A. On the ASW's I believe there b(3) 10 USC 130 pumps -- we did have to remove the mechanical seals again; I don't know if that is significant or not. We did do this.

Q. Was there anything else?
A. No, sir, I don't believe so.

EXAMINATION BY THE COURT

Questions by a member, CAPT Hushing:

Q. After you replaced the shaft in No. 5 MSW operating gear, did you see the pump operate?
A. The pump or the valve, sir.

Q. I'm sorry, the valve.
A. Yes, I did see it operate.

Q. Did you notice any vibration of any kind in it during the closing cycle?
A. Well, this -- I don't know how to say this -- this is an over the center type of linkage, and it does actually slow up seven or eight -- I wouldn't say vibrate.

Q. Deflection?
A. Yes, slightly.

Q. What kind of deflection?
A. Well, this type of linkage tends, as it comes over to push the shaft away until it makes it hump.

Q. Is this the lock feature of the linkage so it will lock in a closed position?
A. Lock in a closed position. yes. sir.

Q. Did you notice any unusual hydraulic noises during the operation of this valve?
A. No, sir, I did not.

Q. Any unusual pressures from the hydraulic system; anything unusual in the hydraulic line?
A. No, sir.

Q. Did you talk to any of the ship's force about the valves?
A. No, sir.

Q. So you have no knowledge of your own as to how the ship's force felt about that particular valve?
A. I don't know whether I'm supposed to say this or not, but this engine room crew of THRESHER's was one of the finest, and I am positive that that was right.

Q. You mean because of their reputation?
A. Their knowledge.

Q. You feel that they would not have accepted anything that wasn't all right?
A. I know they wouldn't accept anything that wasn't all right.

Q. But you did not specifically talk to anyone in the crew about this valve?
A. I'm trying to think if I talked to Chief Arsenault, or not, but I can't remember. I really can't remember talking to them.

Questions by a member, CAPT Osborn:

Q. Ordinarily, when you put a test on some system, like the ASW system, do you test from sea valve to sea valve?

A. We don't test them; 56 tests them.

Q. But when the test is put on them; is it from sea valve to sea valve?
A. I don't know; I couldn't answer that.

Q. The specific question I want to ask you is, when you're testing from sea valves to sea valves, which you have to do in the water, do you cycle the backup valve?
A. I couldn't answer that.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. In removing and replacing sea valves, is any instruction or special training provided the mechanic making the installation?
A. I don't know that; I would say no, nothing special; they are all qualified machinists marine, people that work on them.

Q. What means do you use to insure that the bolts used in attachment of the sea valves are of the proper material?
A. In the THRESHER case we just took the actuator valves off and the studs stayed there, and they were the original THRESHER studs.

Q. How were they identified so that you could be sure that the proper ones were employed?
A. Studs and bolts you're talking about?

Q. Yes.
A. I don't think I follow you. If you took off an actuator you would have to put it back where it came from. Identifying the material, I wouldn't know.

Q. You have bolts between the backup and the hull valve?
A. Bolts between the hull and the backup valves; is that what you said?

Q. Yes.
A. Yes.

Q. How are you sure that they are the right material and that the same ones get back in?
A. I don't know that.

Q. You don't know?
A. No, I do not.

Q. Are special precautions taken to limit the torque in making up the bolts?
A. No torque wrench is used.

Q. What instructions do your people have then?
A. I don't know of any specific instructions they have, although I may be wrong.

RE-EXAMINATION BY THE COURT

Questions by a member, CAPT Osborn:

Q. Ordinarily when a civilian from the Shipyard rides a ship to sea, as was the case of Mr. Palmer's case, he rides in anticipation of a particular trouble, possibly anticipated.
A. No, sir.

Q. In this case do you know whether the major candidate for trouble was the ball valves or the hydraulic system?
A. This is not a true statement that you are asking. We don't ride boats on pre-trials for a specific problem; we ride them for minor weeps that should come up.

Q. Mr. (b)(6) perhaps I've been riding submarines to sea as long as you have been going to sea on them. It has been my experience that I've anticipated problems, particularly with complicated ships. There was no inkling in this case that there might be hydraulic troubles, or ball valve troubles?
A. No, sir. You mean through our selection of Mr. Palmer going to sea?

Q. Yes.
A. Mr. Palmer was one of three from 38 going to sea; the other two people were cancelled, and I have been to sea and I've never gone for a specific trouble-shooting thing.

Questions by the President:

Q. Mr. (b)(6) , most of the work that you do during one of these overhauls, such as the THRESHER's, is done in the shop; is it not?
A. As far as 38 is concerned, yes, sir. We are an outfitting group, and we send most of our stuff to shops, and then install them on the boats.

Q. Removal and installations?
A. Yes, sir.

Q. Do you find that when you have to go down on the boats to install equipment that has been worked on in your shop, that room in which to work is adequate?
A. Adequate, yes.

Q. Adequate, but not commodious.
A. No, sir.

Q. Do you know of any cases where the crowded condition of work on the ships has resulted in, shall we say, something being left out, or the wrong thing being used?
A. Due to the crowded conditions, sir?

Q. Yes.
A. No, sir.

Neither the counsel for the court, the court, nor the counsel for RADM Palmer, a party, 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.

(b)(6) , 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: This is a closed session of the court, Mr. Scholtz, and classified information can be imparted here.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation.
A. (b)(6) , (b)(6) . Leadingman Machinist Marine.

Q. Are you employed at the Portsmouth Naval Shipyard?
A. I am employed at the Portsmouth Naval Shipyard.

Q. What is your background and experience in your line of work?
A. I have approximately fifteen years in the Navy and at the Navy Yard, and at the Watertown Arsenal as a machinist. Approximately a year at Davis and Furber at North Andover, and a few months a Lawrence Pump and Engine Machine Shop.

Q. I direct your attention to the post shakedown availability of THRESHER; were you the Leadingman Machinist, Marine, in Shop 38 on the afternoon shift for THRESHER?
A. I was.

Q. What was the name of the day shift Leadingman?
A. Franklin Palmer.

Q. And he was lost at sea?
A. Lost at sea.

Q. Will you describe for us the removal of sea valves, including those of the auxiliary sea water system, and the work on the bolts of those valves?
A. Well, on the auxiliary sea water valves, the pipefitters took down the piping, coming to the hull valves, and we removed the valves from the hull, blanked the openings, and shipped them to 31 for Telfon coating of the ball valves.

Q. You also reinstalled the sea valves, did you not, b(3) 10 of the auxiliary sea water system?
A. That's right, sir.

Q. Can you tell us about the reinstallation and any test which may have been performed on them?

A. On the reinstallation of the sea valves, auxiliary sea valves, I should say, naturally you cleaned your hull studs and your liner, and the valves were visually looked into to make sure the ball valves were in a closed position, in keeping with the cross indicator on the hex of the valve stem.

Q. What was the maximum size of the valves?

A. I would say five to six inches was what we had in the auxiliary salt water system.

Q. Did you have any problems in connection with the work that you have described to us?

A. No, no problems that I can think of, except some were in darned hard spots to get at.

Q. Did you have any difficulties with the hydraulic actuators during your tests?

A. On the hydraulic actuators, I can probably think of six that were installed backwards, which would operate your valves backward, but these were corrected long before any sea trials, or what we call "fast cruises."

Q. Who discovered that the items that you have described were in backwards?

A. Both the crew and ourselves. As you get to operate, say an auxiliary salt water pump, if you don't get suction you investigate why, closed valves; things like that. The same on discharges, if you're building up a pressure and don't get discharges you know something is wrong. This is the normal procedure on any overhaul.

Q. Were your men working with the crew when the valves were discovered?

A. Oh, yes, sir.

Q. Now installing valves and working on valves for the auxiliary sea water system, you would have to know, would you not, when the system was being tested?

A. Yes.

Q. For that reason, on the work you have described to us, would you have been interested in learning when the auxiliary sea water system aft received its final test and was sold to the ship's company?

A. That is a hard one to answer.

Q. I'll rephrase it then. Did you --

A. May I? In this one here where the test is actually 56's and not ours, and we don't particularly pay attention to their test phase unless we are going to operate something that might tie in with them; then we go to them and ask them if they have a high pressure in this line or that line, or could we open up to this pump or this unit without interfering with their tests.

Q. Did you learn when the auxiliary sea water system in THRESHER aft passed its final test and was sold to the crew?

A. I would say the latter part of March, to the best of my recollection. I wouldn't be too definite on that, because it wouldn't be my --

Q. Were you called into the ship in connection with the casualty sustained to her reserve feed tank due to over-pressurization?

A. I was called down the evening it happened to look at the eight thousand gallon still which had been lifted up on one side, actually conked. Mr. Beiderman, of course, he wanted to start tearing apart the still, but we decided that Shop 11 could pull the tank top down and wait and see how the mounting arrangement came out, and it came out perfect without touching the still.

Q. To your recollection, did the test of the sea water system actually occur before or after that incident?

A. I would say it was right in or around that time; I could not actually say that it was after or before, but it was right in close to that time, to the best of my recollection.

Q. In removing and replacing sea valves, is any instruction or special training provided the mechanics making the installation?

A. Well, practically all my mechanics are old hands at this, so they would need no special instructions, other than to check the position of the ball valve in relation to the markings on the stem, which they did.

Q. You said "practically all of your hands are"; what instructions are given to the ones who are not experienced men in this area?

A. Then you take them aside and tell them exactly what you want, the surface, the grooves, and the visual inspection of your balls and shafts, and things like that.

Q. What means are used to insure that the bolts being used in the attachment of sea valves are of the proper material?

A. Actually most all of the original studs and bolts were used.

Q. How do you make sure that the right bolts and studs get back in the right positions?

A. Each of your hull valve studs remain in place. As you take off your valve you put a blank on to protect your "O" ring surface, using the same studs and valves as attachments. Then on your bolts between your backup and the hull valves, these are put in bags and saved and tagged to whichever valve, ASW, etc.

Q. How do you keep track of the nuts that go back on the studs?

A. The nuts that go back on the studs would be the same nuts we secured the blanks with.

Q. Are special precautions taken to limit torque in making up the bolts?

A. Not necessarily on the hull valve; you make it up as tight as you can; mostly on a target joint or something like that you go to torque.

Q. Are there any markings on the sea water valves, hydraulic actuators, which provide a positive indication as to open or shut mounting position?

A. Yes, sir. Let's start off with the ball valve itself, there is a square stem coming out of your ball valve that has a fine kitty-cornered to two corners; this represents which way your balls -- it's across the valve. You say this finger is a valve, if that line is across the valve it's closed, if it's with the valve, the valve is open. When you have your closed valve in a closed position, the actuator that slides over has a corresponding square shaft and it is mounted the same way, so you put them on one matching the other.

Q. How do you account for the fact, then, that they were installed improperly in some instances?
A. This would be due to handling and getting into the overhead and being turned in the process of rigging, and things like that. These are quite heavy in some cases.

Q. What shop would actually be involved in their installation?
A. It would be Shop 38, primarily and 72 to assist us, lift them up. That is both hull and valves and actuators.

EXAMINATION BY THE COURT

Questions by a member, CAPT Hushing.

Q. You mentioned these actuators being installed backwards and suggested that they could have been installed that way by reason of rigging difficulties or lack of access; did you not?
A. Yes, in some cases it involves -- the fit of these squares is very close, and in jacking those to get them on sometimes you don't watch the mark, and everybody is satisfied once it goes up, but this, of course, you pick up in your test.

Q. I recognize you pick it up in your test, but do you impress your machinics that it is important to get it on right in the first place?
A. Oh, yes, sir.

Q. Now when you find they are not on right, what do you do?
A. Actually, in the case of an actuator being installed wrong, you cannot tell until you operate. There is water either coming through the valve or going out through it, because by this time the indicator on the square of your ball valve is covered by your actuator, so if I actually looked at them I would say "Why is that actuator in the open position?" In order to get it on they turned the valve to the open position. Sometimes this does happen.

Q. What you are saying then, is that if you are not present when the actuator was installed that you could not, by looking at the valve or the actuator, tell which position the valve was truly in?
A. That is correct, sir, unless the piping was off the end and we could actually look at the valve, but if the system was made up there is no way in the world of telling.

Q. Right now if we went down on TINOSA to look at similar valves, we could not tell by looking at them, positively, which position the valve was in?
A. That is right, sir, at the actuator.

Q. Did you find that the backward installation was made by one man or by two, or was it rather spasmodic, that everybody did this occasionally?
A. It would be spasmodic, even the day shift, my shift, and even the night shift. These you know you cannot actually tell until you went into operation.

Q. Is there any way, in your opinion, that this situation could be rectified so that you could tell by looking at the actuator?
A. None that I know of, sir. Probably not, with the present ball type valves that we have.

Q. Then you think that we have to live with this situation?
A. Yes, sir; there's nothing dangerous about it, because this would be caught any time at all in operations.

Q. But suppose you have a casualty on the ship before the tests are performed?
A. A casualty on the ship itself and they had to change an actuator?

Q. Or they needed to operate the equipment, the valves.
A. If the boys are on the ball it would be just a flick of a switch from open to closed. In other words your suction would be in the closed position, let us say, and your closed would be the open position on the actuator. I mean a man could tell whether or not he is getting water; say we are going to pump water. He throws to open on the suction and doesn't get water, he'll throw it to closed and get water, right? They would be familiar with this.

Q. You think this is a very satisfactory situation?
A. No, sir, but I mean it isn't a hopeless situation.

Q. Have you made any suggestions relative to improving it?
A. I don't see how you can improve it with a ball valve.

Q. Let's turn now to the operation of the ASW valve, system main valves which you did take out and replace. Did you check the operation of those valves?
A. Yes, sir.

Q. How did they operate; were any of them binding or difficult to handle?
A. No, sir.

Q. Alongside the dock they looked pretty good?
A. Yes, sir.

Q. Did you personally see them operate?
A. Yes, sir.

Q. And were they of a normal installation, do you think; anything abnormal about them?
A. The only actuators we had to take off were for leakage, which is a minor item.

Q. Were you involved in the replacement of the main salt water circulating valve No. 5? I'm talking about the shaft replacement during the shakedown availability.
A. Yes, right.

Q. Did you witness the operation of that valve after the repairs were made?
A. Yes, sir.

Q. How did it operate?
A. Was this after we put the crossheads on?

Q. Yes, after you put the guides on.
A. Very good, sir.

Q. No difficulties at all?
A. None, whatsoever, sir.

Q. Any hydraulic problems with it?
A. No, sir.

Q. No hammer, unusual vibrations?
A. No, sir.

Q. Did you talk to the ship's force about the valve?
A. The ship's force was the one who bought these valves on the crosshead, as you call it, guide installation. They were the ones who put the tests on to their satisfaction, and operation indication, everything was perfect.

Q. But whom did you talk to on the ship during the tests or after the tests?
A. It would be Chief Wise.

Q. Was he satisfied?
A. Chief W[illegible] ran the deal, as far as testing and operations.

Q. He was satisfied?
A. He was very happy, sir.

Q. He didn't give you a weep of any kind on it?
A. No, sir.

Q. No complaint of any kind?
A. No, sir.

Q. Did you talk to any of the engineering officers on this ship about it?
A. There was a lieutenant with us; he was quite satisfied; I can't think of his name. He had the duty that night.

Q. The Duty Officer that night; what night was that?
A. That would be Sunday, the 7th, until Monday morning, the 8th. We sold the last one about five o'clock.

Q. So the Duty Officer that night was satisfied?
A. Yes, sir.

Q. With no weeps?
A. None, whatsoever; on my valves, now.

Q. Did he have any other complaints?
A. Well, we had to take out a few hangers and a step in order to put these crossheads in. That would just be reinstalling interference that we had to remove for the installation.

Q. Was that taken care of later, do you know?
A. Yes, sir.

Q. By the time this ship went to sea this job had been completed to the satisfaction of the crew?
A. Yes, sir.

Questions by a member, CAPT Osborn:

Q. When you test your installation of your ball valves on reinstallation on the ship, do you always operate split system?
A. The only test on the ball valves, after the reinstallation, would be your auxiliary salt water test by Shop 56, which would be run against these valves.

Q. That is the test that involves a completely cross-connected ASW system and air conditioning system; is that correct?
A. Yes, sir.

Q. Under those conditions would it be fairly easy to have a valve reversed?
A. No, sir.

Q. When the ASW valves were returned from the shop and reinstalled in the ship, were there any torquing requirements as to the torque on the ball valve before the actuator was installed?
A. No, sir.

Q. You obviously had to turn those things several times because they were installed backwards; how did they turn?
A. Not the ball valves, the actuators. You bodily take your actuator off and turn your actuator.

Q. Have you ever turned one of those ball valves by hand?
A. Yes, sir.

Q. How did they turn?
A. Well, a little rugged, but nothing more than what a man could actually turn. Easier after they were Teflon coated than before.

Q. How big a pipe did you have to use?
A. I would say we used a two-foot stillson -- not a stillson, but a monkey wrench.

Q. Not something you turn with your hands?
A. Oh, no, sir, no. What you are talking about is more than five inches.

Questions by a member, RADM Daspit:

Q. Mr. Scholtz, referring to the test of the auxiliary sea water system; is it run by the pipe shop?
A. Yes, sir.

Q. But when they find trouble or a leaky valve, they have to call on you?
A. Yes, sir.

Q. Would any of your records indicate when you last worked on the auxiliary salt water system to indicate that it had not yet completed its test?
A. No, sir.

Q. All right, then; turning to a new subject, in regards to the actuator and the ball valves. When those valves were installed backwards and they are not picked up until the test, then you have to take the actuator off and work on it again. This makes the job much more expensive than if they installed it correctly the first time.

A. Quite true.

Q. It also results in a time delay, perhaps at a very critical time of the ship, when they want to get this system to test other equipment.
A. That's true, sir.

Q. Now we have heard testimony that the post shakedown availability of this ship was extended half a dozen times, so if there's any way you can figure out to modify these valves so that you can't install them backwards it certainly would be worth quite a bit of money to the Yard.
A. I realize that, sir.

Neither the counsel for the court, the court, nor the counsel for RADM Palmer, a party, 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 can think of nothing that hasn't been brought out. We could get back to actuators. Some of these actuators are supposedly operating wrong; it's just the changing of your hydraulic lines. You have other features enter into here, too. You have your two lines coming from your control valves into your actuator. If these are in reverse you are going to open on your control valves and naturally you are going to shut on your actuator. Things like that. Then, of course, you have both your indicator amphinols, and in a few cases they were indicating backwards, but this is just part of the operation.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. When you shift the position of the actuator, how do the actuator hydraulic ports match up with existing hydraulic piping?
A. That is what mislead us on a couple of actuators. By going for the connections it throws them about two inches out of the line. That is what mislead us on a couple of these. In taking down the actuators to make room, you know, your hangers would be disturbed and your pipes would be bent out of original position. Then when you come to put your actuator on, sometimes you go by the piping as you saw it there, plus the cross piece on your actuator.

The witness said that he had nothing further to state.

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

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

Robert C. Arnold, a civilian, was recalled as a witness for the court, was reminded that his oath previously taken was still binding, and examined as follows:

COUNSEL FOR THE COURT: Mr. Arnold, this is a closed session of the court. Classified information may be given here. At the end of your testimony, I shall ask you what classification you would assign to it taken as a whole.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. For ease of reference in the record, Mr. Arnold, will you state your full name, and your present position at the Portsmouth Naval Shipyard?
A. Robert C. Arnold, Mechanical Inspector.

Q. For what division are you an inspector?
A. Code 303B-2.

Q. That is the Quality Assurance Division?
A. Yes, sir.

Q. Are you prepared to tell us about the ultrasonic testing of sil-braze joints in the vital salt water systems on THRESHER during her post shakedown availability?
A. Yes, sir.

Q. Do you have a copy of the authority under which the ultrasonic testing was conducted?
A. Yes, sir.

Q. Will you produce it, please?
A. This is the BuShips letter. And these are the job orders.

Q. Do you have copies of the job orders indicating the work which was done in the ultrasonic testing of those systems?
A. Yes, sir, I do.

Q. Produce them, please.
A. Here they are.

The witness produced two job orders covering ultrasonic testing in the vital salt water systems in U.S.S. THRESHER during her post shakedown availability. The said job orders were submitted to the court and to counsel for RADM Palmer, a party, and were offered in evidence by counsel for the court.

There being no objection, they were so received and were marked Exhibit 112 and Exhibit 113.

Q. Do you have in your possession a letter from the Portsmouth Naval Shipyard to the Bureau of Ships dated 5 October 1962, concerning ultrasonic inspection of sil-braze joints in THRESHER during her post shakedown availability?
A. I do.

Q. Produce it.
A. Here it is.

The witness produced said letter, and it was submitted to the court and counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 114.

Q. Do you have in your possession a letter dated 28 August 1962, from the Bureau of Ships to the Portsmouth Naval Shipyard pertaining to silver-brazed piping?
A. Yes, I do.

Q. Please produce it.
A. Here it is here.

The witness produced said letter, and it was submitted to the court and counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 115.

Q. Do you have in your possession a memorandum from Code 303B-2 to Code 213X pertaining to inspection of sil-braze joints and a replying memorandum authorizing cessation of the tests of lagged joints?
A. I do.

Q. Please produce them.
A. Here they are.

The said memoranda were submitted to the court and to counsel for RADM Palmer, a party, and were offered in evidence by counsel for the court.

There being no objection, they were so received and marked Exhibit 116 and Exhibit 117, respectively.

Q. Do you have a report of the results of the ultrasonic tests conducted, dated 17 April 1963?
A. Yes, sir.

Q. Produce it.
A. Here it is.

The said report was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 118.

Counsel for RADM Palmer, a party, waived the reading of Exhibits 112 through 118 inclusive.

Q. Do you have in your possession annotated plans of THRESHER showing the old joints ultrasonically tested, the new joints ultrasonically tested, the new joints not so tested, the old joints not so tested, and the joints rejected?
A. Yes, sir.

Q. Produce them.
A. Here is the first one.

The witness produced Bureau of Ships blueprint No. SS(N)593-527-1862606, ALT G, entitled "Auxiliary Sea Water Cooling System, Piping Arrangement, Air Regenerating Room." The said blueprint was offered to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 119.

Exhibit 119 was posted on a board for demonstration purposes.

WITNESS: This red fitting circled in blue indicates that it was an old fitting rejected for low bond percentage on the initial testing. Blue indicates there has been a new fitting installed and tested ultrasonically. The brown indicates a new fitting as a result of interference or rejection. This would be the case here (indicating). The red circled in green is an indication that this joint was accepted only by means of a visual inspection during a hydrostatic test.

PRESIDENT: What is the brown without any circle?

WITNESS: Just that it is a new fitting. This indicates a brand new fitting. All these (indicating) are brand new fittings. The green fitting is the original old joint accepted only on a visual inspection during hydrostatic testing. Anywhere you see a green fitting, that is an old fitting. This drawing, incidentally, is the auxiliary salt water system forward. A good many joints were lagged at the time of the integrity inspection.

Q. (By counsel for the court) You have your code explaining the various categories on the exhibit, do you not?
A. Yes, sir. I have another chart which has the same color code and which means the same thing. On this chart, incidentally, we had one rejection, which was this one right here (indicating).

Q. Is there any way you can identify that for the record?
A. Yes. We have our own serialization. This one would be known as F-27-1. This is a little confusing, because the fitting could have been done several times, and we had to put a precinct number on it to be sure we had the same fitting. This one rejection resulted in these new joints (indicating). This one is a "T," and it was impossible to remove the "T" without removing other equipment. This resulted in, I think, thirteen additional new fittings on this plan.

COURT MEMBER, CAPT Osborn: The ones not marked at all were not inspected, is that correct?

WITNESS: That's correct, sir. This was the only one with one rejection.

The witness then produced Bureau of Ships blueprint No. SS(N)593-508-1862776, ALT L, entitled "Trimming & Drainage System, Piping Arrangement, Midships Compartment, Plans and Elevations." The said blueprint was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 120.

Exhibit 120 was posted on the board for demonstration purposes.

Q. (By counsel for the court) Do all these charts which you are now offering us have exactly the same color code?

A. Yes, but there may be one exception. I can explain the reason for that later. Now, this is the trim and drain in the Air Regenerating Room (referring to Exhibit 120). This again is a red fitting circled in blue, which indicates this was a rejected joint. Now, before I go any further, these, according to this plan, are of a welded construction, which they actually were not. They were brazed. They were replaced with brazed fittings. I am bringing this out now because it happened in another instance.

EXAMINATION BY THE COURT

Questions by the president, VADM Austin:

Q. If the blueprint calls for a welded fitting and it became necessary to replace this fitting, why was it replaced with a sil-brazed joint rather than a welded joint?

A. I can't answer that, Admiral. These are just my findings, and I reported this. This happened again on the 775 plan. There were six joints involved that were replaced as brazed joints. I can't answer why this was done.

Q. There is only one on this print, on Exhibit 120, to which that applies?

A. No, sir. There are three out of about six. This particular one was rejected and was replaced as a brazed fitting. This fitting also shows on this plan to be welded, but was actually brazed. This fitting was also brazed. If it had been welded, we couldn't have UT'd it.

Q. So there are three fittings out of five or six that were tested ultrasonically?

A. Yes, sir. These were tested ultrasonically. I have the results of those tests. They were brazed to about 40 per cent bond.

Q. What is the size of those lines?

A. That would be 4-inch. This is one that was rejected and replaced new. This also was tested and brazed. They added a couple of brazed joints. Now, our other plan shows the profile of this.

Questions by a court member, CAPT Hushing?

Q. Was this the plan from which the ship was built, or is this the plan which was prepared for making your inspections?

A. This was the plan from which the ship was built, and I had to use the same plan for my inspections. I asked the Design Division for the latest alteration.

Q. Is it possible that the ship as built from the original plan called for those joints to be made of sil-braze and were later changed to welded joints?

A. I couldn't say, Captain. I wasn't on the ship when it was being built. There must be a design change which authorized this.

Q. You did not find one, however?
A. No, sir.

Questions by a court member, RADM Daspit:

Q. If this was an authorized alteration, wouldn't it appear on the list of alterations on the plan?
A. Yes, sir. There were many joints that were not inspected due to inaccessibility or lagging.

The witness then removed Exhibit 120 from the board.

The witness then produced Bureau of Ships Blueprint No. SS(N)593-508-1862776, ALT L, entitled, "Trimming and Drainage System, Piping Arrangement, Midships Compartment, Sections and Auxiliary Views." The said blueprint was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 121.

Exhibit 121 was posted on the board for demonstration purposes.

WITNESS: This again is trim and drain in the Air Regenerating Room. This is a new fitting (indicating). It's got the blue circle, which indicates it was a rejected joint and replaced new and accepted under ultrasonics. This elbow was a rejected fitting and replaced new and satisfactorily tested. This ship had a "T" that didn't show on the plan. I colored it in. It was ultrasonically tested and passed. This elbow was rejected and replaced new. On this plan there were several visual inspections but none rejected. The only rejection was during the ultrasonic examination. All these fittings colored in red are accepted joints.

Q. As I understand, they were accepted after both visual and ultrasonic tests?
A. Yes, sir.

Q. The green indicates only visual inspections?
A. Yes, sir.

Questions by a court member, CAPT Hushing:

Q. Visual inspections during hydrostatic tests, is that right?
A. Yes, sir. All of them under the integrity inspections were visually inspected during the hydrostatic tests, whether they were ultrasonically tested or not.

Q. You mean all of them that you could see; you didn't take any lagging off to inspect these fittings, did you?
A. I tried to, but I couldn't do it. What I tried to do was, in any area with a high rejection rate, I would continue inspecting in that area. This was my theory.

Q. (By court member, RADM Daspit) When you say you tried to take off the lagging, you were not authorized to take off the lagging?
A. This is true. I tried to take it off with a jackknife, but I was unsuccessful.

Q. (By court member, CAPT Osborn) I would like to clarify that point. I recall that one of the exhibits was a memorandum pointing out the number of inspections made to date and the number of rejections and asking if you could continue and remove lagging to make other inspections; is that correct?
A. Yes, sir.

Q. (By the president, VADM Austin) That memorandum, I believe, was dated 29 November 1962, and the reply you received to that memorandum was in the negative, that you could not go ahead and take off lagging to make further inspections.
A. That's right, sir.

Q. Do you recall at what level that decision was made?
A. No, sir, I do not. I helped write the letter which Code 303 wrote, and the answer came back.

Q. Was it Mr. Fite who signed that?
A. Mr. Heeney. The reply was dated 4 December.

Q. Do you know who Mr. Heeney is?
A. No, sir, I don't.

The witness then produced Bureau of Ships Blueprint No. SS(N)593-508-1862775, ALT G, entitled "Trim & Drainage, Piping Arrangement, Forward Compartment." The said blueprint was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 122.

Exhibit 122 was posted on the board for demonstration purposes.

WITNESS: This is the Trim and Drain in the forward compartment, the forward trim tank. This was one of the first integrity inspections that we started. These four fittings were inspected visually, first by myself, were rejected visually for failure to meet the criteria set forth in NAVSHIPS 250-648-8. However, I requested an ultrasonic examination, which rejected these joints, and when I went down to write the rejection up, I noted that these were also welded fittings.

Q. (By the president, VADM Austin) They were welded?
A. I'm sorry. They were brazed. Excuse me.

Q. They were brazed but the plan called for welding?
A. Yes, sir. These had been replaced, which are represented by this blue circle, and they were welded, with the exception of this green flange that is colored in here, which couldn't be ultrasonically tested due to the geometry of the flange. So it was inspected visually during hydrostatic test. But these joints are now welded. These (indicating) are the original brazed joints. They were ultrasonically tested, and every one was accepted. This,

incidentally, is the flood line to the sonar dome. That BuShips letter stated that these valves should be welded. However, this plan indicates that they were brazed and they were all accepted for bond over 40 per cent.

Q. (By a court member, RADM Daspit) One of the exhibits which we were shown just a few minutes ago indicated that Priority I for ultrasonic testing of piping between the hull valve and back-up valve was to apply.
A. Yes, sir.

Q. Yet you said these joints should have been all welded a moment ago.
A. This BuShips letter stated that they should have been, but the plan shows that they were to be brazed, and they were brazed.

Q. As I read the letter, they expected them to be brazed, and this was Priority No. 1 for testing the brazed piping.
A. Yes, sir.

Q. Have the specifications been changed since that time?

COURT MEMBER, CAPT Hushing: We have in this situation a whole series of changes of instructions starting in 1961 in which the Bureau has changed the specifications for building 593 class submarines to require all welded construction from the hull through the hull and back-up valve for systems over 4 inches, and in certain new construction, starting with 637, this has been reduced to 3 inches. THRESHER, however, was in construction at the time of this requirement, and, therefore, in all probability, there will be areas such as this in THRESHER's original construction in which the plan called for brazed joints, and the brazed joints were in fact installed, and it is this that the Bureau has called out for Priority 1, not only in THRESHER but in 608 and 616.

Q. (By a court member, RADM Daspit) Referring back to the first valve you mentioned which you said you had rejected visually, was the rejection due to overheating, misalignment, or what?
A. I would say, Admiral, it was due to not enough heat. The alloy was very irregular. To me it didn't look as though the fitting was hot enough.

Q. (By RADM Daspit) But was not due to misalignment of the pipe?
A. No, sir, I would say not. This is a new color code (referring to Exhibit 122). There's a brown circle, which indicates a new fitting, and a green, which indicates visual only. In my report, I indicated there were three joints that did not receive ultrasonic examination.

Q. What was the reason for not giving them ultrasonic examinations?
A. Due to the geometry of the flange. The technical reason why, I can't answer.

The witness then produced Bureau of Ships Blueprint No. SS(N)593-508-1862780, ALT K, entitled "Trimming & Drainage, Piping Arrangement Auxiliary Machinery Space." The said blueprint was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 123.

Exhibit 123 was posted on the board for demonstration purposes.

WITNESS: This is the trim and drain in the auxiliary machinery space. The red fittings are the original fittings which have been passed ultrasonically. This is a new fitting; this is brown. This flange was a rejected fitting and replaced by new. This has a blue circle.

Q. (By the president, VADM Austin) Why, Mr. Arnold, do we have new fittings if the old fittings proved to be all right?
A. This is a new installation as a result of a DM or a DLI. This is a new flow meter that was installed.

Q. (By the president) I see; it was necessary to break the old joints. It was not as a result of failure to pass the test?
A. That's correct, sir. I have it illustrated in my color code that brown is a new fitting. Now, this was a rejected fitting and replaced new (indicating). This is a coupling.

Q. (By the president) Are there any fittings on this particular exhibit which called for welded joints but were found to be sil-braze?
A. No, sir. The welded fittings on this particular plan were all welded. This is your hull valve.

The witness then produced Bureau of Ships Blueprint No. SS(N)593-508-1862782, ALT H, entitled "Trimming & Drainage Piping Arrangement, Engine Room, Plan & Auxiliary Views." The said blueprint was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 124.

Exhibit 124 was posted on the board for demonstration purposes.

WITNESS: This is trim and drain in the engine room. Here again we have several rejections via the ultrasonic testing. This fitting has been replaced new. This had been replaced new; this one. This one has been replaced new. This one was on a visual only due to the unacceptability of the joint. I might add these fittings on this plan were brazed, and the plan shows welded construction. These were brazed.

COUNSEL FOR THE COURT: Would you identify them, please?

WITNESS: This is an elbow; this elbow. And we pick it up again over here (indicating). This elbow. This is an added coupling that was not shown on the plan. We drew that in. This was brazed. From here on out it was lagged, all inaccessible. This was brazed. The plan shows it to be welded. However, it was satisfactorily hydrostatically tested.

The witness then produced Bureau of Ships Blueprint No. SS(N)593-517-1862892, ALT S, entitled "Piping 8,000 GPD Distilling Plant, Auxiliary Views." The said blueprint was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 125.

Exhibit 125 was posted on the board for demonstration purposes.

WITNESS: Now, during the course of our inspection, I first did go down and look the system over and prepared it for ultrasonics. This configuration here on this plan is drawn in here like this. This was exactly what is on the ship - not this. Now, these joints were ultrasonically tested. They all passed, except for one. This flange was rejected and replaced.

Q. (By court member, RADM Daspit) What system is this?
A. This is the 8,000 gallon-per-day still. There were very few on this particular drawing.

Q. (By the president) So that the 8,000 gallon-per-day still and its salt water connections are not as shown on this blueprint?
A. Just this small configuration here, Admiral. This is what is actually on the ship. In other words, from the "T," another "T," and this valve, and so forth, and this silencer here.

Q. (By the president) There was one silencer in there?
A. Yes, sir. That was in here, and another in here.

Q. Were they the E.B. type silencer?
A. Yes, sir.

COUNSEL FOR THE COURT: For the record, shall I circle in red the actual portrayal of the condition found to exist.

PRESIDENT: Yes.

Counsel for the court encircled the aforementioned configuration on Exhibit 125.

The witness then produced Bureau of Ships Blueprint No. SS(N)593-517-1862892, ALT S, entitled, "Piping 8.000 GPD Distilling Plant, Plan, Elevation and Sections." The said blueprint was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked Exhibit 126.

WITNESS: This again is the 8,000 gallon-per-day still. This was our highest rate of rejection. Therefore, I went into it a little further. It was in a very inaccessible area for ultrasonics. However, we did check it all. This (indicating on chart) is a strainer, a 2½" IPS strainer. These were rejected ultrasonically. These are circled in blue, which again indicates a new fitting. This elbow (indicating) had passed, but the removal of this strainer made it necessary to remove this elbow. Therefore, it is circled in brown, and it is a brand new fitting. These green fittings again represent a visual only.

Q. (By court member, CAPT Osborn) How was the lagging out around the still there, pretty bad?
A. Yes, sir, quite heavy. As I said, this was the highest rejection rate, and we had many more joints to look at. This view here is a section view. This fitting had been removed and replaced new. The same for this strainer here. The same goes for this strainer here. There was an elbow, a strainer, and an elbow; so we wouldn't have too much of a congested area there. This flange was passed ultrasonically, and this "T" behind here was passed.

Q. (By CAPT Osborn) What size lines are we talking about there?
A. 2½ inch.

WITNESS: This is all the marked-up plans that I have.

Questions by a court member, CAPT Osborn:

Q. How about the ASW system?
A. The ASW system aft at the time of integrity was completely lagged.

Q. So you have nothing on the ASW system aft?
A. As an integrity inspection, no, sir.

Q. Have you any in connection with work?
A. Yes, there was some done around ASW pump b(3) 10 USC although I don't have the reports with me.

Q. Mr. Arnold, I would like to ask another question: How about the air conditioning? What is the status of it?
A. Lagged.

Q. It was completely lagged?
A. Yes, sir.

Q. Only where you did new work on the system did you ultrasonically test?
A. Yes, sir, if it was 2 inches and over.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. Mr. Arnold, do you keep any records on the ultrasonic tests performed in THRESHER?
A. Yes, sir. I will start with the ASW system again.(The witness produced two folders.) Now, I have two folders. One is for the old work, and the other is for the new work.

Q. Are they so marked?
A. Yes, sir, However, I might add, it may be a little confusing, because on each print, regardless of whether it was new or old, I have shown a result, but in the overall picture, I show the original rejection and the final good one. The steps in between I have indicated, but it may confuse you people. This would be the old work, and this would be the new work.

The aforementioned folders were examined by the court and by counsel for RADM Palmer, a party.

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

COUNSEL FOR THE COURT: Let the record show that the court examined the records of the old and new work tested ultrasonically in the ASW system forward.

Q. Mr. Arnold, will you make a full copy of one of the individual items of record here which is representative of your record keeping in these tests?
A. One old, one new?

COUNSEL FOR THE COURT: Yes, and present it to us. You will, undoubtedly, be recalled.

Q. Do you have a folder of silver-braze condition reports on THRESHER since 1961?
A. 1961?

COUNSEL FOR THE COURT: Since 1961. Just give me as far back as you can go. (The witness handed counsel for the court a sheaf of Condition Reports, Form 1ND-PNS-1018).

Q. These records which you have given me, these Condition Reports, refer to her integrity?
A. Yes, sir.

Twelve condition reports (Form 1ND-PNS-1018) dated from 9-13-62 to and including 11-8-62 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 as Exhibit 127. Reading thereof was waived.

Q. I show you a memorandum dated 11 January 1963, from Code 303B to the Commanding Officer of THRESHER. Would you describe what it is, please, for the court?
A. Yes. This memorandum is a list of things, pipe numbers, systems, plan numbers, frame and location, of the brazed joints that have a 100% fillet as approved by various instructions and ship's readings, and signed by the Ship Sup. These also have an ultrasonic report of a satisfactory condition.

A memorandum of 11 January 1963, from Code 303B to CO, USS THRESHER, Subject: Sea Water System New Joints; repair of, was submitted to the party and to the court, and was offered in evidence by counsel for the court. There being no objection, it was received in evidence as Exhibit 128 and the reading thereof was waived.

Q. Mr. Arnold, would you describe for us the manner and procedure used in conducting ultrasonic tests in THRESHER?
A. The manner, first of all, was that we would inspect ultrasonically all systems two inches and over on sea water systems that were accessible and unlagged. The procedure now was through a 303B2 type inspector would serialize the joints on a card, go to the vessel and tag these joints, so that the ultrasonic team could readily identify them. This was our procedure. The Ultrasonic Division can give you more technical knowledge. This is just our procedure of doing it.

Q. Can you tell us about the difficulties encountered in making tests of your own knowledge?
A. On the THRESHER?

Q. In THRESHER, yes.
A. Some of the difficulties were, primarily, were inaccessibility, the lagging. We were not to interfere with any construction going on. This, primarily, is the whole story.

Q. Were difficulties also encountered due to the nature of the joints?
A. Due to the geometry of the fittings, whether it's a thick flange, or a thick socket, or a tapered socket, was inaccessible for the ultrasonic inspectors to interpret.

EXAMINATION BY THE COURT

Questions by a member, RADM Daspit:

Q. Referring to Exhibit 128, the statement in there is that: "All subject joints have 100% fillet added in accordance with reference (b)." Could you explain what that means?
A. Yes. I have reference (b) here if you care to see it. What it means is if a joint is a suspect due to the readings of the ultrasonic chart, percentage of bonds, if it's so close to meeting the approved percentage, then the Ship's Sup will sanction a face fed fitting; and this instruction that involves reference (b) states this.

Questions by the president, VADM Austin:

Q. Mr. Arnold, you indicated that you desired to continue to explore for other joints that might need renewal or rebrazing as a result of some of your discoveries of joints that were not satisfactory. Did I understand correctly that it was the difficulty of removing the lagging, the physical difficulty, that prevented your further exploration, or was it permissive difficulty which prevented it?
A. Well the letter written on November 29th requesting permission to have lagging removed to inspect additional joints on THRESHER, we tried to do; and you have the answer as it was presented.

Q. Yes, that was permissive difficulty?
A. Yes, sir.

Q. Earlier in the period of the PSA before the letter of 29 November was written, did you have difficulty which was occasioned by the physical nature of the lagging rather than the difficulty of getting permission to go in?
A. Yes, sir.

Q. You did not at that time seek permission to remove it?
A. I sought permission to remove it, not by letter form, but by verbal agreement; however, there were other areas to continue inspection.

Q. Without removing--
A. Without removing lagging.

Q. And as I understand it, that kept you busy until approximately the end of November?
A. Yes, sir.

Questions by a member, RADM Daspit:

Q. Did you complete the inspection of all accessible joints of two inches and above prior to the completion of the THRESHER's post shakedown

availability, or did you still have some work to do which was not done because it would have delayed the ship?

A. We completed the salt water integrity before the day of the PSA scheduled completion date, yes, sir.

Questions by the president, VADM Austin:

Q. This included all valves, two-inch and above, between the sea valve and the back-up valve?

A. Yes, sir.

Q. Throughout the ship?

A. Yes, sir.

Questions by a member, CAPT Osborn:

Q. This did not include the majority of the salt water piping that was lagged, however; is that correct?

A. Yes, sir, this did not include all the lagged portions -- if I understood you correctly.

Questions by the president, VADM Austin:

Q. But none of the joints between the sea valve and the back-up valve were lagged?

A. The cases that I have indicated on the plans were not lagged; however, a large percentage of hull valves and back-up valves were mechanically bolted together. There were very minor cases where pipe was between hull and back-up valves.

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 adjourned at 1630 hours, 1 May 1963.

SEVENTEENTH DAY

Portsmouth Naval Shipyard
Portsmouth, New Hampshire
Thursday, 2 May 1963

The court met at 0937 hours with closed doors.

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 and LCDR Hecker's counsel waived their right to be present during this session. RADM Palmer's counsel was present.

No witnesses not otherwise connected with the inquiry were present.

Robert C. Arnold, Jr., a former witness for the court, was recalled as a witness for the court, reminded that the oath previously taken by him was still binding, and examined as follows:

DIRECT EXAMINATION

Questions by counsel for the court:

Q. For the record now, you are Robert C. Arnold, Jr., Mechanical Inspector, Code 303-E-2, Quality Assurance Division, Portsmouth Naval Shipyard?
A. 303-E-2.

Q. Mr. Arnold, when you last testified, you had undertaken to prepare a brochure which exemplified the forms employed in the procedures used in conducting ultrasonic tests of silver brazed joints in this Shipyard; is that correct?
A. Yes, sir.

Q. Do you have those forms with you now?
A. Yes, sir.

A folder containing sample forms used in connection with conducting ultrasonic tests for integrity of silver brazed joints was submitted to the party and to the court, and was offered in evidence by counsel for the court. There being no objection, it was received in evidence as Exhibit 129.
Counsel for the party waived the reading of the exhibit.
Question by the president, VADM Austin:

Q. These are the samples; they are actual samples?
A. Yes, sir.

Questions by counsel for the court:

Q. Refer to Exhibit 129. I notice that you have six forms included in this exhibit which have been lettered serially from "A" through "F"?
A. Yes, sir.

Q. Starting with the first one, would you explain the procedures involved in making ultrasonic tests?
A. Well Form "A" is the Job Order requiring us to ultrasonic silver brazed joints in the integrity system. There are various plans, various sizes.

Form "B" is the certification card with the information for a joint: number, plan number, location and frame. The Ultrasonic Team will inspect the fitting that is designated on this card. After the results of the integrity of the ultrasonic inspection, if it's a rejected joint, this card is handed back to me. I then make out a pink rejection slip --

Q. Is that marked "D"?
A. This is marked "D" -- with the information as the same as the certification card. This is a rejected joint. Card marked "F" is a similar identification card with the same figures. When the new fitting is installed I am notified. I, in turn, notify the Ultrasonic Division, take this card, and record their results. Form "E" is a 771 Form known as an Inspection Request. This is from the shops involved requesting inspection to cover the hydrostatic test. The hydrostatic test is introduced in the system. 303-B-2 inspector witnesses. If it's accepted, he accepts it and signs it off. This is my exhibit.

EXAMINATION BY THE COURT

Questions by the president, VADM Austin:

Q. As I understand it, Mr. Arnold, there would be a slip with two signatures for any joint that you had a rejection slip on when 303 gave it the hydrostatic test.
A. Two signatures?

Q. Yes.
A. I believe, sir, you're talking there would be a signature from the shop requesting inspection and then an inspector signing it if it's satisfactory.

Q. Not two signatures of the test?
A. Not necessarily, sir.

Q. But there would be a signature for the test -- that would be hydrostatic integrity of that particular joint?
A. Yes, sir.

Q. Would this be a systems test hydrostatic test, or would it be a test of just that part of the system which contained the affected joint?
A. It would be a system test including the rejected integrity joint.

Q. We than should find the signature of the person who witnessed the test on any joint in the ASW system which had failed on your ultrasonic test, should we not?
A. Yes, sir.

Questions by the president, VADM Austin:

Q. You had no inspection of any joints in the ASW aft?
A. Not as a result of the integrity.

Q. Not as a result of the integrity. Did you have any at all, do you recall?
A. At this time I could not recall; I could check further if you wish.

PRESIDENT: The court would appreciate your checking and informing the court of any joint in the after ASW system which you tested and, as a result of your test, had a hydrostatic test performed on it.

WITNESS: Yes, sir.

PRESIDENT: Will the counsel let me have the summary of ultrasonic and visual tests made on THRESHER and submitted as an exhibit yesterday.

Exhibit 118 was handed to the president by counsel for the court.

Q. Mr. Arnold, I invite your attention to Exhibit 118?
A. Yes, sir.

Q. Mr. Arnold, there is one column which is headed, "Joints accepted UT inspection," and the total at the bottom of that column is one two five. There is another column with two stars, "Visual Inspection," at the top of it, and the total at the bottom of that column is forty-five. Is it a correct interpretation that the forty-five are not included in the hundred twenty-five?
A. The total is the joints inspected. The forty-five is a separate column for visual only. But the over-all total, the forty-five was included.

Q. The forty-five is included in the hundred twenty-five?
A. No, sir. This is a separate column. The over-all total of joints inspected included the forty-five visual.

Q. Yes, but the total of all joints inspected then would be the hundred twenty-five plus the forty-five?
A. Yes, sir.

Q. All right, that would make one hundred seventy joints tested, either ultrasonically or visually?
A. Yes.

Q. A hundred and twenty-five of them being ultrasonic tests, and forty-five being visual?
A. Yes, sir.

Q. Now there is written in pencil under the "VISUAL" column, "old" in black letters. Does that mean that all of those are old joints?
A. The "old" means existing joints.

Q. Then all of those in the visual inspection column were existing joints?
A. Yes, sir.

Q. Now under the column next to the right, "Joints rejected by UT," we have a total of twenty?
A. Yes, sir.

Q. And then in the next column we have, "New Joints Installed," and opposite one entry there is a star -- that's opposite the number "6." That star is explained as "Five of these replaced joints were changed to electric welded joints."
A. Yes, sir.

Q. Now did any of the new joints installed fail on the ultrasonic tests?
A. No, sir, those were all acceptable.

Q. All passed the test?
A. Yes, sir.

Q. In other words, a hundred twenty-five joints were tested ultrasonically; of those, sixty-seven were new joints and all passed the test?
A. Yes, sir.

Q. That left a total of fifty-eight joints that were not new joints, that were joints that had either been put in during construction of the ship or at some time before the ship came in for this overhaul. And of those fifty-eight joints, twenty were rejected. Is that correct?
A. Twenty of the joints rejected were out of the hundred twenty-five.

Q. Yes, that's true; but of the hundred twenty-five there were sixty-seven new joints, all of which passed inspection?
A. Yes, sir.

Q. Therefore, that left fifty-eight old joints that were ultrasonically tested?
A. Yes, sir.

Q. And of those fifty-eight, a total of twenty failed to meet present day standards?
A. Yes, sir.

Q. Now can you tell us how many of those twenty joints had less than twenty percent bond?
A. At this time, sir, I can't.

Q. Could you determine that for us?
A. I can review my ultrasonic records and perhaps come up with an answer.

Q. Would that be a practical thing to ask of you? What we would like is the actual percentage of bond for each of the twenty joints rejected.
A. I can have this information, yes, sir.

PRESIDENT: This is important information for us and we would appreciate your obtaining it for us.

WITNESS: Yes, sir.

Unclassified

Questions by a member, RADM Daspit:

Q. You have been asked to provide the actual percentage of bond for each of the rejected joints. Would any of these joints have been rejected for other reasons besides percentages of bond?
A. To the best of my memory, no, sir.

Q. If they were, would you give us the rejection reason, if it was not for percentage of bond?
A. It could be, in several cases, different things. It could have been misalignment, excessive solder, a burnt fitting.

PRESIDENT: When you give us the reading on these twenty joints, will you indicate the actual reason for rejection, including the amount of bond. If, in other words, you rejected a joint that had a forty percent bond and you rejected it for some other reason, would you indicate on that particular item on your list the reason for rejection?

WITNESS: Yes, sir.

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.

Cornelius J. Collins, a former witness for the court, was recalled as a witness for the court, reminded that the oath previously taken by him was still binding, and examined as follows:

COUNSEL FOR THE COURT: Mr. Collins, this is a closed session of the court and classified information may be imparted here. At the end of your testimony I shall ask you what classification you would accord to your testimony, taken as a whole.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. For the record, Mr. Collins, you are the project quarterman in the Piping Shop, Shop 56, of the Portsmouth Naval Shipyard?
A. Yes, sir.

Q. You were the Project Quarterman for the work performed on THRESHER during her post shakedown availability; is that correct?
A. Yes, sir.

Unclassified

Q. We would first like you to describe briefly the piping work done on THRESHER during her post shakedown availability in the trim and drain system. Would you first describe the work done in the trim and drain by-pass in the engine room, please?

A. This was also in the AMS. This was a regular lubricating the shaft on the trim and drain pumps, and there was a by-pass installed around the regulators so that it could be by-passed, in other words.

Q. What was the largest size of the pipes involved?

A. The largest size was one inch and three-quarters. The rest were smaller, down to a half-inch.

Q. Would you describe the piping work done in the trim suction priming line?

A. This was a three-eights valve which was installed in the priming line from the trim section in the AMS.

Q. Now did you do work on the trim flow meter and the sea connections to the meter?

A. The flow meter was installed on the discharge side of the trim pump. There was an original one in the suction side left in. This was a new valve installed.

Q. What size was that line?

A. Either three and a half or four, I believe. It's the discharge side of the pump.

Q. Do you have a diagram which shows that work?

A. Yes.

A marked-up blueprint illustrating the piping work on the trim and drain system accomplished in THRESHER during her PSA was submitted to the party and the court, and was offered in evidence by counsel for the court for the purpose of having the witness testify therefrom. There being no objection, it was received in evidence as Exhibit 130 and posted on the board for demonstration purposes.

Q. What is the number of that, please?

A. 1862774 ALT "M."

Q. Mr. Collins, here is a pointer. Will you point out your work, and as you do, describe it for the record.

A. This flow meter there is installed in the trim section line. It's right here. I have it marked with the job order which shows who installed it, and I have it written in. The line is three inch. These tags here, most of them are UT inspections. These were rejections on the first UT inspection, general inspection of the whole boat by Code 303. These tags were made up for that.

Questions by a member, CAPT Nash:

Q. Each tag is a rejection?

A. Well, not entirely. They are marked for UT inspection. We have the joint number on the tag.

Questions by counsel for the court:

Q. How can you identify those which were rejected when they were first inspected?
A. Well it says, "UT inspected" right on the tag here.

Q. How can you tell which ones were rejected?
A. It's marked with yellow in the line approximately where it would be on the main plant. This valve on the trim section line that was installed -- I don't think it shows on this diagram; but it was in the AMS and it was to isolate the trim section from the primary line. And outside of the -- this here -- lubrication is indicated up here. This actually came off the after circulating water. It isn't part of the trim system, but it is shown on this diagram; of course, this here was immaterial. This is just drains off a girder. These here were drains which showed cavity drains in the tanks, topside, went from the top of the tank to the bottom of the tank; these were tested.

Q. Were any of the valves installed by your people during this work later rejected as a result of ultrasonic tests?
A. None that I know of, no. I know they were all finally sold, but I couldn't say that they were rejected. They have records on this.

Questions by a member, CAPT Nash:

Q. Who prepared this chart for you?
A. I did, I think, for the most part. I had another man with me, the leadingman.

Q. And who marked the colors on it?
A. I'm not sure which leadingman it was, sir; it was probably Mr. Merrill.

Q. Did you do any of this yourself?
A. Oh, yes, we worked together on it.

Q. Which part did you do?
A. Well I couldn't say. I mean we did it on separate slips, take a test, and went on through it. I checked it all finally.

Q. I'm not sure you understand me. Who prepared the color markings on here?
A. You mean the code in itself, or who put the lines on it?

Q. Yes.
A. Well the man, as I say, I'm not sure which leadingman. We were working on all these diagrams and we were working together and I'm not sure which man did it actually on the trim and drain.

Questions by the president, VADM Austin:

Q. When was this prepared?
A. This was prepared after the THRESHER went down. This was done so we would have a record to show what was done.

Q. And you don't remember what part you played in the preparation of this?
A. Oh, yes, I was in charge of the whole thing, but, as I say, we had approximately ten diagrams that we were marking up at one time.

Unclassified

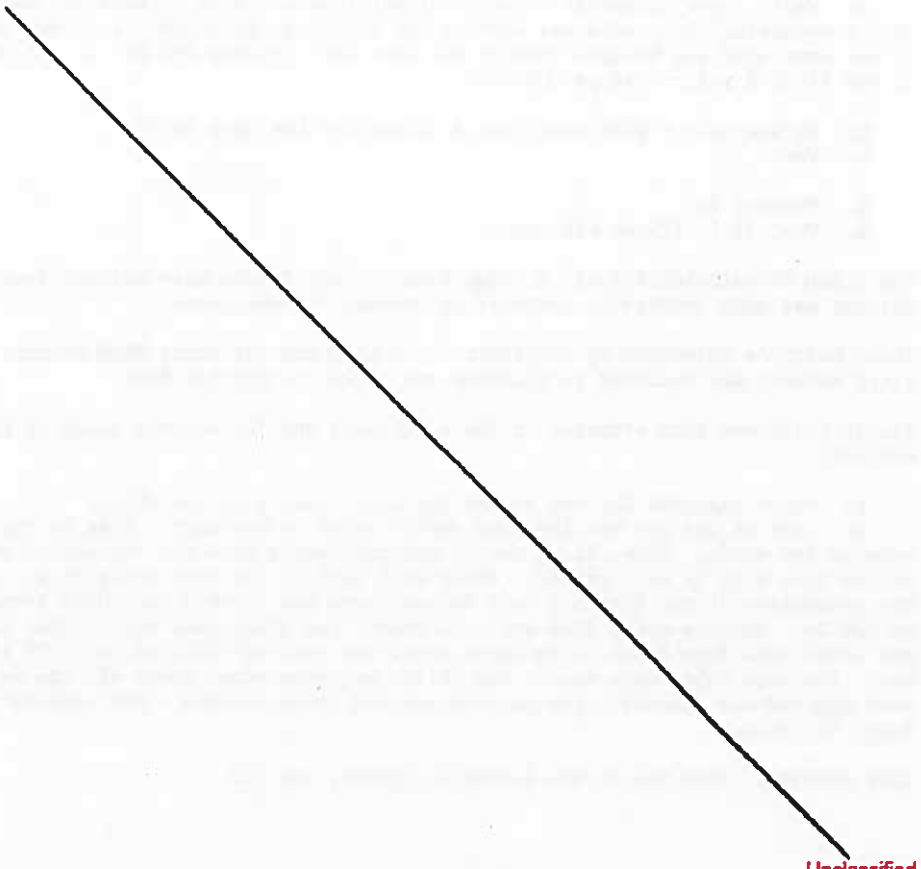
Q. What is your color code on there?
A. Well this yellow denotes new work.

Q. Is it explained anyplace?
A. I don't think so. No, I don't believe we put it on this.

Q. Well will you give us the explanation of the code then?
A. Well the red is testing has been tested. The green is a test slip; this number is on the test slip also. Yellow would denote new work, which is in here. Where there was any work done on it, it was marked in yellow.

Q. During the overhaul of THRESHER did you keep a progress sheet similar to this so that it would facilitate understanding the jobs that were in progress?
A. Well the only thing we ever had was these log books. These aren't complete. These are just things that we put in there to remind the other shift.

Q. You didn't put it on a blueprint?
A. No, no, sir; absolutely not. We never keep a chart like this. This was done just specially for this.



Unclassified

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

(Mr. Collins resumed his seat at this point)

Q. During the complete work performed on the entire trim and drain system, can you tell us what rejections--what valves rejected by ultra-sonic tests were replaced?
A. Valves, sir?

Q. Joints, I mean joints.
A. Well, this is marked on the print. That is the only way I can tell; it is marked.

Q. Do you have any summarization of it?
A. We have marked a plan, the same, exactly the same as 303.

Q. Turning now to the high pressure air system in the THRESHER and the work done on that, would you describe, very briefly the work done on the service air?
A. The service air, we had originally APEX valves when they came in and we had a job to change these valves and install Walworth's.

Q. With regard to the high pressure air system, describe first the work done with reference to the new high pressure manifolds?
A. Well, these manifolds were installed; they replaced a series of valves with a manifold. This work was done in the ship, in the mockup, in other words it was completed and brought down to the boat in a package and put in and then it was flushed and tested on the boat.

Q. Do you have a plan which would illustrate the work done?
A. Yes.

Q. Produce it.
A. Yes, sir. (Takes out chart)

Chart SSN 593-513-1862812 Alt N, High Pressure Air System Main Ballast Tank Blow Systems was then offered in evidence by counsel for the court.

There being no objection by the court or counsel for the party RADM Palmer, the cited exhibit was received in evidence and marked as Exhibit #131.

(Exhibit 131 was then attached to the blackboard and the witness stood at the exhibit)

Q. First describe for the record the color coding on the chart?
A. This is red for the test and yellow marks is new work. That is the same as the other. Also, it is really not noticeable here but the yellow number of the test slip is also marked. Other work done on the high pressure air was the relocation of the flasks in the ballast tank due to this new PUFFS system we put in. One was moved from one tank across the other side and another flask was moved down from lower to an upper level and this was flushed here the same way. The only other work was on the Cellulube conversion, where all the valves were removed and renewed - the packing and end seals on them - and removed the Butyl "O" rings.

CAPT HUSHING: That was on the hydraulic system, was it?

WITNESS: That was on the HP system too because the air compressors were converted also. The air compressors were separated to allow for working; they were too close. These were relocated.

Q. Does that chart show the work done on the Marotta valves?
A. No, it wouldn't.

EXAMINATION BY THE COURT

Questions by a court member, Captain Hushing:

Q. On new work, do you do alterations to the plant?
A. Any time that anything was cut out or renewed it was designated in yellow.

Q. But you have not designated in yellow the gaskets and "O" rings and so on which were changed?
A. No. These were--because it was entire, in other words every valve came out. There was no exception.

Q. So that within the entire system there were a number of items broken into and new "O" rings, gaskets, etc. inserted?
A. Yes, sir. In other words every mechanical joint was renewed.

Questions by the president:

Q. Mr. Collins, how do we know that the air banks were properly functioning after you had moved flasks from one side to the other?
A. Well, we flushed and tested, as I said and the systems were put back together and had a drop test--24-hour drop test- on all the lines, and then it was turned over to the crew. From then on we assisted them in any troubles we had, which were on the Marotta valves, mostly.

Q. When was this diagram prepared?
A. At the same time as the other one, sir.

Q. After the casualty?
A. After the casualty, yes sir.

Q. And who prepared this?
A. This was done at the same time with the leadingman and myself. I could get the leadingman's name; he would know. There was three or four there handy. I don't specifically know which ones they were but as I say, I checked them all myself.

Questions by a court member, Captain Osborn:

Q. What is your personal opinion of those b(1) reducers?
A. My personal opinion, sir?

Q. Your personal opinion.
A. I don't think they were too good-I think they were really too ticklish for me. In other words they could very well be harmed easily. The clearances were very small.

Q. Would you like to have one operating for you if your life depended upon it?

A. Well, if these did blow--the trouble they were having was the relief would not reseat. They were still operable even though they were blowing. They would operate.

Q. The main trouble, I understand, with them is that they exhibited a leak into the ship rather than an inability to pass air?
A. That's right.

Questions by a court member, RADM Daspit:

Q. Mr. Collins, do you know of any other type reducer valve or other valve which is less susceptible to leaking through dirt in the system, than is employed on this ship?
A. Not at that pressure, I do not. I know of Grove reducers but they were only a b(1) limit, I think--I am not sure.

Question by court president:

Q. Mr. Collins, how long have you been associated with high pressure air system reducing valves?
A. I am sorry, sir, I don't quite understand--you mean that I supervised?

Q. Well, that you knew anything about them at all?
A. Well, 25 years, sir.

Q. Have you ever seen a high pressure reducer vaive that did not act in a ticklish manner?
A. No, sir.

(The witness then resumed his seat in the courtroom)

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. The difficulty was with the Marotta valves and not the piping, is that correct?
A. That is so.

Q. But the work on the piping affected the cleanliness of the system?
A. Yes.

Q. Would you describe procedures employed in the work on the high pressure air system and the instructions your men had with regard to cleanliness?
A. Yes, sir. Any pipe in any system is fabricated in the shop, it will be cleaned in the shop by flushing or soaking, whichever they can do--I mean everything is available. The ends are capped with steel caps--metal caps--and taped and brought to the ship and the piping is installed; then it is completely flushed for one hour with hot water. And this is bought by Code 303.

Q. Do your men have any instructions with regard to the establishment of an area of cleanliness around the work which they do in place on the ship?
A. They are instructed not to work in a dirty area but there is no requirement to have a clean area similar to what they use in nuclear power, no.

Q. Turning now to the work involved, piping work involved, in the air systems, would you explain the extent of the work involved in the relocation of the air flasks?

A. Yes, number 2 and 3 air banks was -- well, I say it was cut up pretty badly; in other words there was a lot of replacement of pipe -- new pipe. This was completely flushed, retested hydrostatically and drop tested.

Q. Do you have plans which will illustrate the amount of work done?

A. This is the same plan, sir.

Q. You are referring to Exhibit 131?

A. Yes, sir.

Q. In the removal of the check valves in the main ballast blow line, you described, the work was accomplished to take the "O" rings out due to the Cellulube conversion?

A. Yes, sir.

Q. What did you find when you removed these "O" rings?

A. Well, when we removed the "O" rings in the valves we noticed the springs which close--hold these checks closed--was sticking out of the ends of a lot of these valves and these were sent back to the factory to be reworked.

Q. When they were reinstalled, do you know of any malfunctions which occured thereafter?

A. None whatsoever.

Q. Do you have a plan to show the work required on the system as a result of the relocation of the high pressure air compressors?

A. Yes, sir.

Q. Will you produce that?

A. That is the same plan.

Q. Have you indicated that work?

A. That would be in the same area as the manifold.

Q. Again, that is Exhibit 131?

A. Yes, sir.

Q. Will you explain to the court the procedures employed for the tests and acceptance of work in the high pressure air system?

A. On the high pressure air system, all work was tested and inspected by Code 303, and the ship.

Q. Do records exist of those?

A. Code 303 has them, sir. We have some. I don't know how complete they are.

Q. With regard to the work done on the auxiliary sea water system, to tie it together, was that work also monitored by the Quality Assurance Division so that they would have test results?

A. Only in instances where the lines were cut. As I say on this trim and drain line, they would inspect any line, any new work.

RE-EXAMINATION BY THE COURT

Questions by a court member, Captain Nash:

Q. Do you recall any instances in which the ASW system aft was cut?
A. Only for these valves which we replaced, and one instance--I believe it's on b(3) 10 USC pump--for the lining up of the pump to the pipe to the new mounts.

Q. Would that be sufficient cutting to necessitate a test?
A. Yes, sir.

Questions by a court member, Captain Hushing:

Q. In connection with the inspection and test of sea water systems on Job Order 15-930-15162 there was a test to be performed on the ASW system aft, is this correct?
A. This is so.

Q. Was this test to be the responsibility of Shop 56, or the ship's force-or the crew, if it was not one of those two?
A. We have the responsibility of putting the test on and presenting it to the ship's force.

Q. What does that responsibility consist of?
A. To be sure that the system is complete and is holding pressure.

Q. Can you describe your preparation for such a test and the manner in which you would assign personnel that were given a job on a similar ship to do?
A. Certainly, I would have a leadingman. He would assign the man and he would give him instructions which are on this particular JO, the complete line up of the test, and he would do this, and this one here, in conjunction with the crew. The crew did have to be with us on the line up.

Q. The crew assisted in the line up?
A. Yes, sir.

Q. And then what happened?
A. Then we would test and repair any leaks that we found.

Q. How many men of Shop 56 would be involved in this kind of a test?
A. In that area, probably one on every shift that they were working.

Q. One on each shift, and what would he do?
A. He would put the pressure up and go around and check for leaks.

Q. He would make the installation of the test pump?
A. Yes, sir.

Q. He would then put the pressure on the test system?
A. Yes, sir.

Q. He would then go around and check for leaks?
A. Yes, sir, right.

Q. How would he check for leaks?
A. Visually.

Q. Visually?
A. Yes, sir.

Q. If the system had insulation covering the joints and the fittings, how would he check for leaks?
A. He couldn't very well, sir.

Q. He could not very well?
A. No.

Q. How long would he leave the test on under these circumstances where part of the system is covered by lagging?
A. The requirement was one hour.

Q. One hour?
A. b(3) 10 USC 130 allowable drop.

Q. b(3) 10 USC 130 allowable drop?
A. Yes, sir.

Q. Turning to the air system, did you see the air system at any time when it was first broken down to make the conversion from the cellulube to the petroleum base oil?
A. I imagine I did.

Q. Well, did you?
A. I must have but I couldn't state any instance of any time. I certainly must have.

Q. Did you look at it?
A. In what regard, sir?

Q. Was it dirty, for example, when it was opened up?
A. No, sir, I didn't find any evidence of dirt.

Q. It was not dirty when opened up?
A. Not visually, nothing you could see.

Q. How about the conditions of the seals, the O-rings and gaskets--did you look at them?
A. Yes, they were in good condition.

Q. They were in good condition?
A. Yes, sir.

Q. What did you or your men do toward keeping that system there when it was broken apart in some places?
A. These systems have to be capped again with a metal cap and taped.

Q. Were they capped?
A. Yes, sir.

Q. Did you inspect them to see that they were?
A. Yes, sir. That was one of the things we did continually.

Q. After the system was put back together, and was operative, I understand that the filters had to be changed from time to time.
A. The only thing I do know, it wasn't the filters that I know of personally.

The only thing I know of in these Marotta valves, they install a cone-shape strainer and we did take one of them out one time. It appeared to have evidence of, well, I say paint chips-that was what it looked like.

Q. Well, did you find any evidence of dirt in the high pressure air system?
A. Only that instance.

Q. Only in that instance?
A. Right.

Q. How about the hydraulic system?
A. Yes, sir.

Q. Did you find it dirty when it was broken down for the changeover from cellulube to petroleum base oil?
A. Not to my knowledge, no.

Q. How about the condition of the seals and gaskets in that system?
A. Well, there was nothing I know of--I knew of no complaints.

Q. Did you see them?
A. I can't say I did on that system. Mr. West was the coordinator on that.

Q. Did you have any reports of dirt or foreign particles in the hydraulic system when it was put back together again?
A. None, no, sir.

Q. Did you check that at all or did you just not have a report?
A. We did not have a report, so we wouldn't check it. I mean it would be flushed on new work only on that.

Q. Was there anything unusual in the flushing report?--Did anybody report anything unusual to you?
A. No, sir.

Q. So that to the best of your knowledge then, the hydraulic system was clean after you went into it and was clean after it was done?
A. Yes, sir.

Q. The air system was clean when you went into it and it was clean when you were done?
A. Yes, sir.

Questions by a court member, Captain Osborn:

Q. Mr. Collins, we have evidence that one of the after group blows did not work on one of the fast cruises. Do you know anything about that?
A. Yes. This was reported, that the indication was not right. This valve is the same. We just removed it and sent it to 31 where it was worked on.

Q. By "indication" you mean the tank was blowing but the electrical indication was not correct?
A. That is right; that is what I understood, but the only thing we would have to do with that is disconnect the valve from the piping and ship it to the inside machine shop to work on the valve. We do not work on the valves.

Q. Have you ever had any improper indication with hull regulators on this ship?
A. No.

Questions by court president:

Q. Mr. Collins, you were the quarterman from Shop 56?
A. Yes, sir.

Q. You supervised all the leadingmen that had to do with all of the piping systems during the PSA of the THRESHER?
A. Yes, sir.

Q. A number of times you have answered questions to the effect that that's what you understood, and some of those questions pertained to rather important matters concerning these piping systems. Did you just assume that all leadingmen would take care of everything or did you actually supervise these leadingmen?
A. I supervised the work of these leadingmen, yes.

Q. Why is your memory so hazy about these more important items?
A. I don't know what you're referring to.

Q. Well, I am referring to the question just asked by a member of the court for example.
A. What is that?

Q. This was in regard to disconnecting a valve from the piping.
A. That does not fall under my shop. The only thing we have to do is take it out and then sent it to the machine shop. We do not work on the valves.

Q. But when you work on a piping system, aren't you interested in the whole system?
A. Yes, sir, definitely.

Questions by a court member, Captain Osborn:

Q. I have one other question, Mr. Collins. It has to do with a continuation of the question on the ASW system primarily, of which this is an example. Was it your opinion that your responsibility was to furnish services for putting pressure on the system and the total responsibility for acceptance of the test rested with the ship's force?
A. Yes, sir. The ship's force is responsible for accepting the test the way the job order was written up.

Questions by court president:

Q. Who was responsible for performing the test?
A. Fifty-six.

Q. Then the responsibility was Shop 56's for performing a satisfactory test?
A. That is right, sir.

Q. It was only the ship's responsibility to check you to see that you did that?
A. To accept it, yes, sir.

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

The president 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 add.

The witness indicated that his testimony was unclassified.

The witness was duly warned concerning his testimony and withdrew from the court room.

The court then recessed at 1036 hours, Thursday 2 May 1963.

The court opened at 1048 hours, Thursday, 2 May 1963.

All persons connected with the inquiry who were present when the court recessed were again present in court.

No person not otherwise connected with the inquiry was present.

Mr. Willis Merrill, a civilian, was recalled as a witness for the court, was reminded that the oath he had previously taken was still binding, and advised that at the conclusion of his testimony he would be asked to assign the highest classification he thought applicable thereto.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. You are Mr. Willis D. Merrill employed at the Portsmouth Naval Shipyard as a leadingman pipefitter in Shop 56, is that correct?
A. Yes, sir.

Q. And you were so employed during THRESHER's post shakedown availability?
A. Yes, sir.

Q. We would like now to have you describe the work done on THRESHER's trim and drain system during the period of her post shakedown availability. Will you first describe for us the removal of the valves and piping in the trim and drain system?
A. We removed various sea and backup valves on the trim and drain system and shipped them to Shop 31 for overhaul and repair, replaced them on their return and then the system was tested. I was involved in the removal and replacement of some of these valves.

Q. Was the majority of the reinstallation of the valves done on your shift?
A. I wouldn't want to make that statement, no.

Q. Was a significant portion of it done during your shift?
A. I would say yes.

Q. What shift was that?
A. The second shift.

Unclassified

Q. Did you have any difficulty in the removal and reinstallation of any particular valve?
A. These hull valves going out into tanks, the tail pipes had to be cut, involving quite a little hard work.

Q. Do you remember one valve, TD-255 in the engine room where there was some difficulty due to its tightness and inaccessibility?
A. Yes, sir. We had a leaking O-ring on one of the flanges of this valve. It took nearly a full shift to correct the deficiency.

Q. What was the difficulty involved in working on it?
A. It was partially behind a frame--I think Frame 88--and the piping was very tight and the valve partially inaccessible. In fact, the piping was so tight that we had to force the pipe apart and remove the entire valve to get clearance to put our O-ring back in.

Q. Did you have any part in the test of the trim and drain system?
A. I believe I lined up one of the lines once for a test. I did not fully pressurize the system.

Q. No test was performed during your shift, is that right?
A. No, sir.

Q. We turn now to a discussion of the air system in THRESHER. Will you describe, insofar as you can, the installation and pipe hookup of the air manifold in the air regenerating room in the high pressure air system?
A. This boat had a new air manifold installed that included the entire air services from b(1) down to the 20 pound air system. We had quite a few problems getting it fit in there, and the entire installation was brand new, including, I believe, new type valves, Marotta valves.

Q. Was it a prefabricated manifold?
A. It was prefabricated, sir.

Q. Describe the piping work done for the air compressors?
A. The air compressors were relocated and new lines were necessary throughout--both salt water and air--the air compressors, I believe, had contained cellulube and had to be taken out and cleaned of that, and regular hydraulic oil put in or lubricating oil.

Q. Did you work also on the removal and reinstallation of the reducer valves in the high pressure air system, the Marotta valves?
A. For pulling them out for repair, yes, sir. The original removal I was not in on.

Q. In pulling them out for repair, was that a one time operation or were there continuing--
A. That was a continuous operation, nearly.

Q. What work did you do on the ballast blow valve?
A. We had to remove the Marotta valves at the ballast control panel twice for mal-function, and the check valves and hull valves were removed from the boat for overhaul, that is at the tank side--hull.

Q. Very briefly, what work did you do on the service air system?

Unclassified

Unclassified

A. b(1) or what, sir?

Q. Did you change the APEX valves in the system?
A. Most of that was done by me, I believe.

Q. That was the b(1) air?
A. That is the b(1) air system. They had all Apex valves in it and they were all changed to Walworth type valves.

Q. What instructions did your men have with respect to the cleanliness of the work in dealing with the high pressure air system?
A. On the high pressure air system, all the piping was Grade A clean.

Q. How would you describe Grade A clean to your men?
A. If it is Grade A cleaned, it goes to the clean room, and is taken care of over there and when ready, is sealed and sent back. My men are not involved except in removing the pipe and to be sure each piece does make the trip. In order to do this I have to make out a shipping tag, so-called Form 955, to go with it.

Q. In removing the pipe, what instructions do the men have to preserve cleanliness in the system?
A. The ends are taped over, sheet metal-capped, normally, and the pipe is left that way until reinstallation, when it is removed by the mechanic putting the pipe back.

EXAMINATION BY THE COURT

Questions by a court member, Captain Hushing:

Q. Relative to the procedure for putting a cap on the end of pipe, taping them over, etcetera, did you observe any instance during the PSA when this was not done?
A. Occasionally we would find a pipe opened as we were fabricating. Once we started to clean, we had all our piping fabricated at the time and then it was sealed with caps and it was kept sealed. I was in there hours every day.

Q. Did you have many instances where the caps were torn off through abrasion or people bumping into them?
A. No, sir. When we sealed with caps we had pretty good luck with them. When we are working on the system we often use just the green tape and that will get torn off, burned off, or pulled off or just left laying. But when we had finished our fabricating, metal caps were taken down and put on as the pipe came out and it was kept sealed and it did remain that way.

Q. When you first went into the air system, did you find it clean or dirty by comparison with the previous ones you put in?
A. I did not tear out, down in the air regenerating room. However, little parts of the system here and there that I did go in seemed to be clean.

Q. How about the condition of the seals and O-rings and gaskets when you went into it?
A. They were average. Every so often you would find one that was fairly well jammed up and out of shape. We did not try to use any over.

Q. How about swelling or breaking up of O-rings and gaskets? Did you find any of that?

Unclassified

Unclassified

A. There were some that were chewed up on the edge, an occasional one that was broken or cut. Most of them were flat and starting to get stiff.

Q. Once you had the system put back together again and were trying to clean it and get it into operation, did you find it difficult to get it clean?
A. No, sir, not as a system, as far as the piping was concerned.

Q. Did you have any reports of dirt in the system?
A. Yes, we did.

Q. Would you describe those reports?
A. I can only describe second hand. I believe Mr. West went over to 31 to observe some dirt they claim they took out of one of the Marotta valves. It proved to be brass. The Marotta valve was one of the high pressure type and we had no brass in that system. The dirt was definitely not ours. It must have been lodged in the valve.

Q. Scrap-filings, or any indication of the kind of brass it was?
A. I can't answer that, sir; I don't know.

Q. But it was brass?
A. It was brass--determined that it was brass, I understand.

Q. Do you know whether this triggered a look-see at the other valves to see whether the same condition existed in them?
A. In the course of our starting to operate the manifold, or the ship starting to operate the manifold, all of the high pressure valves down to the hundred pound one, I believe, were taken out and sent over to 31 several times.

Q. Did they find any dirt when they were sent over, do you know?
A. There was only one or two reports of any dirt. One valve, we found that the strainer was missing on.

Q. Did you observe personally, any dirt or did anyone tell you of any dirt in the system other than this report by West that you gave us?
A. No, sir.

Q. How about the hydraulic system when you put it back together. Did you have any reports of dirt there?
A. I didn't, sir, although a lot of the hydraulic system was fouled up where we took out old pipe. During our flushing operation, on valve removal, the pipes were fairly dirty. I did a lot of the repair and alteration on the hydraulic system although I didn't have lead on the job.

Q. When you say the pipes were dirty, what do you mean, that there was crust on the pipe walls?
A. I wouldn't say crust, no; I'd say a filament, a lining of--well blackness.

Q. On the walls?
A. Yes. You could take your finger and run it in a lot of these pipes and bring it out quite black. It was soft; it was oily. There was no apparent sediment or anything of that sort in it.

Q. Did the flush get all this out, do you know?
A. Apparently, it did. There were some three flushes, I believe, and then an air-dry on top of that and it seemed to get it all.

Unclassified

Unclassified

Q. Do you know of any chemical or spectographic analysis on the flushing water?--Were there any checks made?

A. There were checks made on the 220 cellulube flush and I am quite sure there were checks made on the water too--yes, I know there was.

Q. Did you get a report of what was found?

A. On the last sample when we put the hydraulic fluid that was to be used, into the system on final flush, that was sent to a chemist, and I don't recall quite what the figures were, but each area had to be cleared by the chemist before we buttoned it up permanently. Otherwise we started in on a new flush on that area.

Q. Is that the chemist from the Shipyard Materials Testing Lab?

A. Yes, sir. They were carried right down here to Building 20.

Q. And was the Materials Laboratory--would the Materials Lab have information on the analysis of the various flushes?

A. I presume they would. We got written reports back on them. This was kept as a separate system. Mr. West was liaison at that time.

Questions by a court member, Captain Osborn:

Q. Mr. Merrill, in the past ten years, the air systems, hydraulic systems and ASW systems have increased in complexity, perhaps ten to twenty-fold. Have you had to study very much to keep up with this increase in technological increase?

A. Yes, I have, quite a bit.

Q. How about multiplicity of instructions that you have--are they hard to keep up with?

A. They are very hard to keep up with. In fact, we have in our shop a set of these small binders, and every so often I know the instructions are changed in those and when we catch--I hadn't worked hydraulics for several years when this boat came in and I had to go to the ship and finally dug up one of these books and chased around two days to be sure I had the latest revisions on everything and then read it and I took three men with me to read this book.

Q. How about the insurance that you got the latest dope on a particular item? Is there any requirement for your checkoff on these instructions or memorandum in any way, initial them, or this type of thing?

A. No, sir.

Q. I am interested in two things, one as you looked at this personally, from your troubles in keeping up on the information; how did it look below you with respect to a large number of people you supervised--how current they were; and how did it look upward with respect to the people that were supervising you? What's your opinion as to that?

A. My supervisor wanted to know if I knew all the procedures, and I told him no, I would go and get them, which I did do. I took two or three of my top mechanics after I went through this information and briefed them with the book in my hand. These men were my--what you might call lead-off men. Any flushing or testing that was done, at least one of them would be there.

Q. There is no formal procedure with respect to checkout on latest instructions, either above or from below?

A. I would say no to that.

Unclassified

Unclassified

Questions by a court member, RADM DASPIT:

Q. Mr. Merrill, there seems to be two procedures for keeping the high pressure air system clean; that is, when you are tearing it down you merely tape up the ends of the pipe. After your new pipe is fabricated, them you go to another standard by putting a cap on, and that the tape that you use in the first phase is sometimes broken or burned or something else; this would permit dirt to enter into the system. Is there any reason why caps could not be used right at the start?

A. Perhaps I was a little off on that, sir. If the pipe is staying in the boat, it is metal capped. These loose pieces that we are working with, we are not especially so careful of because we realize that it has got to be sent to the clean room and it has got to be clean. If we protect our threads, we are in on our end of it. The clean room, any dirt it will pick up will flush right out. The clean room will flush it out becuase they are checked by Code 303 over there as well as themselves, and the boat itself is sealed off with metal caps and taped.

Q. I am very glad you cleared that up because it didn't make any sense to me.

A. No, when I spoke of green tape that is loose pieces we might take off and put on maybe six times a day to go on to get another piece fitted and so forth. We don't try to metal-cap that because we do know it is dirty to start with.

Questions by the court president:

Q. Mr. Merrill, you spoke of having difficulty with Valve TD-255 in getting it out. Did you have any difficulties getting it back together?

A. No, sir.

Q. And in forcing pipes apart to get your new O-rings in, you didn't do any damage to the best of your knowledge?

A. I know we didn't, sir, because another man was needed and I was riding the job out, helping.

Q. It is difficult to insure continuity of effort and performance when you have three shifts, is it not, Mr. Merrill?

A. Yes, sir, it is.

Q. In order to try to pass on information from one shift to the other, you have these rough log books, do you not?

A. Yes, sir.

Q. You are responsible, as a leadingman, for the work on your particular shift, and in your shop there is a quarterman over you who has general supervision of all the leadingmen of all the shifts, is that correct?

A. Yes, sir.

Q. Is it this quarterman who provides a sort of continuity for all your leadingmen on a given pipe system?

A. Yes, sir.

Q. How often did you see this quarterman down on the THRESHER during the THRESHER's overhaul?

A. On the afternoon shift, very seldom. When I was on the day shift he was on the boat quite a little.

Q. Because, naturally, he can't work all around the clock.

A. That's right.

Unclassified

Q. And he would be mainly on the ship during the day shift?
A. That's correct, sir.

Q. But while you were a leadingman on the day shift, you did see your quarterman quite frequently on the ship?
A. Yes, sir.

Q. And when any of your leadingmen had problems of a more than minor nature, was it customary for the quarterman to come down and assist in solving those problems?
A. If I have one that I don't want to make a decision on, I never hesitate to get him.

Q. Mr. Merrill, you were aware that a number of joints were being tested ultrasonically during the PSA of THRESHER, were you not?
A. Yes, sir.

Q. Were you aware of the rate of failure to pass these tests of the previously installed joints?
A. No, sir, I wouldn't be. The day shift would be much more familiar than I with that. I'd get a report of this one or that one bad perhaps but an overall picture not at all.

Q. In other words the reports of failures which you got, did not give you a feel as to whether there was a high percentage of failures or a low percentage?
A. No, sir, it didn't.

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

The president 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 as follows:

WITNESS: I don't think of anything to say except these Marotta valves could stand some more improvement.

The witness was duly warned concerning his testimony and withdrew from the court-room.

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

Raymond E. Plourde 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:

COUNSEL FOR THE COURT: Mr. Plourde, this is a closed session of the court. Classified information can be given here. At the end of your testimony I shall ask you what classification you would accord to it, taken as a whole.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Please state your name, address and present occupation.
A. Raymond E. Plourde, (b) (6) At the present time I'm in Planning and Estimating.

Q. Are you employed at the Portsmouth Naval Shipyard?
A. Yes, sir.

Q. Were you the leading man pipefitter on the day shift for the U.S.S. THRESHER during her post shakedown availability until the 3rd of March of this year?
A. Yes, sir.

Q. Briefly describe your background and experience in that sort of work.
A. I was working mostly on piping in the tanks.

Q. I was referring to the experience that you've had in pipefitting work, starting at the beginning.
A. Well, I've been here twelve years, and I've been a pipefitter and a leadingman for the last two years.

Q. Did you do any pipefitting work before you came to Portsmouth?
A. Yes, sir, I did.

Q. Tell us about your experience in that trade.
A. I started my trade back in 1928, and I did plumbing on the outside and steam fitting in the shop. I've done that just about all my life, sir.

Q. With regard to the work done on the trim and drain system of THRESHER during her post shakedown availability, will you tell us about the replacement of some of the silver brazed joints rejected by ultrasonic testing?
A. Yes, sir. I done about five of these rejected joints from ultrasonic on the trim and drain system. They were all ultrasonic tested after I completed the work.

Q. On the five joints which you replaced, do you know whether they had been installed at some time previous to the post shakedown availability; were they part of the original construction?
A. Yes, sir, they were, sir.

Unclassified

Q. Can you tell us which of the joints in THRESHER were ultrasonically tested?
A. Which ones, sir?

Q. Were they the joints which were lagged?
A. No, they were not lagged. Most of my joints were in the bilges, with no lagging.

Q. With reference to the old joints, it was only those accessible and unlagged?
A. As far as I know, sir.

Q. And as far as those are concerned, your knowledge extends to five?
A. That's right, sir.

Q. Did you do any work on the installation of the flow meter?
A. Yes, sir, I installed that.

Q. Will you describe that?
A. I cut out a piece of the old piping and installed two new flanges, which were ultrasonically tested and inspected before the job was completed.

Q. Did they pass the ultrasonic test the first time they were installed?
A. Yes, sir, they did.

Q. In the forward trim tank piping system, from the forward trim valve to the tank, will you tell us what work was performed there?
A. I removed all the old silver soldered joints from the valves of the hull, and installed welded piping in place, except for one, a 3/8 flange, and that was ultrasonically tested before it even went into the boat. Then in turn I tested that pipe from the outside of the trim tank to the hull valve on an Item 1 pressure, b(1)

Q. Was that a three inch flange, or 3/8 flange?
A. 3/8 flange.

Q. Did your men also test the floodline to the garbage disposal?
A. One section, about three feet, sir.

Q. Will you describe that?
A. It was from the check valve, disconnect and check it from the system, because they couldn't blank it off at the gun, and they tested just about three feet long with a blank on one end.

Q. From the stop valve to the union itself?
A. Yes.

Q. Did it pass the hydrostatic test?
A. It did, sir.

Q. Was that also a b(1) test?
A. Yes, sir, it was.

Unclassified

Q. From your observation of the old joints, made before the post shakedown availability, which were ultrasonically tested, did you get any indication of the rate of failure to pass the ultrasonic tests?
A. No, from the Inspectors' Code they gave it to us as rejected joints, and we had to replace them; that was the only information we usually had that there were rejected joints.

Q. Did you do any work on the auxiliary sea water system aft?
A. No, sir, I didn't.

Q. Any work on the auxiliary sea water system at all?
A. No, I didn't get in at all on that.

EXAMINATION BY THE COURT

Questions by a member, CAPT Nash:

Q. Did you examine those joints which it was necessary for you to improve?
A. Yes, sir, I did.

Q. On the basis of these observations, what did you find in the way of quality in the old joints?
A. On the old joints -- well, as I said, I got this on the design from 303, which is the Inspectors. They give us the instructions to remove these fittings and I have no way of knowing just what condition they were in, sir, but as far as looking at them, they looked fairly decent, but you cannot tell.

Q. I refer to those which you removed. Were you able to tell anything by looking at them?
A. No, I could not, sir.

Neither counsel for the court, the court, nor the counsel for RADM Palmer, a party, 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 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 said that he had nothing further to state.

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

Thomas R. West, a former witness, was recalled as a witness for the court, was informed that the oath previously taken by him was still binding, and examined as follows:

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Mr. West, you are a leadingman pipefitter in Shop 56 at the Portsmouth Naval Shipyard?
A. This is correct, sir.

Q. When you were here last to testify, you undertook to obtain a copy of Form 771, relating to test of the auxiliary sea water system of THRESHER; do you have that with you?
A. Yes, sir.

Q. Would you produce it?

(The witness produced a Form 771.)

Form 771 submitted by the witness was offered to the court in evidence, and there being no objection it was received as Exhibit 132.
Counsel for the party waived the reading of the exhibit.

Q. Referring to Exhibit (132) Mr. West, will you describe, if you know, who made out the form?
A. I made out the form, sir.

Q. And the date that appears is 3-7-63; is that also yours?
A. That is correct.

Q. What is this inspection request intended to cover?
A. This inspection request was intended to cover the entire ASW aft, sir.

Q. Do you have any information as to the signature appearing on the bottom, "R. Podwelf"; do you have any information as to who signed it and when?
A. I am still not firm on the date that this was signed, sir. Through back checking -- I have checked with Fiscal to find out when Mr. DiPietrantonio last worked aboard the 93 boat, and I found this to be 3-15, was the last time he worked aboard the 93. I also went out to see the Chief Quarterman of the Pipe Shop, Mr. Perry, who was out on sick leave, in hopes to be able to possibly come up with something firm from him, because at this time Mr. Collins was out on sick leave, from the 14th on until, I believe it was the 22nd. At that time he went on afternoons, and Mr. Perry had sat in on the conferences, daily conferences, with me at that time. From him I could not pick up a positive date. I did not try to influence him one way or the other. I was asking him if he could recall anything that might have gone on at this time. I had no positive date. He thought he remembered selling the salt water system, but it was not firm, and this was not satisfactory to me. I had no intention of entering this as evidence, because it is not firm. This does not substantiate a date; this doesn't give us a firm date.

Q. Where did you receive Exhibit (132) when you brought it to us today?
A. I took it from the spare copy file of the test slips which were impounded and taken to Building 174.

Q. Is it your understanding that that slip is one that you had in your desk as evidence of the test performed in THRESHER?
A. To the best of my knowledge, sir.

Q. When you first received Exhibit (132) and put it in your desk, was it your understanding that it evidenced a final selling of the auxiliary sea water system aft to the ship's crew?

Unclassified

A. To the best of my knowledge, sir.

Q. Do you have anything further to tell us with reference to this matter of the final test of the auxiliary sea water system aft?

A. I believe -- when I was called in to review my testimony yesterday before the court reporter, that I neglected to make it clear to the court that I was the supervisor responsible for starting this test. In starting this test I had b(3) 10 USC 13(pumps on this: I had Al Jean, pipefitter, he was the one who started this test, and I wanted to get the flushing on the reverse feed tanks under way at that time. I requested another man and they sent Mr. DiPietrantonio back from the 350 boat, and I put Mr. Jean down flushing the reserve feed tanks. I also recalled Mr. DiPietrantonio changing an "O" ring on b(3) 10 USC 130 I believe it would discharge, as I see it in my mind now. I was trying to think if there was something else that I had neglected to put into the previous transcript.

Q. This morning did you go through Exhibit (106) with me in an effort to see if there were any entries after the date of March 7, 1963, with reference to any work being done on the auxiliary sea water system aft?

A. This is correct, sir. I requested the counsel to produce the Day Book, Exhibit (106), to see if I could go through this and possibly pick up something which would substantiate the date that this test was sold.

Q. Did you find anything after the date of March 7?

A. I found nothing after the date of March 7. I found an afternoon report on March 7, which indicated leakage in the system, which meant that the system was not satisfactorily sold at that time.

Q. Turning now to a different subject, Mr. West, will you relate the work done under your supervision on the high pressure air system on THRESHER during her post shakedown availability? First, describe for us the work done in removal of all reducer valves and ball valves in the high pressure air system?

A. When the THRESHER came in in July, I went aboard as hydraulic conversion coordinator. The air system, having been a cellulube job, was to be converted. All of the valves were removed from the ship, the Marotta valves, there was a complete kit ordered from Marotta for replacement parts for all Marotta valves. These valves were repaired over in Shop 31. All the strainers, or filters, went to 31 for element change and gasket oil seal. The Sealol checks from the air system were sent back to the Sealol Company because these had a special crimp seal, which we had no tools for which we could change their packing, or seals. If I remember correctly, there were about thirty-nine of these that went back. A portion of those would have been off your high pressure air blow. Your ballast control panel Marottas were overhauled and later repaired after they were in the ship. Some of these were leaking by their vents. Along with this same job, on all of your high pressure air stops, we installed a new type ball, as well as packing, and a new type handle, which made it more difficult to open these valves the whole way without first going through the bleeder port, which is an approximately 1/64 inch hole through the ball. This would let air go through so as to start the equalizer system. This, I believe, was to eliminate the possibility of auto-ignition. The hull valves for your bank stops, the seals and the balls were converted aboard ship, because these valves are welded into the hull. The flex hoses were changed on your air system, on your high pressure air system. There was only one hose, as I recall, that had any damage, and that was from the fourth stage on the No. 2 compressor which the flex was torn on, frayed, which we replaced. This was replaced during the conversion.

Unclassified

Q. Where was it frayed?
A. That was off your fourth stage of your compressor, and it was frayed where they used the passageway, getting over to your electronics cooling area.

Q. One end of it at the fitting?
A. Well, just below your fitting, just before your dogleg. During operational test, we removed one high pressure air hose from the ceiling which had been replaced. It leaked around the swivel. All of these hoses that were replaced were tested for twice working pressure, which is normal procedure. These hoses were fabricated in the shop, Shop 56.

Q. Were you involved in any tests of the air system?
A. Not directly, sir.

Q. What was your connection with the tests?
A. I was aboard the ship at the time tests were going on. This would have been the only association I had with this.

Q. Do you know of a report of dirt in the air systems? I make particular reference to a report of brass found in a Marotta valve.
A. This report -- Captain Heronomus and Captain Guerry came back from Shop 31 on a Marotta valve on the ballast control panel which was over in 31, and they told me that they were told that there was a piece of brass in there, and asked me if I had any idea where this piece of brass could have come from. Now this is an entire copper-nickel system, outside of the valves themselves. I could not find out what size this chip was. I did not personally see it, and this is the reason I have not brought this up at this time, because the only knowledge I have of it is hearsay, granted it may have come from a good source. At that time we discussed it and neither one of them could come up with a possible answer as to where a brass chip would come from.

Q. In working on the high pressure air systems, what instructions did your men have as to procedures for cleanliness and safeguarding the integrity of the system?
A. When a valve was removed from the system, the pipe, the valve, or component, would be capped and taped. All components are supposed to be this way; air hydraulics or any other type components; this is standard procedure.

Q. Do the men have any special instructions about the cleanliness apart from capping the ends?
A. Our air system is not a Grade A type system, but we have always tried to keep this type of cleanliness in our air system, as this also is reduced down, the ship's breathing air, and everything else.

Q. What is a Grade A type system?
A. A Grade A System, first would be one which was cleaned to the point of where there are no foreign matters. It would be as clean as --

Q. Is that your full reply?
A. No, sir. This would be entirely clean, free of any foreign particles, dry and sealed the same.

Q. Is that it?
A. I'm afraid so, sir.

EXAMINATION BY THE COURT

Questions by a member, CAPT Hushing:

Q. Mr. West, turning to the test of the ASW system aft.
A. Yes, sir.

Q. What would you think would be the minimum time to conduct that test from the time your men with the pumps arrived in the engineroom?
A. I would say the minimum time you would get a test off from that, if everything was satisfactory, would be six hours, would be the minimum, I would say. I dare say it would go over this; it all depends whether they are all ready to start up, whether your valve lineup is completed, or not.

Q. But your experience then would indicate that six hours would be a minimum time?
A. Six hours would be a minimum from the time you got your pumps on, your system up, and checked your system out completely.

Q. Did you say that Mr. Jean was initially involved in this test?
A. Initially involved; that is correct.

Q. Did he stay on this test, or did you move him off to the reserve feed tank?
A. I moved him off to the reserve feed tank.

Q. So he was not involved at the final selling of the procedure?
A. That is correct.

Q. Do you make out the time cards for your men?
A. I do make out time cards for men when I have men working for me, sir.

Q. Do you have that as a responsibility for those men who are working for you at the time?
A. That is correct, sir.

Q. What is the smallest time element that you charge?
A. One hour would be the smallest.

Q. So that any job that takes more than an hour, you would normally put the job order number for that job down on the man's time card?
A. That is correct, sir.

Q. Did I understand you correctly, that Mr. DiPietrantonio was sent to you to assist in this work of testing the ASW system?
A. That is correct.

Q. Did you then make out the time card for Mr. DiPietrantonio during this time?
A. On that date the time card was signed, I believe, by Mr. Ross on the 350 boat. In checking with Fiscal he was the man who signed the cards for that day.

Q. Did you make any time cards for Mr. DiPietrantonio?
A. Yes, sir, I did.

Q. Do you believe, from your memory, that these time cards should indicate when Mr. DiPietrantonio did the work on testing the ASW system aft?
A. I believe it should give us some indication, sir.

Q. How good an indication?
A. I think it should give us a fairly good indication, sir.

Questions by the President:

Q. Mr. West, when do you make out a Form 771 for a test?
A. I make out a form for a test, I normally make out a form for a test when I get the test up to a point where we believe it might normally sell, before we go down to check the system over, sir.

Q. In other words, you do not make out a Form 771 in advance?
A. We make them in advance of going down and checking out the system with the mechanic, yes, sir.

Q. But you would not make out a Form 771 on the 1st of March for a test which you did not expect to start for a week, would you?
A. No, sir.

Q. It would be reasonable to assume, therefore, that tests on the ASW system aft, which is described on Exhibit (132), and which is dated as the 7th of March, would not have been made out even on the 6th of March?
A. I would say no on that.

Q. It is most logical to assume that the test, at the time you made out the slip, was intended to start approximately on the 7th of March?
A. That is correct.

Questions by a member, RADM Daspit:

Q. In preparing for such a test on the auxiliary salt water system, the first step is to line up the valves, then to fill the system with water, and then to vent it, to make sure that you get all of the air out; isn't that correct?
A. That is correct, sir.

Q. And the fact that the afternoon shift on 7 March found some leaks and repairs that had to be made, indicates to me that this work had already been accomplished, and that it was merely a question from that time on to applying pressure, fixing any new leaks as they developed; is that a correct assumption?
A. I would say that that was a correct assumption. There would be a time lapse in there that I could not account for.

Q. Well, if they started this on the morning of 7 March, it might well take six hours to fill the system up and vent it, and do all that work?
A. That's correct, sir.

Questions by a member, CAPT Osborn:

Q. How long does it take, ordinarily, to get the conductivity in the reserve feed tanks down to spec?

A. Sometimes you will only get a slight amount of conductivity; you might only run five hundred to a thousand gallons of water in after you made your initial fill, and the next one you may put water to, in fact you may completely change your water and fill them twice or three times trying to drop your conductivity, sir.

Q. How long does this take?
A. Six to eight hours, sir.

Q. Per tank?
A. What I'm making reference to right now is filling about four hours and then by the time you flow over and take the sample, I would say probably six hours, four to six hours. I'm going by the last tanks we worked on; that is why I was going by this; I can't even remember the capacity of it at this moment.

Q. Was that the last tank that you tested; were the other b(3) 1 tanks --
A. The other b(3) 1 tanks were already sold.

Q. When the other b(3) 1 tanks were sold, did Mr. Jean work on these particular tanks? He had originally started on the ASW system final tests; is that correct?
A. Right.

Q. Then this could have been as much as two days earlier; correct?
A. I don't believe so, sir.

Q. All I'm trying to do is establish the sequence of events, Mr. West. Now let me see if I have the correct picture on it. As I understand it Mr. Jean went down to conduct the final ASW system tests?
A. Right.

Q. In the meantime you pulled him off the job and put him on the reserve sea water tanks flushing job.
A. Right, sir.

Q. During this time you asked for another man to assist you on the ASW system tests, which was sent over to you by Mr. Ross from the DAVEWISH.
A. That's right.

Q. Then your final piece of paper, really written March 7, could have been in the framework of events that I have established, a real preparation for the final test?
A. That's right.

Q. Now it has been testified in this court that the test was completed on the day shift. Were you very busy on the day shift on the 9th, and what were you working on during that period of time?
A. I was not in the Shipyard on the 9th, sir.

Q. Where were you?
A. The 9th was on a Saturday and I was up in the mountains skiing, sir. I left here the night of the 8th and came back to work the 12th, I believe.

Q. Who took over your day shift on the 9th?
A. Mr. Rowell, sir.

Questions by a member, RADM Daspit:

Q. Did I understand you to say the high pressure air system was not a Grade A system, but that you attempted to apply Grade A standards to it to keep it clean?
A. I believe that was my statement, sir.

Q. What standards are prescribed for the ASW, Grade B or C?
A. This would be a Grade B system, sir.

Questions by the President:

Q. Mr. West, during the PSA, were you aware that such tests were being made of sil-brazed joints by the ultrasonic method?
A. Yes, sir, I was aware of this.

Q. Were you required to do any work as a result of some of these tests not passing?
A. Are you referring to me as an individual, sir, or as the shop as a whole, sir?

Q. No, I'm referring to any observations of yours of work going on, either during your shift or turning over?
A. There were ultrasonic repairs made, sir.

Q. Did you observe any of the old joints that were taken out as the result of the failure of these tests?
A. I would say, no, sir, not to my knowledge.

Q. You don't recall having observed any of the old joints that were taken out?
A. I recall an old joint, in fact a couple of old joints down in the No. 3 main ballast tank, which were removed because of ultrasonic failure.

Q. Did you happen to notice the appearance of the old joints; did they appear to be a good bond, or not; did you have any curiosity as to why these old joints failed?
A. Yes, I have a normal curiosity as to why they failed. Looking at a joint just to see if it had overheated to the point where it might have oxidized and formed a carbon so that your alloy would not flow, and the curiosity as to why maybe the alloy had not flowed into the inner land, or maybe why we would get four consecutive no-bond readings in another land.

Q. Did you observe whether or not these old joints seemed to have a good percentage of bond, or not?
A. They had below the minimum requirement of bond, sir, otherwise they wouldn't have been removed.

Q. Yes, the ultrasonic test indicated that.
A. That's right.

Q. But the ultrasonic test required forty percent bond. Did you observe any of these to see whether it appeared to be about forty percent, or ten percent or none? In other words, Mr. West, I'm trying to get you to give the court the benefit of your observations?

A. I understand what you're trying to get me to do, sir; I'm trying to think of an incident where I physically, personally witnessed the ultrasonic test and heard what the readings were. I'm not trying to evade the issue; I'm trying to be able to get a specific case that I witnessed. In the No. 3 main ballast tank, on the fuel oil sill there was a borderline elbow in there, which was in place, and its physical appearance was all right, but I was down in the tank with the man -- technically I don't know what they call it, the meter that is set upon and there is a man up above. This is to take the density of metal, so this is how they tell whether they have a bond, or not, and I watched him. In fact I asked him to go back in one place where he was getting a low percentage bond, because I thought -- it looked to me as if he was getting a fair percentage and still gave a low reading. This elbow was replaced; this was replaced by cutting and sweating off, so this would not give a very good picture when it was off. As it happened this was welded into the top, into your tank top in your outer hull. This was why this was cut off, because it was a welded fitting.

Q. Now, Mr. West, did you, as a result of observing any of these tests, get the feeling that a very few of them were failing, when made on old joints, or a pretty high percentage of them?

A. I would say a fairly low percentage was failing, and considering the fact that this boat was built, started with very little control of this type and then came into the control area at the point where they started X-raying joints.

Q. Well, would you say one out of every two old joints was failing, one out of three, one out of four, one out of ten, or one out of fifty, or did you get any feel?

A. I wouldn't say that I had a feeling for an actual percentage basis, sir.

Q. As a member of the pipefitter part of the Yard force, and in light of considerable effort and development along sil-brazing lines, wouldn't you have an interest to know whether or not the work which had been done by this Yard a couple of years before had, by present standards, stood up well or not.

A. I was very interested in this fact that they had stood up well. I started this boat up on the hill when the keel was laid and I followed it through one phase or another, including the test programs, until she went to sea the first time, and the percentage of rejects is in the back of my mind and I can't bring it out. I know the number of joints checked. Also I know the number of rejects.

Q. Can you quote percentages; was it a low percentage of the old joints that were rejected?

A. I thought it was a low percentage. I thought it could be increased with the type of standards we were using; not the type of standards; with visual inspection rather than by mechanical means, I thought that this was fairly good, sir.

Q. Well, the pride on the work done by your people is commendable, but your knowledge of the percentages of failures is not so commendable. Actually there was one out of three of those old joints which failed to meet present day standards. Now, as a member of the pipefitting shop, and leadingman, that, I think, would have been something that would have registered with you.

A. I'm sorry, sir, I thought it was one out of five; that seemed to be stuck in the back of my head.

Q. It seems to me that one out of five would --
A. I realize that it's rather high, sir.

Questions by a member, CAPT Osborn:

Q. I know that when one of these pipe fittings if rejected, something like a "T", this causes you an awful lot of work. Did you ever physically go and look at one that failed to see if you could see anything wrong with it?
A. This one I made reference to I did look at down in the tank to see if I could physically see if there was a lack of bond. The possibility of overheating, which would cause oxidization, which would stop your alloy -- create a carbon, causing the alloy not to flow.

Q. Now after the BARBEL incident, and the investigation into the silver braze situation, there was a period of time when ultrasonic testing was not available. Did you use any other methods of test in the Yard at that time other than just a straight hydrostatic test?
A. After the BARBEL incident, at that time we came into the era of X-ray; we were X-raying salt water joints, even on brazing. This would give you an indication of a void area where the solder had not been flowed.

Q. Did you ever have any hydraulic shock tests on the system; was this ever used?
A. They used hydraulic shock tests on the 93 boat, but I was not aboard it at the time it was used, sir.

Q. I'm not referring to the hydraulic shock test with respect to the trim drain system; I'm referring to the hydraulic shock test with respect to the salt water system.
A. Not to my knowledge, sir, because I was not aboard the boat at the time they were doing shocks, and this is the first indication that I've had that it was only the trim drain system.

Neither counsel for the court, the court, nor the counsel for RADM Palmer, a party, 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 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 said that he had nothing further to state.

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

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

(b) (6) , a civilian, was recalled as a witness for the court, was reminded that his oath previously taken was still binding, and examined as follows:

COUNSEL FOR THE COURT: Mr. (b) (6) , this is a closed session of the court. You may divulge classified information here. At the end of your testimony I will ask what classification you would accord to it.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Mr. (b) (6) , you are a leadingman pipefitter in Shop 56 at the Portsmouth Naval Shipyard?
A. Yes, sir.

Q. And you served in this same capacity on the afternoon shift at the time of the post shakedown availability of THRESHER?
A. Yes, sir.

Q. Will you describe the work done under your supervision on the trim and drain system of THRESHER?
A. Well, you mean on the testing end of it?

Q. First, the work done on the valves and piping, and describe the tests which were made on the trim system and the drain system.
A. On the trim system down on the AMS there was some changes on new construction put in down there. Offhand, I can't recall exactly what pieces were put in, but there was work done down around the trim pump. The trim pump had a leak in the casting in the body of the pump, and we had to take it out. There was other flanges and other work that was done down there. Just exactly what it was, I would have to refer to records to give you definitely what was replaced or repaired.

Q. Do you have any papers with you to which you may refer?
A. I have test memos here that I had signed.

Q. You may refer to them to refresh your recollection.
A. Okay, sir. (The witness produced some papers in his possession.) Down on the trim discharge, down on the air regenerating room, there was two 3-inch tees, one 3-inch elbow, and one 3-inch flange that were reworked. In the torpedo room, starboard, there was a P-143, one coupling; P-147, one elbow in the AMS; one 3-inch coupling and flow meter; one flow meter and two 3-inch flanges that I had had tested and signed by 303 that this was satisfactory on the hydro that we had on that particular system. Just what the work is, I don't know, but that's the general description.

Q. Would you produce the test memorandum relating to that inspection?
A. There it is, sir. (The witness produced the said test memorandum.) This is a duplicate that I had run off yesterday.

Q. Is this a true copy of that test memorandum?
A. Yes, sir. Mr. Collins has the original.

The said test memorandum was submitted to the court and to counsel for RADM Palmer, a party, and offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 133."

Counsel for the party waived the reading of Exhibit 133.

Questions by counsel for the court:

Q. Mr. (b)(6) , will you tell us the work which was done on the drain system? Do you have anything with which you can refresh your recollection?
A. I have a test memo where we had tested the complete drain system down to the stop valve just before we got to the check valve. I have a test memo on that which was signed. It's going to be a little hard to read this, but Mr. Collins has the other copy, sir.

Q. Will you produce it?
A. Yes, sir. (The witness produced said test memorandum.) This top slip is where it passed through the reactor compartment and the small slip is the station that connected with the reactor compartment. We put pressure on both, and they signed a sales slip stating there were no leaks whatsoever in the reactor room, which is usually welded pipe. I have not checked this, myself, however. I've never been in the reactor room, but I'm almost positive that is welded pipe in there. This memo that I'm going to give you is very hard to read because it is not plain, but Mr. Collins has one that is much clearer. On the back side is one that was done on the midnight shift. That was taken down to the stop valve and from the stop valve to the check valve. This was a test put on by the midnight shift, and they have stated it was satisfactory. As I recall it, there was an O-ring leaking, which they replaced.

The aforementioned test memorandum was submitted to the court and to counsel for RADM Palmer, a party, and offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 134."

Counsel for the party waived the reading of Exhibit 134.

Questions by counsel for the court:

Q. Now, turning to work performed on the high-pressure drain system, Mr. (b)(6) , will you describe the piping work involved in the installation of high-pressure air system manifold in the air regenerating room?
A. On this high-pressure air regenerating room on the starboard side, we started assembling pipes and valves. This station was all rebuilt. This was primarily Mr. Merrill's job, who was the other leadingman on the shift. At the time he was out, I carried on. There was a spell when I had a man fitting out valves and getting welded pipe, and other times there were some gauge lines that I had installed when Mr. Merrill wasn't there. But it was primarily Mr. Merrill's job. When he would be out, I wouldcontinue on with the job.

Q. Were there any final tests conducted during this afternoon shift?
A. Not by me, sir. Whether Mr. Merrill did or not, I don't know.

Unclassified

Q. What instructions did your men have with regard to maintaining cleanliness in their work on the high-pressure air system?

A. Well, to my knowledge, it was a Grade B cleanliness system. We kept all open ends--whenever they have any welding done on the system, any open ends, they would have them covered. It was kept the cleanest possible way we could.

Q. What are the standards involved in a Grade B cleanliness system?

A. Well, it is similar to a Grade A clean system, which is--I'm getting out of my territory now. There shan't be any oil or grease or dirt of any kind, and no minute particles left in the valve, if it happens to be a valve. It would be as clean as it is practically possible to get it.

Neither counsel for the court, the court, nor counsel for RADM Palmer, a 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 or 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.

At this point, the president announced that the court would adjourn to Drydock No. 2, Portsmouth Naval Shipyard, for the purpose of observing a simulated submarine pipe casualty test and demonstration.

The court adjourned at 1250, 2 May 1963.

The court met at 1330, 2 May 1963, in Drydock No. 2, Portsmouth Naval Shipyard to observe the aforementioned demonstration. A description of this demonstration follows:

A test tank was set up in Drydock No. 2 with adequate protection and safety precautions. A 4-inch hydraulically operated ball valve was attached to an outlet in the tank and a 2-inch IPS pipe nozzle was attached to the valve. A surveyed SS radar control panel was set up and anchored approximately fifteen feet away in line of the flow patch.

Unclassified

The test tank was partially filled with sea water and air loaded by an air compressor to simulate submergence conditions. The SS radar control panel was energized with 110 AC power and cameras and lights were set up.

Three test runs were made at different flow rates. The results of this test are as indicated below:

PRELIMINARY SUMMARY OF TEST DATA

Test Run Number	Time of Test Run (sec)	Pres. Prior to Test Run (PSIG)	Pres. Drop During Test Run (PSI)	Ave. Mass Flow Rate (lbs/sec)	Ave. Volume Flow Rate (ft^3/sec)(gpm)	Average Velocity (ft/sec)	(mph)	Average Thrust (lbs)	(tons)
1	(b)(1)	b(1)	(b)(1)	b(1)					
2									
3									

Unclassified

After completion of the test demonstration, all personnel present returned to the regular place of meeting where the court was reassembled.

The court opened at 1355, 2 May 1963.

All the members, counsel for the court, counsel for RADM Palmer, a party, and the reporter, (b) (6) , were present.

No witnesses not otherwise connected with the inquiry were present.

Robert C. Arnold, Jr., a civilian, Mechanical Inspector, Portsmouth Naval Shipyard, was recalled as a witness for the court, was reminded that his oath previously taken was still binding, and examined as follows:

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Mr. Arnold, the court requested that you provide two additional bits of information. The first related to any tests which might have been performed as a result of a joint being replaced in the after auxiliary sea water system and any tests which may have been performed on the system, itself. Do you have a record of such tests performed in the after auxiliary sea water system in THRESHER during her post shakedown availability?
A. Yes.

Q. Produce them, and would you identify them, please.
A. This is a 771 Form, dated 3-7-63. Item 1 on the auxiliary salt water systems includes b(3) 10 USC 130 pumps. This is dated 3-7-63 and is signed by the ship's force, and it is for the entire system. This is the latest one I have on this.

COUNSEL FOR THE COURT: Mr. President, as to this first one which the witness has just described, it is an identical copy of Exhibit 132, already received in evidence.

PRESIDENT: Yes. I just wanted to see if there was any other information on it.

(The said Form 771, Inspection Request, dated 7 March 1963, was examined by the court, but was not admitted in evidence.)

Questions by counsel for the court:

Q. Will you produce the next inspection report which you have?
A. Yes, sir. This was in March.

Q. This one is dated 3 March 1963?
A. 3 March 1963, yes, sir.

The witness produced said inspection report, dated 3 March 1963, and it was submitted to the court, to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 135."
Counsel for the party waived reading of the exhibit.

Questions by counsel for the court:

Q. Please read Exhibit 135 and explain the signatures at the bottom thereof.
A. The signature on the bottom, C. White, would be a 303B-2 Mechanical Inspector. The signature on the top above that is ship's force.

Q. And the name is McCord?
A. The name is McCord, yes. It looks like MM1, I guess.

Q. Describe the nature of the test reported thereon.
A. Well, this is on the stern tube flushing. Without the plan here with me, I couldn't give the boundaries. This is on a number of valves associated with the auxiliary salt water system.

Q. What is your next test record?
A. The latest one after that would be 2-17-63.

Q. February 17th, 1963, is that correct?
A. That's correct.

Q. Will you produce it, please.
A. This is it here.

The witness produced said inspection report dated 17 February 1963, and it was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 136."
Counsel for the party waived reading the exhibit.
Questions by counsel for the court:

Q. I show you Exhibit 136. Will you describe briefly the nature of the test and explain the signatures on the bottom thereof.
A. Again, this is a hydrostatic test of the auxiliary salt water piping system. Without the plan, I'm not sure of the boundaries, but I am assuming it is a complete test. I have no way of proving this. The signature on the bottom is again C. White, who is a 303B-2 inspector. The signature above is R. C. Mattson. I guess TM1 is the rate.

Q. There is a date underneath Mattson's signature, is there not?
A. Yes, sir.

Q. What is that?
A. 2-17-63.

Q. I notice the name "C. White" appears twice at the bottom of this paper.
A. This signature here is this particular man's way of signing this part of the test off.

Q. The first signature means what?
A. That it was hydrostatically tested as satisfactory before he signed it. He sees to it that it is completed and final acceptance is met before he signs it. That is my interpretation of that. Incidentally, not all our mechanical inspectors do it this way, but I'm sure this is what he meant.

Questions by a court member, RADM DASPIT:

Q. Does the fact that one of your men signed off on this indicate that it is new work?
A. No, sir. What I am going by is the date, which indicates it is new work.

Q. In other words, one of your men signed it off on the after ASW system, which is the one you showed us previously?

COUNSEL FOR THE COURT: I show you Exhibit 132, to which the last question relates.

THE WITNESS: No. This particular inspection request, the man that signed this from 303B-2, he inspected Number 3 arrays only. It was signed on the same inspection request. This is all that he accepted--just that part which he signed.

Question by a court member, RADM DASPIT:

Q. So he had no responsibility for the over-all test of the system?
A. No, sir, not to my knowledge.

Questions by counsel for the court:

Q. Would you please produce the next record of tests performed.
A. (The witness produced the said record.) This is dated 2-5-63, and it is accepted only by ship's force.

Q. Would you describe that?
A. Yes, it is the auxiliary salt water system, port, hydrostatic test.

The said inspection report, dated 5 February 1963, was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 137." Counsel for the party waived reading the exhibit.
Questions by counsel for the court:

Q. From an examination of Exhibit 137, can you describe the extent of the areas covered by the test?
A. This would be the auxiliary water to the 8,000 gallon stills, and shows the rejected joints to the integrity. The reason the 303 inspector's name is not on here is that it probably was an afternoon shift, or a Saturday or Sunday. I wanted to be informed of all our hydrostatic tests on the integrity. This is on the continuous vents, emergency propulsion coolers, and check valves up to the hull valve on continuous vents. This is part of the ASW aft.

Q. Please produce the record of the next test, and identify it for us, please.

A. (The witness produced another inspection report.) This is a hydrostatic test dated 12-8-62. It is on the auxiliary salt water, aft, the pipe associated with the auxiliary b(3) 10 US pumps.

The said inspection report, dated 8 December 1962, was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 138."

Counsel for the party waived reading the exhibit.

Q. Please refer to Exhibit 138 and describe the nature and extent of work accomplished, and explain the signatures thereon.

A. As I said before, this is auxiliary water, aft, the pipe associated with b(3) 10 USpumps. As to the boundaries, whether it is a complete test or not, I would have to check with the plan. The signature of the 303B-2 inspector is on here, and the signature above it is--I believe it's R. C. Babcock, or Belcock, Lieutenant (jg), USN.

Q. Would you interpret that signature to be a member of ship's force?

A. Yes, sir.

Q. Your next inspection report, please; would you identify it?

A. This is auxiliary salt water overboard discharge. I believe it is an internal test for the hull valve only. This is what it appears to me. Here, again, it is signed by the ship's force and a 303 inspector.

The said inspection report was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 139."

Counsel for the party waived reading the exhibit.

Q. Refer to Exhibit 139 and explain, if you will, the signatures and the date.

A. This, again, is the ASW overboard discharge for ASW 57. The signatures are a 303 mechanical inspector, and the signature above it is R. P. Bram, or Barnes, FN2. I would take this to be a ship's force signature.

Q. Do you have other records of tests going back to August of 1962?

A. Yes, sir.

Q. Will you produce them?

A. (The witness produced another inspection report.) This is the air conditioning system, salt water. This was when the ship first came in. There was a hydrostatic test put on the systems. Everything on it is noted as to exactly what took place.

The said inspection report was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 140."

Counsel for the party waived reading the exhibit.

Q. Refer to Exhibit 140 and explain the nature and extent of the work covered by it and the signature and dates thereon.

A. The first page of Exhibit 140 is a hydrostatic test put on the salt water suction and discharge for the air conditioning system, port. The system was lagged. The pressure drop was noted. The request is signed by a 303B-2 inspector. The other page is again the starboard air conditioning salt water system, and the system was lagged. A test was held for one hour. A pressure drop is noted. It is signed by two mechanical inspectors and a ship's force signature that I can't identify.

Q. Is it John S. Regan?

A. John S. Regan, MM1.

Q. And the date?

A. The date is 8-2-62.

Q. Were you able to find any additional inspection records for the auxiliary sea water system of THRESHER.

A. No, sir.

Q. Another request made to you by the court was to obtain certain information with regard to ultrasonic tests conducted on old existing joints in THRESHER during her post shakedown availability. Do you have such a compilation and record?

A. Yes.

Q. Produce it, please.

A. Here it is.

The witness produced said report.

Q. What is the subject of this report?

A. The subject would be the U.S.S. THRESHER Silver Braze Joints 2 inches and Over; Sea Water Integrity Inspection of. It shows the twenty rejected joints and the percentage of bond, and the reason for rejection.

The said report was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 141."
Counsel for the party waived reading the exhibit.

Q. Please read Exhibit 141 and explain the data appearing thereon.

A. This is a summary of the twenty original rejected joints, the percentage of bond, and the reason for rejection. The twenty are listed by plan, system, and size of fittings. I can read each individual one, if you wish.

PRESIDENT: I don't think it is necessary.

Q. Do you have in your possession a Portsmouth Naval Shipyard Instruction dated 3 October 1962, which established acceptance standards for ultrasonic tests of sil-braze joints, non-nuclear?

A. Yes, sir.

Q. Produce it.

A. Here it is.

Unclassified

Q. Please read the instruction number.
A. It is Production Department Instruction 4855.2 (303A).

The said Portsmouth Naval Shipyard Production Department Instruction 4855.2 was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 142."

COUNSEL FOR THE COURT: Does counsel for the party waive the reading of all papers unless otherwise indicated?

COUNSEL FOR RADM PALMER: That is affirmative.

EXAMINATION BY THE COURT

Questions by a court member, CAPT HUSHING:

Q. Mr. Arnold, I believe, in connection with Exhibit 132 you stated your opinion that that was a test for the entire ASW system aft; is this correct?
A. Yes, sir. This is the way I read it. It says, "Item 1 of the entire ASW system, including b(3) 10 USC 130 pumps. It also includes Number 3 PUFFS.

Q. Other than reading that, do you have any knowledge that this was to cover the entire system?
A. No, I wouldn't know, other than reading this.

Q. In connection with the initials "K.N." on that exhibit, what do they stand for?
A. It stands, as I read it, for the inspection of No. 3 PUFFS only.

Q. Do you know who K.N. is?
A. Yes, sir.

Q. Who is he?
A. A fellow inspector.

Q. What is his name?
A. Ken Newsom.

Q. Are your inspectors charged directly to the jobs, or are they all charged to overhead?
A. If a job order issues testing of a system and includes us in the job order, then we are charged to the job order. There are some cases where we would be charged to overhead.

Q. How about this occasion? Would it be a direct charge to overhead?
A. As I look at the job order, Job Order 5612, for salt water testing, we were included on that, I would say.

Q. It would be probable, then, that we could find the labor charge for Mr. Newsom for that particular test?
A. I couldn't answer that. I don't know. This is in our bookkeeping records. I don't know.

Unclassified

Questions by the president, VADM AUSTIN:

Q. Mr. Arnold, you indicated in your testimony that the ultrasonic testing which you had done caused you to feel that more should be done, and that a memorandum was written in November asking for permission to do more and to remove lagging as necessary to do such. Is that correct?
A. Yes, sir.

Q. Who initiated that memorandum?
A. That was the one from our office?

Q. That is correct.
A. I had some part in it. My supervisor wrote it and signed it.

Q. And his name?
A. Robert Fite.

Q. Mr. Fite. When that memorandum was answered on 4 December, I believe, denying permission to remove lagging for additional tests, were any representations made at any level of authority in the Yard to try to get a reconsideration of that decision?
A. To my knowledge, no. That letter was written in advance of work that I still had to do of the unlagged portions, but by the time I got done with the unlagged portion, I wanted to know whether I could do it all or not. Whether there was any other explanation other than these two letters, I wouldn't know.

Q. So, to the best of your knowledge, there was no reclama of this decision by the 303 code?
A. No, sir.

Q. Do you recall when you finished your ultrasonic testing of the unlagged parts of the system? Just roughly. I don't want the exact date.
A. It was either just before the end of the year or just afterward.

Q. Just before or just after the new year 1963?
A. Yes, sir.

Q. After you had completed your ultrasonic testing on the THRESHER, were you shifted to another ship, or what was your occupation from that time up until April?
A. I worked THRESHER from August until February 22nd.

Q. What type of inspections were you making between the turn of the year and February 22nd?
A. I was making all that I could in the areas of silver braze, hydrostatic tests, mechanical tests, insulation inspections -- the routine end work done by any inspector.

Questions by a court member, CAPT HUSHING:

Q. Mr. Arnold, I believe you have now given us all complete inspection memoranda relative to the tests of the ASW system on THRESHER?
A. All that I have, yes, sir.

Q. Do you know of any other memoranda, letters, or other documents relating to the ASW system in THRESHER which would shed light on its state of completion as regards testing towards the end of the availability?

A. Yes, sir. There was a test memo issued covering the new installation of continuous vents and their new valves. This was primarily written for a flush and soak test on this system. Why I didn't bring that with me is because it didn't involve the integrity. This was a test document that was done and was witnessed and signed by 303 personnel. This is in our records.

Q. Can you think of anything else?

A. No, sir, I cannot.

Q. Did you have any discussion with any of the other inspectors involved in THRESHER to get any feel for whether the ASW system was finally tested in its entirety?

A. The only one I did was this exhibit which we have here (referring to Exhibit 132). This is the only one I discussed with Mr. Newsom on. I left the boat on the 22nd of February and didn't get back on it until just recently. This is the last document on which I witnessed a hydro on.

Neither 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 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) relieved (b) (6) as reporter at this point.

Robert E. Boutet, a former witness for the court, was recalled as a witness for the court, reminded that the oath he had previously taken was still binding, and examined as follows:

DIRECT EXAMINATION

Questions by counsel for the court:

Q. You are Robert E. Boutet, Leadingman Machinist, Shop 31, are you not?
A. Yes.

Q. You worked in Shop 31 until the first of April, is that right?
A. Until the first of April.

Q. And now you are assigned to the Production Engineering Division of the Portsmouth Naval Shipyard?
A. Yes, sir.

Q. Referring to the work which you supervised in THRESHER during her post shakedown availability period, describe to the court the work done under your direction on the trim and drain system of the ship?
A. The trim and drain system, we had the ball valves, which was done on the same DM that the ASW valves was done on --

Q. That's a Design Memo, is that it?
A. Yes, sir, the one that I had discussed yesterday.

Q. Will you describe the procedures for the work and the tests which were performed?
A. The procedure of the work was for the ball valve to come into Shop 31 to be disassembled and visually inspected for corrosion and pitting, both on the seating area and in the ball. This was done, a condition report made on some of them. Some of them did not have a condition report because Design wanted to visually inspect these and decided it would be a lot of extra work to put a condition report out.

Q. Do you have a list of the ball valves worked on which were removed from the trim and drain system?
A. Yes, sir.

Q. Produce it.
A. Any valve on this list which is referred to as a "TD" valve is a trim and drain valve. The trim and drain and the ASW and the CG's and EX valves are all on this same list, but the valve can be identified by a "TD" preceding the number.

Q. And is this list complete and correct to your knowledge?
A. This list is complete and correct to the best of my knowledge.

The list of ball valves worked on in Shop 31 from the trim and drain system of THRESHER was submitted to the party and to the court, and was offered in evidence by counsel for the court. There being no objection, it was received in evidence as Exhibit 143.

Counsel for the party waived reading the exhibit.

Unclassified

Q. Would you refer to Exhibit 143. Do you have any further explanation to offer regarding it?
A. I would like to offer the explanation, as you know these valves were covered on two shifts, which part of the work I supervised in one stage, and Mr. Painchaud supervised in another stage, and Mr. Carl supervised in another stage. The biggest majority of the testing on these valves I did the supervision on.

Q. Do you have in your possession a BuShips Instruction 9480.40 entitled, "TESTING OF SUBMARINE SEA VALVES: (SS212-515), GLOBE, ANGLE GATE, INCLUDING MANIFOLD," which sets forth the precedures under which the tests are performed?
A. Yes, sir, here it is.

Q. Does this copy of instructions which you have produced constitute excerpts from the Bureau of Ships Instruction?
A. Yes, sir.

Q. Is it a true and correct copy of the excerpts?
A. To the best of my knowledge, it is a true copy.

Excerpt from BUSHIPS INSTRUCTION 9480.40 was submitted to the party and to the court, and was offered in evidence by counsel for the court.

There being no objection, it was received in evidence as Exhibit 144.
Reading of the exhibit was waived by the party's counsel.
Q. Turning now to the work performed on the air systems on THRESHER under your supervision, will you describe in some detail the work done on the reducer valves of THRESHER's high pressure air system, not only the b(1) but the b(1) ?
A. Yes, sir. The valve comes to us with the Work Process Sheet which instructs us, the number of the valve plan pertaining to the valve. This valve is taken into our high-pressure test section, it is disassembled, all parts inspected, and invariably it calls for a Condition Report. We list all items that need to be replaced. On a Marotta type, which you are referring to, the poppet is the main source of trouble. These poppets are not machinable; they have to be replaced by the vendor. The nylon sheet has to be replaced by the vendor. The "O" rings and the back-up rings we are able to buy out of our Shop Store in Shop 31. This valve, if it shows any pitting at all, we re-lap -- excuse me, let me retract that statement and give it in sequence. If the seat has any pit marks, which is an unreplaceable seat -- some of them have a false seat that is replaceable and some the seat is incorporated right into the body, it is part of the initial metal that is cast into the body -- this we re-cut with a hand tool to the right degree with tools special made for this valve. Then we take a lap which has the same angle and we polish this seat. After this is all done the valve is washed and cleaned and wiped dry.

Q. On what system were the Sargent type of valves used?
A. The Sargent type of valves were used on an air system.

Q. Were they used on the b(1) per square inch?
A. I could not tell you the reduction side of the valve, but I do know it was used in the b(1) air system.

Unclassified

Q. What were the major problems you encountered in working with the high pressure air systems of THRESHER?

A. The main problem was foreign matter and dirt in the system. This would show up on the valve poppet and seat. And when I am talking about dirt, I wish it would be understood that I'm talking in fine particles. Some of these pieces were probably ten-thousandths in diameter, and probably the largest piece we would ever have would be a sixteenth, which was very seldom. The biggest majority of the time it was a fine particle, and most of these pieces it would become embedded in the body. To give you a fair idea of how large or how deep they penetrated, probably two or three thousandths removal of the stock would bring the seat back to its original operating condition.

Q. Did you find any particles of copper in these valves?

A. Sir, in regards to actually identifying the material, some of it was so small I could not tell you if it was copper, CRES, steel, or a sand-blast, or a flux.

Q. Do you have in your possession the Portsmouth Naval Shipyard Process Instruction No. 513.1C, entitled "Cleaning and Cleanliness Maintenance for High Pressure Air Main Ballast Tank Blow and Ship's Service Air Systems"?

A. I do, sir; there it is.

Portsmouth Naval Shipyard Process Instruction No. 513.1C was submitted to the party and to the court, and was offered in evidence by counsel for the court for the purpose of reading into the record an extract therefrom. There being no objection, it was received in evidence as Exhibit 145.

Counsel for the party waived reading the exhibit.

Q. Would you please read the paragraph entitled "Purpose"?

A. "Purpose. To establish the procedures for testing, attaining and maintaining a specific degree of cleanliness for air piping systems for new construction and repair. Cleanliness is required to enable operation without fouling hazards to operating mechanisms and equipment."

Q. This Instruction relates to new construction as well as repairs?

A. It does, sir.

Q. Referring to Exhibit 145, were these standards of procedure prescribed in Exhibit 145 employed by the personnel under your supervision, both in the shop and on the ship, when they worked on the high-presuure air main ballast tank blow and ship's service air system?

A. To a certain extent.

Q. Please describe the extent?

A. To maintain a Grade B Cleanliness, you should have an encapsulated area to work in, with approximately one degree above atmospheric pressure so when anybody opened the door there would be no airborne dirt or matter induced into this room. These conditions we do not work under in Shop 31. Our air test section is completely right in the open adjacent to the Machine Shop. Welding, grinding, was within, I would say, approximately fifty to seventy feet away. Through out effort of using clean wipes and lint-free cloth and conscientious effort of the men, we are able to assemble and control the conditions of the valve. This required a lot of effort on our part.

Q. Will you describe the tests that were run on the reducer valves and give the results of those tests?
A. Yes, sir. The reducer valves -- you're referring to Marotta's or Sargent's?

Q. Both. Treat them separately.
A. Basically the tests are the same and when we run a test on a Marotta Valve or Sargent Valve we have a technical manual which tells us just how to proceed with this test. I can give you a general description of it, but it won't be exactly as worded in the book.

Q. Proceed.
A. We overhaul the valve, assemble and mount it on our test stand. We mount it on our test stand; we induce b(1) pounds of air or whatever the plant calls for on the pressure side of the valve, the inlet side of the valve. The downstream side of the valve is left open. This is the first test that is run on a Marotta Valve. This gives us a check to see that the poppet is holding the pressure and not letting it out into the downstream side of the valve. We do this by a soap bubble across the face, and we have another mechanical device which is just a round wafer with a flexible plastic tube coming out. We hold this flush against the outward face and immerse the tube in water. If a bubble signifies, we know we have a leak. One bubble, an inspector will not pass it. This has to be an absolute tightness test.

Q. It is our understanding that there were recurring problems with the Marotta Valves in the high-pressure air system, the Marotta High-Pressure Valves. The valves, therefore, were continually brought back to your shop for checking, were they not?
A. Yes, sir.

Q. Were you able to form a judgment as to whether the trouble was in the valves or in the air system itself which resulted in trouble to the valves?
A. The trouble was not with the valve itself. These valves will not operate with the slightest -- and when I mean slightest, I mean anything that can go through a ten micron filter -- they will not operate, they will leak -- and when I mean leak, I don't mean a volume of air, a massive volume of air, I mean a slight leak. This would raise a bubble, a soap bubble, across the face port before it could evaporate in the atmosphere. So it has to be a very, very slight leak without breaking the bubble. When we are talking about leaks, that is the condition we are talking about. It does not mean the valve is inoperable. This valve is very operable. But your downstream side, your reducer, is set so close it would start to leak; and also, you have a built-in relief valve in the reducing valve itself, and this would vent back out into the ship compartment.

Q. You have described the amount of shipyard and factory re-work required in certain cases with these precision air valves. Based on your experience with them, did you develop any concern as to whether the ship's force could maintain these valves in proper operating condition over a period of years?
A. From the past experience that I have had with Marotta Valves and Sargent Valves in the system, after a boat has been put back in service, after an overhaul, within a few months the biggest majority of the particles and airborne dirt that is in the system is eventually eliminated either through the reducers or through the relief valves, and after that period I don't believe they have any trouble to amount to anything that weekly or monthly maintenance wouldn't take care of. May I cite an example?

Q. Certainly.

A. We have a Marotta system in a high-pressure test in Shop 31 and we use practically the same type of a valve, only it's on a smaller scale, and we have very little trouble with it. If we make a minor repair to our system, and, as you know, airborne dirt can get in there -- a man is not infallible, he lets it in, can't help it -- we have trouble for a few weeks till we eliminate this dirt and after that our system runs very good.

Q. I show you Exhibit 144 again. This is an excerpt from BuShips Instruction 9480.40, you have testified. Does this list all the procedures in that instruction relative to the testing of the submarine sea valves enumerated there?

A. For a shop test, yes.

Q. Then these are the instructions from which your shop people work?

A. These are the instructions from which our shop people work. There is a copy of these posted in our test room.

EXAMINATION BY THE COURT

Questions by a member, CAPT Nash:

Q. Do I understand that your responsibilities were limited to work done in the shop in Shop 31?

A. Yes, sir, just components that came into Shop 31.

Q. From your observation of the components that did come in and the contamination that was evident therein, can you help us to understand in any way the contamination that developed on board ship?

A. I believe I could, sir. I think they have the same problem that we have in Shop 31 in regards to maintaining Grade "B" cleanliness. As you know, you open a pipe and there is airborne particles in the air, and if they should land on there before you could cap it, it would be induced into the system. And I believe flushing a system does not eliminate all the dirt that could be in the system. There is low spots, I imagine, where foreign matter could lay. And the system is actually with a hundred pound -- between seventy and a hundred pounds of yard service or hot water flush, and when you go from a hundred pounds to b(1) pounds, it induces the dirt to travel; and your first source of travel in that would be your Grove reducer where it reduces from b(1) pounds down to whatever service is working aboard the ship.

Q. Did you say "Grove reducer"?

A. Marotta reducer.

Questions by a member, CAPT Osborn:

Q. Mr. Boutet, do you take any special precautions with respect to the air you use in the shop?

A. We certainly do. We have a 5.2 cubic foot Ingersol-Rand Air Compressor. She has four ten micron cuno filters on it. These filters are changed every eight hours, with the exception if we are running a continual test we do not shut it down, because actually we don't induct that much dirt when we're doing a job like this. These filters are electrically alternated from one side to another. When one filter reaches a certain dew point, it shifts to the other side.

Q. Now when a ship is undergoing overhaul, the ASW systems and the air compressors quite frequently are out of the ship for a long length of time. What special precautions with respect to yard air and high pressure air are used in this yard with respect to delivering to b(1) pound systems?

A. I wish you'd word the question again, sir. I'm a little bit confused in your "yard air" and your b(1) pound system."

Q. I'm trying to get b(1) pound air from the yard into the submarine when the submarine's generating equipment is out of commission during overhaul?

A. Yes, sir.

Q. What I want to know is, what special precautions are taken to be sure that air meets the requirements of the valves installed in the system?

A. Sir, I do not know, because Shop 38 has that part of the portable air compressor that would handle that charging. The only thing I do have is when we have a set of spare bottles that come over, they have a set of portable bottles, flasks, that we do charge, but this is on a b(1) pound system.

Q. When you've observed this dirt in the valves, have you actually gone down and looked to see how they charged the system?

A. No, sir.

Questions by a member, RADM Daspit:

Q. You indicated that Shop 31 did not have adequate facilities for maintaining Grade "B" Cleanliness. Do you know of any steps that you could take to provide such?

A. Yes, sir, there have been letters put into the Production Engineering Division to have this taken care of.

Q. Do you know whether it is planned new?

A. It is in the planning stage right now.

Questions by the president, VADM Austin:

Q. When was this initiated, Mr. Boutet?

A. Sir, I could not tell you the date.

Q. Within the month?

A. Probably longer.

Q. During April?

A. As a leadingman from Shop 31, I have had high pressure air for a period of, off and on, for twelve years, and this is something we have been trying to get done through a Shopping List -- what we call a Shopping List -- having material bought for us to help us get a better control over our system. But actually I could not tell you the dates or the time the letters went in. Probably the foreman or Mr. Letch in Shop 31 could.

Q. Did the loss of the THRESHER perhaps help to expedite the affirmative answer on this request?

A. Yes.

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 made the following statement:

WITNESS: I would like to make one comment in regards to Marotta Reducers. The number of reducers that came in and out of Shop 31 is not anything excessive that has gone on in any submarine previous on an overhaul or new construction.

Questions by the president, VADM Austin:

Q. Are we to understand that that statement applies to the number of Marotta Valves that came into your Shop 31 from the THRESHER?
A. Yes, sir.

WITNESS: May I make one other statement, sir.

PRESIDENT: Yes, indeed, anything you wish. It doesn't even have to have to do with air systems.

WITNESS: I would like to make it on the Marotta, on the reducer valves. The Marotta actually is a new valve to us. When I say "new," it's probably six or seven years that we have been handling it, probably a little bit longer. Now people get confused. There are five Marotta Reducer Valves. There could be one out of each different system come into the shop, and when we list it on a work process card, we list it as a Marotta Valve. Anybody sees this card in the shop, they say, "This is a Marotta Valve back in again." They do not realize that there is three or four different services, a b(1) pound reducing station, a b(1) pound reducing station; there's a b(1) pound reducing station. And they still think it is just one Marotta Valve.

Questions by a member, RADM Daspit:

Q. Do you, from your experience, know of any other valve which could replace the b(1) Marotta Valve and be more reliable?
A. I am no engineer, but from practical experience if the Grove people should put out a valve that had the velocity and the area to handle the air required, I would be willing to try a Grove Reducer instead of a Marotta.

The witness stated that he had nothing further to say.

The witness was duly cautioned concerning his testimony, categorized his testimony as not classified, and withdrew from the courtroom.

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

COUNSEL FOR THE COURT: This is a closed session of the court, Mr. Miner, and you can divulge classified information here. At the end of your testimony I will ask you what classification you accord to the testimony you have given.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Will you state your name, address and present occupation?
A. Walter A. Miner, machinist, inside; address, (b) (6)

Q. (b) (6)
A. (b) (6)

Q. And you work in the Inside Machine Shop, Shop 31, of the Portsmouth Naval Shipyard?
A. Yes, I do.

Q. What is your background and experience in your present job?
A. Well, I've been about fifteen to eighteen years in assembly work, high pressure air, Shop 31, as a machinist.

Q. Did you do actual work on the day shift on the reducer valves from THRESHER during her post shakedown availability?
A. Yes, on some.

Q. Now you worked right up until the end; is that right -- when she put to sea?
A. I worked on the weekend before the THRESHER went to sea.

Q. Mr. Boutet left your shop on the first of April, did he?
A. I couldn't say just when, but it was somewhere around then.

Q. Were you working on valves from THRESHER as late as the 6th and 7th of April?
A If that was the weekend before the THRESHER went out, I did.

Q. Can you describe the work that was being accomplished during that first week in April?
A. Well, if this relates to the Marotta Valves, Number AHP 29 and 30, we did overhaul them.

Q. Tell us what work you did and what you found with reference to the valve?
A. The valve was brought into the shop. The supervisor brought the valve to us and told us to repair it. We get the plans out, disassemble the valve, check it.

Q. What did you find?
A. We found dirt -- that is small, I'd say something somewhere around five-thousandths, six-thousandths in size. I couldn't swear that it was that exact size because I didn't "mike" it.

Q. Did you work on three or four of such valves during that first week in April?
A. We had two or three. I wouldn't say just how many, but I know there were several valves in and out.

Q. All from THRESHER?
A. No. Some of them came off the other boats, some other boats.

Q. We are only interested in the work required to be done in the first week of April for THRESHER?
A. That would be the Marotta Valves, yes, sir.

EXAMINATION BY THE COURT

Questions by a member, CAPT Osborn:

Q. AHP 29 and 30 are the b(1) reducers. Mr. Miner. What was the trouble with these reducers? Was it minor trouble or major trouble in terms of valve operating?
A. It was a minor detail in terms of dirt in the system, that when it does, would get in the system and under the poppets, they would leak; and, therefore, your valve wouldn't be efficient. Now when I say "efficient," you would have a leak from b(1) pounds down. That would be on your vent side.

Q. How would this affect the system in terms of operation? Would it mean that you wouldn't have a reducer?
A. You would have still b(1) pounds as long as your banks were up. What their set-up is on the boat, I don't know. In our particular case in the shop, our compressor cuts in at b(1) pounds and shuts off at b(1) Now whether the THRESHER had that particular type of set-up, I don't know.

Q. What I am particularly interested in, Mr. Miner, is are the troubles that you looked at in the last week on the 6th and 7th of April on THRESHER's valves, troubles that would cause you to have no air or minor leak around a poppet into the compartment?
A. Well, that would be the Marotta Valve, Air High Pressure 29 and 30, and that would be dirt under your vent poppet. Occasionally if it came into your pressure side then you wouldn't have b(1) But in most cases we have found that the pressure side was in fair condition, that the vent side leaked considerably. I will say this, we have a valve that came off the THRESHER in the shop now, and the valve that we have was replaced by one off the other boats. And the reason this valve was in the shop, it leaked quite badly, the seat was quite pitted, and we didn't have parts to repair it; that's why it's still in the shop.

Questions by the president, VADM Austin:

Q. Mr. Miner, when you say "dirt," you do not mean dirt in the sense that, "He hit the dirt," do you?
A. No, sir.

Q. You mean dirt in the sense of a foreign particle that might get in your eye and cause it to be irritated, do you not?
A. I would say dirt that came through your system.

Q. Well, is "dirt" a good description of what you're talking about?
A. Well, I describe it in my Condition Reports as foreign metals. There is a certain amount of oil, which is very, very little.

Q. Shouldn't it be called foreign particles?
A. It could be, sir.

Q. It wouldn't be necessary for a particle to be metal to cause this malfunction then, would it? If it were a little piece of sand or grit, it would have the same affect, would it not?
A. On this particular type valve, yes. But most of the time if you find a shiny spot in there, we try to take it out, wipe it -- that is, wipe it out, and put a glass on to determine just what's doing it.

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 made the following statement:

WITNESS: I have nothing to say on the valves, sir, other than the fact that on our Sargent Reducing Valves, I did overhaul one of them one day that there was a considerable amount of copper chips in it -- that is, very fine, like you'd cut off from a hacksaw; and that was brought before a board, I believe, by Mr. Charlie Downing here, some time ago.

Questions by the president, VADM Austin:

Q. This is from the THRESHER?
A. I will not say because I'm not sure, sir.

PRESIDENT: Well, we are primarily concerned about work done on the THRESHER.

WITNESS: I do know this, that those particular valves, your Marotta Valves 29 and 30, and your Sargent Valves, they swap back and forth occasionally. If one leaked on the THRESHER and they needed it right off to keep in operation or test, they would borrow from another boat.

Questions by the president, VADM Austin:

Q. But you cannot be sure that this valve that you found copper chips or filings in was from the THRESHER?
A. No, not unless we looked on the records, sir.

Q. And it was investigated at the time?
A. Yes, it was, sir.

The witness stated that he had nothing further to say.

The witness was duly cautioned concerning his testimony, categorized his testimony as not classified and withdrew from the courtroom.

The court recessed at 1522 hours, 2 May 1963.

Unclassified

The court opened at 1545 hours, Thursday, 2 May 1963.

All persons connected with the inquiry who were present when the court recessed were again present with the exception of (b) (6) who was relieved by (b) (6) as reporter.

No persons not otherwise connected with the inquiry were present.

Mr. (b) (6), a civilian was recalled as a witness, was reminded that his previous oath was still binding, was advised that at the conclusion of his testimony he would be requested to place the highest classification on his testimony that he considered applicable, and was examined as follows:

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Your name is Mr. (b) (6) and you are a quarterman outside machinist in Shop 38?
A. I am a leadingman machinist. I was project quarterman on the 593 boat, THRESHER.

Q. The actual THRESHER work was done mainly by Mr. Palmer, was it not, in your Shop?
A. There were three leadingmen involved in the THRESHER overhaul on the day shift. Howard Sholtz, Arthur Woodworth and Frankie Palmer, and myself as quarterman.

Q. Mr. Palmer was lost at sea?
A. Lost at sea, yes, sir.

Q. Can you discuss from memory the work performed in THRESHER during her post shakedown availability in the trim and drain systems by personnel of your shop?
A. Yes.

Q. Have you made notes to help you refresh your recollection?
A. Yes, sir.

Q. Were part of those notes taken from Mr. Palmer's writing?
A. No, sir, they were not.

Q. They are your own?
A. They are my own, yes, sir.

Q. Please describe the work done in the trim and drain system.
A. On the trim and drain system? On the trim and drain, we had nothing on trim or drain pumps. The drain pump motor, 38 did remove and ship to 51 for balancing, and whatever other work they had to do. The pump was left. The trim pump in AMS when we went to put pressure on it, test pressure on it, leaked when we got to b(1) pounds. The pump is a split Ingersoll Rand pump, and we did in fact, take it apart on the ship and install a new gasket. The first time we brought it up to pressure after the new gasket was put on it, it leaked again and we had to redo it. The next time it did take the full pressure. Trim and drain ball valves, as we discussed yesterday were the same thing, with a Teflon coating, and they were removed from the ship and sent back to 38 and

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were installed.

Q. Did you have any difficulty with the actuators?
A. I could not distinguish which actuators. As I told you yesterday, some four to six actuators; I was speaking of actuators as to both the hydraulic -- all actuators on the ship. I was talking about some four to six that I could recollect.

Q. Were any of the actuators in the trim and drain system installed backwards to your knowledge?
A. Not to my knowledge, no.

Q. Is there anything else you can tell us about the work done on the trim and drain system, Mr. (b)(6) ?
A. No, sir, there isn't.

Q. Now I would direct your attention to the work performed under your supervision in the air systems in THRESHER.
A. Yes, sir.

Q. Would you describe what work was performed in those systems?
A. Both 1 and 2 air compressors were removed from the ship. The air regenerating room, as you know was altered or changed, and these air compressors were turned around so they were running fore and aft and put on a single foundation and bed plate. The overhaul of the compressors was extensive and we had company people here, company personnel that worked on them--Ingersoll Rand people. We did not sell the air compressors to ship's test. We sold them to the ship on an eight-hour static run, both 1 and 2, an eight hour load run. And they were bought--well, one I am sure of, Number 2 compressor was bought by Chief Johnson. I am not positive who bought Number 1. We did experience minor leakage on Number 1. 2 was excellent and we repaired Number 1.

Q. Is that the extent of the work done on the air systems of THRESHER?
A. On the air compressors.

Q. Was there other work done?
A. The other work, we had a modification of the ball valves in the system and this is from a DM that called for bleeder ports in these small ball valves.

Q. A design memo?
A. Actually, it was a design memo--I believe it was a change order. Actually, it was a change order. That is a design memo 2648520-61. Now most of these valves, a lot of them, mainly half-inch were sent over to 31. The five hull stops in the boat we changed over and this was to prevent a full opening of the valve. The handles were plactisoled and installed.

Q. Did you do any other work besides that that you have described?
A. No, sir.

EXAMINATION BY THE COURT

Questions by the president:

Q. You spoke of Ingersoll Rand personnel overhauling the compressors.
A. Yes, sir.

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Q. Was that due to the fact that the work to be done was of a peculiar nature requiring peculiar equipment or was it because it required peculiar skills?

A. I don't know that, sir. I don't know how that came about. It was - change over, naturally, from cellulube to mineral base, and the repairs were extensive, but I don't know how we called those people in here.

Q. You don't know whether it was because of contractual responsibility, or on the basis of hiring experts-you don't really know?

A. No, sir, I don't.

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

The president 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 states as follows:

WITNESS: I think that the drain pump on the 585, I am not sure whether it was trim or drain, experienced the same trouble and had to have a gasket reinstalled in it, and it seemed odd at the time why we didn't notify the manufacturer as to this weak point which is just a shade on--a little more casting up at the upper end of it and it would have eliminated this, and that is why it was done twice, due to cutting the gasket.

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

Mr. (b) (6) , a civilian, was recalled as a witness for the court, was reminded that his previous oath was still binding, was advised that at the conclusion of his testimony he would be requested to place the highest classification on his testimony that he considered applicable, and was examined as follows:

DIRECT EXAMINATION

Questions by counsel for the court:

Q. You are Mr. (b) (6) and you were employed as leadingman on the afternoon shift in the outside machine shop, marine, in the case of the post shakedown availability of USS THRESHER?

A. That is right, sir.

Q. Will you please describe the work done under your supervision on the trim and drain systems of THRESHER during her post shakedown availability?

A. This is the post shakedown availability?

Q. Yes.

A. We removed the drain pump motor that went over to 51 for new bearings, and the sea suction valve to trim pump, the overboard discharge. Those were pulled for Teflon coating. And the actuators naturally came off all the trim and drain valves. The swing checks were changed on the drain lines. to the

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bilges that is. There were more valves taken out for Teflon coating but I don't just recall those right now.

Q. With reference to the actuators of the trim and drain valves, do you know of any instances in which they were installed backwards?
A. There was only one on the drain system installed backwards to my knowledge. That was corrected.

Q. Was that done accidentally?
A. Accidentally, of course, sir.

Q. Was that corrected?
A. Yes, sir.

Q. Who discovered this installation backwards?
A. Well both the crew and us. This was on pumps, the bilges; we went through a trial of pumping each bilge pocket and this is positive. We checked for positive indication and operation.

Q. Is there the same difficulty, of detecting a backwards installation in advance, with reference to the trim and drain system actuators, as in the case of your testimony earlier?
A. Yes, they are the same thing.

Q. Did you perform the operation of the trim and drain system to the satisfaction of the ship's crew?
A. Yes, we did, sir.

Q. Would you describe that?
A. We pumped forward trim to after trim with our trim pump naturally and negative tank, and we didn't go into the collecting--the waste fuel oil or fuel lube oil collecting tank because they didn't want to get anything into their system. They had been running into turbine oil and stuff like that. So everyone was satisfied with the trim pump. We also, or course, ran on the garbage disposal unit. We cross-connected from the trim pump to the drain pump and ran through the same procedure. We actually put water in each bilge and pumped with our drain pump. We did not use the trim pump through the cross-connect on the drain because they didn't want to get any possible dirt into that trim pump or trim system.

Q. When did you do all of this?
A. This went on over a period of, I'd say, four or five nights on different occasions. This was for the first class auxiliary man and he was a very conscientious man and wanted to be sure that everything was right. We didn't have any test memo to do this that I remember, but this we done to satisfy him.

Q. Can you recall whether all of this was done before the first fast cruise in THRESHER?
A. Yes, it was, sir.

EXAMINATION BY THE COURT

Questions by a court member, Captain Osborn:

Q. Where is that check valve in the drain pump--how close to the pump is it located?

A. The check valve?

Q. Yes.
A. Maybe you know there is a foot valve just above your strainer, your drains going down into your bilge pockets are encased in a strainer and a little ways above it you have your swing check.

Q. Where is the exact position with respect to the location of your discharge to your waste oil tank remote operated?
A. That I couldn't tell you, sir.

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

The president 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 as follows:

WITNESS: There is one thing, I want to add, sir, as to these ball valves. You can make them foolproof because it takes a little modification, quite a bit of modification, I imagine if you want to get into the valve it could be foolproof, but the present actuator we could modify that stem so we could actually look down through it to the top of the ball valve. If they actually want to give us a Design man, I could go along and show them how to do it. I could make that valve foolproof as far as open and close, sir.

RADM DASPIT: Doesn't the yard have a system provided for beneficial suggestions?
WITNESS: Yes, sir, but in the rush of getting a boat ready, you know--

RADM DASPIT: Why don't you make one now.
WITNESS: I will, sir.

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

Mr. James Rogers, a civilian was recalled as a witness for the court, reminded that his previous oath was still binding, was advised that at the conclusion of his testimony he would be requested to place the highest classification on his testimony that he considered applicable, and testified as follows:

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Mr. Rogers, for ease of reference in the record, will you state your full name and present position again for the record?
A. My name is James Rogers, Assistant Quality Assurance Superintendent, Code 303X.

Q. Will you describe the quality assurance control system which was in effect during THRESHER's post shakedown availability insofar as new work items and then again insofar as repair items are concerned. We would like you to divide your description into the following categories: those jobs where quality assurance division had definitive control. Second, those jobs where there was a split of responsibility, and thirdly, those jobs where inspection performed by quality assurance people was done by them acting as agents for shop work. Can you do that?
A. Yes, sir. In the area of non destructive tests, the PSA period, the system was used the same as was utilized on the 620 using Production Department Instruction 4410.5, which sets up a joint control system for radiography of butt-welded joints. In this case, the Yard request for work is initiated by Shop 56, is then sent to the welder, from the welding shop by the shop Liaison Section; it is sent to radiography where radiographic inspection is performed and fed back through the same chain. In the case of the 593, each joint was uniquely identified or named by Shop 56 for this purpose. In the case of new construction, at the present time, this work is accomplished through the Joint Control Center.

Q. Mr. Rogers, I would like you first to describe this system as it existed during THRESHER's post shakedown availability. I will ask you later what changes have been made.
A. That would be in the area of NDT, the one I have just described. In the area of shipboard tests, specific areas of coverage were designated by Test Memorandum and a job order brief. These areas were and are rather limited in their scope. Our responsibilities are spelled out specifically in this test memo coverage. Certain inspections were made jointly with the ship's force. Our principal customer, COMSUBLANT, policy in these matters is to have the ship's force inspect certain systems. It has been a basic principle imposed here in this Shipyard. We have on record the areas of the tests and inspections that Code 303 performs. Would you like them specifically?

Q. Yes, please.
A. These would cover the three systems, auxiliary salt water, trim and drain, and air.

Q. As the criteria existed at the time of the post shakedown availability, is that right?
A. Yes, sir. The auxiliary salt water continuous vent system was inspected and tested in accordance with the appropriate test memo,-if you wish these,- and job order.

Q. When was that?
A. I don't know whether I can come up with a date or not. I don't have that date.

Q. Is there any way for you to estimate?
A. Yes, it would be in February. I am sure I have it here somewhere, but I'll probably come across it.

Q. When you tell us about it, can you amplify your description of the division of responsibility in connection with tests performed on the auxiliary sea water systems, whose responsibility was it to accept those tests?
A. All right. The auxiliary salt water system, first of all, had the integrity test followed by ultrasonic inspection which has been taken up here previously. Towards the end of the availability, the entire after auxiliary salt water system was subjected to hydrostatic test. And I have the date on this one. That is on 3/7/63. This is an example of split responsibility, in which case 303 had the responsibility of accepting the new work on the PUFFS. The ship's force accepted the other parts of the system, the engine room and the auxiliary machinery space.

Q. Are you refreshing your recollection from an inspection request dated March 7, 1963?
A. Yes, sir.

Q. I show you Exhibit 103 which has been admitted before this court. Is that an identical one?
A. That is the record in our office.

Q. Signed on the bottom with a pencil signature of "R. Podwell," is that correct?
A. Yes, sir.

Q. Do you have personal knowledge of the fact that the entire ASW system aft was inspected pursuant to this inspection request or are you working solely from the knowledge you can derive from looking at Exhibit 103?
A. From my knowledge of looking at this, sir, plus what my men would have told me that were on the job.

Q. Who was on the job?
A. Bob Arnold was one of the men on the job.

Q. Was Mr. Newsom also on it?
A. Ken Newsome, yes.

Q. Who told you about the inspection of that test?
A. Well, Mr. Fite has given me most of the information, sir.

Q. What was that information that he gave you?
A. That the system around the PUFFS was accepted under hydrostatic strength test by Mr. Newsom , and at the same time they had the ship's force people down there as the system was under test by Shop 56 and the ship's force witnessed the rest of the system, the rest of the after auxiliary salt water system.

Q. Did he specifically mention the date, or did your testimony concerning the date come from your citing of the figures "3/7/63" on the Exhibit?
A. That is correct.

Q. The latter is correct?

A. Yes. I would base my statement on the fact that the slip would be made out on the day that the test was accepted.

Q. Please proceed.
A. As a result of the ultrasonic inspections and visual tests that were put on the auxiliary salt water systems, there were no joints rejected in this system. Code 303 had no job order on the trim and drain system.

Q. Whose responsibility would be the inspection of that system?
A. That would call for the shop, the lead shop, in this case it would be Shop 56, would pressurize the system and present it to the ship for their acceptance if there were any work done on that system, and that would be typical of many systems.

Q. Could you name a few?
A. Hydraulics, high pressure air, any system, I would say, that the shop worked on, would be in that category if it was not specifically designated for Code 303's acceptance. This is a test memo of the continuous vent. Another specific test is the high pressure air compressors. There were certain test inspections performed on this unit due to moving the unit and piping rerun. And that was completed satisfactorily, sir, according to the issued test memorandum. Lithium Bromide--another test memorandum issued, which has been previously submitted. There were certain tests that remained to be done on this unit, and there were some of them to be done at sea. This has previously been submitted on that list of uncompleted tests submitted by 303B. I have also certain hydrostatic tests that were performed on salt water systems overboard discharge; I have the slips here where we were called in on these systems by Shop 56 to witness the test.

Q. Does that fall into the category of jobs where you conducted the inspection as an agent for the shop?
A. Yes, sir. This would be in that category, sir. These were also conducted in conjunction with the ship's force. We have many cases here of the ship's force signature on these acceptance slips along with 303's.

Q. Can you describe very simply for us how you determine into which of the three categories a given inspection job will fall: one, where quality assurance has definitive inspection of the test control of the inspection and, second, where there is a split responsibility and third, where the quality assurance people act as agents for the shop?
A. First, where we have a specific, definitive responsibility, sir. There again it is derived from the test memo which really is a mandatory document or a job order brief, which would spell out for inspection to perform work, would be the second one.

The area of joint responsibility is areas that shops have to perform certain tests or inspections to prove their work and these would be witnessed and accepted by the ship's force, the shop presenting them to the ship's force company. If we tied in, it would be specifically set up on a job order as I repeated, or a test memo. As we said before there are on an overhaul or PSA many in this area that go directly to the ship's force for their acceptance of shipyard work.

The area where we act as an agent is at the request of a shop, either to comply with the job order or test memoranda; the shop calls us to perform the inspection or test, or over and above that, to call us in to witness a test that they put on for the ship as indicated by these slips here which did not specify 303's participation but which we became involved in.

Q. For those inspections and tests in which the quality assurance personnel acted at the request of an individual shop, if the work were rejected, how is the ship apprised of the situation?

A. Just a rejection slip is made out, sir; and it is forwarded to the ship superintendent, and the form is 979. I believe this was entered before, but this is the form we use. That is a formal recognized piece of paper in the Shipyard. And for all deficiencies, weeps, or unsatisfactory conditions, one of these is issued to the ship superintendent.

Q. How does the ship hear of it?

A. In the case of this, a copy goes-for new construction tbo-a copy goes to the commanding officer of the vessel. He is put down here for distribution. It also goes, of course, back to the shop via the ship superintendent.

Q. Would you describe the responsibility of the Quality Assurance Division for the inspection and test of silver brazed piping joints which are included in work items in the three categories we have mentioned?--

A. All this is the PSA.

Q. All this is for the post shakedown availability of THRESHER.

A. In the case of silver brazed inspection on the 593, the work requests to perform UT, originated with the ship building inspector Code 303B. As a result of their surveillance of the system, they initiated the card that called for UT. In some-we quoted the figure before of the number of joints in the neighborhood of a hundred and ninety were done under this system. New work which Shop 56 might perform as a result of rejects, ripout or other changes that required UT, would be initiated by a request from 56 on the same form, same card. This would go through the chain to be UT'd and satisfactory back to the shop or rejected until we had a clear card on one specific joint. Shop 56 in this case would designate the joint uniquely by a name.

Q. Were any tests--ultrasonic tests--of silver brazed joints conducted during THRESHER's post shakedown availability under that third category, that is where there was a split responsibility?

A. I could think of none, sir.

Q. The ship requested none directly?

A. Not to my knowledge. If they did, and it could happen on a ship that the ship's force might--and they may have--it would work the same way. We would UT it for the ship and in case of reject we would send out, not only a copy to the ship, but also back through to the shop for corrective action. There may have been. It would be handled exactly the same. It would have to be cleared before it could proceed.

Q. Have there been any changes since THRESHER's post shakedown availability period in the procedures which you have described to us in your testimony today?

A. Yes.

Q. Would you describe them please.
A. There have been some during her post shakedown availability in the period from the time she came in through the winter months in the area of non-destructive testing primarily whereby certain instructions have been written to cover Level 1 hazardous piping systems.

Q. Did you say Level 1?
A. Yes, sir, Bureau of Ships designation of piping system, Level 1 being hazardous piping systems such as salt water, high pressure air, hydraulic, steam, auxiliary steam, to mention a few. They are specifically designated.

Q. Are they also referred to as P-1?
A. Yes, sir, these are also in the category of P-1 piping or P3A.

Q. What changes have there been?
A. In this respect we have specific control of some seven thousand controlled joints on a specific ship. The plan is actually designated and marked up so that each joint is identified on the plan by a unique number so that every joint is accounted for on any one system.

Q. What does it mean that you have control of those joints?
A. There would be a composite list of all these joints for any one system. The request for ultra--for non-destructive test would come through the joint control center, whereby all work from 56 or 26 through this center. The joint control center is aware that 56 has started to fabricate a certain joint, that 26 is now welding it, ultimately that it is non-destructively tested and fed back through and accepted, with every joint identified on a plan, a complete list of all joints; when you finish a system that all joints involved have received their required non-destructive test. This is now in effect and is working.

Q. When did it go into effect, what month?
A. I think March but I will verify it in a second. I have the instruction here which is 4410.7, Quality Assurance Fabrication and Inspection of Non Nuclear Piping Systems, effective date 25 February for the 636 and subsequent ships. This not only takes care of welded joints but the ultrasonic inspections of sil-brazed joints also are controlled in this same manner whereby a plan indicates all of the joints that are involved in any one system and absolute control is therefore able to be maintained.

Q. Were there any other changes in the procedures applicable?
A. Regarding shipboard tests which cover a large area of our work in new construction, there have been no changes of any consequence. In case of new construction, there is a complete set of test memoranda which covers the entire range of tests that are to be performed upon the ship, complete in all respects. And that is our guide and our reference and our responsibility to see that these are carried out.

Q. Before the Joint Control Center was set up, in the case of a joint worked on by Shop 56, is it possible that the Quality Assurance Division would not know about it and would not, therefore, inspect the joint?
A. It could be possible.

EXAMINATION BY THE COURT

Questions by a court member, Captain Hushing:

Q. Mr. Rogers, you said, I believe it was possible for Shop 56 to complete a joint and you did not know about it before this new joint control center was set up. Can you describe this situation a little more carefully, please.

A. Well, take a system, sir, that 56 worked on it for some reason or other. They would normally submit the request and they do submit the request for the non-destructive testing that is required. If they neglected to do this, in the case of PSA work, where we do not cover the ship as a whole, 303 might not be aware that the shop was working on this particular system.

Q. Wouldn't this new work be covered in a job order?

A. Yes, sir, it would be covered in a job order.

Q. If it were covered in a job order, would not the P&E man who wrote the job order normally inform 303 if it is new work?

A. For NDT requirements?

Q. Yes.

A. Not necessarily, sir.

Q. Under what circumstances would he not?

A. If the job order brief would call out the NDT requirement, that is if we take an example if we may, a system that required radiography on a butt-welded pipe joint--the job order brief would not necessarily say for Shop 56 to put together the pipe, for Shop 26 to weld the joint and Shop 29 or 32 as the case might be, to perform radiography. It would be mandatory for the shop to request it as they were cognizant that this is a high pressure system and requires NDT work, but it might not be in the brief.

Q. What is your Shop 29 and what is your Shop 32?

A. Excuse me. They are cost center numbers for Code 303 sir, 32 being the per annum people and 29 the Group III per diem.

Q. But if they were on the job order, 303 would get a copy of it?

A. Yes, sir.

Q. So 303 would know it is supposed to perform such a test?

A. We would do that, we would, sir.

Q. And then it is just a case of following up to make sure that such a request was made at the proper time?

A. Right. We would then have surveillance over that item and be aware that we should receive a request for specific work in that area.

Q. Then I don't understand your example as being one in which Code 303 would not be aware of the requirements for quality assurance test?

A. I dare say that in some cases the job order brief does not go to that detail.

Q. Are you stating then that the P&E is not doing its job properly in not including it?

A. The job orders, I think should be all inclusive; it would be most helpful.

Q. A job order is supposed to cover all of the productive elements in the shipyard and certain of the overhead elements, is it not?

A. Yes, sir.

Q. So that a failure to indicate proper test is a failure on the part of the P&E man to do his job properly?
A. I would say so.

Q. What kind of instances of this situation do you have? Is it regularly five per cent, ten per cent, fifty per cent?
A. It's irregular, I would say.

Q. Irregular. Does Shop 56 normally catch up with this sort of thing?
A. Yes, sir, they do.

Q. So what then would be your estimation of this probability of such an event having occurred on THRESHER?
A. I would say it would be very remote.

Q. You are saying it is possible but very remote?
A. I would say so, yes, sir, it is possible but very remote.

Q. Let's talk about welded joints in the ASW system of THRESHER. Did Code 303 make any inspection of old welded joints in THRESHER?
A. To my knowledge, no, we made an inspection of some old joints but I think they were all in the steam system, sir.

Q. But in the ASW system, did you make any tests with welded joints that were made prior to the PSA?
A. To my knowledge, no.

Q. Did you make any inspection of new welded joints in the ASW system--were there any that you inspected?
A. I am very sure there were. I do not have them, sir, with me. I say there must have been.

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

Q. Relative to radiography of welded joints, has there been a change during the past three years as regards radiography in terms of quality of radiography?
A. Yes, sir.

Q. About when did this take place in this Shipyard?
A. It took place in November and December of '61.

Q. Was the quality of radiography sharply increased as a result of this change?
A. In some areas, yes. Not immediately in all areas.

Q. But comparing the period 1962 in the Fall with the pre 1961 period; would you say that radiography had been sharply improved?
A. I would say that we have improved considerably, sir.

Q. As a result of the improved radiography, do you now see defects which were earlier not discernible in piping welds?
A. We haven't had opportunity of doing too much of that work. Some of our older radiography, the quality of the radiographs might be such that it would be difficult to discern any more increase in defects.

Q. Did your reject rate in pipe welding go up as a result of the improved radiography?
A. I would like to go back to the 593 new construction period.

Q. No, answer my question. Did your reject rate in pipe welding go up after you had improved your radiography?
A. Yes, I would say so.

Q. Did you go back and re-radiograph welded joints in THRESHER, which had been put there in construction?
A. New construction?

Q. Yes.
A. No, sir.

Q. Now what is your position again, Mr. Rogers, in the Shipyard?
A. Assistant Quality Assurance Superintendent.

Q. And what is your GS rating?
A. 14.

Q. Do you know all the shopmasters in the Shipyard?
A. I do.

Q. Do you know them well?
A. I know most of them quite well.

Q. What kind of relations do you have with them; is it friendly?
A. I have friendly relations with the masters.

Q. Do you talk to them on a regular basis?
A. Some of them; the ones that are involved in my business; that is the Outfitting masters, more than some others.

Q. When you find evidence of recurring deficiencies, do you give them feedback information on these recurring conditions?
A. We do, in the areas of welders, brazers and test people, also.

Q. Do you give it to them officially?
A. Yes. In both ways, Captain. We have official documents which go back, and show the deficiencies of their people, and we talk across the room; tell them verbally.

Q. Do you make it a practice, in addition to the official memos, to talk to the shopmasters and shop management when deficiencies occur?
A. In many cases I do, and in some cases I do not.

Q. When have you last talked in such a way to the foreman of the 56 area?
A. Well, Mr. Scarponi and I have discussed the quality of sil-brazed work, but not specifically to any individual or any reject rate.

Q. How about type of rejects?
A. No, that is fed back through the Quality Assurance engineers, back to his people.

Q. Tell me how this information gets back; for example in the sil-braze deficiency area, from Quality Assurance to the people who are doing the work.
A. On the request for radiographers, the brazer's number is recorded, and if, as it has happened, that we get a reject rate that seems high for a particular brazer, we then notify the Quarterman or the Foreman of what is taking place. This is done.

Q. Would you happen to have any sample memos of that kind on the silver braze problems over the last seven or eight months?
A. No, I have not.

Q. Do you happen to remember the approximate time of any of your conversations with Mr. Scarponi?
A. I had none on this particular subject with him; my supervisor had discussions with his supervisor?

Q. What supervisor?
A. Mr. Marsden.

Q. And to whom did he talk in the Shop 56 area?
A. He talked with the Quarterman who had that particular shift. I recall one case that was specifically on the SKIPJACK.

Q. Do you think if we talk to Mr. Marsden he could recall some of these discussions with Shop 56 people?
A. I'm sure he would, sir.

Q. Let me ask you a little bit of an embarrassing question, perhaps, and I will preface it by the remark that in many Shipyards the Quality Assurance people are known as the warts on the fanny of progress, meaning generally that production people sometimes do not understand what the Quality Assurance people are doing, and they feel that they are getting in the way. Is there any such feeling, that you know of, in this area between Quality Assurance people at this Shipyard and the management of the various shops?
A. I would say there is; it's evident to me in the area of radiography.

Q. Elaborate on that a little bit, will you?
A. Where we have our standards to meet in welds quality, and it results in a reject rate on pipe joints or hull structures, which necessitates repair, re-radiography and sometimes repair again. This is going on even at the present time.

Q. With whom do you have difficulties under these circumstances?
A. Shop 26, primarily, as it's concerning welding. I have discussed this at some length with Mr. Cole, Foreman of Shop 26.

Q. How about Shop 56; do you have any difficulties that way with Shop 56?
A. Not particularly.

Q. How about Shop 38; are they receptive to Quality Assurance?
A. I think Shop 38 recognizes that we have a job to do. In their case it's more testing, to test out equipments adequately. We do have some complaints that we are not moving along fast enough.

Q. How about Mr. Poor, the Outfitting group master; how does he react to your recommendation and suggestions?
A. Mr. Poor cooperates very well when we have items that are brought to his attention.

Q. You think then that he is receptive to the information provided him?
A. Yes.

Q. Have you seen any evidence that he has used it?
A. In the case of the 620, a boat under test right now, he has, and he does.

Q. Would you say then that the Quality Assurance program is gaining some recognition in the Shipyard?
A. I would say it is, definitely; in the area -- I think the biggest gain will be in the area of non-destructive tests, and control has to be exercised once again on pipe joints. It takes more time to do this; it's not quite as quick, but the shops recognize this, and we have no difficulty with our program.

Q. Do you have any major obstacles of this kind at the present time to which you do not see a reasonable answer?
A. I have a problem, a matter of keeping records and books on this particular phase of work; we are just really starting it; it's quite recent, but it's going to be a big job to keep proper records and the records must be proper. That is going to be an area where it is difficult to man. However, it will be manned by clerk type people and not mechanics.

Q. How often do you talk to the Production Officer?
A. Well, Captain, when I was in 303, the Head, I was under his direct supervision and I talked to him quite frequently. Now I talk to him infrequently and do most of my business through Commander Rule.

Q. Do you get full support from Commander Rule?
A. Yes, sir.

Q. Are you ever unduly pressured to pass an item in the way of gaining time?
A. I have never been in that position.

Q. Would you say, then, that so far as you can tell, the Production Officer, through Commander Rule, supports the Quality Assurance program?
A. I would say so.

Questions by a member, CAPT Osborn:

Q. Mr. Rogers, how difficult do you think, based on your experience on two ships, THRESHER and SKIPJACK, it's going to be to institute the same quality controls, that say you have in the 636?
A. To institute in which ship, sir?

Q. I'm talking about ships that are already built on lower quality standards, namely, SKIPJACK and THRESHER. How difficult do you think it's going to be to institute the same procedures on joints and hazardous systems as say you're going to have on 636?
A. I understand the question. It would be very difficult because of the inaccessibility of pipe joints, one, the biggest item. They are difficult to get at to perform ultrasonic inspection, a hundred percent of the joints, and ultrasonic was not used in 593 construction.

Q. Were you alarmed, or did you take any action with respect to ultrasonic results that you have observed yourself with respect to SKIPJACK or THRESHER, in the light of the fifty-six joints that you examined; did you think the number was too high in rejections, or too low?
A. We didn't have a very high rejection rate on the 593; and those that fell below the bond criteria fell below with a very small percentage, so we had no gross lack of bond in any joints that were ultrasonically tested.

Q. Let's get the specific joints you're talking about. Are you talking about specific joints that are made, new ones or old ones, that were not made under the control program?
A. First we could take the old ones that were made when we didn't have the control, and those are the ones that were ultrasonically inspected as the result of the directive to do those. Those would be the first area and that is what I referred to.

Q. You thought you had pretty low rate of rejections on them?
A. Yes.

Q. What would you say was a low rate of rejections?
A. Ten or fifteen percent. In the case of new work, our rejection rate did not run any different on the 593 than on any new ship that we are doing now.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. The question that I shall ask relates to the THRESHER's period of post shakedown availability. Before the establishment of the Joint Control Center System, which you have described, to make sure that every joint worked on by Shop 56 was ultrasonically tested or X-rayed, as appropriate, would require maintenance of a checkoff list, master checkoff list by Shop 56?
A. Yes, sir.

Q. The checkoff list would have to be established. Do you know whether Shop 56 has such a checkoff list for systems such as THRESHER's auxiliary sea water system?

A. I do not know.

Questions by the President.

Q. Mr. Rogers, the name of your particular part of the organization is Quality Assurance; is it not?

A. Yes, sir.

Q. And we have given to your Quality Assurance Division a job called Integrity Tests; is that correct?

A. Yes.

Q. Recognizing full well that submarine design and submarine construction have both become more and more complicated, at a rapid rate in the last three years, is it not true that Quality Assurance and Integrity Tests will only be as good as they are made to be? No degree of elaborate systems, such as the new one of your Joint Control Center, no number of job orders that say to do an Integrity Test on the U.S.S. THRESHER, will in fact give you an integrity test if you do not believe what you find when you make those tests: is that correct?

A. That is certainly correct, sir.

Q. Now I am referring to a memorandum from your part of the organization, from 303B2 to 303, and in that memorandum I find that there was a joint ultrasonically tested and rejected on the ASW lines forward. Now I believe that you testified there were no old joints that were found on that line to be defective; is that correct?

A. My memorandum states that no joints were rejected in this system.

Q. The ASW system? Your memorandum and this memorandum do not give the same information; do they?

A. No, sir.

Q. Now I also find in this memorandum that of the total of 58 joints in THRESHER which were made prior to her post trial availability, a total of 20 were rejected. My mathematics gives me thirty-four plus percent of rejections of old joints, and yet you just testified that you considered that the percentage of failures of old joints to be rather small. I find it difficult to reconcile these. Would you try to reconcile them for me?

A. I was taking the total number of joints that we ultrasonically inspected on the Integrity Test and I thought that it was in the neighborhood of about thirty joints, or thirty-five, perhaps, that we rejected. Those are the figures that I --

Q. Well, that's high, according to this memorandum. Total number ultrasonically rejected was twenty.
A. We ultrasonically inspected, Admiral, approximately 190 joints on this program.

Q. This memorandum would indicate that you inspected visually and ultrasonically, a total of 170 joints, but of those, 67 were new ones, and therefore, taking 67 from the 125 joints accepted by ultrasonic tests, that left 58 old joints that were inspected by ultrasonic methods, and of those 58, 20 failed. Now as the Assistant Quality Assurance Superintendent, didn't this ring a bell with you, that something further needed to be done in testing for quality assurance of the old silver brazed joints in this ship, which had been through a shock test just before coming in for this PSA?
A. No, sir.

Q. You see, Mr. Rogers, our concern is not with systems, but with results. Who is your immediate superior?
A. Commander Rule is my immediate superior.

Q. Did you bring to Commander Rule's attention the rejection rate of the older joints that were tested in the ship?
A. Not personally, no, sir.

Q. Did you do it other than personally?
A. The report went through Commander Rule.

Q. You saw this report, did you?
A. Yes, sir.

Q. And you knew that Commander Rule would see it and therefore you felt that it was not necessary for you to bring any particular attention to it; is that correct?
A. No, sir. I wouldn't say that.

Q. What would you say, Mr. Rogers?
A. I would say that the reject rate, as evident on the 593, was probably what we were experiencing on new construction.

Q. On new construction now?
A. The joints that we find reject will run fifteen, twenty percent.

Q. Mr. Rogers, we are talking different figures. Let us get synchronized. According to data from your own part of the organization, contained in this 17 April memorandum, which I am reading, from 303B2, to 303, Exhibit 118 before this court, there were 67 new joints inspected. There were a total of 125 joints ultrasonically tested, according to testimony before this court, not one of those 67 new joints failed to pass ultrasonic tests. It would seem that the state of the art, as practiced in this Yard at present, is not giving a high rejection rate for sil-brazed joints by ultrasonic testing processes, but of the remaining 58 joints from that 125 total, 20 joints were rejected. These joints were old joints that were made in the shop before the post shakedown availability. Therefore, 20 out of 58 is not fifteen percent; it's thirty-four plus. So now that we are synchronized on data, will you go ahead and answer my previous question?
A. I did not call it to Commander Rule's attention.

Q. Are you the senior civilian in the Quality Assurance branch?
A. Yes, sir.

Q. Who would call this to Commander Rule's attention, if not you?
A. I would be the one to call it to his attention. He does, of course, do business with other supervisors than myself in the organization directly, both back and forth.

Q. Would Mr. Marsden be one of the supervisors who might have been more responsible in this particular area than you?
A. No, sir. Mr. Marsden is the head of the ultrasonic section, to perform the ultrasonic work.

Q. But in effect is under you?
A. Yes, sir.

Q. As are other supervisors in 303?
A. Yes, sir.

Neither the counsel for the court, the court, nor the counsel for RADM Palmer, a party, 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 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.

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

The court adjourned at 1715 hours, 2 May 1963.

Unclassified

EIGHTEENTH DAY

Portsmouth Naval Shipyard
Portsmouth, New Hampshire
Friday, 3 May 1963

The court met with closed doors at 0910 hours.

All persons connected with the court who were present when the court adjourned were again present in court, with the exception of (b) (6) , who was relieved by (b) (6) as reporter. RADM Palmer, a party, and LCDR Hecker, a party, and his counsel waived their right to be present at this session of the inquiry. Counsel for RADM Palmer was present.

No witnesses not otherwise connected with the inquiry were present.

(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 was examined as follows:

COUNSEL FOR THE COURT: Mr. (b) (6) , this is a closed session of the court, and classified information can be divulged here. At the end of your testimony I shall ask you what classification you would accord to your testimony 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) , (b) (6) . I am Senior Supervisory Inspector, Metals.

Q. You are employed at the Portsmouth Naval Shipyard?
A. Yes, sir.

Q. What is your background and experience in your present line of work?
A. I have been with the X-Ray Section for sixteen years. My background in this line of work starts with the actual radiography work using cobalt and radium capsules back in 1947. I progressed in this field up to the present day, where I now observe the use of more advanced means of radiography and newly acquired iridium sources and x-ray equipment. We started with two employees in this section in which I am concerned, and we now number around eighty. The background, as I just stated, is from constantly being connected with radiograph work. I would say that this is wholly my line of work, radiographic inspection.

Q. Did you have any special formal training in this field?
A. No, sir. The training I acquired was from association with my supervisor, Mr. Howard Dickerman back in 1947. Mr. Dickerman was the head of the Non-Destructive Test Branch at that time. I have been to one school out in Columbus, Ohio. Doctor McMaster's School on radiographic work, radiographic testing. Throughout the years I have been exposed to lectures and talks in Boston, at the Massachusetts Institute of Technology, and various seminars that have come our way.

Unclassified

Q. My questions now will be specifically related to THRESHER during her post shakedown availability. Will you describe the procedures and methods for the radiographic inspection of welded joints in sea water pipe systems?

A. Yes, sir. We receive all work requests which have anything to do with sea water piping from Shop 26, the liaison section of Shop 26.

Q. What is Shop 26?

A. That is the welding shop, sir. The welding shop submits to us work requests by forms, IBM forms, and others. They are 1369 Forms. These forms are self-explanatory. They give us location, ship location, size of pipe, wall thickness, and all of the pertinent data necessary to conduct our radiographic inspection. We are scheduled to do this work by Shop 26; that is, they will clear an area for us, and we in turn will dispatch groups of men to the location to perform our specific duty. We take our cards, our work requests, and go to the location, perform the radiographic inspection of welded joints according to specifications. We at present, and have been for years, have been using the MIL standards. In this particular case of THRESHER, MIL standard 271-A was employed. This spells out in detail the necessary requirements for Grade "A" radiography. Our acceptance standards for the pipe joints of THRESHER and ground work is NAVSHIPS 250-692-2 of January of 1961, as amended by Shipyard Notice 9480 of September. These are our acceptance standards today.

Q. Is that September of 1961?

A. September of 1962, sir. After having accomplished our radiographic inspections in the case of THRESHER again, our pipe sizes were over the 4-inch diameters. In this instance we are obliged to perform 100 per cent radiographic inspection of piping, anything over 4 inches, as prescribed by standards. This was done. We have completed our radiographic inspections of the piping. The films are developed by us, processed, and read by qualified readers. By "qualified readers" I am referring to men who have been exposed to a month's course, plus two weeks refresher, at the Bettis Plant in Pittsburgh. Personnel at this plant conducted a course in radiographic inspection and interpretation. Four of these men have been exposed to this. We feel that their background and their education and interpretation is quite adequate and satsifactory. These joints were interpreted by these men.

Q. Do you have more readers than just the four men you have mentioned?

A. Yes, sir, we do.

Q. Did they make readings of film plates taken from THRESHER during her post shakedown availability?

A. I have one other reader, sir, and he is strictly on castings.

Q. Without formal training?

A. This is right, sir. His training has stemmed from his association with myself and other technicians.

Q. What sort of training do the men who take the pictures have?

A. They are subjected to six months basic training with us in radiographic work. They attend a health physics course by the Industrial Hygiene Department, and they are trained by actually being on the job and doing the work with radiography. They are referred to as Inspectors "B."

Q. Do they carry cards indicating their qualifications to perform this work?
A. No, sir. The only cards they carry are those which indicate they passed the health physics course. These were issued to the men.

Q. During THRESHER's post shakedown availability, was there an occasion when you found that unsatisfactory work was being performed either by those who took the pictures or those who interpreted them?
A. No, sir.

Q. Do you have a list of welded sea water piping joints which were radiographed during THRESHER's post shakedown availability?
A. Yes, I have, sir.

Q. Is your list broken down by plan number, system, joint number, size, location and date of clearance?
A. Yes, sir.

Q. Would you produce it, please?
A. Here it is.

Q. Did you make this list yourself?
A. Yes, sir.

Q. Is it, to the best of your knowledge, true, correct and complete?
A. That is right, sir.

The forementioned list of radiographed welded joints was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 146."

Counsel for the party waived the reading of Exhibit 146.

Q. (By counsel for the court) Referring to Exhibit 146, will you explain your tabulations to us, please?
A. Yes, sir. First, by plan, all of the requests are submitted to us. The forms include all of the data which you have seen here on this exhibit (Exhibit 146). We show the plan number, which is indicative of a particular system. We use the last three digits of the plan number on our radiographic films so that we can correlate and compare the films to the plan number. I will read the top of the list, which runs from FL-2 to F-225. This is a system whereby the "FL-2" represents a flange according to the plan. The "F-225" indicates a fitting number. The sizes are predetermined and are written on our cards by the leadingman welder, who is responsible for the data supplied to us. He is closely related to the job, and so his location is most important. This indicates "Frame 81, Port, Engine Room." This enables us to immediately dispatch men to go directly to the boat, to the engine room, to the port side, and it enhances our program in that we are able to obtain a few more shots per shift, as the case may be, to cut down on searching for the joints. The date of completion is the final date on our 1436 Forms, which are our disposition sheets, radiographic disposition sheets. This is the date of final acceptance of that particular joint.

Unclassified

Q. Do you have a plan diagram showing the general location of welded piping joints that were radiographed during THRESHER's post shakedown availability?
A. Yes, sir, I have.

Q. These include the auxiliary sea water system, the trim and drain system, and air conditioning salt water system?
A. This is right.

Q. Would you produce it, please?
A. Here it is here.

The witness produced the aforementioned plan showing the location of welding joints radiographed during THRESHER's post shakedown availability. It was submitted to the court and to counsel for RADM Palmer, a party, and was offered in evidence by counsel for the court.

There being no objection, it was so received and marked "Exhibit 147."

COUNSEL FOR THE COURT: If you will step over here, Mr. (b)(6) , I think we can mount it for you.

Exhibit 147 was mounted on a board for demonstration purposes.

THE WITNESS: The legend is as follows: The green is air conditioning; the orange is trim and drain; and the red is auxiliary sea water. There are 35 such joints in these three systems. This is the top side plan indicating that back here, the green, this is in the engine room at Frames 80, 81 and 82. We had twenty-four air conditioning pipe joints to x-ray, which was accomplished, and were found to be completely satisfactory, passing the requirment. We have one orange trim anddrain joint in the AMS, which satisfactorily passed radiographic requirements. We had one other trim and drain joint -- there were nine in all, one here and eight here up in the forward section of the Sonar Sphere at Frames 13 and 14. We had two auxiliary sea water joints located in the auxiliary machinery space, and as you notice, they are all on the port side. There are two joints here. This totals 35 joints. This does not include, sir, the 22 joints in the engine room which were taken on the post shakedown availability. These joints were steam system. There were 22 other joints not included in this, but these are the salt water joints.

EXAMINATION BY THE COURT

Questions by the president, VADM Austin:

Q. Did all of these joints pass the radiographic test?
A. Yes, sir, they did.

Q. Were they all old joints?
A. There were newly welded joints.

Q. All of them?
A. All of them, sir.

Q. No old joints were radiographically tested?
A. None to my knowledge, sir.

(The witness resumed his seat)

Unclassified

Questions by counsel for the court:

Q. Do you have a compilation of the number and percentage of rejects of welds tested during THRESHER's post shakedown availability which were radiographed?

A. Yes, I have, sir.

Q. Produce it, please?

A. Here it is. This compilation is in the rough. I didn't have time to do this in the smooth. There were 24 joints in the air conditioning system. Thirty-seven per cent of these joints contained defective discontinuities in excess of acceptance standards. In the trim and drain system 44 per cent of the joints had discontinuities out of standard, and in the auxiliary salt water, 100 per cent; two out of two needed repair. I would like, if I may, further to say that the discontinuities which rejected the joint in linear measurement all represented less than one-half of 1 per cent of the amount of welding performed on these particular joints. The acceptance standards tell us that a slag inclusion of b(3) 10 USC 130 slightly better than b(3) 10 USC 130 would disqualify the complete joint. This was the case, sir, in these pipe joints. The actual percentage of joints rejected does not reflect bad welding throughout. One small discontinuity would reject the whole joint. Most of these joints are 5½ inches in diameter. That would represent 16 inches of linear measurement, compared to b(3) 10 USC 130 of slag, representing a small amount of defective area.

Q. Were the rejection figures on welding work performed on THRESHER's joints substantially different from those obtained from work performed on other submarines in the Yard?

A. No, sir. This is the general run of work. We find that porosity and slag inclusions are our common enemies, and the standards are such that they don't allow a line porosity and slag inclusion beyond what I mentioned. This is the regular type of work.

Q. Were the standards of such work substantially the same at the time of THRESHER's construction?

A. The standards were slightly less severe.

Q. Do you have knowledge as to whether the rejection rate at that time was similar?

A. I have records indicating that. I don't recall off-hand.

Q. What is your best recollection?

A. I'm afraid I couldn't answer that, sir. We kept records on all the pipe joints on THRESHER. We had repairs, naturally, but I can't tell you what the percentage was.

Q. Do you have with you a complete filming of each welded piping joint which was radiographed during THRESHER's post shakedown availability?

A. I have records of 35 joints completely radiographed of the salt water systems. I have excluded the steam.

Q. Are you prepared to read such a film on any joint selected by the court?

A. Yes, sir.

COUNSEL FOR THE COURT: At this time, counsel offers such a demonstration to the court.

PRESIDENT: The court would be happy to witness such a demonstration.

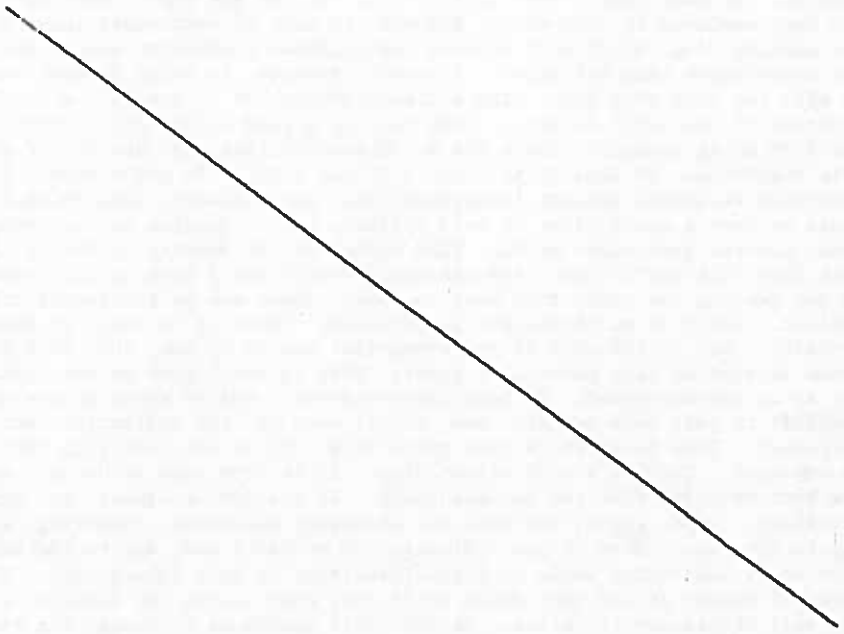
Q. (By counsel for the court) Do you have a film of a joint which was rejected as well as one which was accepted?
A. Yes, sir.

Q. Would you show us one of each, please?
A. Yes, sir. This will have to be shown through the viewer.

COUNSEL FOR THE COURT: Yes, do whatever is necessary to set it up.

A radiograph viewing machine was prepared for demonstrating the aforementioned films.

Q. (By counsel for the court) Would you identify what you demonstrate for us so that, for the record, we will know what we have looked at?
A. All right, sir. I have a shot of a joint on the air conditioning salt water system. The joint number is FL-2 to F-25. This is on Plan No. DLI 150-40. This is a 5½" copper-nickel joint. It is located in the engine room at Frame 81. port side. (The witness then produced an IBM card form.) This is the card that is submitted to us as a work request from Shop 26. This particular joint was x-rayed. It is a shop weld, and it was so x-rayed. On the boats we use isotopes.



Q. Did you perform the X-ray?
A. Yes, sir. In order to assure that we have 100 per cent coverage, we take eight exposures on such a joint.

Q. It would more or less depend on the size of the joint?
A. That is correct. This is our disposition, the radiograph interpreter's disposition of this particular joint. These are all of the discontinuities that could exist. This is the discontinuity which he found did exist. There's one spot of porosity in this whole transparency which he felt was beyond standard. In viewing this radiography film, we first must acquire proper density between the location markers. As you can see on the film, there are small lead numbers and letters on the piece of work. This is FL-2 to 25, as stated on the report. This is the penetrometer.

Q. Will you outline the penetrometer for us, please? Just indicate it for us.
A. It is right here, sir. (Indicating on film) This penetrometer represents 2 per cent of the wall thickness; that is, we must be able to see a small hole in this penetrometer. There are three holes existing in this penetrometer. This is the 4-T hole. We are showing 2 per cent sensitivity by seeing the outline of this penetrometer. We are obliged by specification to see this outline and to see this 2-T hole when we employ X-ray in our examination. However, when we go to the boats and use isotopes--and in all cases today we have improved over-all examination by using iridium 192 source, which gives us more latitude and better sensitivity. In this particular case an X-ray was employed. Now, this small indication here is an indication of porosity, well within standards,--this little dark spot here. First, we look for the proper sensitivity before we grade the film. We look for proper density. We must have a test of 2 to 3.3. We can see that a packing ring had been employed in this weld. However, in many of such areas they remove the packing ring, which will enhance radiographic inspection and do away with any uncertainty that may exist. In many instances, in using packing rings we will run into what looks like a discontinuity but is actually a little undercut on the inner surface. Now, this is a good sound weld (referring to the film being viewed). There are no discontinuities that are beyond acceptable standards. We look at it first with two films. We use a double film technique to assure correct interpretation. For instance, that white spot could be just a small piece of weld spatter, but in looking at this other view, you see good clear metal. This difference in density is due to the fact that this particular joint was counterbored for a packing ring insertion. We are reading the joint from here to here. There are no crack-like indications. There is no incomplete penetration. There is no slag, no excessive porosity. So, in the mind of my interpreter and in my own, this is a good sound section of this particular joint. This is one-eighth of the joint as far as we are concerned. We have completed every one of these joints on the THRESHER in just this manner. Now, I will show you the indication that was corrected. This is an extra-fine grain film. It is the best film that could be employed. This is a much slower film. It is very nice to handle, and is the best material that can be used today. It's a little slower, but much more revealing. Here, again, you have the necessary lettering, numbering, according to the plan. Here is one indication of porosity and, due to the density, this small indication would pass specifications by that interpreter. This looks as though it has some depth to it, so, even though the diameter of this was well within specifications, he felt this should be corrected and removed. This should be shown on my prepared film. That was Location 5 to 6.

Q. When you say "corrected," do you mean it was rejected?
A. This was rejected, sir. That's right. That particular indication would reject the joint. (The witness produced another film.) This is the retake of that same area after repair. You will notice in this case that we used--we put a penetrometer right on the weld itself so as to assure ourselves we were getting the proper sensitivity. Here is a 2-T hole, which shows we are well within specifications. This is ten-thousandths of an inch in diameter. We see the outline of our penetrometer. Here is the qualifying exposure. Here is the subsequent exposure showing the 5 to 6 location. The indication is that porosity was removed. It was ground and reground.

COUNSEL FOR THE COURT: Thank you, sir. Will you resume your seat, please.

(The witness resumed the stand.)

EXAMINATION BY THE COURT

Questions by a court member, CAPT HUSHING:

Q. Mr. (b)(6) , in your testimony, I believe you indicated that there were rejects in the air conditioning, trim and drain, and ASW systems of 27 per cent, 44 per cent, and 100 per cent, respectively?
A. Yes, sir.

Q. Do you know whether any of these joints were rejected more than once?
A. Some were rejected more than once, yes, sir.

Q. This is not unusual, is it?
A. No, sir, this is not unusual.

Q. Do you have any feel for the maximum number of times some of these joints are rejected in normal practice?
A. In normal practice, as many as three and four times. This is due to the fact that in grinding, the grinder will feel that he has removed the discontinuity, and the joint will be rewelded. Now, we are very careful to try to have an inspector down there for all of the removals of discontinuities, but this is almost impossible, in that we could not employ that many inspectors. Not that I am saying the welding is bad, but a small discontinuity deserves as much attention as a large discontinuity, and some of these joints had been rejected three and four times.

Q. The discontinuities that you showed us appeared to me about the size of the point of a well sharpened pencil, is that correct?
A. This is correct.

Q. How would you locate that for a grinder in terms of position on the pipe and the depth to grind?
A. We locate it for the grinder from the previously applied etched numbers. We etch the pipe. We start with etched numbers "1" and "2." In many cases, we will etch the complete joint.

Q. How about the depth of the grind?
A. The depth is something else. We have no way of telling the depth other than the sharpness of the indication, and we feel that if it is as dense as what we just saw, we will know that this is quite a deep spot of porosity.

We have no way of telling what the depth would be. The grinder will grind it down until he reaches it in his own mind.

Q. Does it sometimes happen that the grinder has to work all the way into the root pass to be sure he has found the discontinuity?
A. This is true, yes, sir.

Q. Does he sometimes have to go past the root pass and perhaps grind it all the way through?
A. If he does this, this is a workmanship mistake.

Q. But it does sometimes happen?
A. Sometimes it did happen, yes.

Q. Do you have any idea how much these radiographs which you take cost on the average?
A. They are various prices. I think a figure of eight to ten dollars is average.

Q. Per radiograph?
A. Per radiograph, yes, sir. This would include overhead, processing, interpretation, and all of the penetrometers.

Q. So that for the joint which you showed us, taking eight radiographs of a 5-inch joint, you might figure this would cost in the vicinity of $64.00, and since you rejected this area and had to run further radiographs, we could figure a minimum of $75 for radiography in this particular case?
A. This is what I would say, yes, sir.

Q. Has the radiography improved in the past three or four years?
A. Very, very much, sir.

Q. When did this great improvement take place?
A. It took place mostly about two years ago. We were previously employing cobalt and radium sources. These two sources do not give you the latitude and sensitivity that we have acquired with iridium.

Q. You have improved your radiography and have improved sensitivity?
A. Yes, sir.

Q. As a result of which you are able to see more defects now?
A. That's correct, sir.

Q. Do you think the improved radiography resulted in an increase in the rejection rate in the Shipyard?
A. I do.

Q. Do you think that the quality of welding in the Yard has gone down, or gone up as a result of improved radiography?
A. I believe that the quality of welding in the Yard has progressively improved.

Q. You stated that the rejection which you showed us was in accordance with the standards and interpretation of your radiography, I believe. Is that right?
A. Yes, sir.

Q. Were you talking about non-nuclear standards?
A. This is non-nuclear, yes, sir.

Q. You use non-nuclear standards?
A. Yes, sir.

Q. Have you compared the standards which you use to the ASME standards or other commercial standards?
A. We employ the ASME standards for porosity, as so directed by our Production Department Instruction.

Questions by a court member, CAPT OSBORN:

Q. Were all the radiographs that you made in the THRESHER's post shakedown availability the result of new work?
A. To my knowledge, yes, sir.

Q. Was there any idea of looking at some of the old welds in view of the increased standards?
A. Not to my knowledge, sir.

Q. I note that your radiographic interpreters were all trained at the Bettis plant, which is associated with nuclear standards. How are these standards extended to non-nuclear piping?
A. I would say they were comparable, sir.

Q. Where is the master checkoff list kept for the work that you do?
A. We don't have a master checkoff list. We have our cards which are submitted to us from Shop 26, and we have our disposition sheets all in one area at our Building 128, the X-ray Laboratory.

Q. If I were to go any place in the Yard and ask for a complete checkoff sheet, with the associated work lists which requested that your inspections be made, where would I go?
A. I wouldn't know that, sir.

Questions by a court member, RADM DASPIT:

Q. Could you tell us briefly the difference in standards between the time when the THRESHER was built and during her PSA of these welded pipe joints?
A. In our first radiographic inspection of THRESHER, we were using the standard 250-692-2 of 1957. P-1 piping at that time did not allow us any slag up to b(3) 10 USC 130 wall thicknesses. Now, previously, I mentioned that the standards were a little less severe than than now. I believe I made that statement, and thinking back to the 1957 standard, we weren't allowed any slag b(3) 10 USC 130 wall thickness. So I will have to retract the statement I previously made to say that, by today's standard, we are allowed slightly more than when the THRESHER was first built.

Q. Were there any other differences in the number of X-rays and things?
A. The difference in our operation when it was first built and now is that our coverage of a particular joint was complete, in that we would take perhaps four exposures on something on which today we would take eight. This was due to the fact that our local markers were a little more extensive, and extremes were greater. Today we are getting more revealing radiography than we did before. The type of films we used back when the THRESHER was first fabricated and welded is not as fine as this as what we are using today, but the over-all radiographic work was as complete as it is today, in my judgment.

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

Questions by the president, VADM AUSTIN:

Q. Mr. (b) (6), all welded joints in THRESHER were radiographed during her construction, were they not?
A. All welded joints submitted to us were radiographed.

Q. That isn't my question. I will ask another question. Were all welded joints of the THRESHER submitted to you?
A. I do not know, sir.

Q. There was no requirement during the PSA for an integrity test of welded joints of THRESHER, was there, Mr. (b) (6) ?
A. Not to my knowledge, sir.

Q. Mr. (b) (6), I have one more question. Will you give the court a feel for the amount of space required to do an in-place radiograph?
A. An adequate radiograph may be obtained in a minimum space of five to seven inches, sir.

Q. Are we to interpret the minimum space of five to seven inches as meaning that any pipe on which it was desired to radiograph a joint could not be adequately radiographed if that pipe ran within less than five inches of other parts of the ship?
A. No, sir. I can explain that I mentioned five to seven inches from what we call contact exposures. We would have a pipe which has a diameter of five inches; we can adequately obtain a radiograph by actually putting the source on one side of the pipe, the film on the other side, in obtaining one small portion of this weld. This is what we term a contact exposure.

Q. How large is the source?
A. The physical size of the sources we use on pipe are wholly a sixteenth by a sixteenth inch in physical size.

Q. Say again?
A. Sixteenth by a sixteenth, sir.

Q. That is in a container, is it not?
A. This is in an encapsulated pill, yes, sir.

Q. How large is the container?
A. The container we use to house the source depends on the potency; and the physical size of the containers we use are plates that are about eight inches in diameter, by the same in height; it's a rectangular s of thing rather.

Q. So, you would have to be able to get the container back of the pipe, too; wouldn't you?
A. No, sir, I'll explain this in this manner. We employ source cables which are attached to the container. These source cables are anywhere from seven to twenty-one feet in length. Well, they are seven feet in length, and we attach two and three, as the need may be, and the actual size of the head in which the source is supported is only about an inch in diameter; and this particular piece of equipment is so designed that it will hold a smaller source cable that is about as big around as this pencil, so that we have no trouble in putting our source on the pipe, itself.

Q. I deduce, therefore, that it is not frequent that you find space a bar to a radiograph?
A. Absolutely correct, sir.

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 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.

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

(b) (6) , (b) (6) 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: This is a closed session of the court, Mr. (b) (6), and classified information can be divulged here. At the end of your testimony I will ask you what classification you would accord to it, taken as a whole.

DIRECT EXAMINATION

Questions by the counsel for the court:

Q. State your name, address and present occupation?
A. (b) (6) , (b) (6)
Leadingman Welder.

Q. You are employed at Portsmouth Naval Shipyard?
A. Portsmouth Naval Shipyard.

Q. Would you spell your last name, please?
A. (b) (6) .

Q. Would you briefly describe the nature of your duties at Portsmouth Naval Shipyard?
A. Assigning people to work on weldments, such as structural work, pipe work, explaining their duties to them, such as material, and other things pertaining to procedures.

Q. What is your background and experience in your present line of work?
A. Three years as a supervisor, one year as an inspector, and about fourteen years welding.

Q. As a leadingman welder, would you describe for us the procedure for initiating a request for a radiographic inspection of welded joints in the sea water system of THRESHER during her post shakedown availability?
A. We use an IBM card. We'll start when the welding is complete on the joint. We have the IBM card which the lead shop, which is Shop 56, initiated, and we tape the pipe with black tape and check it to see that it is properly "X'd." And then this IBM card goes to Shop 26 later on. And then we wait for X-ray results.

Q. Well, the initial request then was made out by Shop 56; is that right?
A. Yes, this card is initiated by Shop 56.

Q. Who is responsible in Shop 56 for supervising the initiation of such requests?
A. I believe that was Mr. Dame, leadingman pipefitter; Mr. Collins, quarterman pipefitter.

Q. Mr. Collins ultimately, is that it?
A. Yes.

Q. Who determined that a radiograph was required; which shop would determine that?
A. Shop 56.

Q. Let me put the question another way. If Shop 56 requested a radiograph, did that finish the matter? There was a radiograph performed? Or could Shop 26 say, "No."?
A. I don't know. Usually we go by the plans, design memos, and pipe classification. If it's Class P-1 piping, it requires X-ray.

Q. What were those criteria for Class P-1 piping? Were there any criteria as to heat, and so forth?
A. The system requirements?

Q. Yes.
A. As a rule, the system that would exceed b(3) 10 USC 130 would be classed as P-1 piping.

Q. And must be radiographed?
A. And must be radiographed.

Q. Then, if a request came in for a radiograph of a joint or weld which didn't meet those criteria, could Shop 26 decline to make the radiograph?
A. If it came from the inspectors, they would have to do it.

Q. What if it came from Shop 56?
A. I don't know if I would have to do it for them or not.

Q. Is a record maintained when the card for the radiograph is released to Shop 26 welding liaison?
A. When I release it?

Q. Yes.
A. It's not required, but I do keep records of that so that I won't lose track of the work that I'm waiting X-ray results on.

Q. Is it a complete list of all radiographs?
A. No, it's not complete; just kept enough so as to keep my records so that I can follow the work through so that a joint wouldn't be completed and X-ray requested and then, possibly, having to wait too long for the result.

Q. Is it correct, then, that Shop 26 would have to rely upon Shop 56 in making sure that every welded sea water piping joint which required inspection was inspected by radiograph?
A. I don't know for sure.

Q. You only did what was requested of you by Shop 56?
A. No, I checked the joints myself, checked the system myself, checked these general notes on the plan.

Q. If you found a joint which required radiographic inspection and which had not been requested to be radiographed by Shop 56, what would you do?
A. I would go to Shop 56 for the IBM card.

Q. Did such an occasion occur during THRESHER's post shakedown availability?
A. No, I don't recall that it did.

EXAMINATION BY THE COURT

Questions by the president, VADM Austin:

Q. Mr. (b)(6), roughly how many joints that require radiographic inspection fail on the first go-round?
A. This is on the salt water piping?

Q. On any piping? Just a general average. Does one out of every ten joints welded have to be re-done, or one out of a hundred, or one out of five?
A. This is for repairs?

Q. No. Any welded joint, whether for repairs or new work or whatever.
A. Has to be re-radiographed?

Q. No. I will phrase the question again. If today your shop requests ten radiograph jobs on welded joints and indicated them as requiring radiographic tests, how many of those would you expect to pass and how many to fail the test?
A. On this particular type of joint we'd do awful well to have forty percent of them pass on the first. That would be considered very good.

Q. Now what do you mean by, "on this kind of joint"?
A. On the salt water system.

Q. On the ASW?
A. Yes.

Q. Does the material have a significant effect on the reject rate?
A. Yes. Copper nickel is one of the most difficult.

Q. Copper nickel is the most difficult and steel is less difficult?
A. Less difficult, yes.

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.

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

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

COUNSEL FOR THE COURT: Mr. Butler, this is a closed session of the court and classified information can be divulged here. At the end of your testimony I will ask you what classification you would accord it, taken as a whole.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Would you state your name, address, and present occupation?
A. My name is Albert Butler, live at (b) (6) and my present position is liaison man between Shop 26 and X-Ray Department.

Q. Your full name is Albert E. Butler and you are employed at the Portsmouth Naval Shipyard; is that right?
A. Yes, sir, that is right.

Q. You act as liaison man from Shop 26, the Welding Shop, to the Quality Assurance Control Test Branch for Radiography, do you not?
A. This is true.

Q. What is your background and experience in your line of work?
A. Well originally, of course, I worked in the Welding Department as a welder. I worked my way to Leadingman Welder. Then due to a reduction in force I was returned to welding again. Then with my knowledge and background I was given a position as liaison man between our shop, Shop 26, and the Radiographic Department Non-Destructive Test Branch.

Q. Over what span of years does that experience extend that you have related to us?
A. Originally I worked here before the war; and after my service in the Navy I didn't come back. But I came back in 1956 and I've been here ever since.

Q. My questions as to procedures and records which I shall now put to you relate to the period of THRESHER's post shakedown availability and not to any changes which have been made since, if any have been made. Will you describe the procedures, so far as Shop 26, the Welding Shop, was concerned for the keeping of records for the radiographic tests of welded joints in vital systems?
A. In referring to the THRESHER, when a joint was submitted, a fit-up joint from Shop 56 to Shop 26 to be welded -- I have here a sample of a card.

Q. The court is familiar with those cards, but go right ahead and describe it.
A. Well, as you know, Shop 56 initiates the first card, the Number "1" card. This card, when the joint is fit-up, it is turned over to the Leadingman Welder who, in turn, turns it over to my department when it is ready to be X-rayed. I copy the information from this number "1" card on to the number "3" card, which is sent to the Non-destructive Test Branch, notifying them to the fact that this is time to be X-rayed -- this joint is ready to be X-rayed. When they receive this

card they sign and date the number "1" card and return it to me. This goes into an active file. They, in turn, copy the information onto a number "4" card, which eventually ends up as their record. Now these number "3" and number "4" cards are stapled together and they go out into the field with the men who are X-raying the joint. When the joint has been X-rayed and the film has been evaluated, on this corner of the card the radiographer states whether this joint is accepted or rejected. If the joint is accepted, they mark it as such, return the green card to me, and they file that number "4" card with the film; this stays with the film at all times. The green card comes back to Shop 26 and the white card is marked according to the green one and returned to the Leadingman Welder, and the Leadingman Welder will return this to Shop 56 providing that it is accepted.

Q. What would be your responsibility if a newly welded joint had not been satisfactorily radiographed or was in the active file because it had a series of rejections?

A. If the joint came back as a reject, then a second card would be attached to this number "1" card stating that the joint is a reject and that it must be repaired and resubmitted for X-ray. When this work has been done and the job is ready for re-X-ray, it is returned and a second number "3" card is attached to the first one stating that this has had one repair. Then it goes back to the X-ray Department, who, in turn, does the same thing. They made out a second number "4" card and it goes through the same process.

Q. My question was intended to refer to a situation where you have a card in your active file and there seems to be no forward progress on it. There has been rejection after rejection, or you don't get the word that the test had been satisfactorily completed. What do you do; what is your responsibility?

A. If the card is laying idle in our active file, then it is brought to the attention of the Leadingman Welder that this particular joint hasn't been cleared and that it is either under repair or the repair has been made and he hasn't resubmitted it for X-ray. If, at this time, there is nothing done about it, then it has to be referred to the Quarterman, who sees to it usually that the Leadingman resubmits it for X-ray or finds out just what the hold up is, so that at no time will any of these joints be left in the active file.

Q. Well, whose responsibility is it to insure that all welded joints that ought to be radiographed are, in fact, satisfactorily welded and pass their radiographic tests?

A. This is the responsibility of the shop who initiates the first card.

Q. You are saying Shop 56?

A. This would be Shop 56. This is where it is initiated. This is where it should end up satisfactorily. And this joint is an active joint until such time as they clear their records.

Q. And the responsibility for an active joint, for seeing to it that it was finally cleared up, is at least jointly shared by Shop 26?

A. Yes.

Q. Do you have any written instruction that puts that responsibility on you to keep your active cards under close account?

A. There is actually nothing in writing stating that I shall see that this is taken care of. I do this because it's one of the jobs, part of the function, to see that none of these jobs are left in our record file.

Q. When THRESHER left for sea at the end of her post shakedown availability, had all of her active cards been taken from your active file and all tests satisfactorily completed?

A. They had all been cleared by X-ray; there were no active cards left in the file.

EXAMINATION BY THE COURT

Questions by a member, CAPT Hushing:

Q. If Shop 56 prepares a joint and is ready to have it welded, would your Leadingman Welder perform the weld without having received the cards?

A. He may start this work. Now theoretically he is not supposed to start the job without a card.

Q. By "theoretically," do you mean the process calls for him not to start the work without a card?

A. This is right.

Q. So that in starting the work without a card, he is, in fact, violating the process?

A. Violating the process?

Q. Is he technically guilty of violating the process at that point?

A. I suppose he is, but he is trying to expedite the job.

Q. I know; but he is technically violating the control process at that point in his effort to expedite or whatever else?

A. This is true.

Q. The process says that he shall not start the welding without a card?

A. This is right. This happens. It happens and it has to happen at times. The joint is fit-up and ready to be welded and they may not have the card in their hand at that particular time; and rather than wait and hold that job up until somebody comes back to the shop and makes out this card, they will start the joint. This may be a delay of maybe two to three hours. And by starting the job they are violating the instructions, but they are getting the job done.

Q. Does the Leadingman have the responsibility, Shop 26 Leadingman, of having a card in hand by the time the weld is completed?

A. Yes. Yes, he will definitely have the card before the weld is completed.

Q. Is that part of the process?

A. That is part of the process, to have that card before the job is finished.

Q. Has anyone in Shop 26 spot-checked to see whether this is, in fact, so?

A. This, I presume, has been left up to the Leadingman, which is his responsibility, and I don't believe anybody has ever questioned a Leadingman as to whether they are.

Q. Have you?

A. I never have, no. It's not my responsibility to question the Leadingman.

Q. And you don't know if anyone else in the shop has?

A. No.

Q. You don't know of any such audit?
A. No. I would probably have heard if there were such an audit. Somebody would have said, "Well, they spot-checked today." But they leave this strictly up to the Leadingman.

Q. What do you think would happen to a Leadingman who was found to have completed a weld without having a card in hand?
A. If he was found to have done such, he probably would have been reprimanded by the Quarterman or the Chief Quarterman.

Q. Do you know of any such cases?
A. No, I do not.

Questions by the president, VADM Austin:

Q. Mr. Butler, I deduce from your testimony that there could be a situation arise where a leadingman, towards the end of an overhaul, with the best intentions in the world, might have a welder repair a joint without having a card in hand and, purely through oversight, neglect to see that such a card was initiated, with the result that a joint might be welded for which there would, therefore, never be a record. Would this, in your opinion, be possible?
A. Well the system isn't perfect, but I don't think anything like this ever happened.

Q. But it could happen?
A. Well I suppose it could.

Q. Do you know of any such instances as this ever having occurred?
A. No, sir, I don't.

Questions by a member, RADM Daspit:

Q. There is a number "2" card in that set, is there not?
A. Yes, sir.

Q. And that is kept by the shop that initiates it?
A. Yes, sir.

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 made the following statement:

WITNESS: I think the subject has been fairly well covered. We did use another form which you probably are aware of. This is the 1369 Form. This type of form was used on a few of the joints. This type of record was not made out in the same form as this. There was just one permanent record. If you will notice on the back of this yellow card, you will find that there is space there for up to four repairs to be made on the same card, so that would be the only difference in the system, and they both end up with the same results. We have the same type of file for each one of these forms so that there would be no chance of a card being left in the active file in 1369, as well as the IBM card.

Questions by the president, VADM Austin:

Q. This system is still in use?
A. Yes, it is. It's partially in use in your pipe system and fully on structural hull work.

Q. Fully on structural hull work and partially on pipe work?
A. Yes.

Q. The IBM cards are only used on pipe?
A. That is correct.

Q. So that in the case of pipe jobs you have a partial duplication?
A. Yes, sir.

Q. Anything further, Mr. Butler?
A. I can't think of anything at this time. I think that the system has been pretty well covered. Like I said, this is not an absolute foolproof system. There's a chance for error, naturally. But to the best of my knowledge every one of those joints have been X-rayed and accepted, and we have the film covering them. There's no doubt in my mind but that they were all perfectly all right.

Q. But the system does admit of joints slipping by?
A. I wouldn't say the system admits that any would slip. It's possible that they could slip by.

Q. But the system admits of that possibility?
A. Yes, I suppose that's true.

Q. In other words, I'm not getting you to admit to anything, but I am getting you to say what the system permits, and it does permit a possible slippage of a joint, does it not?
A. Yes, yes, it does.

Q. Anything further, Mr. Butler?
A. I don't believe so.

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

Gardner Ladd, (b) (6) , 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: This is a closed session of the court, Mr. Ladd, and classified information may be divulged here. At the end of your testimony I will ask you what classification you would accord to it taken as a whole.

DIRECT EXAMINATION

Q. State your name, address and present occupation?
A. Gardner Ladd, Materials Engineer; home address, (b) (6) .

Q. How do you spell your last name?
A. L-A-D-D.

Q. Are you employed as a Materials Engineer in the Design Division of the Portsmouth Naval Shipyard?
A. That is right.

Q. What is your background and experience in your field?
A. I am a graduate of Rhode Island University, 1938; Masters Degree, University of New Hampshire, 1939, in Mechanical Engineering. Do you want my complete experience from there?

Q. Yes, please?
A. I have worked for Westinghouse Electric for about a year, a year and a half. I was a student trainee in Engineering. During the war I was at Newport, Rhode Island, at the Torpedo Ordnance Station, in the Design Department at Newport. Subsequent to the war, I worked in Waltham, Mass., for the Waltham Watch Company for a few months.

Q. Just the high spots, please.
A. University of New Hampshire, a teacher in Mechanical Engineering subjects, about five years; and in 1951 I came to the Shipyard as an Ordnance Engineer in the Design Division and I have been at the Shipyard since in various jobs, Marine and Nuclear Power Division, and in Design, as Ordnance, and now Materials.

Q. Are you familiar with a request made by the Bureau of Ships for a listing of the use of aluminum bronze equipment and components in the sea water system of THRESHER?
A. Yes, I am, sir.

Q. Do you have a letter request to that effect?
A. Yes.

Q. Will you produce it and identify the letter for us, please?
A. Yes, From Chief Bureau of Ships --

Q. To a number of addressees, including Commander Naval Shipyard?
A. Right.

Q. What is the subject?
A. This is 28 November '62 letter, subject: Cast aluminum bronze equipment or components in submarine sea water service; request for information concerning.

Q. Thank you. This is a true copy, is it not?
A. Yes, it is.

A copy of the above cited document was submitted to the party and to the court, and was offered in evidence by counsel for the court. There being no objection, it was received in evidence as Exhibit 148.

The counsel for the party waived reading of the Exhibit.

Q. In essence, is that a letter requesting a survey of all aluminum bronze material in sea water applications installed in THRESHER also?
A. This asks for information on material in sea water services. My interpretation of this letter is that a list would be prepared in accordance with the data required in paragraph 4, listing the material, service, and so forth.

Q. Thank you, and that would be applicable in the case of THRESHER, would it not?
A. Yes, sir.

Q. Did you send a letter forward listing such materials which applied to the sea water systems in the THRESHER?
A. Yes, sir, I did.

Q. Would you produce it?
A. The forwarding letter and the list as an enclosure was sent. This list was also issued as a BUSHIP's plan, and I submit them both.

Q. Will you identify the letter, please?
A. The letter was Portsmouth Naval Shipyard to the Chief of the Bureau of Ships and Mare Island. Subject: Cast aluminum bronze equipment and components in submarine sea water services.

Q. The letter was dated January 25th, 1963, was it not?
A. Yes, it was, sir.

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

The cited document was then offered and received in evidence and marked as Exhibit 149. Counsel for RADM Palmer waived reading the exhibit at this time.

Q. Now was there a second letter forwarding the revision to the first?
A. That is correct, sir.

Q. Will you produce it?
A. Yes, sir. (Hands document to counsel for the court) We had a letter from the Shipyard to the Chief of Bureau of Ships.

Q. Dated April 5, 1963?
A. That is right. And there were two enclosures, one was a phone conversation which we had and also a revision to the list.

Q. Does the phone conversation add anything to an understanding of the enclosure as you have given it?
A. It was incidental as to classes of material that were not included. I think this is it.

Q. All right, let me have it here as a whole.
A. Yes, sir. (Hands document to counsel for the court)

The cited documents were then offered in evidence by counsel for the court. There being no objection by the court, or counsel for RADM Palmer, party, the exhibit was received and marked as Exhibit 150. Counsel for RADM Palmer, party, waived the reading of the exhibit at this point.

Q. Will you describe the inspection of the main stern valve ring in THRESHER, and the results of that inspection please?
A. The correspondence in this inspection took place to the November letter, that was the first letter of evidence. There had been correspondence, whether the Bureau had an INSERV item on THRESHER for replacing stern propeller shaft seal. The housing in the original design was aluminum bronze and I understand it has been redesigned for another metal and the item asked that it be inspected for probable replacement. I have documents or letters indicating that the seal was opened and inspected and the list of people attending the inspection. I did not attend this inspection.

Q. Are you familiar with the result of the inspection?
A. As I say I have documents indicating the results of the inspection.

Q. To enucleate it, the results were that no de-aluminization was found, is that correct?
A. That is correct. It is stated that no de-aluminization was observed.

Q. Can you testify as to whether or not money was provided by the Bureau of Ships for inspection and replacement of aluminum bronze equipment and components in the sea water system of THRESHER?
A. To my knowledge, there was none. We were asked to make this--that is the survey--a listing of material, and there is another letter which may be pertinent. It has been cross-referenced with this survey. The requested components removed would be inspected metallurgically for de-aluminization; also the possibility of doing in-place evaluation on the components as in place.

Q. But no job order was ever issued for the inspection and replacement of such equipment and components?
A. That is right, as far as--to my knowledge, that is so.

Q. What is the significance of this failure to inspect and replace?
A. The letters from the Bureau, I believe, did not require this. It was also late in the availability. It meant that if we did any inspection, that would mean removing or opening up equipment to make this inspection. It would mean a delay in the availability, the time factor involved. I know of no other reason why it was not done. But we were, of course, busy in making these lists, and checking every source that we could, to make or to try to obtain information on all aluminum bronze in the vessel. We were doing it for the whole class which meant a lot of plan research. That was our objective, to get lists of components, aluminum bronze components.

EXAMINATION BY THE COURT

Questions by a court member, Captain Hushing:

Q. You stated that the seal ring in the seal had been examined, however?
A. That is correct. It was opened up. I have pictures here of it. I don't think I have the aluminum bronze. It was mainly--the pictures involved the seal, shaft seal itself. There was some damage.

Q. But I am concerned with the aluminum bronze portion. It was examined?
A. Yes, sir.

Q. There was no de-aluminization found?
A. That is correct. That is the--the document indicates that, yes, sir.

Q. So that for the item that was examined, there was no problem?
A. That is right. We have letters from the Bureau indicating that this particular item could be left until the next availability.

Questions by a court member, Captain Osborn:

Q. Could I ask you, have you ever been before a board of investigation before?
A. No, sir.

Q. This may be a personal problem, but you feel very nervous before the court. Do you have any anxiety about this particular aluminum bronze problem?
A. No, sir. I have no reservations or no feeling that it was the cause of the disaster, but of course I don't know the cause, so I think we're all worried from that point of view.

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

The president 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: I have nothing more in the aluminum bronze area. I did, at the request of Commander Allen, go down in the drydock, the Friday before the THRESHER was undocked. This was to inspect a suction screen over the main induction valve, a question of coating. It was stainless steel wire mesh screen. We found--there were other people from Design that went with me--and the screen had been removed and it was on a set of blocks at the side of the dock. We examined the screen for corrosion and I did observe that there were mechanics or machinists working in the area of this induction valve, but I asked no questions. I didn't know what it was all about, but as I say, I was in the dock on this Friday; I don't think it is too pertinent. It is the only thing I have on my mind.

PRESIDENT: But it does indicate the something was being worked on just before the ship was completed?

WITNESS: Yes, sir.

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 a closed session of the court. You can divulge classified information here. At the end of your testimony I will 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. (b)(6) , (b)(6) . Present occupation is, I am a mechanical inspector in Shop 29.

Q. That is the Quality Assurance Division?
A. Yes, sir, inspector in the Quality Assurance Division.

Q. And that is the Portsmouth Naval Shipyard, is it not, Mr. (b)(6) ?
A. Right, sir.

Q. What is your background and experience in your present job?
A. Well I've been in the Shipyard--it will be 22 years in July. I came on as a laborer, transferred to Shop 38 as a machinist's helper. I went in the service for three years, came back as an apprentice, served four years apprenticeship there, worked in Shop 38 as a mechanic and I believe I have been five years in the inspection division.

Q. Directing your attention to the 7th of March of this year, were you in THRESHER doing a PUFFS hydrophone piping test on that day?
A. Yes, sir.

Q. And did you test out that section?
A. The PUFFS piping only, sir.

Q. Would you describe that please?
A. Well it was about three-eighths inch pipe, I would say approximately 15 to 20 feet. It was tied into the auxiliary sea water system.

Q. Can you describe its location please?
A. It's the aft end of the engine room on the starboard side of the ship.

Q. Was the test satisfactory and so initialled on the test memo by you?
A. On a Form 771, an inspection request.

Q. Do you have a copy with you?
A. Yes, sir, I do have a copy with me.

Q. Will you produce it?
A. Yes, sir. (Hands document to counsel).

COUNSEL FOR THE COURT: Instead of introducing it in evidence, I ask the court to take judicial notice that it is an identical copy of Exhibit 103.

PRESIDENT: The court so notes.

Q. Mr. (b)(6) do you know, of your own knowledge, that the auxiliary sea system aft was being tested at that time?
A. Yes. This request here required the whole auxiliary sea water system to be tested, yes, sir.

Q. What time of day was this?
A. Truthfully, I can't say.

Q. Morning or afternoon?
A. I don't remember, I was working 12 hour shifts and was pretty busy. I truthfully don't remember when we did it.

Q. It was daylight, was it not?
A. It was daylight, yes, sir.

Q. Can you testify there was pressure on the system on the auxiliary sea water system aft?
A. Yes, there was a test gauge at the pump.

Q. Do you know whether that test was ever satisfactorily completed?
A. The ship's force and myself went over the PUFFS piping which was my only responsibility. We inspected that. When I completed that, the pipefitter on the job said, "I don't need you any longer." The ship's force was to buy the rest. I don't know after that how it stood.

Q. On the 8th of March, 1963, you were hurt, were you not?
A. Yes, sir.

Q. You did not return to THRESHER thereafter?
A. No, sir.

Q. Do you or do you not know, as of now, whether the auxiliary sea water system aft was finally tested and accepted?
A. I cannot testify to that, sir.

EXAMINATION BY THE COURT

Questions by the court president:

Q. Mr. (b)(6), do you recall the Yard workman who was assisting on the test of the ASW system at that time?
A. No, sir, I can't.

Q. Did you know him at the time?
A. If I saw the gentleman, I could probably recognize him.

Q. Was he a stranger to you?
A. No.

Q. Was he tall?
A. I truthfully can't say. I was working two boats at the time and between one and the other, I really can't pin it down.

Q. You have no fixed impression that you can recall?
A. No, sir.

Q. And you have no way of knowing whether or not that test ever was completed or if so, when? In other words, no one told you "Hip hip hooray, we got the ASW line sold"?
A. No, sir. As I say I went out hurt and I came back on the 606. I was never on the THRESHER again.

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

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

The witness made the following statement:

WITNESS: No, sir, I don't know a thing. I go to sea on these ships myself and as far as the tests that I witnessed and the tests that I see, I feel that they are done to the best of people's ability.

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

The court then recessed at 1224 hours, Friday, 3 May 1963.

The court opened at 1325 hours. All persons connected with the inquiry who were present when the court recessed were again present. No witness not otherwise connected with the inquiry was present.

The court proceeded to Shop 56 at 1330 hours to observe techniques in flexible hose fabrication, examination of sil-brazed joints, and insert rings, ultrasonic testing; sil-brazing and induction brazing of joints; also a hydrostatic test of a flexible hydraulic system hose under (b)(1) hydrostatic test.

The court returned to its regular meeting place.

All persons connected with the inquiry who were present when the court viewed Shop 56, were again present.

No person not otherwise connected with the inquiry was present.

Anthony Karetnuk, CWO-4, USN, was called as a witness for the court, was informed of the subject matter of the inquiry, was informed of his rights under Article 31 of the Uniform Code of Military Justice, was sworn and examined as follows:

COUNSEL FOR THE COURT: Mr. Karetnuk, this is a closed session of the court and classified information may be divulged here. At the conclusion of your testimony I will ask you to assign the highest classification you would accord to your testimony.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, rank and present duty station.
A. Anthony Karetnuk, Chief Warrant Officer W-4, U. S. Navy. I am presently attached to the Portsmouth Naval Shipyard as a ship superintendent in the Production Department.

Q. How do you spell your last name?
A. K-A-R-E-T-N-U-K.

Q. State briefly your naval background and experience?
A. I've been in the Navy over 26 years. I've spent most of my naval career at sea in a destroyer, three submarines, a heavy cruiser, two fleet tug boats, an aircraft carrier. I had a tour of shore duty at New York City as a Naval recruiter; a tour of shore duty briefly with CNO attached to a unit in Burma. I've had a full tour of duty at the Boston Naval Shipyard, and my present tour of duty at the Portsmouth Naval Shipyard, which I reported here in October 1962.

Q. What were the duties you performed at the Boston Naval Shipyard?
A. I was a ship superintendent in the Production Department in the Repair Division in connection with overhaul in destroyer types mainly. Also some new construction on an LST type ship.

Q. Turning to the period of THRESHER's post shakedown availability here, what duties did you have in connection with THRESHER?
A. After my indoctrination at the Portsmouth Naval Shipyard in October, the shipbuilding and repair superintendent Captain Heronemus assigned me to the USS THRESHER for indoctrination in nuclear submarines and as a tentative relief for Mr. Cadenhead who was going to retire about the first of the year. I was to be the ship superintendent mainly for machinery in connection with the Shipyard work in the AMS and engine room spaces.

Q. What had been your enlisted rating Mr. Karetnuk?
A. I had been a machinist's mate first class and then I went to submarines in the new rate of motor machinist's mate--I was then. My rate was changed to Chief Motor Machinist's mate and finally a chief engineman. That was done administratively but I was originally a machinist's mate.

Q. When did you assume your duties as assistant ship superintendent for THRESHER?
A. I relieved Mr. Cadenhead the first of January, 1963, although I had been aboard the ship since November.

Q. Directing your attention to the period of 7 and 8 March, 1963, had it been your practice to have a daily conference to check on the items of work completed in THRESHER?
A. Yes.

Q. Who would be present at such conferences?
A. Lieutenant Biederman who was the senior ship superintendent, myself, and all the supervisors of the different trades, mainly the quartermen and leadingmen from all the trades who were members of the THRESHER project team.

Q. And to assist you at these conferences, did you have prepared a list of outstanding work items to be accomplished in THRESHER?
A. Yes, we did.

Q. Do the records for the 7th and 8th of March which you have described as work items lists prepared for your convenience, indicate whether the auxiliary sea water system aft in THRESHER was finally successfully hydrostatically tested and sold to the ship's company?
A. Yes, sir.

Q. Would you produce the records to which you refer.
A. Yes, sir. I might point out these were my personal notes that I kept myself, and they are not--although we made the plan of the day--these were not required to be kept except for my own use. This is the daily plan of the day as we refer to it. Here is the sixth, seventh and eighth.

Q. Just the 7th and 8th are the ones we want. Would these be the two?
A. Yes, sir, that is the 7th and that is the 8th. (Handing documents to counsel for the court).

Counsel for the court then offered in evidence the so-called "Plan of the Day" for March 7th and 8th. There being no objection by the court or counsel for RADM Palmer, a party, the cited documents were received in evidence and marked as Exhibits 151 and 152. Counsel for RADM Palmer, party, waived reading the exhibits at this time.

Q. Would you explain how these papers are made up, who chooses the items to be placed on them and where other copies of them are located and used?
A. Well, we--the senior ship superintendent Lieutenant Biederman, with the progressman and myself, we selected the most urgent jobs that the Shipyard was doing and listed them on a plan of the day for our own use. We had a conference every day at 1:15 to use as a rundown for the plan of the day with the supervisors and get the latest information on the most important items. As the items were completed, we deleted them from our plan of the day and we went to the next most important urgent item. This here, on the eighth, which we carried the ASW system as number one item for a long time because it was the most important system, and as we got a rundown each day on these, we would be brought up to date on the current status of the job, and as I say, as the jobs were completely sold, as far as the Shipyard was

concerned to the ship or whoever it required to accept this system or the job, then we deleted them from the plan of the day and they were no longer brought up in the conference. We just went to the next most important item. We selected the most important items that affected us in the Shipyard for the completion of the ship, and we did this on a daily basis for the last three months of the availability.

Q. Was the auxiliary sea water system aft in THRESHER sold to the ship's company at the completion of the successful hydrostatic test?
A. To my best knowledge, it was, yes, sir.

Q. On what do you base that statement?
A. Well with these notes and a review with Captain Heronemus and Ensign Lucas. This was the most important item and I remember that the day that this was finally sold, there was a sense of great relief to Lieutenant Biederman and myself, and the supervisors who were principally concerned with this was Shop 56, the pipefitters. And there was a sense of great relief to us that this was accomplished because we were acutely aware of our problems here and it was always a hard job to do.

Q. Based on your recollection, as refreshed from the exhibits before you, can you state on what day it was successfully completed and sold?
A. We made these plans up on the morning of the day that we had these conferences, so apparently this was still listed on the 8th; we had the conference at 1:15, and at 1:15 is when I deleted this from my notes here, so it must have been completed the night of the 7th or the morning of the 8th. It was completely sold prior to 1:15 on 3-8 when I deleted this.

Q. Do you have a file of such papers which extends all through the month of March and up to the time of the end of the post shakedown availability period?
A. The latest plan of the day, we went through the 12th--3/12. At that time I went on nights; I was working nights so I was not in the daily conferences any more after that.

Q. Have you examined them to the limit to which they go, up through the 12th?
A. Yes, sir.

Q. Did you find any other item thereafter dealing with the auxiliary sea water system aft?
A. I did not find any more references to the auxiliary--to the ASW system after that, no, sir.

Q. Do you recall who it was who gave you the information that the hydrostatic test had been sold?
A. I would say it was the leadingman pipefitter or the quarterman pipefitter. I was sure it must have been Shop 56 who gave us this information.

Q. Do you recall the names of the two individuals?
A. It was either Quarterman Collins or Leadingman West. I don't remember which one but it could have been either one of those.

Q. Do you recall whether any details of the test were given to you at that time--the duration of the time that pressure was placed on the line, and the amount of pressure--any information of that nature?
A. I don't recall clearly, no, sir, not the details.

Q. Based on your own recollection, as refreshed from these exhibits, is there any question in your mind at all as to whether the hydrostatic test was finally sold in the auxiliary sea water system aft on the 8th of March?
A. No, sir. I am convinced in my own mind that it was complete and we did a proper hydro on the system.

Q. Are you also convinced that the hydrostatic test was completed and sold prior to the casualty to the reserve feed water tank in THRESHER?
A. Yes, sir. I may add that this was the final test. We had had other tests on the ASW system which required repairs.

Q. In connection with that reserve feed water tank casualty, Mr. Karetnuk, were you called in as a result of that casualty--called in to the THRESHER?
A. I was in the field house when it occurred. It occurred on a turnover of shifts--I'd say approximately at 1630 or so--and somebody came into the field shack and said they just ruptured one of the reserve feed water tanks.

Q. Do you know whether, after the casualty occurred, any inspection was made of the auxiliary sea water lines and salt water lines associated with the still and in its vicinity?
A. It was not that same evening as far as I know. We had to pump the tank dry and we were going to inspect the inside of the tank. First, all the indication we had was we just had a crack in the top of the tank.

Q. Do you know whether such an inspection was made at any time thereafter?
A. 38 Shop was down there, a supervisor was down there, and this was not the same day; this was the following day, I believe, and he told me he had just made an inspection of the still and had looked through it and they were going to get some more people down there to make a thorough inspection.

Q. You know of none of your own knowledge?
A. No, sir. I did see him there when I came down in the engine room.

Q. Can you discuss the difficulties with a Hammel-Dahl valve in THRESHER which you experienced?
A. The Hammel-Dahl valve is an automatic regulating valve for the Lithium Bromide plant and it is connected up by a series of elbows which we were required to weld, and pass an X-ray and a hydro b(1)
We did experience quite a bit of difficulty making up the joints.

Q. Did this valve regulate the sea pressure to the air conditioning system?
A. The Lithium Bromide plant, that is an air conditioning system, yes, sir.

Q. Was the difficulty ultimately corrected?
A. Yes, sir.

Q. How was it tested?
A. Hydrostatically b(1)

Q. Did that test result in final acceptance of the work or was there to be final acceptance of the valve and system during the sea trial?
A. The test proved our weld joint. The final operational test was going to be accomplished at sea.

Q. Can you discuss, in general terms, the difficulties experienced with--any difficulties experienced with silver brazed joints in the auxiliary sea water piping system during the post shakedown availability of THRESHER?
A. On our tests, we had, I'd say, several rejects that had to be repaired again and done over. I'd say in the order of about ten per cent were rejects.

Q. Do you have copies of your weekly progress report to the Production Office which give the actual number of joints compared to the rejects?
A. Yes, I have some of those here. Our weekly progress report to the Production Officer, yes, sir.

Q. Would you refer to the first one dated 16 November 1962?
A. Yes, sir, 16 November 1962.

Q. Is that one of those which gives actual numbers rather than a generalization of the terms?
A. Yes. May I read this?

Q. Please do.
A. This is "Major Job,"--the title is, "Spec and Test the silver brazed salt water systems." Under "Material Status," it says "unsatisfactory." "Plant Status" was satisfactory. Here is the ship superintendent's comments for this report here. There was 166 joints tested, 146 acceptable; 20 rejects. UT inspection complete, except UT of new joints. Seven new joints failed UT, and six of these remained to be repaired. Nineteen Teflon coated ball valves have not been installed; only ten require work by Shop 31, and are awaiting delivery of balls now scheduled 11-21. Other nine are complete but are held up by hull valves.

Q. Is that item a genetally fair representation of difficulties with silver brazing or is it an extreme occasion?
A. I would say that was an average report.

Q. Can you discuss in general terms the effectiveness of the welding performed in the steam system piping?
A. We did cut our steam system and were required to make a new joint and it required an excessive amount of time to make this joint due to flaws on the X ray which required repair, the flaw to be ground out and reweldad, and the joint again inspected by X-ray.

Q. It just required one rewelding, is that it?
A. No, there were several. This was a long drawn out procedure.

Q. Could you estimate the time involved?
A. I'd say there is one joint required approximately three weeks, but that was not working steadily upon it--three weeks from the time it was started to the time it was finally sold as complete.

Q. Turning back to Exhibits 151 and 152, I note that they are reproduced. Who else would have copies of these which extended all the way to the end of THRESHER's post shakedown availability?
A. Well these were made up on a reproducible mat, and 20 or 30 copies were reproduced every day for each of the supervisors and ourselves, the three ship superintendents, and anybody else who was interested.

Q. Do you know of any place where a complete file of these is maintained?
A. No, sir. I do not. I do know there were no files made of these; these were our own personal--I mean our own working papers for the field shack itself.

Q. Do you know of any place we might look to find the plan of the day from the period where yours ends to the end of THRESHER's PSA?
A. We have some papers in Captain Heronemus' office and he had some plans of the day--the dates of which I am not familiar with.

EXAMINATION BY THE COURT

Questions by a court member, Captain Nash:

Q. We have heard reports of improper installation of flexible hoses. I specifically refer to twisting of a hose in the process of installation. From your observation, would you comment on hoses which you had occasion to observe?
A. The many flexible Aero-Equip hoses, I observed, I noticed some bends in some of them, but this twisting--I personally did not see any hoses that were twisted, distorted by twisting. I did see some that were not straight, or they had a bend in them. The bends are acceptable in certain cases, if it is one bend, as long as it is not a dog-leg bend. But to the best of my knowledge, I saw none that were twisted.

Q. Do you recall any other things in connection with the flexible hoses? Did you hear any complaints from the members of ship's company about the installation of hoses?
A. Yes. I heard complaints from the ship's force. Generally it was that there was paint on some of the hoses, and that some of the fittings had not been replaced, renewed, although the Shipyard job was to replace the rubber and use the same fittings in many of the hoses. So I think the engineer officer accepted that all right, after I produced a BuShips instruction outlining the procedure of installing Aero-Equip rubber hoses. He accepted this changing of rubber. As far as the paint on the hoses, we got a letter from somebody up here giving us a rundown of the paint on hoses which stated that it was not harmful to the rubber.

Q. Can you recall if tests were satisfactorily performed on those systems wherein flexible hoses were installed?
A. The hoses themselves were shop tested. We installed them with mechanical joints, and to the best of my knowledge, the places that they were installed, they proved satisfactory. I know of no hoses that we had trouble with outside of the paint and the bends.

Questions by a court member, Captain Hushing:

Q. We have reports of check valves being installed backwards. Did you see any such or did the ship's force report any such to you?
A. On the constant vent system, we did install approximately 30 new spring-loaded check valves, and I did hear, on several occasions, that some of them had been installed in reverse. Both ends were identical and they both matched up so you could install it either way. The last time I heard of such an incident, I was in the field office and as soon as I heard this--somebody said some check valves on the constant vent system had been installed in reverse in the engine room. I went right into the engine room--it was a matter of two or three minutes--and I tried to get somebody to point out to me exactly which one was reversed and the answer I received then was the valve had been corrected and it was all right now. But I could not get anyone to actually point out to me and say, "This was the valve."

Q. No one was ever able to point out to you a valve that was actually installed backwards?
A. No, sir, and each time I went down, they said it had just been corrected and it was all right now.

Q. How about the hydraulic system--were there any valves in the hydraulic system installed backwards to your knowledge?
A. I wasn't too knowledgeable about the hydraulics--in fact I didn't have anything to do with it, but I did hear an instance that some of the valves had been installed backwards, yes.

Q. But you didn't see them?
A. No, sir.

Q You did not follow up on it?
A. No, sir.

Q. A few minutes ago you read a comment relative to silver brazed joints, did you not?
A. Yes, sir.

Q. Do I remember that correctly that it was the result of the surveillance inspection of silver brazed joints? Would you re-read the words relative to that?
A. This was 16 November 1962. I will re-read the ship superintendent's comments. "One hundred 66 joints tested. 146 acceptable. 20 rejects. UT inspection completed except UT of new joints. Seven new joints failed UT test and six of these remained to be repaired. 19 Teflon coated ball valves have not been installed. Only ten require work by Shop 31 and are awaiting delivery of balls now scheduled for 11-21. Other nine are complete but are held up by Hull valves."

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

Questions by CAPT Osborn:

Q. Will you read what that job is that you're talking about?
A. This is Job Order No. 50612N60 "Inspect and Test of Sil-brazed Salt Water System."

Q. What did you think of the crew of the THRESHER?
A. The ones I was associated with were mainly the engineering personnel in the engineroom. I knew the good ones; I mean you could really tell who you would go to see to really get something done. I'm not too familiar with the rest of the crew, although I did see them occasionally. The engineering personnel, mostly, impressed me very much, and I'm sure they were knowledgeable of what they were doing, and aware of what they were doing. Chief Wise, in my opinion, was outstanding.

Q. There's no question about the depth of competence of the personnel in the engineroom that you were familiar with?
A. No, sir.

Q. Did you inspect the reserve feed tank, No. 2, after the over-pressurization?
A. I went inside the tank, yes, sir.

Q. Will you describe your general thoughts with respect to deflections and what you saw inside the tank?
A. The tank top had been bulged, I would say, the maximum -- it was still bulged when I went into the tank, a maximum of two inches. The rods that had been inside the tank, there had been many rods, steel rods, welded to the top and bottom of the tank in the general vicinity of the center of the tank, all of these rods had been pulled off either from the top of the tank or the bottom of the tank. The welding had been actually pulled apart. It surprised me greatly; I didn't expect to see that, and the crack itself was just a crack in the top of the tank, which is not too much of a thing. That is all I expected to find, the crack, and I was surprised to see the tank top bulged so much.

Q. Was it bulged very much in the vicinity underneath the still?
A. The stills were close to this after top of the tank top. It was bulged almost at a maximum there.

Q. How about the drain line discharge; do you remember looking at it?
A. I didn't notice anything unusual about that.

Questions by the President:

Q. Mr. Karetnuk, I believe you said that at the time you inspected the feed water tank the bulge was approximately two inches; is that correct?
A. At the maximum, yes, sir.

Q. This was after it had burst and come to rest?
A. Yes, sir, we had to pump the tank dry before we could enter it, and open it. The manhole was on top of the tank.

Unclassified

Q. Did you hear any expression of opinion by members of the crew, or by any of the Yard personnel, regarding the 12% plus failure of ultrasonically tested joints on the Intergrity Test on the ASW line?
A. No, sir.

Q. They thought that was quite normal?
A. Well, I would generally say, yes, sir.

Questions by a member, CAPT Nash:

Q. Did THRESHER have some difficulty with sea valves right near the post shakedown availability?
A. Main sea suction, yes; b(1)

Q. Was this satisfactorily repaired before the sea trials?
A. Yes, we had to go in drydock to do it.

Q. Did you hear any discussion, or have any discussion with members of the ship's company regarding the possibility that this, or similar valves might bind at deep submergence?
A. There was some talk on that, yes; not too much. Apparently, at one time they must have had difficulty trying to operate the valve, the sea suction. Normally it's in the open position all the time.

Q. Do you refer to some trouble that happened at sea before the beginning of the post shakedown availability?
A. I refer to some other time prior to the ship coming back here; yes, sir. Exactly when, I don't know, but I heard some one on the ship talk about it, and I didn't question as to when.

Q. Do you have any reason to believe that this possibility of binding in any way entered into the agenda which was planned for the deep dive?
A. I know that they were going to try to operate it; Lieutenant Biederman and the engineering officers of the ship talked about it; they said they would try to operate it at deep submergence.

Q. The agenda indicates that they planned to make a deep dive without operating these valves; then make a second one in which they would operate them. Do you remember any discussion in this connection?
A. No, sir, I don't, although I know the first dive, they were just going to go down to test depth and come back up again before they started doing any of the testing that was scheduled. There wasn't very much talk on this.

REDIRECT EXAMINATION

Questions by the counsel for the court:

Q. Mr. Karetnuk, you have given an estimate of the maximum deflection of the tank top. Now I would like to ask you to give us your most careful and best estimate, and tell us on what you base it. Could it have been one and 7/8 inches, instead of two inches, or what? Tell us how you estimated it and how good you consider that your estimate was.

Unclassified

A. I would say approximately -- I don't know whether I could estimate to an eighth of an inch, or not -- but approximately from the top of the tank to where one of these rods had parted, or pulled away from the weld, is approximately two inches at the maximum.

Neither the counsel for the court, the court, nor the counsel for RADM Palmer, a party, 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:

WITNESS: Just my own opinion, sir, I would like to express that.

PRESIDENT: Go right ahead.

WITNESS: The THRESHER, in my personal opinion, was a very fine ship. The morning that it left here, in my opinion, it was as ready as any submarine will ever be to go to sea. I certainly, myself, would not have hesitated to have gone out with her. This was the farthest, the most remotely connected, with anything that we ever expected.

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

The court recessed at 1515 hours, 3 May 1963.

The court opened at 1528 hours, 3 May 1963.

All persons connected with the court who were present when the court recessed were again present in court.

Commander John Woolston, U. S. Navy, was called as a witness for the court, was informed of the subject matter of the inquiry, was warned under Article 31 of the Uniform Code of Military Justice, was duly sworn, and examined as follows:

COUNSEL FOR THE COURT: This is a closed session of the court, Commander Woolston, and you may give classified information here. At the conclusion of your testimony I shall ask you what classification you have assigned to your testimony, taking it as a whole.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, rank, organization and present duty station.
A. Commander John Woolston, (b)(6) /1400, USN, Bureau of Ships, Code 525; Project Officer for SS(N) 593 and 637 class submarines.

Q. The 1400 designator which you mentioned indicates that you are an officer qualified for Engineering Duties Only; is that correct?

Unclassified

A. Correct.

Q. You are also a qualified submarine officer?
A. Yes, sir.

Q. Briefly state your naval and professional background and experience?
A. I graduated from MIT with a Bachelor of Science in Naval Architecture and Marine Engineering 1944. Served in U.S.S. INDIANAPOLIS, U.S.S.PHILIPPINE SEA; I went back to post-graduate school, the Navy Standards School at MIT, and received the degree of Naval Engineer, in 1951. I had a short tour at Hunter's Point, and then went into the ED program for submariners.

Q. That's Engineering Duties Only Officer program?
A. Correct. Six months of Submarine School, and then a year and a half at Remorra on the West Coast, and then came back for two and a half years in Charlestown, one year on the waterfront; two years as assistant P and E Supe for noise and vibration, and a year and a half as assistant P and E Supe for submarines.

Q. Commander Woolston, try not to use abbreviations which would be unintelligible to others than those initiated in the intricacies of your science. Would you describe what you meant by P and E Sup?
A. Planning and Estimating Superintendent. After that I went to Portsmouth. where I served from August, 1956 until July 1961, as Assistant Design Superintendent, and Project Officer for the SS(N)593 and 593 class, and then transferred to the Bureau of Ships, and since that date have been Project Officer at the Bureau of Ships for the 593 class.

Q. Would you briefly highlight the duties of the Project Officer in the Bureau of Ships for the SS(N)593 class submarines?
A. Project Officer in the Bureau of Ships is responsible for all Bureau of Ships matters relating directly to the submarine class; that is, financial, construction, improvements or changes, alterations or change-orders. The Project Officer, obviously, does not make all the decisions, but he is the working level person responsible.

Q. Then in your last two duty stations, you have been in a peculiarly good position to learn the details of the design history of THRESHER, have you not?
A. Yes, sir.

Q. From its inception to its execution here at the Shipyard?
A. Not quite back to its inception, since there was some development before I went in it, but in general, yes.

Q. Have you familiarized yourself with the design history of THRESHER?
A. Yes, sir. Its history, concept and design objectives, yes, sir.

Q. Will you relate them to the court?

The witness requested and was permitted to refer to charts and diagrams in his possession to testify from his recollection.

Unclassified

Unclassified

A. Yes, sir. As a part of the development of the design of THRESHER, I think it may be well to look at it in terms of other new designs, which were in progress over its period of concept. The SS(N)585 design started from a set of characteristics in September of '55. Completed preliminary design and started contract design in March '56. In June '56, contract design was turned over to working plans, detailed design, and the ship detail design and construction continued until final delivery in 1959. This SS(N)585 is the first of the teardrop ALBACORE shaped hull, single screw nuclear submarines. The SS(N)597, whose characteristics were firmed up in March of '57, preliminary design and turned over to contract design was turned over in October '57, contract design to detailed plans in February of ' 58, working plans and construction period phase until October 1961 the ship was completed. 597, TULLIBEE, was the lead ship for the new BOOl sonar system. 593, THRESHER, original characteristics in July of '57, turned over in October, the contract design went through two phases, which I will describe later, but the final turnover was July of '58, and construction was started early that year and finally completed in August of '61, when the ship was commissioned.

The development of these ships may be of some interest. The 585, the ALBACORE hull form, single screw, a length overdiameter ration of 7.9., b(1) shaft horse power plant to the S7W reactor, a little bit over b(1) knots; (b) foot test depth, HY-80 pressure hull, 318 inches in diameter; thickness was b(1) inches; cone cylinder intersections on SKIPJACK were similar to those on NAUTILUS. Bulkheads internal were two holding bulkheads b(1) foot, and two intermediate bulkheads, b(1) foot, with flat end test depth bulkheads. The velocity of this that b(1) feet is about the limit with an ASR for rescue. These are two escape compartments at the end of the interior bulkhead; b(1) feet is satisfactory for containment for the nuclear plant and gives you a reasonable margin for surface damage where you may duck down and then have to come up again. Sonar a BAN/BQR-2B passive located below the torpedo tubes, which come out through the bow, and an SQS4 active above the tubes. They had six torpedo tubes in rows of three.

I would like to invite your attention to the principle characteristics on the board of the 585, and we will refer back to it as we go into the development of THRESHER. Additional items which I hadn't mentioned were the air bank capacity of b(1) cubic feet air pressure at b(1) The Chief of Naval Operations had indicated to the Ships' Characteristics Board his desire for improved performance of these submarines in greater diving depth, greater submerged speed, greater quietness and improved sonar. As far as the increased depth was concerned, the key to this development was HY-80. We have a chart of Collapse Depth in feet versus pounds per cubic foot of steel. This is the weight of pressure hull, plus its framing per unit volume. This is a relationship of the efficiency of structure. Using the (b)(1) foot test depth submarine with HTS, we arrived at b(1) for the same general type of structure with HY-80. The state of the art of HY-80 at this time was that it had been used in a modified form on ALBACORE, and we were committed across the board on the 585 and 588 class. The thicknesses, as you can see, were slightly thinner. SKIPJACK was b(1) , ALBACORE had the b(1) maximum, where in THRESHER we were looking for b(1) . Studies had been made during this period of time on b(1) b(1) . Original sketches of the spring styles were at b(1) feet.

Q. What do you mean by "spring styles"?

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A. Spring styles is a presentation of possible future designs by the Bureau of Ships to CNO. Based partially upon this relationship of collapse depth for HY-80 versus HTS, and on other development problems, it seemed at this time that it would cost insignificantly more to develop a ship for b(1) than b(1) feet. b(1) wherein the weight of the structure created would be a much greater problem. As far as the increased speed was concerned, in order to do it with the SKIPJACK type hull, it would have required that we would have had to develop a new reactor. This was considered to be too much to do in the short time period involved, so we looked for other ways of reducing drag. One look was at the removal of the sail. The operating forces had expressed interest in a fairwater and sail-less submarine, with a one-man bridge, which would be retractable, and an absolutely clean, tube-shaped body. The only appendages would be the stern appendages. This would increase the speed by about one and one-half knots, and would completely knock out the serious heel in the turn, that was noticed in the 585. It was also anticipated that the radiated noise, (b)(1) would be significantly less, due to the complete lack of fairwater and sail. To the way of quieting, considerable work had been done on b(1) ; and the decision was made to put in full b(1) in submarines in Fiscal '57. Machinery was considered to be a major problem and various types were looked into. I'll discuss the machinery developments later.

Sonar, at this time the long range, low-frequency sonar which had been under development by the Underwater Sound Lab, looked to be feasible. This was the state of the art sonar; that is, we would do everything that we knew how to do to get the maximum out of it at the time it went into the ship. This involves, among other things, the fifteen foot diameter sphere in the bow of the ship. It also has an informal array, which conforms to the shape of the hull and wraps around outboard of the forward compartment, almost back to the beginning of the sail. The PUFFS array was another type of sonar that was desired, basically because it would provide you with a passive ranging device which has been one of the things submariners have been calling for for many years. The ideal PUFFS array involved three-line hydrophones and it measures the curvature of an incoming wave front. Because of the desire to keep THRESHER clean and quiet, instead of placing large masts running in a straight line, it was decided to use a quadrilateral array, with one hydrophone in the bow, one on a retractable mast in the midships compartment, one on a retractable mast that went out through the bottom of the auxiliary machinery space, and a fourth on a mast which came out of the after ballast tank. Use of two hydrophones in the center of the array was an adequate substitute with some electronic modifications to the three in-line hydrophones. The torpedo tubes had to be located in some place other than the bow, since the sphere was needed at that point. Consequently, it was decided to locate them in the midships compartment and put them through the cone, so that the penetration of the actual pressure hull would be at a minimum. These are on the third platform deck. Inasmuch as this was the first high speed ship to get angled tubes, TULLIBEE had them, but she was not as fast a ship, and it was not considered at that time that her firing torpedoes at high speed would be as important as with THRESHER, we set up some tests in the AO NEOSHO. NEOSHO was a fleet oiler and capable of high speeds, and had large tanks outboard along the hull, so we were able to put a submarine tube complete with its ejection area into the tank, and we ran some tests in Narragansett Bay to prove that this setup was satisfactory for the launching of both ejected and swim-out weapons. These trials were in July of 1957. As a result of these studies, in June 1957, a set of proposed characteristics was circulated, because the Characteristics Board has representations

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from all interested parties, including the Bureau of Ships, the Bureau's comments were fairly minor at this time. Basically the mission was put down as to locate and destroy all types of ships. The general discussion involved the best submerged characteristics, the best sonar performance, surface performance was definitely secondary, minimize self and radiated noise. Hull characteristics were put down as approximate dimensions, displacement of 3350 tons light, 4100 tons submerged. Length of 274 feet, beam of 32 feet.

Maximum shock resistance. I might mention at this point that resistance goes along with increased depth, because it is desired that all hull penetrations shall withstand the same shock that the hull can withstand. Internally it is desired to maintain this, although on this we have a lot further to go. Silencing goals involved reaching sea state 1 PUFFS noise while proceeding at three knots at 200 feet submerged. Radiated noise to the same background at ten knots at 200 feet at 100 yards distance. There were certain notches below this to sea state zero in the bands of interest to the B223 Test depth of this ship was to be b(1)

Special features were two b(1) foot escape compartments, rescue chamber adaptations, the other was the rest of the bulkheads b(1). Originally there was one messenger buoy aft, but BUSHIPS demurred, and this was later changed to two messenger buoys. A sonar bow was mentioned.

The armament dropped to four torpedo tubes angled forward. The reason for the four was that we could only get two tubes on a side into the deck height, and it wasn't considered at that time that it was worth it to take in another deck, and we added power operations for hoisting, ramming and athwartships handling in order to maintain the same firing rate as we had with a six tube ship. Eighteen reloads went into the original ship; later we made it nineteen.

Fire control and communications. A simplified Mark 101 system was the original fire control system, the masts were to be useable only at three knots, and there were to be three masts. Later the Bureau said that this could be done in two. Note that this is a very slow speed available, which indicates that the ship is definitely sub-standard in near-surface operations in any seaway.

Propulsion and engineering speeds were to be sixteen knots surface, b(1) submerged; emergency propulsion five knots. Endurance of reactors b(1) Diesel 2250 miles at five knots.

Power plant, with a single screw nuclear, S5W plant. Battery, snorkel availability five knots on battery charges.

At this point the one-man bridge was still in a proposed characteristic, with a very high periscope and no bow planes. At this point the Bureau of Ships demurred and said that they objected to a sail-less sub, because they did not feel that at this time we were ready to go to masts which would extend so high above the ship that the danger of ramming was increased, that for near-surface operations it would be almost mandatory that we have bow planes or fairwater planes, and they recommended the minimum sail. This decision was ratified.

Accomodations: Eight officers and seventy-five enlisted men.

Stores were for thirty days chilled, sixty days frozen and seventy-five days dry.

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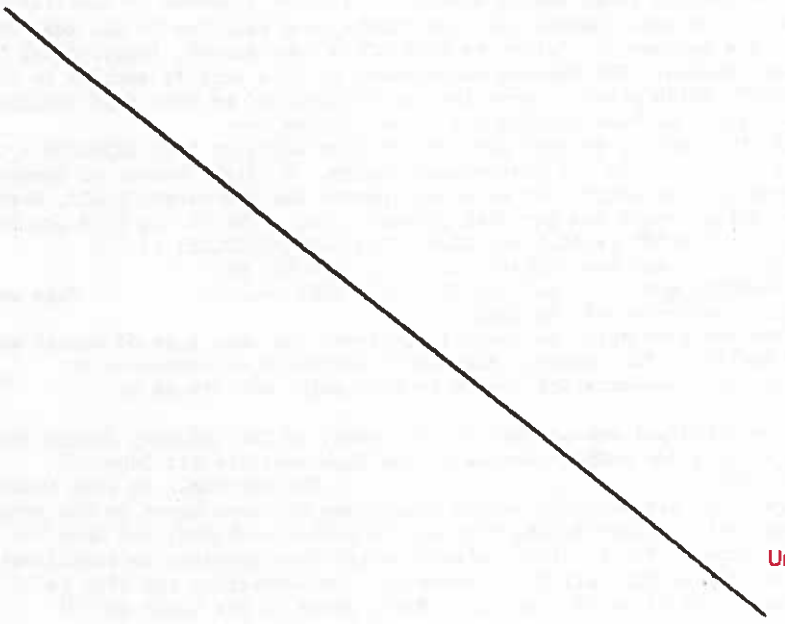
Another oddity was the anchor was located aft; this was the first time this was ever done, and the oxygen generator and other air regenerating equipment was called for. The Bureau at this point did not have the oxygen generator in hand and recommended that twenty-eight days of bottled oxygen and carbon monoxide, and carbon dioxide removal systems, with a drop-back to five days bottled oxygen whenever the oxygen generator became available.

In July of '57 the characteristics were approved, as requested by the Bureau of Ships and the contract design was about to get underway. In equating the submerged characteristics required with the things that were done, consider the best possible submerged characteristics. This called for the hull form that we had been considering. We were constrained by the S5W plant diameter to a rather longer ship than we had heretofore, and greater than we desired. The length of the diameter ratio being 8.7 rather than 7.9 of SKIPJACK. However, at this point the dry curve is quite flat, so we lost very little in form drag, due to this increase. The ship's size increase of some 14% over the 585 did, obviously, cause greater skin friction. This was to be countered by the small sail. The appendage reduction was quite dramatic in its effect. The appendage drag, as a portion of bare hull drag, or relative to bare hull drag, from the fleet boat of 140%, to the early attack boats of 49%, BARBEL class, 45%, SKIPJACK, 40% and with the original THRESHER we were down to 27%. This decrease of 33% in the appendage drag, allowed us to recoup almost all that we lost in increasing the size of the ship.

The original fairwater of this ship had as masts the short-rise, very low frequency antenna, the snorkel forward with an ACM attached. This was located forward so that it could take advantage of the extra space forward at the cone. Radio masts and a periscope.



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

WITNESS: Because the periscope, being a penetrating mast, could have a higher rise than the snorkel, which was to be a non-penetrating mast, it was decided there should be a two-position periscope, which could be operated from the first or second platform deck. This gave us one for the snorkel and one for the periscope. This was to allow minimum periscope exposure at such times as you might have to snorkel. All proturberances that could possible be removed from the surface were removed. This included grinding welds over the forward part of the ship. As a result of this work, the predicted speed came out to some 0.4 knots lower than the SKIPJACK. The maneuvering characteristics would be very similar to SKIPJACK; however, the longer hull made a little bigger circle. The increased stern appendages kept the ratio of the turning circle to length about the same.

The best possible sonar performance at high speeds involves self noise reduction. The AN/BQQ-1 system was: a 15-foot active ball; this is the BQS-6, and the AN/BQR-7. With the BQQ-3, which is the analysis sonar, identification sonar, and the PUFFS, it makes up the so-called BQQ-2 integrated sonar system. The sonar bow caused us some problems, and we were required to use plastic in a very large free-standing dome. This would extend from somewhat aft of the forward end of the elliptical bulkhead and all the way out in a free-standing dome. The reduction of radiated noise was related to machinery work, with the exception of the (b)(1) . These are naval architecture considerations. We have the same five major compartments as SKIPJACK. The degree of subdivision has been similar to nuclear submarines as heretofore, but compartments have gotten larger. We no longer have a one-compartment ship, which, at any depth, could stand flooding. Consideration was given to adding bulkheads. However, for almost any bulkhead you add, you would have to put in five or ten feet additional in the hull, and you would experience serious arrangement difficulties.

The general arrangements midships: I think everyone is familiar with this feature. We used spherical escape trunks as a solution to the test depth problem. The tankage is similar to SKIPJACK's wrap-around; longitudinal bulkhead top and bottom. The forward compartment on this ship is smaller in diameter than SKIPJACK, which gives us more tankage forward and we have main ballast tank, number seven to help support the larger engine room.

At this point, we have gone for reserve buoyancy from SKIPJACK's b(1) up to b(1) in the preliminary design. A quick rundown on reserve buoyancy on some earlier ships: We have two figures for the diesel boats, because of the main ballast tanks and the fuel ballast tanks. The 563 is 12.5 percent and 21.4 percent. The 580 is 14.0 and 23.0. The 571 (NAUTILUS) is b(1) . The 578 is . And the SKIPJACK is b(1) . The 586 was b(1) . The THRESHER was b(1) and the 597 (TULLIBEE) was b(1) . This was due mainly to the arrangement of the ship.

The pressure hull, in general, followed the same type of detail as had been used earlier. The original ship had a corrosion allowance on it.

The high-pressure air system at this point was listed at (b)(1) (b)(1) .

The principal changes now at this stage of the contract design led us to make some studies for making changes in the high-pressure air from b(1) and the b(1) . The rationale on that involves several things. The air capacity of our submarines has been based on the amount of air necessary to surface twice, fire all torpedoes on board, and have b(1) psi left in the banks. For ballistic missile ships this involved an additional surfacing and ability to fire all their missiles.. Consequently, the rise to b(1) increased the value of each cubic foot, since it was based on b(1) base,

Unclassified

by almost b(1)

The stores were raised from 75 days to 90 days for dry stores, and from 60 to 90 days for frozen stores. A new mast was added. The block hoses were increased. The corrosion allowance was removed, and the plastic bow was changed to steel. This was in the middle of the development of the contract design. The final contract design, which was signed out in July of 1958, then had used the b(1) system and had gone to b(1) . The length was increased from 273 feet to 278½ feet. The reserve buoyancy b(1) . The actual figures indicate an increase in ballast tank capacity from the last change, but a decrease from the preliminary design. Hence, the final design still matches the criterion. A series of tests were run during the contract design stage on structural models; pressure tests and some cycling tests to almost collapse pressure: a whole model of an engine room. All of these tests indicated satisfactory conformance to the requirement of collapse depth of at least b(1) feet. Another representative of the Bureau will go further into the details of these tests.

Questions by a court member, RADM DASPIT:

Q. May I ask a question here: Was this ship built in fiscal year 1957?

A. It was a fiscal 1957 ship, but the actual construction did not start until May of 1958. Now, while these things were going on in the hull section, the engineering people were looking at many different studies, different kinds of propulsion: turbine electric, solidly mounted; turbine electric drive, resiliently mounted; geared turbine, solid and resiliently mounted; direct drive turbine; hydraulic torque converter; and different combinations of them. After looking at all the different possibilities, it came out with the decision to leave the 585 as is and the 588 to 592 follow the 585, with the addition of quiet gear and direct coupled turbine generator sets. They broke the 593 loose from that class and designed b(3) 10 USC 130 main propulsion plants and turbine generator sets. The basic design that left the Bureau in September, 1957, had b(3) 10 USC 130 turbine and gear on a common sub-base b(3) 10 USC 130 direct coupled SSTG sets on a common sub-base. The basic arrangement of the propulsion plant was similar to SKIPJACK. Other characteristics were quiet gear, improved sonar, accent on acoustics; the electrical distribution system was similar to the 585; the diesel was moved forward to eliminate the superstructure, which had previously covered the diesel exhaust line. The reactor bulkhead penetrations were similar to the 585. We changed to hemispherical heads on the condensers from the earlier ellipsoidal heads. We provided b(3) 10 USC 13 main circulating pumps. With b(3) 10 U speed on the circulating pumps, it was considered wise to take the main engine auxiliaries and put them on the auxiliary sea water system. Main propulsion is then dependent on b(3) 1 sea water systems. A loop auxiliary sea water system was installed, b(3) 10 USC 130 We had studied main condenser fresh water cooling and other combinations of fresh and salt water throughout plant. This will be gone into in greater detail by another Bureau representative.

At the time preliminary design turned it over to contract design, we had not resolved all the problems of flexible connections, steam, exhaust and shaft but these studies were developed during the early detail design stages, and by the time THRESHER went to sea, no one had any doubts about a flexible mounting, and no ship has been on solid mounts, except for sea trials, since that time.

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During the latter stages of contract design and working into detail design, a great many development programs were instituted both by the Bureau and by Portsmouth. Project Pressure, started in Portsmouth, was espoused by all concerned with deep ships, and it called for group action on all items that were needed to beat the developmental problems of submarines; such things as depths, shock, hydraulic shock, thermal shock, hydraulic impulse, vibration, noise, and other special environments. Flexible shaft coupling tests were run at the boiler and turbine laboratory. Each main propulsion plant went through a full test at the manufacturer's plant. The secondary propulsion system was tested at Portsmouth in the test tank. Shaft seal development work was done at the Engineering Experiment Station and Electric Boat.

At the time the Machinery Design Branch turned the contract design over to Portsmouth for detail design, they had complete confidence in the propulsion plant and its support systems. Portsmouth did the contract design for the Bureau of Ships. It was done here at Portsmouth with liaison work back and forth. The Bureau of Ships signed the plans in the end.

Going from there into detail design, the major problems were those of developing the equipment to meet the special problems and to emphasize operability, reliability, maintainability, and habitability.

Questions by counsel for the court:

Q. You were here at Portsmouth to handle that end of it, were you not, Commander Woolston?

A. Yes. To accomplish this, we had the people, and we made mock-ups. We consulted with forces afloat on the development of the operation of systems both from the standpoint of developing it and the way it was located. In order to prove the design, we had reviews by other activities and by forces afloat. Each system went through long and exhaustive casualty studies. The ship's information book includes the system diagrams and the system descriptions, which include all these casualty studies. In general, casualty studies, if they go into a system description, are strictly studies of casualties to one particular system. In addition to that, we looked at the over-all type of casualty to try to prevent a built-in row of dominoes on the beginning of casualties. Certain changes have been made to the ships since the beginning of the detail design to improve their safety and ability to recover from casualties. Certain studies have been going on at the Bureau level to make rather radical improvements in these capabilities. Most of these will be discussed by the technical people directly involved.

Now, if there are any questions that have been developed during the period of time that you may have been looking at the design, from the standpoint of concepts of systems, I was administratively the technical man directly responsible.

EXAMINATION BY THE COURT

Questions by a court member, RADM DASPIT:

Q. Does this include any questions relative to the air banks, or are you going to take that up later?

A. I will attempt to answer these questions.

Q. Can you tell us why the air bank capacity was reduced down to b(1)? Why didn't we continue at least at b(1)?

A. This developed by looking at several things. The decrease in reserve buoyancy from the preliminary design to the final contract design would not allow putting too many bottles in there to eat up too much of the space. A second item

Unclassified

is that in 1957 and 1958 we were very much aware of the problem that we had in the tanks in the older ships from the standpoint of structural surveys. We had not enough space within the system where we could cram a tankful of air bottles in there and expect to maintain integrity. There was a desire to maintain inspection and presentation access in the tanks. Then we had this basic requirement to meet a capacity which basically b(1) but if this were related to the difference between b(1) we met this capacity requirement, so that while we had the opportunity to increase this capacity we met the criterion. In hindsight, we would not do this again, as was proved in fiscal year 1962, during the time when the contract plans were ready to go out. The then current 525, Captain Roseborough had requested the change, and it was changed to increase the capacity to everything that we can cram in there, which is in the vicinity of b(1).

Questions by a court member, CAPT OSBORN:

Q. Will you state the reasons for changing the air bank capacity in the first place?

A. The criterion that has been used is that you can surface twice from periscope depth, fire all your torpedoes, and still maintain b(1) psi in your banks. I won't, and I can't, defend this as a criterion for a modern submarine.

Q. You mean to tell me that since the NAUTILUS, the first nuclear submarine we built, we have not had a real good air bank capacity correlated with blow rate and capacity with respect to flooding?

A. I can't answer for the ships other than the 593 class, and others leading up to it, but basically the air b(1) capacity and air bank pressure for all the ships are related to the surfacing characteristics. Now, the capacity doesn't turn out to be as critical from the standpoint of studies that we have been running as does the blow rate. The blow rate had not significantly increased until we started running the studies last year on recovery capabilities and blow rate at very deep depths with the FEM's.

Q. These were the result of FEM studies rather than the 593?

A. They were run on FEM's first, but it was a submarine study.

Q. Has any study ever been run with respect to reaction time involved with respect to casualty? I mean equipment reaction times, valve closure, automatic closure, manual closure - studies of this nature?

A. Yes. Individual studies are made on valves in individual systems. Test memos require that valves operate within a certain period of time. Some of them stretch out, particularly in the air systems and in the sea water system to prevent hydraulic hammer. The current specifications for the 637 class and the re-engineered 616 or 640 group include a coordinated requirement for sensing, closure and blow to obtain recovery. The studies that we are running on a highest priority basis are those involving the ships that are out now on this same relationship. This study has been presented informally to representatives from the fleets and the submarine type commanders, and the Chief of Naval Operations. Our time scale of what we think we can do to arrive at an understanding of where we are in each ship as to how big a hole it can take and recover, involves times that are running through the next few months.

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Q. They have never been run before?
A. We are running involved recovery capabilities and to the best of my knowledge, these have not been run prior to the last summer. Most of the work that has been done on recovery involves failures of stern planes into hard dive at deep depths or recovery at steep angles. It was considered - and this is a matter of philosophy - that this was the critical type of casualty. Most studies involved those of getting an up angle in a hurry, and there are recent studies on ALBACORE which were directed to this same end. Flooding was considered, but it was considered that the proper valves, or all valves would be shut in a hurry so that the net increase in weight would be taken over a combination of speed and blowing.

Q. Had you ever observed a simple test that the board observed yesterday involving a 2-inch line simulating a 2-inch break at b(1) feet?
A. No. sir.

Q. What margin of error do you think there is with a ship between (b)(1) feet and b(1) feet, just based on your engineering judgment at the present time?
A. What do you mean by "margin of error"?

Q. I mean the risk. Is it about ten times as dangerous, or is it about the same?
A. At depths and the type of casualty that you are looking at?

Q. I'm talking about a flooding casualty.
A. All right. It's hard to establish a figure as to how much more dangerous it is. The real desire is to have a system wherein you won't get this kind of a thing to happen. You can look at the various recovery capabilities at different depths. I have seen the results of some of these tests under certain circumstances at zero speed, where you can recover from a hole of about b(1) the area at (b)(1) feet as you can from b(1) feet with the same blowing system. This is based on the flow as applied to the square root of the depth, but you have the added factor that the bubble works in the same way, the amount of air you get into a tank and water which you can discharge. Also, one particular factor I picked up on that from the standpoint of flooding is a ship at (b)(1) at b(1) feet can, cope with roughly the same flooding hole as a ship at (b)(1) at b(1) feet.. Now. these are round numbers.

Questions by a court member, RADM Daspit:

Q. Commander, you spoke of studies which had been brought to the attention of the type commander and the Chief of Naval Operations. Were these flooding studies?
A. Yes, sir.

Q. When were they first presented to the forces afloat?
A. They were presented last Thursday. An original preliminary report of these studies had been signed out on multilith on the 9th of April, and was withdrawn, in the light of the hearing on THRESHER. Information was passed to the operators as an indication of the effects of rapid blowing, rapid shutting the lines, and speed. The main impetus at the Bureau was letting the people know as much as we can as early as we can.

Questions by a court member, CAPT Osborn:

Q. I am interested in how operational characteristics got generated into operational procedures and thoughts. Now, in the process of designing ships the way we do at the present time, how do we ever get operational characteristics fed into the way CNO is committing himself until the ship is already built?
A. I'm sorry. You're a little beyond me.

Q. We have nothing in this particular ship's characteristics involving air capacity, recovery capacity, either in pitch or in blow or anything else until the ship is in final hardware.
A. We have nothing in the characteristics on these subjects, period, except maximum shock resistance and test depth. I can't answer why ship's characteristics don't include safety features.

The court recessed at 1632 hours, 3 May 1963.

The court opened at 1645 hours, 3 May 1963.

All persons connected with the inquiry who were present when the court recessed were again present in court.

No witnesses not otherwise connected with the inquiry were present.

Commander John Woolston, U. S. Navy, the witness under examination when the court recessed, resumed the witness stand and continued his testimony as follows after being warned that his oath was still binding.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. Will you describe for us the damage control features of the auxiliary sea water system, and address yourself particularly to the two-station isolation procedures required in THRESHER as against a design which would provide a one-station isolation capability?
A. Would you like me to operate from a diagram or sketch one on the board?

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PRESIDENT: Why don't you sketch one on the board?

(The witness drew a diagramatic sketch of an auxiliary sea water system on the blackboard.)

WITNESS: Basically the THRESHER's system in the auxiliary sea water system goes from the engine room through the auxiliary machinery space in b(3) 1 loops. b(3) 10 USC 130 (b)(1) , which is supplied by one or more of b(3) 1 pumps. b(3) 10 USC 130 (b)(1) . Most of the equipment that is cooled from this system is located directly between these b(3) 1 loops in either the engine room or auxiliary machinery space. One section is different. It operates from this section back here (indicating on diagram.) This is isolated with two valves, as it stands now. The sea valves in the engine room and the sea valves and back-up valves in the auxiliary machinery space are remote hydraulically operated. The station for controlling these valves currently is in the upper level of the auxiliary machinery space. The engine room valves are controlled, along with the other sea water valves, in the engine room, and are stationed in the maneuvering room outboard.

The philosophy of the loop system, the basic concept is that you can maintain a larger number of equipments, at least on one side of the ship. It does require, in order to isolate b(3) 10 USC 130 the loop, though not the stern items, that valves be closed in both rooms. As far as an advantage is concerned, I feel as a damage control measure, you must have an ability to close a valve that can flood into a space, but there is no reason why this cannot also be done in the maneuvering room. One of the items which has been under consideration--not study--but consideration by the Bureau, has been changing the operator hydraulic valves in the AMS from manual hydraulic valves to solenoid operated valves, and have the buttons in the maneuvering room. This then would allow isolation of the system from either space.

A further change which is under consideration is to further split the system in from here (indicating bulkhead on sketch). They would be considered not so much as bulkhead valves but splitting it into quadrants, and these valves (indicating return loop bulkhead valves) could be left shut. The valves on the supply line would be remotely operated and in accordance with the needs of the coolers. These are things we are thinking about, because we are smarter today--we hope--than we were several years ago. There is a definite disadvantage in operating these valves from the next space without being able to do it in this space, except manually. If a fellow here (indicating maneuvering room) doesn't get the word, the guy here (indicating auxiliary machinery space) couldn't do anything about it.

EXAMINATION BY THE COURT

Question by the president, VADM Austin:

Q. But as I understand your considerations in the Bureau now, you would so alter the system as to permit closing of everything on the ASW system from the maneuvering room?

A. This is what we are bringing up for consideration by the Change Review Board.

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Questions by a court member, RADM Daspit:

Q. As the system stands now, if you develop a leak in the engine room and close the valves in the engine room, you still have not stopped that leak; you have to close a valve in the auxiliary machinery space also to stop a leak in the engine room?

A. Not necessarily. It depends on where the leak is. A leak in the main, yes, this is correct. A leak in all the branch lines are isolated by isolation valves. From the standpoint remote operation, you have to get into the AMS also.

Questions by a court member, CAPT Osborn:

Q. Don't you think one of our problems in the handling of this system has been too much emphasis on individual isolation?

A. No, sir. I consider that individual isolation is necessary, because you want to get the plant back on the line. Individual isolation is not -- as you know better than I, because you saw the thing yesterday, individual isolation is not an answer to damage control. It is an answer to getting the plant back, but it does not stop the damage. This is another question that comes up and involves another up-dating beyond what we were considering and that is that, should a line give way any place in the forward part of the engine room, how selective can a man be in shutting hydraulic valves? Now, again, I did not see the test. I can imagine it, and I have felt that a man is probably more likely to shut everything than he is to selectively shut and try out. He is not going to find his casualty immediately, which leads to the next step, which is to maximize the benefits of an automatic system, which either tells you what valves to shut, or it shuts them. Here again, we are talking about the costs in time and money and development to do it and whether or not it is considered worthwhile to do.

Q. In the present time frame, since we've got the ships built, do you think it would be a good idea to completely isolate the AMS and operate split system from the engine room, which you could develop as single station isolation?

A. For personal opinion, you can almost flip a coin on cost, and you gain a tremendous amount more by putting in a manual valve in the overboard line and a remotely operated hydraulic here (indicating). Now the feed loads are not balanced and if you--

Q. What I am doing or suggesting, Commander, is that you shut all the valves in the AMS, run b(3) 1 pumps in the engine room, using the loop just the way it is, so that you have single isolation from the engine room only, particularly when you are going into conditions of test depth.

A. You are talking about whether we should leave these valves open or shut. I consider the valves are necessary in the supply line.

Unclassified

Q. I am talking about operating the system as it exists right now.
A. You can't operate the system with the valves shut, because they aren't in today.

PRESIDENT: Forget the valves that you are going to put in, and let's talk about the system as it is today. Now, Captain Osborn, go ahead and pose your question.

Q. (By CAPT OSBORN) I think you could get isolation at the present time by shutting all the valves in the AMS, operating your b(3) 1 pumps split from the engine room, and have a single isolation at the present time, which would give you, I think, certainly a better damage control procedure as the equipment exists right now. Do you concur with this?
A. You would operate with these four isolation valves shut, (indicating engine room and auxiliary machinery space supply and return isolation valves) these b(3) 1 pumps operating, (indicating engine room pumps) so long as you can cool everything necessary with b(3) 10 U speeds, yes. There's no doubt about it.

Q. One thing I would like to interject is that I am violently opposed to electric solenoid control of those valves, because I think if you do have a flooding casualty, you probably would have to have direct hydraulics involved, and I think you should give this serious consideration.
A. The exact method of remotely operating them would have to be considered.

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

Questions by counsel for the court:

Q. You have shown us a chart depicting a comparison of reserve buoyancy features of various submarines. Do you have a study showing a comparison of de-ballast capabilities of submarine at test depths?
A. I have some figures here -- At a cursory glance, this looks correct; I can't certify it.

Q. Go ahead, please.
A. I have some figures which indicate percentage of ballast tanks that can be blown, which are, to the best of my knowledge, correct.

Q. Would you give them to us, please. Can you read them; would that be just as simple?
A. I can read them. Which ones are you particularly interested in?

Q. Start with the fleet boats.
A. If you have a piece of paper like this, why don't you take the piece of paper in evidence, making the change on the test depth of the 597 and 598.

Q. I show you a table of figures indicating the ship's name and various data concerning the number of air banks and their capacity and characteristics; is this true to the best of your knowledge and belief, as corrected on the third page?
A. To the best of my knowledge and belief, this is correct.

A table of information citing the number of air banks, their capacity and characteristics and other information relating to specific submarines was submitted to the party and to the court, and was offered in evidence by counsel for the court. There being no objection, it was received in evidence as Exhibit 153.

Counsel for the party waived reading of the Exhibit.

Q. Exhibit 153 indicates the decrease in percentages of de-ballasting capability from 425% down through 32% for SKIPJACK, to 13% for THRESHER. Has the decreasing de-ballast capability of the submarines over the years been a matter of concern in the design of submarines by the Bureau of Ships?
A. This has been a matter of concern over the last few years. When it became obvious that a reconsideration of the main ballast tank blow capacity would have to be made, the first actual step that was taken was in the increasing of the air bank capacity in Fiscal '62 follow-on 593 Class ships.

Q. Which would be the first boat of her class with increased de-ballast capability, and how much increased de-ballast capability will it have over THRESHER?
A. The class of ship that I was talking about will never be built. The actual 637 Class does have an increased capacity.

Q. Do you have the figures for that increased capacity?
A. No, I do not.

Q. Can you state its order of magnitude over THRESHER?
A. It's approximately thirty percent. I can establish the figure if I can have access to the specifications for building submarines SSN-637 Class.

Q. Staying with the high-pressure air system then, will you comment on the casualty reaction features of THRESHER's high-pressure air system with specific

Unclassified

reference to the fail-safe feature of her air banks for a period of about thirty seconds upon interruption of power?

A. As is probably obvious from the ground rules for sizing of the air banks, consideration relative to the air bank size is involved with near surface operations. It was considered originally as to whether the banks should fail all open, all shut, or something inbetween. A casualty which was considered as particularly serious would be a near surface collision or a serious fire which would cause loss of electricity or burning out of the wires to the particular stops and break a line. The desire was to stop the flow of air, don't pressurize the boat, don't increase the fire, don't dump all your air, but keep always one bank available, so, at worst, you'd drop one bank off the line in this consideration. This was considered to be more important than the availability of the banks instantaneously in the event of electrical failure at deep depths. Since last week we have put out a Change Order to change this from three shut and one open to three open and one shut. Again, the desire, as expressed in our informal meeting with the forces afloat, indicate the desire, the real desire, to be able to get your banks off the line when you're near the surface and on the line when you're down deep. This kind of a change in failure mode with depths is somewhat complex to arrive at. We have not done this as yet.

Q. From the point of its susceptibility to failure and flooding, would you comment on the design of THRESHER's constant vent system, with its large amount of sea water piping and hoses?

A. Are you talking about the susceptibility to damage or its safety, as in the event of damage?

Q. Primarily, damage; and secondarily, safety?

A. Well, quite obviously, if there is more pipe there is more pipe that can break. Therefore, there is more likely to be damage. THRESHER's system, as different from all the others, had one advantage that none others have. It has some check valves which were put into the line to prevent backflow through continuous vent lines from other systems after you isolate one. The safest thing to do with a continuous vent system when you're submerged and you've cleaned out the air in your system, is to shut the valves. Except on certain reactor components which the Bureau has suggested that the vent be left open, most of the vents should be so shut.

Q. From the point of view of safety while submerged, would it not be desirable to have a manual vent system?

A. There is a manual vent system installed.

Q. In addition to it?

A. At the moment it is in addition.

Q. Would you comment on why THRESHER and one other ship of her class have so-called thin main condensor heads?

A. I think you might prefer to hear the answer from Captain Jackson, who will represent the Bureau of Ships on this particular item.

Q. Was there any concern for water hammer high peak pressures accompanying THRESHER's initial sea trials with reference to the effect on her trim system?

A. Yes, sir. Because of the casualty which occurred in the THRESHER on her first dive b(1) the problem of water hammer was looked at

Unclassified

more closely than had been heretofore. The test that was done, and it was poor judgment on the part of those who signed the Test Memo, required that the suction back-up valve for the trim system by cycled at deep depth. Although the trim suction system is designed to withstand collapse pressures, the system has in it priming valves and may have in it air bubbles. It definitely is at low pressure. Consequantly, it is a more dangerous system to open to the sea rapidly than is the trim discharge system. Now, since THRESHER's deep dive, we interlocked the trim suction valve to prevent this thing from happening again. The suction valve to the trim suction could not be opened if the ship were deep, where any valve opened to the sea at deep depths when the pressure in the system is low will have a water hammer of some sort. We knew that we would have it; we did not know at that time as to how high it would get. As a result of the shocks that we felt in the system and some tests that were run on THRESHER after her sea trials, we slowed down the opening of sea water valves which could open to the ocean at deep depths into low pressure system -- and by low pressure system, I mean a system which was not at that time equalized. Let me say one other item about the air banks at this point -- that the circumstance as far as opening the air bank valves under failure condition was changed by the finding of both Dieselization and shock wave heating in the high pressure air lines when the b(1) pound air valve was opened rapidly; and although the original valves opened in a matter of a very few seconds, in order to slow down the rise of pressure and to make the system safe from possible explosion, we slowed the valve down to some thirty seconds. At that point we did not re-analyze the deep depth casualty situation, but we do have the local over-rides on the valves.

Q. Can you estimate the maximum peak pressures which were applied to THRESHER's trim system during her initial builder's trials?

A. Peak pressures during the initial builder's trials were not particularly high. During the second builder's trials the peak pressures were in the order of, I would estimate, b(1) psi or greater. There is a test report on the so-called "bump" test that we ran on this system which included the trace of pressure gauges at sensitive points in the system, and these are available. I don't remember the number of the Test Memo, but Portsmouth can produce them.

Q. The report refers to a time after the valves were slowed to the peak pressures in the neighborhood of b(1) pounds per square inch. We're interested in the pressures before the valves were slowed?

A. These valves had restrictions in the hydraulic supply lines from the very beginning. The valves were not instantaneously operating valves at any time. There was an order of magnitude change in the rapidity with which they were opened. If b(1) psi is the peak pressure measured after slowing the valves down, it might have been as high as twice this, or even more than that before. We do know that the piping was expanded at one portion of the forward trim main. The joint that was broken was not an extremely bad joint.

Q. We have had testimony that the priming valve floats were crushed by the peak pressure. Do you know at what pressure those floats collapsed?

A. Those floats should withstand better than collapse pressure of the ship, I can't tell at what pressure they did collapse, but the pressure which they saw was considerably greater than collapse pressure of the ship.

Q. Do you think this could have had any effect on the integrity of the trim system main?

Unclassified

A. It had some effect on the integrity of the trim system at the time. Pieces of pipe were expanded and had to be replaced. Some joints had to be replaced. The effect upon joints which were not broken or right close to the expanded pipe, I couldn't tell for sure. Any leaks that were found would have required replacement of a joint. As to a joint which did not leak after this test or on hydrostatic test afterwards, I think and this is an opinion and not too well schooled, that it probably was not damaged. It was just as good afterwards. I will note that the damage occurred to the trim suction line and that the trim suction line was interlocked to prevent pressurization after that time.

Q. With reference to the hydrostatic test to which you referred, was the whole trim system then unlagged and inspected, or were plans for this made?
A. Consideration was given to it. It was not done throughout the entire ship.

Q. After an investigation of a casualty to BARBEL, how did the Bureau of Ships address itself to a review of the safety of silver braze joints in THRESHER?
A. After the BARBEL casualty, the silver braze joint to welding joint size limitation was changed. Offhand I can't give you all the figures and the dates. These are available in Bureau Change Orders which occurred after BARBEL.

Q. Did this give any impetus to the use of welded joints in new construction design?
A. Yes, sir. One other comment. Since the cause of BARBEL failure was wrong material, materials were checked throughout the system -- on THRESHER I'm speaking.

Q. Was the check done only during constructions of submarine hulls; for example, would materials be checked in a lagged system?
A. Any area on a lagged system was required to be checked for material. You would have to get at some part of each length of line.

Q. That was done in the case of THRESHER, is that right?
A. Opinion. I can't testify with surety that this is so.

EXAMINATION BY THE COURT

Questions by a member, CAPT Hushing:

Q. After the damage to the trim system from water hammer effects, were there not a series of tests made in the Shipyard involving the trim line?
A. Yes, sir.

Q. These were a series of hydrostatic tests and hydraulic shock tests?
A. Yes, sir.

Q. In your opinion, would these tests have revealed deficiencies in the trim system which might have been caused by the water hammer and not found?
A. Yes. This was a more severe test of the system than hydrostatic tests, and they proved the system was stronger than the hydrostatic tests proved the system could withstand at that pressure.

Q. Can you describe these tests in a little more detail to give us a feel for why you feel this way?
A. The test was set up with the conning tower test tank as a high-pressure large volume source to simulate the ocean. Large pipe was run to the particular sea connection which was under consideration. This was done, incidentally, on the ASW systems in part, as well as on the trim system. The connections were made into the hull and various tests were run. One set of tests involved leaving all the valves on the ship open and cycling valves on the tank. Other tests were run with the pressure available up to the hull connection and different ship valves cycled. We started at comparatively low pressures, kept a check on the sensitive points of the system for peak pressure. If the peak pressures got too high, we would slow down the operation of the ship's sea valve. This was done covering all the combinations in the trim system, both from the standpoint of

opening the outboard valve with both low-pressure, and in some cases, low-pressure plus a bubble inboard; and also letting the conning tower ocean go through the line into a tank and then shutting individual valves in the system to pick the stopping, water hammer, like you get when you shut off a faucet.

Q. So that you would say then that the trim system was subjected to considerably more testing than would normally be the case for the trim system?
A. More, and much more severe.

Q. And during these tests it did not fail?
A. That is correct.

Q. Do you feel that the trim system at the end of these tests was still in good shape?
A. I believe so.

Q. You have mentioned peak pressures several times, I believe. Are these peak pressures extended over a long period of time in the system, or are they very fleeting?
A. Very short periods of time, an impulse.

Q. That's an impulse type thing rather than a comparison to the working pressure which the system normally sees?
A. Yes, sir. It is a kind of pressure time history, which can be sustained by a fitting to a much higher peak than hydrostatic. It is the same type of thing as we find in testing of sea valves and back-up valves for hydraulic shock to simulate depth charge attack.

Q. And then, when you were talking about pressures of [redacted] PSI and twice that, and I believe you used the words "peak pressures", you were not talking about pressures which were maintained on the system for any appreciable length of time?
A. That's true.

Q. In your discussion of PROJECT PRESSURE, I believe you mentioned hydraulic shock, hydrostatic tests, and various other kinds of tests?
A. Yes, sir.

Q. Can you describe in a little more detail your general approach in PROJECT PRESSURE?
A. The general approach in PROJECT PRESSURE was, first, to list all the components that were needed for the ship; then to determine for each component what its worst environment would be; to determine what kind of a test would be used to simulate this environment; and to run tests on items which were developed to meet the service. At the time we went into THRESHER there were very few valves that were built for this kind of pressure. Oil fields had them, but a gate valve that was almost as large as this table wasn't of much use in a submarine. We contacted companies to give them the problem and have them come up with a developed unit and described the tests that it would have to have. When units were presented, we tested them to meet these requirements. Basically, sea valves were required to operate at collapse depth and be tested hydrostatically to one and a half times collapse depth. Other valves in the system had to operate at test depth and be tested to collapse depth. Sea and back-up valves of all components going through the pressure hull and outboard of the pressure hull subject to sea pressure were

tested to hydraulic shock. Hydraulic shock tests -- may I ask, do you know what the hydraulic shock test is or do you want it described?

PRESIDENT: Describe it for the record, please?

WITNESS: The hydraulic shock test is to put a device on a machine. The machine is a small reservoir which is filled with glycerine. It has a piston at the top; a large weight is lifted up and is dropped on the piston; and the piston compresses the glycerine; and a shock wave goes down into the component. This shock wave is measured and the pressure time-history is used to compare it with a depth charge. It has certain limitations in that its capacities aren't very great. It's a good test for small components. It's a very poor test for a large component. To back this up, we had tests on what are known as caissons at the Underwater Explosion Research Division at Norfolk, and these were tested to near fatal shock levels. Most small items on the submarine went through this explosion test as well as the hydraulic shock test. Large sea valves have not been checked in this manner. Hatches have. For internal service we have a parallel type of test which is the hydraulic impulse test which is given to piping configurations, flexible joints, hoses. This is an impulse-type loading superimposed upon working pressure. The thermal shock is mainly of interest to electrical connections and things like that which might be damaged by a sudden change in temperature. Vibration tests are used both on piping configurations and on black boxes in general to insure that you don't have something that goes into orbit when you vibrate it. The high impact shock tests were run on every item that would fit on the medium weight machine, which is the largest one available at the time the THRESHER equipment was being purchased. Noise tests were run on all equipment which had to run, but this was not a destructive test: this was a matter of improving the breed.

Q. Were any combinations of silver braze joints and piping run through this PROJECT PRESSURE Program?

A. Yes. I can't enumerate all the individual tests. They are available in the PROJECT PRESSURE documentation. But valves and heavy flanges and weights which were sil-brazed in the yard were used on PROJECT PRESSURE tests. As a matter of fact, the original test to develop the first flange for the first item ever developed for the hydraulic shock criteria for THRESHER was sil-brazed on a piece of pipe and the piece of pipe ballooned out to a third again its diameter and the sil-braze joint was fine.

Q. Were the sil braze joints for PROJECT PRESSURE made by specially skilled mechanics under controlled conditions, or were they made by average mechanics under average shipboard conditions?

A. The intent of any test on a joint is that the workman was an average workman under average working conditions. I don't think anyone can guarantee that the average workman does an average job if he knows that there's going to be a test. Some joints have, historically, been pulled off ships and tested. In general there's nothing startling found in these tests. A good sil-brazed joint holds up extremely well and a very poor one falls apart.

Q. But there were tests of silver braze joints. Did these tests lead you or the shipyard to believe that sil-braze joints should not be put into THRESHER; did they lead you or the shipyard to any conclusions as to the Quality Assurance that might be needed for sil-braze joints?

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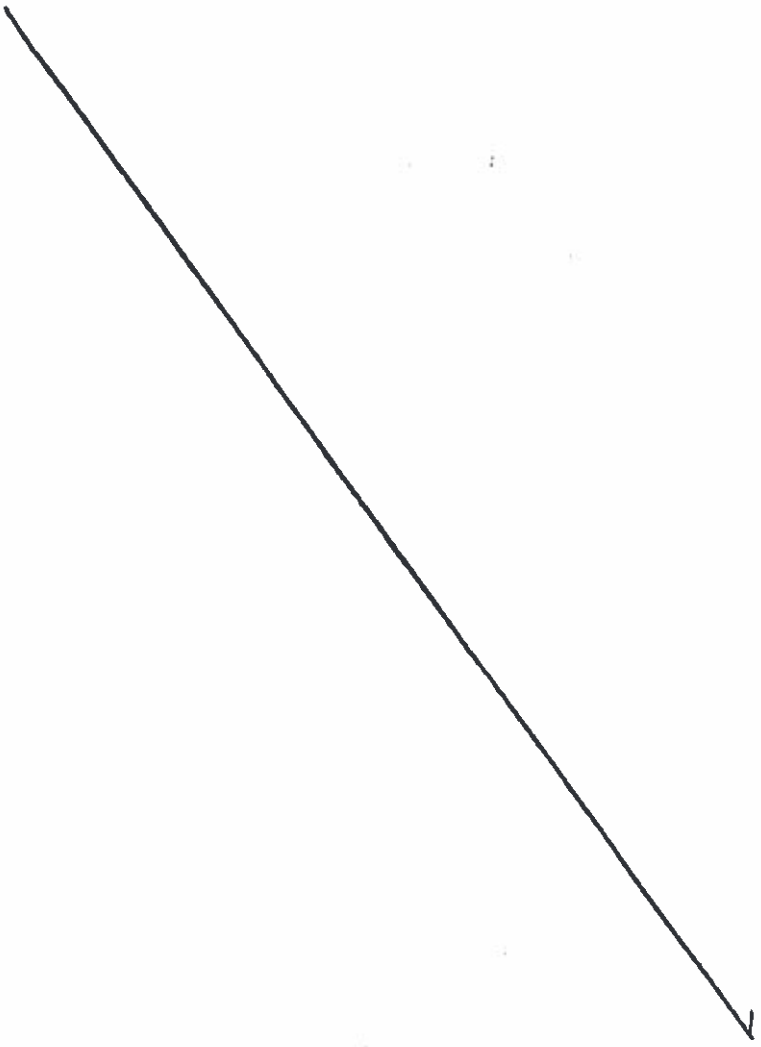
A. The tests that were run on sil-braze joints have, in general, been reassuring as to the quality of the joint -- now, I'm talking about destructive tests at this point. After BARBEL, and some other ships in the last less than two years have been checked both ultrasonically and destructively, our experience then is that we have some joints of poorer quality than we thought we had.

Q. I was referring specifically to PROJECT PRESSURE valves.

A. PROJECT PRESSURE gave us nothing to reduce our confidence in sil-braze joints.



Unclassified

Q. Where you had failures in PROJECT PRESSURE, was the component or the pipe as apt to fail as the sil-braze joint?
A. Yes, sir.

Questions by a member, CAPT OSBORN:

Q. When you were testing the ASW system with respect to valve cycling and peak hydraulic pressures, were you testing this for test of valves, or were you proving to yourself the condition of the sil-braze joints?
A. I believe that we were, more than anything else, trying to prove the integrity of the system in a very severe way to increase the confidence of the crews. This was the main thing that we would get out of this kind of a test.

Q. Was there any theory ever advanced by you or anyone else that the way to test the system, the sil-braze joints, was by hydraulic cycling?
A. It was considered but it was not continued. I don't advocate it, if that's what you want to know.

Q. That's exactly what I wanted to know. The bulkhead stop valves indicated on the ASW system were on the original contract drawing prints prepared by Portsmouth for THRESHER. Do you remember why they were discarded?
A. Not entirely. There were two changes that were made to the ASW system after the Mod-A to the contract plan. One completed the loop in the overboard line, and the other deleted some valves, including the two in the supply line that you're referring to. One point is that we were denied the opportunity of using hydraulic operation on non-sea valves, the philosophy being you had too much complexity, you put too much expense into this, you allow more mal-operation by having a lot of remote control. At that point, remote control of fluid systems was not considered to be the ideal. Another point is that most bulkhead stop valves are put in to protect the piping system from failure on the other side of the bulkhead, and since the piping system is stronger in the bulkhead, you didn't need the valve in the system. I would not do it, as you know, if we were to do it again.

Q. In your experience with the THRESHER crew, did they ever operate this system cross-connected?
A. To the best of my knowledge, they have operated it both ways.

Q. Do you think that if they were going down for a deep dive, they would certainly operate it as a split system, don't you?
A. A sure hypothesis on my part, but I would think that they would split the system. Pure hypothesis. I do not know what their doctrine was on what pumps were cut in, whether they would follow what you suggest or not.

Q. Well, you had a lot to do with their original instruction, and your concept with respect to the operation of the system was also split system, is that correct?
A. Except during those times when you required more cooling than you could get on one side of the system in this way. You see, there is a tail on this system that goes out and you can put on either side, but it takes b(3) 10 pumps in hot water to meet the requirements. But the split plant operation is an option and is a known option, and is not presented as a required or--I'll leave it at that--required method of operation for deep depth.

Q. I am aware that you have to be conditioned for b(3) 10 USC 13 degree injection with respect to operating these plants. Do you think this is realistic?

A. There are some areas that, where even at comparatively shallow submarine depths, the temperatures get that high. I have not seen the results. I have been told that these are reasonable, based upon oceanographic data that has been collected for the Bureau of Ships. If it is your desire, I can get this data and have a presentation made. Is it?

Q. No. I think to some extent in our whole operation of the system, in our whole operational concept for that matter, we are somewhat hamstrung by trying to meet every single condition that can be met. Even our operating procedures to some extent are hamstrung with these same things. For instance, if you were designing the system again, would you put the constant vent system in?

A. No, except under certain conditions where we're required to have constant vent. I think with a ship of this depth it is quite possible to have a constant vent system of this general type, eliminating those from the non-critical areas, which is perfectly satisfactory. However, with a little more thought at the beginning of the work, and it was done in the AMS in THRESHER, ability to put a constant vent line in to get its advantages and put it into the overboard line is the ideal situation. Now, in the AMS we have no continuous vents spilling overboard and, aside from a comparatively minor amount of small line exposed, there is no additional danger due to this system.

Questions by the president, VADM AUSTIN:

Q. I'm going to ask you a simple question. Taking into consideration the frailties of reality and the dangers inherent in unknown conditions in the high pressure lines, what would you consider the rate of failures on ultrasonic testing of a whole series of joints that were tested during an availability of a ship? If we had one hundred of those joints tested, what number of failures would cause you to be highly concerned?

A. There are a lot of very smart people who are worried about trying to worry that to a conclusion right now.

MEMBER: Thank you.

WITNESS: Even places other than this, sir.

PRESIDENT: Thank you.

WITNESS: The answer is partially dependent on when the ship was built, under what particular ground rules of sil-brazing it was built. Personally, I feel that, in general, the sil-braze work that was done by qualified sil-braze people with insert type joints some years ago, without a great deal of inspection and without our ability to inspect these joints except destructively, was better than the average today. The piping systems, in general, were smaller and thinner, which made the problem less. I think that joints made within the last few years, when we began to try more inspection and perhaps some workmen felt that some of the load was taken off their shoulders, is probably the nadir of our advance. Now that we have a tool that can non-destructively test, I think we can insure that we get a good joint. We

can have faith in our system. Looking at the older ships and the results of the tests which might be run, considering that no records were kept at the time for these ships, that if you found a significant number of very poor joints in large systems that had to be opened during submerged operations, that you would be forced to continue the inspection of the system until you had done all the work.

Q. Would fourteen per cent be a significant figure?
A. I think--well, what system, what age ship, Admiral?

Q. The USS THRESHER.
A. Large systems?

Q. All two inches and above, some four; cause of failure, mainly, very small, if any, binding in the inner land?
A. Again, I don't think there's any choice but to say yes, this is cause for definite concern. There are two things about concern. Should something more be done? No question about it. From the standpoint of confidence that the ship could take deep dives for a significant period of time without expecting a catastrophic failure, I think your going through the shock test of the ship definitely increased everybody's feeling that the ship was solid all the way. Whether this is all subjective or objective, it's hard to say; but if you take the shock test, plus hydrostatic testing--

Q. --plus hydrostatic tests, lots of people are willing to say, "That's proof enough for me."
A. Not proof enough for me that it is a satisfactory ship and that the piping system shouldn't be inspected further. But satisfactory to go on a deep dive. Satisfactory not to restrict her posthaste.

Q. In other words, with fourteen per cent failures on your joints tested ultrasonically--that is, failures by the standards presently established--that doesn't mean the joint would fail under stress by any means, of course--but with fourteen per cent failure by current standards, do I understand that you would not have been too concerned with letting her go on her deep dive?
A. As I recall, most of the--may I? (The witness referred to his notes) Considering a sentence in a report which I have, wherein it is stated, "And these bonds in rejected joints as low as 15.5, 10, 8, 7, 5 and 4.5 per cent were noted in original and repaired joints," yes, I would be disturbed. On the philosophy of the criteria of forty per cent and sixty per cent, as well as other sil-braze problems, representatives of the Bureau are coming to give this straight information and the basic pitch of the Bureau today. The fact that a criteria is set up at sixty per cent and forty per cent is not, to my mind, unjustified, even if a ten per cent joint is satisfactory.

PRESIDENT: I think the court fully appreciates this point. The court also appreciates the fact that a joint that could fail by the current Bureau standards of ultrasonic testing is not necessarily a dangerous joint--not necessarily. It depends on how it fails.

WITNESS: Yes, sir.

Unclassified

CROSS-EXAMINATION

Questions by counsel for RADM Palmer, party:

Q. Commander, alluding to the question initially put to you by the president of the court, would the percentage of rejects acceptable in the trim and drain system be greater than the ASW lines of the same size?
A. Would you repeat the first couple of words of that sentence?

Q. Would the percentage of rejects available in the trim and drain system be greater than in the ASW lines for the same size?
A. From the standpoint of danger, or from the standpoint of whether I would or not ride the ship, yes. From the standpoint of indication of a situation, no.

RE-EXAMINATION BY THE COURT

Questions by a member, CAPT OSBORN:

Q. Do you mean to tell me that you think the trim and drain system is more important than the ASW system?
A. Much less.

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.

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

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

The witness made the following statement:

WITNESS: I think I should make one more statement. My comments relative to sil-brazed joints are based on my own personal opinion, and a position which I would take in my current job. Not having the final responsibility to take action on this, it is a lot easier to come to this conclusion.

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

The court then adjourned at 1802 hours, Friday, 3 May 1963.

Unclassified

NINETEENTH DAY

Portsmouth Naval Shipyard
Portsmouth, New Hampshire
Saturday, 4 May 1963

The court met at 0930 hours with closed doors.

All persons connected with the court who were present when the court adjourned were again present in court.

RADM Palmer and LCDR Hecker, parties, and LCDR Hecker's counsel waived their right to be present. Counsel for RADM Palmer was present.

No witnesses not otherwise connected with the inquiry were present.

Clarence Russell Bryan, Commander, 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: This is a closed session of the court, Commander Bryan, and you may give classified information. At the end of your testimony I shall ask you what classification you would accord to it taken as a whole.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, grade, organization and present duty station?
A. Clarence Russel Bryan, Commander, United States Navy, presently assigned as Aide to the Chief of the Bureau of Ships.

Q. Will you briefly review your naval and professional background and experience?
A. Yes, sir. Graduated from the Naval Academy in 1944; immediately assigned to Submarine School. Then from January of '44 until the end of the war, on war patrols on the USS HAMMERHEAD, staying in submarines until 1949, when I took a three year post-graduate course in Naval Architecture and Marine Engineering at MIT. On completion of that, in 1952, designated Engineering Duty Officer. Three years duty following that at Portsmouth Naval Shipyard in the Production and Planning Departments. Then four years at Mare Island as Assistant Design Superintendent; then in the Bureau of Ships for three years in the Ship Design Division; this lat year in my present job.

Q. What were your duties in the Bureau of Ships while attached to the Design Division?
A. My basic assignment was Project Coordinator for submarine design in the Hull Design Branch of the Ship Design Division, with a collateral duty as Chairman of the Polaris Submarine Design Committee for the Special Projects Steering Task Group. During that period of time I spent some time on special, technical investigations. Separated from my primary duties, were those special assignments to look into such things as the use of the HY-80, the control of weight and stability on ships during construction, and the deep submergence tests of certain deep diving submarines.

Q. Were any of those duties specifically related to THRESHER?

A. In my opinion the investigation into the use of HY-80 and the first deep dive trials of THRESHER were related to the subject here.

Q. We shall want to treat those separately, but first I would like to know if you are under any Bureau orders at this time?
A. Other than those relating to my primary duty assignment?

Q. Yes.
A. No, sir.

Q. Will you give us a brief history, then, of the HY-80 studies to which you refer?
A. Yes, sir. If I may refer to some notes so I don't fumble for times or dates here.

Q. Refer to notes, but testify as to your own knowledge, please.
A. Yes, sir. The Chief of the Bureau of Ships, in a memorandum to the Assistant Chief for Shipbuilding Design and Fleet Maintenance, on 6 November 1959, directed that a complete review of the over-all problems into the use of HY-80 in submarine construction be made and there be a complete reconsideration of the pros and cons of its use in future programs. This was occasioned by the continuing reports of difference in opinions and techniques among the shipyards as to which were the most economical and the most assured way to get the final structure built without any detectable cracks in it. It appeared to the Chief that there were too many different opinions, that there should be a one better, more efficient, most economical way. He directed that the complete background of the HY-80 be looked at again in the light of any more recent knowledge that had been developed since the previous decision to use HY-80 was made. This was done to see if anything had happened that might require the changing of that previous decision. To carry out this investigation a special, full-time group was formed under the Director of the Ship Design Division. This was a deliberate assignment of responsibilities since these were people who did not have the day-to-day job of carrying out the development and improvement of the fabrication techniques in the shipyards. These were, in a certain sense, "engineers from out of town," to give a detached, objective and complete inspection and review. The team was formed with a Steering Group of senior officers and engineers and scientists in the Bureau and a Working Group. I was the Project Leader of the Working Group, with complete freedom to select any engineers in the Ship Design Division that I needed. We started with a deliberate attitude of assuming or believing that nothing was taken for granted. We enlisted the support of the scientific community. We got all the literature on the subject, that even went back to where the parent steel or HY-80 (a KRUPP steel in the 1890's). We sent teams to the shipyards to take notes and see what were the variables (that maybe the people that lived there didn't recognize) that might account for the fact that they couldn't seem to agree on the most economical way to get the same kind of a structure when they finished up. We reviewed all the work; we initiated some re-investigation to confirm what other people had accepted previously. In the course of this restudy and consultation, we came to a conclusion that there was one area that we felt we didn't know enough about -- the subject of fatigue of a massive, highly-stressed structure, like a submarine hull. There was really nothing in the literature specifically directed to this. There had been no knowledge of fatigue failures of submarines to date, but it was the very "not knowing" that we would have such a problem in the future that led us to

recommend that we find out more about it. We added this to our assigned task of considering HY-80 and its fabrication. The fatigue question was one thing that concerned us as we looked over the experiences of other industries. The change of materials in the aircraft industry is a classical example of an industry that did not predict ahead of time or recognize when they went to different materials that they were going to get in fatigue trouble. Fatigue found them before they recognized it. And we did not propose that we should get into such an "after the fact" situation. As a result of this overall technical review we came to some conclusions and recommendations which were presented to the Chief, Bureau of Ships. Subsequently, I made personal presentations to the Chief of Naval Operations, to the Assistant Secretary of the Navy for Research and Development. These findings, conclusions and recommendations were accepted and endorsed in their entirety. If I may briefly summarize those --

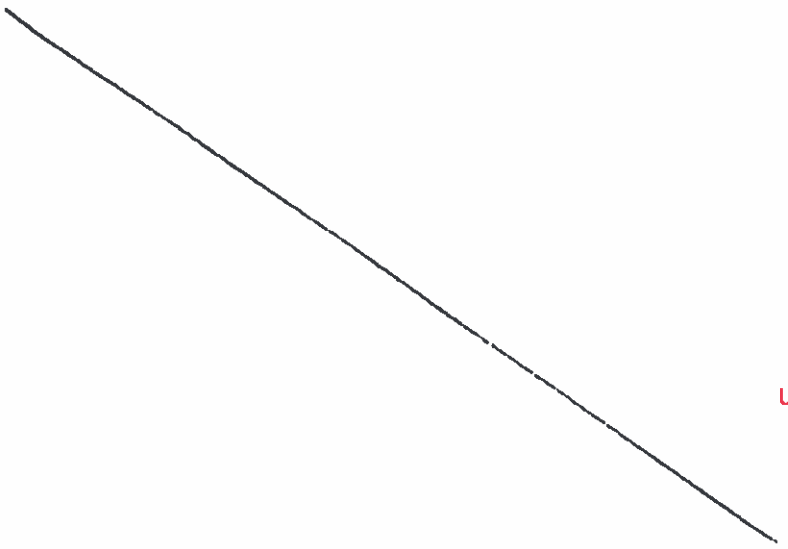
Q. Please do.

A. On the findings and conclusions, we concluded that proper and uniform fabrication of HY-80 is possible, but we felt that the Bureau should immediately determine and issue, from the Bureau, the uniform procedures for everyone to follow. Even though there might be a family of "acceptable" ways, we thought it should be up to the Bureau to select the most economical and uniform. We felt that fatigue life may have an effect on the life expectancy of submarines. We felt there should be work undertaken immediately to determine this before any submarines could come close to experiencing or reaching a fatigue lifetime of any vital part of the hull. And we felt, further, that we should not just wait until we found this out. If there were any possibility that there would be a fatigue problem (for the first time in the history of submarines) we should immediately start inspecting areas of the submarine even while we were finding out whether or not we would have a problem. Our confidence in depending on this surveillance, was based on the conclusions (both in the literature and from our expert consultants) that, generally, a specimen that is going to suffer a fatigue failure will exhibit detectable indications of that incipient failure, well before the actual failure point is reached. A fatigue crack can be detected by existing-state-of-the-art non-destructive testing measurements at least the half-way point of its ultimate failure point.

In complex structure such as a submarine hull, some of these might be detectable at only ten percent of the thousands of cycles that might ultimately be required to propagate through the hull. We also concluded that HY-80 steel should be continued for high performance military submarines of the present characteristics. We also found, as matters of fact, that welding cracks in the course of the construction process were occurring and had occurred. We also found that welding cracks had occurred in every steel used before HY-80. But the frequency of weld cracking during construction, even at the time we reviewed this in late 1959, was already materially less than it had been a year before, when the normally cognizant group in the Bureau had themselves started going out in the field to accelerate the development of improved and uniform procedures. We felt that the present state of the art does permit the production of HY-80 submarines that, when completed, are substantially or essentially free of detectable or deleterious hull cracks in pressure hull structure. We also concluded that as-built cracks are of primary concern regarding the effects of explosive loading and fatigue life -- not in the hydrostatic collapse considerations of the pressure hull, if there was experimental evidence that these kind of "construction" cracks in this type of structure would have no significant effect upon the hydrostatic collapse pressure. We concluded that submarine fatigue life should be determined. We would probably have to start from scratch in building up a background of basic knowledge. No one had ever done

this before. We recommended that it should be done; that it should have all the necessary funding support and priority; that it would undoubtedly require large scale models of realistic details constructed of the same materials and in a similar manner as were the actual ships. The second half of the problem was, "how fast does one of our new submarines build up cycles in a known period of time?" We didn't know. At the time of our findings, no one knew. It just seemed to us that inevitably these high speed, maneuverable boats were going to accumulate cycles at some faster rate than our old, slower fleet boats. We didn't know what the difference was but we thought someone should find out.

Based on these findings and conclusions we recommended that necessary experimental programs be initiated; that the Bureau immediately take charge to establish cognizant, responsible groups to develop uniform, adequate construction and inspection techniques that all the shipyards would follow; that we embark immediately upon a fatigue program to find out what we had or whether or not we had a problem. We recommended that we inform the Forces Afloat and Type Commanders, of our findings on HY-80; that we felt there were problems; that there were problems we had had before in other kinds of steel; we were going to make it better; we had a program to make it better. We recommended we should tell them about our questioning the fatigue life; that we didn't know whether or not they had a problem, but we were going to find out whether or not they did before they had one in fact. We should tell them that we might find that the fatigue life, for the first time in our submarine history was shorter than the otherwise useful life of the submarine, that is, it might fatigue (before it rusted away or got obsolescent). We would recommend, in this interim period of finding out the problem, that it would be only prudent to inform the operating forces that the fatigue life of a submarine may be analagous to the number of ampere hours in a battery, or the number of full power hours in a reactor core -- there are only so many and we don't yet know how many cycles there are in these hulls. The rate you use them up will determine how soon they will be depleted and now soon that piece or part that was used up will have to be replenished. I know that Commander Submarine Force Atlantic Fleet did issue a general prudential and informative instruction to his officers to go through extensive, hydrostatic maneuvering only when it was necessary or useful for tactical or other operational purposes.



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Q. Will you identify that report to which you have referred, for our record, please?

A. Yes, sir. It is titled, "HY-80 in Submarine Construction." It is signed by J. M. Farrin, Rear Admiral, United States Navy, who, at the time was Assistant Chief of the Bureau of Ships for Design Shipbuilding and Fleet Maintenance. It was submitted and signed by the Steering Group members on 5 January 1960.

At this time the special investigation group, having completed its findings and recommendations, disbanded and went back to their regular jobs. The Bureau then immediately developed and implemented the preparation of hull surveillance instructions and promulgated them. Other implementing action included the augmentation of fundamental work on testing of fatigue specimens; the construction and tests of both large and small scale fatigue models; the formation of a continuing advisory council (of professors from universities, of senior metallurgists, and Vice Presidents in charge of Engineering from industry, of experts from laboratories) to meet periodically and monitor and review technically the progress, and the technical adequacy of this program for learning everything that could be known about the fatigue life of submarine hulls. There was also established an officer's billet in the Submarine Type Desk with a special responsibility for seeing that all of these directed actions were, in fact, kept on the line, were initiated, carried out, and reported on in timely fashion; to coordinate everything from the surveillance instruction and its reports and records; the testing of what is the best way to bake and heat electrodes, to the proceedings of the panel who advised on theoretical and technical aspects of fatigue model design.

I come to a pause, not knowing whether I'm going too far or how far you want me to go.

Q. No, that's fine. Did you also learn more about the characteristics of HY-80 when used in the hull structure of a submarine from any studies performed on the ETHAN ALLEN?

A. ETHAN ALLEN information was more in context as a follow-on to the experimental deep dive work done on THRESHER. ETHAN ALLEN, as such, was not a part of the basic HY-80 Program. I think that ETHAN ALLEN remarks would perhaps come in proper context with the THRESHER tests.

Q. Regarding the deep dive?

A. Yes, sir.

Q. From all you learned about HY-80 steel, would you say that we know as much about HY-80 steel today as we know about HTS, high tensile steel?

A. In my opinion, yes. In the course of technical investigation we have found out things about HY-80 that no one knew about any steel.

Q. Do you think HY-80, then, would be more or less susceptible to fatigue failure than the submarine steels which we have used before it?

A. A direct answer, no. Per se, it is not more susceptible as a basic material. If I may elaborate, when you say "fatigue failure," I assume you mean that the structure or the specimen fails all the way through, and leaks, or falls apart, or breaks up, as a basic material, not only is it not more susceptible, but in view of its much greater toughness, it's a better steel for withstanding the propagation of a crack, whether the driving force is explosion or repeated stress loads. Even without this toughness: for the same stress level it would be less

Unclassified

Unclassified

susceptible to fatigue. This would be generally true since a stronger steel, is working at a much smaller percentage of its yield strength, would last longer than a weaker steel which was working at a much higher percentage of its yield strength.

If I may elaborate one step more, to insure I don't mislead. There seems to be general agreement in the experimental work that at extremely high loading or high cycle values, (up in the order of the one million or the two million, such as the flutter on the vibration regimes) the fatigue life of all basic steels seems to be about the same, (no matter what their initial strength is) with the same given load applied to them. I would like to point out that we are not in this regime of loading. (mean the ten to the six cycles.)

Q. This court has received information that if THRESHER had been made of HTS steel instead of HY-80 steel, it would have been four or five knots slower, nine hundred tons heavier, and seventy-five feet longer. From your knowledge of this steel and hull design, would you say that is a correct statement?

A. For two of those three I would say, "at least". It would be at least nine hundred tons larger. It would be, my professional estimate, about that order of speed slower. If I may also qualify this, I do not wish to infer that I think a submarine like that could be built of HTS. I do not. The thickness of HTS for this same depth would be b(1) As all of us recall from those previous HTS boats and from recalling that the kind of a steel HTS is: the thicker it gets, the less quality assurance there is that it's as strong all the way through; so your allowable strength drops with increase in thickness. It drops from, (at a thickness of about one-half inch) b(1) psi yield strength, to (a thickness in the order of one and a half to two inches) down to b(1) Even if three and a half or so inch HTS plate could be made, I don't know how far down that dependable strength you could use for design would go. And HTS, even in the thickness that we used in our fleet boats and in our seven hundred foot boats, was a very difficult steel to weld without cracking it.

Q. How would you modify your response to the last question if the HTS boat were designed for a b(1) submergence level?

A. For the degree of accuracy consistent with these estimates, I think you'd be within that degree of accuracy with a linear scaling of the depth here. In other words, b(1) of those differences. Within this area of adjustment (if you assumed other variations and hull geometry would remain approximately the same) you could scale down by the ratio of the design test pressure. That is just an approximation, sir.

Q. Are you familiar with incidents that occurred in 1959 at the Mare Island Naval Shipyard in which it was reported that a condition of unsatisfactory hull welding had occurred in the THEODORE ROOSEVELT, and that raised a question as to inadequate radiography?

A. I was at Mare Island Naval Shipyard at that time as an Assistant Design Superintendent. My recollection is a little inconsistent with both things you stated there. To the best of my recollection, the initial reports were on surface welding cracks, both transverse and longitudinal, near the toe of the weld, in way of the weld attaching the canning plate to the hull structure, as I recall. This kind of a weld is not inspected best or adequately by radiographic techniques. It's a surface phenomena and so magnetic particle or dye check or the other inspection techniques are the ones that are used and are the ones to find

Unclassified

this kind of a thing. As I recall, this was initially discovered not as a result, of on as a side effect of, testing the tightness of the canning plate boundary. There is a very low pressure air test to insure that. As I recall, all of these frames, not only the canning plate attachment, but all the attachment welds of the main frame itself to the shell, were then inspected, completely, 100%, with magnetic particle; and it was the recommendation of the Shipyard and approved by the Bureau of Ships to not even assume that these "as-built" cracks were or were not deleterious, but to check them all out and re-weld till you don't find any deleterious surface cracks. This is to the best of my recollection, sir. The first reported instances of construction welding cracks in highly restrained areas like this, I recall, were as much as a year or so before, on some of the hard tank boundaries on the 598, which first heightened or accelerated the attention which was given to it and was being given to it at the time this incident you mentioned about came up at Mare Island.

Q. Did this incident involving THEODORE ROOSEVELT raise serious questions as to the adequacy and extent of the radiography of the HY-80 structure?

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

A. To answer your question directly, no, not to my knowledge, however, your question seems inconsistent to me in a way. As I said before, these kind of cracks, the areas they are in, the method of detection is not radiography. It is another non-destructive method, but perhaps it is just a matter of a difference in nomenclature here. I got the impression your question says, was this the thing that generated alarm or concern?

Q. Yes, exactly.

A. No, not to my knowledge. That business of wanting to get the way to build and weld these structures so you didn't have to spend the additional time to inspect and to re-weld--the desire to find this best way had existed ever since we started using steel, and existed when we started using HY-80. The shipbuilders in those days were spending a lot of time inspecting, chipping out, and re-welding until they got it correct and arrived at a sound weld. Because of having to do a lot of this on the THEODORE ROOSEVELT. it obviously cost more time and money and effected delays on the ship. This was certainly not the initial recognition or knowledge, and it did not, all by itself, generate a program. It merely became another piece of the puzzle. I am sure it served to create additional interest or to accelerate interest.

Q. Do you know whether, as a result of the THEODORE ROOSEVELT incident. the Bureau of Ships sent a representative to Portsmouth to look into the radiographic coverage of THRESHER's hull structure?

A. No, sir. I didn't know that.

Q. From your duties in the Bureau after that date, with specific reference to your duties applicable to HY-80 hull structures, can you state whether there was any question at all at the time of her post shakedown availability period as to whether or not the radiographic coverage of her hull was adequate to determine the integrity of the hull?

A. There was no question to my direct knowledge. There was none before we conducted the successful deep dive. No question at all existed, to my knowledge. If there had been any question in my mind I would never have permitted a deep dive to get underway and would have used whatever power I had to stop it at that time.

Q. Are you familiar with the fact that recent inspections of two nuclear submarines built at Pascagoula, Mississippi, revealed that each ship had a significant amount of weld metal which had been omitted in the circumference of the pressure hull at a highly stressed transition joint?

A. Yes, sir.

Q. Does this in any way reflect any concern as to the condition of THRESHER's pressure hull in connection with the welding performed in it?

A. No, sir. I could not logically draw a conclusion or reference between those. These submarines were built at different Shipyards. This was an omission of the reinforcing weld. It was obviously not done and was not detected by the builder, but it was detected by the Naval Shipyard when it was in there for a hull surveillance inspection.

Q. Did they detect it by radiography?

A. No, by visual inspection. It was a reinforcing weld that was missing. I think they discovered this when they were making a standard surveillance inspection. In the course of doing this, they noticed that the reinforcing layers were not on that weld. They were going to make a magnetic particle inspection as a part of the surveillance program. Again, logically, I cannot see what connection this has with THRESHER.

Q. Turning now to the phase of model testing in connection with the development of our knowledge of THRESHER's reliability; will you describe briefly the nature and extent of model testing which is pertinent to our inquiry?

A. Yes, sir. There were three basic structural hull confirmation models that were authorized to be tested for THRESHER. One of these was a model. in approximately one-fifth scale (which has been our standard scaling model work for some time) of the representative cylindrical portion of the hull. There was a model which represented, or reproduced, the forward portion of the ship, a section which included the forward cone cylinder transition and the large penetrations of the torpedo tubes. Then, there was a third one which represented, in model form, the engine room, with its cone transition. These models were built, instrumented and tested. Each exceeded the design requirement collapse depth. As has been the case for as many years as I know of in our Navy. there is a design criterion that the assured collapse depth of the pressure hull will be b(1) : the maximum operating test depth. All of these models exceeded that prescribed collapse depth. Even when corrections or subtractions were made (for example, if the model material was a little stronger than the minimum HY-80 80,000 yield, the model did not get credit for being a little over that minimum).

The engine room model, as well as the other two, failed in what the structural theorists and experts say is the right way. This is a failure by a symmetrical yielding of the shell, so that the plating does its work all the way while the shell squeezes in. Even though it actually failed in this model, it gave the visual appearance of a general instability mode of failure. As a consequence of having a relatively greater model volume in this engine room model, the release of the pressure forces after the collapse point eventually tore the hull apart and punched a hole in it. This gave the appearance of a general instability kind of failure, and at first glance this is what was assumed. Upon looking at the performance of the hull and the records of strain indication, the stress analysts knowledgeable in that field concluded it was, in fact, at its required collapse depth and failed in the right way. The Model Basin made a couple of recommendations regarding the ship's design as a consequence of that last model. It is the Bureau's general target to have these confirming structural models completed prior to the end of the contract design stage and, without exception, to be completed before the ship is committed in detail design for any detail that has not been so confirmed. These recommendations from the Model Basin--the first recommendation, if I could refer to that report--

Q. By all means, refresh your recollection, and please identify the report for our record.

A. (The witness produced some papers in his possession.) The report I am referring to is titled, "Structural Tests of the 1160 scale model YD-3, Frame 63 to 95, of the U.S.S. THRESHER SS(N)-593, Report No. C-1026." The first recommendation: that the frame spacing in the two bays on each side of that

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cone-cone juncture could be adjusted to eliminate the weaker end bay section of the juncture deformation. They mention one alternative design procedure to produce the same result by increasing hull plating in the first two bays. To speak to this recommendation, neither of these alternative suggestions were applied to the ship design. The reason for this was that the model failed at a pressure of b(1) psi. Even with it corrected for yield strength and other properties the model had, this would give a collapse pressure of b(1) feet. Since this pressure is measurably above the minimum required collapse pressure of b(1) feet, it was considered that the model scantlings in this area were adequate for ship application.

The second pertinent recommendation in that report indicated that an allowance should be made for the additional end bay stresses in the way of the juncture. What they were saying in effect was, to reduce the stresses at the transition in the cone-cone arrangement, although, as you will note there was no quantitative mention of this "end of the model stress effects" in their recommendations. Their recommendation, as they stated it here, is one method of making the ship different from the model. The ship, in that area, was made different from that model in another manner, however, to more effectively reduce the stresses in that transition. Whenever a joint between two pieces of material carries stress, and the lines of stress have to turn a corner, they crowd up, and the stress concentrates. The sharper the corner, the higher the concentration. Lines of stress don't like to turn corners. On the model that transition angle was on the order of 30 degrees. In the ship that angle was reduced to something on the order of 22 degrees. The actual transition ring itself with which we attach these two cones on the ship was also given a taper and smoothed out instead of being the rather square block insert that was used on the model, since sharp corners also lead to stress concentrations. These, it was considered, adequately accomplished the purpose intended by the recommendation in the report in a more effective way. Also, the submarine hull, in the course of design development, had to get about 13 inches bigger to get the hardware in than at the time the model was designed and built.

Even with this considered, the model collapse depth as tested, was equivalent to b(1) pounds per square inch. This compares with the b(1) pounds per square inch that applies to a b(1) foot depth. So, it was considered that this model verified the assured design model prediction of the collapse depth of the prototype, that is, to be at least b(1) feet. These were the hydrostatic model tests of significance pertinent to the verification of the THRESHER's fundamental design.

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Q. How reliable are the model tests, such as the ones which you have described, in giving us assurance that THRESHER's hull did perform in accordance with the expressed requirements?

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

A. As they are carried out, we must recognize they are one part of the whole fabric of things that determine our confidence level in predicting what the prototype structure is going to do. My opinion is that there are few other things that we do that have already established such a known level of confidence. The model scale used is more accurate and requires less extrapolation than that which was used a decade ago. At that time, as we well knew in the years before, this was a fundamental building block in the business of combining tests, experiments and theory to know that you've done it before and it worked, and to have confidence in where you are now and what this ship will do. This accuracy is within the range that we depend on it here. Its validity here applied to HY-80 larger size models tested to collapse (not a whole full-sized THRESHER, as we don't have a tank that could do it), but other various sizes of HY-80 and other steels, that correlate. If done properly, in accordance with the rules of the game here, they correlate, just as our model programs do among full-sized, intermediate-size and model-size hydrostatic test sections of submarines. As long as you don't try to kid yourself and scale down without any degree of acceptable experience or confidence. I have no question as to confidence in this area.

Q. Do you have personal, direct knowledge of THRESHER's initial deep dive and the events that followed it?

A. Yes, sir.

Q. Please give us an account of it.

A. First, a very slight qualification; I was not physically present upon the first attempt at a deep dive, although I have made myself knowledgeable of those events as a consequence of being appointed by the Chief of the Bureau of Ships to take charge of the organization, the administration, the execution of all actions necessary to find out what went wrong on the first dive, to have those things corrected; and to do all the things necessary and carry out a successful first deep dive of the ship. The day after the first deep dive was aborted (by a deliberate decision at b(1) feet) people returned to Washington, a special conference was called, and I was given this assignment at that time by the Chief of Bureau of Ships, with full authority to organize, use, and to do anything with anybody that I wanted to do.

At that time, that same day, my first task was to prepare for the Chief of Bureau of Ships' signature a report to the Secretary of the Navy and the Chief of Naval Operations, of: 1. this occurrence; 2. of the Bureau of Ships' reaction to it; and 3. the Bureau of Ships' intended action as a result of it. The Chief of Bureau of Ships stated that he had reviewed the events that had transpired on this anomalous situation that occurred and that still could not be explained the day after; he considered that the decision to call things off and come home was a prudent one; in view of the importance of THRESHER, and the inherent gravity of deep submergence operations, he came to a conclusion that he would not propose or recommend a rescheduled b(1) foot deep dive until he had unequivocal assurance that the present, unexplained situation on THRESHER was completely researched, investigated and understood. When he had come to that conclusion he would then so inform the Chief of Naval Operations. He also

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intended, after he got the THRESHER understood, to take a complete review of the other kinds of b(1) foot submarines that were coming down the pike. So, with that charter in hand, we immediately started to look at what went on during the previous dive. One day later, on a Saturday, Mr. Palermo, whom I had picked as one of my first lieutenants in charge of stress analysis, and who is here today to testify directly, if you so desire, had laboriously hand-plotted all of these tapes of plotted data that had come out of the automatic recorder. The recorder had said that everything was going in compression all at once. There was no rational explanation why, all of a sudden, not only the elliptical head, but every other part of the ship on which there were strain gauges hooked up to this one recorder (different kinds of structure, other areas) all happened to go into compression at exactly the same instant. Even though some of them had been working under tension five feet before, it appeared that all of them, everything on that one recorder, went into compression at the same time. I thought we had to believe that it might have been instrumentation. We decided to find out. We came to Portsmouth immediately. Portsmouth was already stripping everything off the forward heads to inspect it. We got the original mold loft templates that had been retained. We got those out to fit them back on to see if, in fact, the elliptical head had moved, or changed or dished. We also, alongside the pier, took the same recorder, cranked it up to the same depths, and poured water over those gauges topside. It was known that water had seeped in under a few of them, since it happens to some small percentage of the external gauges. We found out, while we were sitting there, that this instrument would say the pressure hull was going into compression by exactly b(1) micro-inches/inch, the same thing that was experienced at an actual depth of b(1) feet. We were able to reproduce the phenomena on the recorder sitting alongside the dock. Obviously, this can't physically happen. This gave us the confidence we needed to recommend to the Chief of Bureau of Ships, for me to recommend, that we thought that we were ready then to proceed with a re-instrumentation in greater scope, with an expanded organization of the strain gauge party, and that I be permitted to go ahead and initiate the planning and preparations for a rescheduled dive. He accepted this with one provision, that before he would say this, he wanted me to arrange one more additional review;--to call in a number of authoritative people in this general field of instrumentation and pressure hull and materials, and have them just sit back and hear a complete presentation by the Bureau and the Model Basin of pressure hull design criteria, materials, instrumentation and everything we had done. We did so arrange with people from the scientific, advisory staff of the White House, from universities, retired officers of the Navy who were knowledgeable in this field. They confirmed our initial conclusions and concurred that our plans for re-instrumentation on another deep dive made under proper control was a wise and acceptable thing to do. We so proceeded.

We added over one hundred additional strain gauges and organized a special party of people for manning the instruments. We took out the new instruments and got the old instruments back. I had structural analysts and structural engineers operating the instruments. We went down in carefully controlled increments. At each depth increment, the Commanding Officer and I exchanged, "I'm ready, if you are" and "If you're not ready yet, Okay, I'll wait until you are." We analyzed it every step of the way down. We started in fifty foot increments when we approached b(1) Even though we were convinced that it was instrumentation, we just wanted to make sure that if anything happens again let's have the whole story before we get there. We then continued on down. As we got to b(1) feet, we went to twenty-five foot increments. We got to b(1) feet, the pressure hull behaved beautifully.

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The structure was linearly elastic in its response. There was not a significant degree of permanent set. I had been used to seeing some initial deformations in our previous older boats on a first deep dive, and was expecting to see a certain degree of this. Upon concluding that dive and analyzing the data, I reported to the Chief of Bureau of Ships, who in turn reported to the Chief of Naval Operations, that we had successfully conducted (from a structural pressure hull standpoint) a deep dive test of the THRESHER, and we considered, from a hydrostatic collapse standpoint, that we had confirmed that her static collapse pressure was at least b(1) feet.

Q. From your knowledge of studies conducted on ETHAN ALLEN, have you modified your confidence in the structure of THRESHER's pressure hull?

A. No, sir, to the contrary, we immediately picked up on ETHAN ALLEN, and as one of the preludes to the actual work on ETHAN ALLEN, we called together again, a group of consultants and experts (not only our own, but from those other towns and other fields of area). As part of our getting their reaction to what we planned to do on ETHAN ALLEN, we also told them what we had done and what we had learned, and our conclusions on THRESHER, because some elements of the structure were similar. These gentlemen on that part of structure pertinent to THRESHER, confirmed that we were correct and accurate in our judgments and conclusions from the structural design standpoint.

Q. One last question. I believe that one of the conclusions of the HY-80 special investigation group that you told us about was that HY-80 use should be continued for submarines of "present characteristics." Are there any changed characteristics in THRESHER, which in any way makes invalid this conclusion of the investigating group, as applied to THRESHER?

A. No, sir, not at all. That particular conclusion was in context with "when we go to larger, deeper diving submarines." The rest of that was "you will have to get an even stronger material to go to b(1) if you still want these large submarines to go down."

BY THE PRESIDENT: In view of the fact that Commander Bryan has been on the stand for some time, the court does have urgent matters to attend to. We will clear the court and take time for deliberations.

The witness was cautioned concerning his testimony and withdrew.

The court closed at 1120 hours, 4 May 1963.

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The court then opened at 1225 hours, Saturday, 4 May 1963.

All persons connected with the inquiry who were present when the court closed were again present, with the exception of (b) (6) who was relieved by (b) (6) as reporter.

No persons not otherwise connected with the inquiry were present. The witness was reminded that his oath was still binding.

EXAMINATION BY THE COURT

Questions by a court member, Captain Hushing:

Q. Commander Bryan, I believe you have testified that there was a committee formed in the Bureau of Ships to look into HY-80 problems?
A. Yes, sir.

Q. Of which you were the project leader?
A. Yes, sir.

Q. Was there also a committee formed of shipbuilders' representatives, about the same time, to look into this problem?
A. Approximately a year earlier, there was a committee formed under the leadership of those in the Bureau whose normal cognizance was the welding and fabrication. I do not personally recall the exact composition but it included representatives of shipbuilders on it.

Q. And did these committees continue to operate for some little period of time?
A. This committee--the one to which I just referred--as a result of our special investigation, was superseded by a much larger committee which was a continuing body with representatives of all the welding engineers from all the shipyards building submarines and it may still be in existence now. It continued as a group for a considerable period of time with the assigned task of developing, in the shipbuilder's language and terminology, authoritative procedures to follow to get uniform results among all the shipyards.

Q. Do you consider that any reasonable avenue of approach to this problem was left uncovered?
A. I know of none. They impressed me, from what I saw of their work, as a very thorough-going bunch of men.

Q. Do you know of any pressure vessels of the size of nuclear submarines which have been designed and built by commercial interests in the United States or elsewhere?
A. Yes.

Q. What are they?
A. Well, the external pressurized pressure vessels of anything approaching this size, such as the Bathyscaph TRIESTE, although it is much smaller than this ship--it's the only thing (even though it is a sort of rare bird) that could be considered as coming close--although, as you may know, it is much smaller itself. Other than this kind of special vehicle, I know of none.

Unclassified

Q. In view of this lack of commercial interest, do you consider that the Bureau of Ships performed enough research into the problem to consider it prudent to continue with the building of THRESHER class submarines?
A. In my opinion, yes, sir.

Q. Why do you say that?
A. I say that because, from my capability to understand, to think, to compare what we are doing now with the degree of thought and preparation and research that preceded our previous successful submarines, in my opinion and in my judgment, what we have done to prepare us for the continuation of this class is at least equal to, if not in fact exceeding our technical preparation that got us into previous demonstratedly successful submarines. This is my opinion, sir.

Q. I believe you testified that were HY-80 not to be used and HTS were to be used, that a substantial increase in thickness of hull plating would result in submarines under construction?
A. Yes, sir.

Q. This is approximately b(1) as I remember.
A. Approximately. A little less than b(1) -a little less b(1)

Q. Now, disregarding the difference in chemical composition when you speak of such steel, is it true to say that fabrication difficulty increases with thickness of plating?
A. In my opinion, yes, sir.

Q. Do the forming technique difficulties increase with thickness in plating?
A. In my opinion, yes, sir.

Q. Is there a reasonable limit at this time to the rolling capabilities of naval and private shipbuilders within the United States?
A. Yes, sir, there definitely is.

Q. About what size plate is the maximum limitation reached?
A. In this case, sir, my memory does not recall the exact number, although I have personally seen authoritative, realistic studies made of steel materials and actual industrial machines--studies which stated the physical limits that exist for the capabilities to handle ranges of strength of steel and thickness, and that there are physical limits that existing machines will handle.

Q. Do you know whether we have any capabilities to handle plate for submarine hulls, say above six inches in thickness?
A. I know of none.

Q. How about five inches?
A. No, sir, you are bringing me to my previous point--I don't recall the exact number that our present facilities will handle.

Q. As regards quality of steel, are adequate measures taken to insure the quality and uniformity of HY-80?
A. In my opinion, yes, sir.

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Q. Do you know what these measures are?
A. In the sense that the steel itself is purchased to a specification, as a part of the specification, and also the procurement and naval inspection requirements, chemical composition, the heat treatment, the handling, the inspection, even the preservation of the plate at the mill site, are subject to chemical analysis, inspections, records and so on. I also know that those plates, when received by shipbuilders are subject to a rather thorough re-inspection as to thickness, as to even surface condition characteristics--roughness or smoothness of surface. I do not--having been away from the shipyards for some years--know the precise material identification procedures used in our submarine yards at this time, although they are, I know generally, more rigorous than when I was in the shipyard.

Q. Do you know how many manufacturers make HY-80 steel for submarine construction?
A. To my knowledge now, Lukens and U.S. Steel are the last I heard, although in the last few months I haven't been in a position to be dealing with steel companies.

Q. Would the fact that there are only two suppliers permit concentration of inspection efforts to insure high quality?
A. I don't mean to be facetious, but it would almost appear axiomatic that if you had a lot of people making something and then if you had a given number to inspect--then--yes, sir, if you put them all in fewer spaces, one could concentrate those people. I am sorry to give this kind of an answer, but I would think if I just said yes, or no--

Q. This question is partially conjecture and I think this is satisfactory. Were the initial dives of other submarines than THRESHER of the b(1) variety, instrumented?
A. Yes, sir.

Q. Can you mention a few of these?
A. The ETHAN ALLEN, 608, which was the first deep b(1) diver of SSBN. The 610; the 618; the 617. Some degree of instrumentation was done on the next following SSN of the 593 class out at Mare Island, I think it was the 594. There may have been others but I have been away from that business for many months.

Q. As regards calculated stress levels in the hull structure, did these instrumented tests generally confirm the magnitude of stresses in the hull?
A. Yes, sir, I would say so.

Q. Would this give added confidence as regards the calculations and the extrapolation of model tests to the full size structure?
A. Yes, sir, and this is a very necessary and important product of instrumented deep dives. In instrumented deep dives, of course, the primary purpose is to establish the soundness of that ship and class and type, but a very important part of it is to see if it does continue to give you confidence in the techniques by which you continue to predict and calculate.

Q. Would this additional confidence, generated by additional tests, give you an additional feeling of confidence in the basic design of THRESHER's hull?
A. Yes, if in slightly different words, "Additional confidence" infers that I was not confident at the time we finished the THRESHER. If I could suggest a word, it "reaffirmed" my confidence in the THRESHER.

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Questions by a court member, Captain Osborn:

Q. Commander Bryan, Admiral Rickover has testified before this court with respect to two processes, namely the sil-braze process and HY-80 process as used in deep-diving submarines. I think both of his questions as to use of these were in inspection and process in-being at the time. Will you briefly outline for me the lessons you have learned in HY-80 and how they are retro-fitted into hulls that were previously fabricated?

A. I am collecting my thoughts because this goes back. A major portion of the lessons that continued to be learned, of how to do the welding with the minimum amount of having to repair after the first welded detail, to get a sound weld, this is the kind of thing that the word "retrofit" isn't really applicable, because to my knowledge, none of the submarines we are talking about ever left the shipyard with "known" cracks present. So to "retrofit," in this sense, of those lessons, doesn't apply. We have learned, and this is not about the processes so much, but we have learned, that we will increase the fatigue life of highly restrained flat plate, stiffened flat plate structures like auxiliary tanks and negative tanks, by cutting down the stress level at which they work. This is the kind of thing that "back fit" is pertinent and applicable. This was the first action taken when we had gotten far enough in our experimental fatigue program to indicate in these kind of structures that we should cut down the stress level. The first step was to prepare and issue ShipAlts and working orders and the like to cut down design stress levels in the stiffened flat plate structures of ships that had already been built.

Depending on the particular ship and kind of tank, in some cases it was more economical and easier to do this by cutting out that piece of plate and putting in a heavier piece of plate with the same number of stiffeners, or adding more stiffeners to the existing structure. Even before this, we re-designed the cone cylinder transition rings--reducing the stress levels in it--as a result of those initial model tests of the THRESHER. The second one of those THRESHER models after it had been hydrostatically tested to almost collapse--about 95 per cent of collapse--was taken out of the hydrostatic tank and cycled for almost 8000 cycles. Before this cycling, it had been pretty rough treatment by being taken almost to collapse. It was then cycled from periscope depth pressure to test depth almost nine thousand times. This indicated that we would be wise to change the geometry of that ring, taper it, to cut down the stress concentration problem. That is where these fatigue cracks started to appear. This was back-fitted into all of the SSN's then under construction. Different details of doing this were developed depending on the state of construction particular of the ships.

The hull surveillance is another area that perhaps one could say is a kind of a "back fit." At the earliest opportunity we started re-inspecting areas on ships like SKIPJACK--which was welded before we came to our final selection of best procedures, best electrodes and the like--the SKIPJACK has been almost continuously re-inspected and resurveyed for particularly close monitoring of areas on SKIPJACK, where we have noticed a high incidence of weld cracks. I do not have with me nor can I recall the specifics of every one of those things on SKIPJACK.

Unclassified

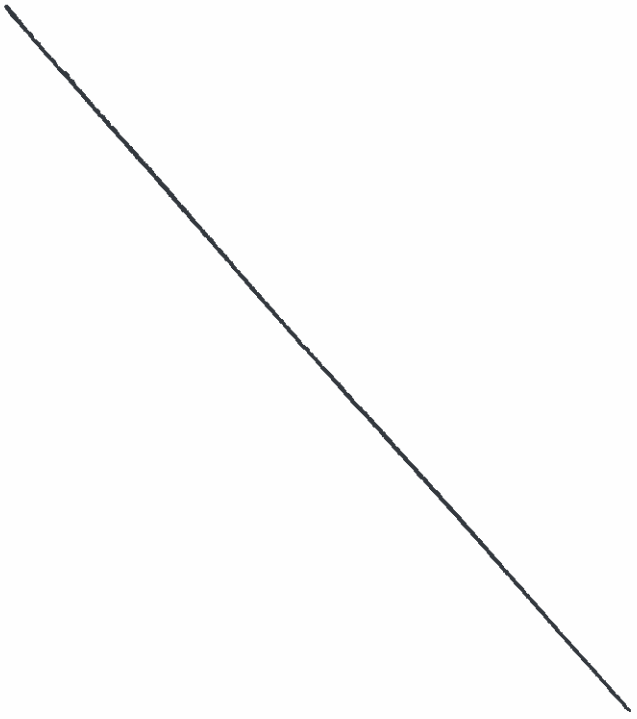
Q. With respect to preheat, welding rod, certain procedures involving details of execution as they affect quality control, is there any method of retro-fitting this or is it required that they be retro-fitted with respect to current hulls that were built prior to when you learned these lessons?

A. As I say, it appears to me that this, what you say then is not pertinent to retrofit, because even though at the time the ship was built, before they have the best most efficient procedures, the ship was built and even though it took them more time, more re-inspection, more repair of those initially cracked areas to finally send the ship out crack-free as far as could be determined, in the same state it first left the yard, it did go out that way.

PRESIDENT: We will adjourn until Monday morning.

The witness was duly warned concerning his testimony and withdrew.

The court then adjourned at 1245, Saturday, 4 May 1963, to meet again at 10 o'clock Monday morning.



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TWENTIETH DAY

Portsmouth Naval Shipyard
Portsmouth, New Hampshire
Monday, 6 May 1963

The court met with closed doors at 1000 hours.

All persons connected with the court who were present when the court adjourned were again present in court, with the exception of (b) (6) who was relieved by (b) (6) as reporter. RADM Palmer, a party, and LCDR Hecker, a party, and his counsel waived their right to be present at this session of the inquiry. Counsel for RADM Palmer was present.

No witnesses not otherwise connected with the inquiry were present.

Clarence Russell Bryan, Commander, U. S. Navy, the witness under examination when the court adjourned, was recalled as a witness for the court, was reminded that his oath previously taken was still binding, and was examined further as follows:

REEXAMINATION BY THE COURT

Questions by a court member, CAPT Osborn:

Q. If you remember, Commander Bryan, we were discussing two processes that had been the subject of testimony in this court involving HY-80 steel welding and silver-brazed joints. What new processes with respect to silver-brazed joints were developed subsequent to the THRESHER's completion?
A. On this subject I do not know. I am not knowledgeable or familiar with the silver braze developments in that area.

Q. Were there any new processes developed with respect to testing of hulls other than state of art improvements since completion of THRESHER?
A. Not to my knowledge.

Q. Then you would say that our ability to determine HY-80 problems as contrasted with STS problems, or the old hull problem, was just about the same with respect to when the THRESHER was completed as it was in the previous period?
A. Could I ask one clarifying question? Did you mean STS or HTS?

Q. HTS. Excuse me.
A. As regards the ability to inspect the pressure hull, I am confident that, if properly used, our techniques will give us a sound pressure hull.

Q. I want to ask about the structural tanks and why these were strengthened. Was this the result of measurement actually made on the ship that this alteration was put out?
A. Yes, sir. A combination of actual measurements made on the ship and actual experimental tests with tanks built like those stressed under controlled experiment tests.

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Q. Would this be a pretty difficult calculation, to calculate it ahead of time, or was it something that wasn't calculated before?
A. It was calculated as far as what the stress levels would be. What was not calculated and not known was the fatigue life of the structures subjected to this stress level. It was known they would not suffer collapse under static testing. The ultimate fatigue life of those was not known. This was determined experimentally by tests.

Q. And the real strengthening of the flat plate structure and the tanks was the result of additional information derived after the completion of THRESHER?
A. Yes, sir.

Q. And this particular area was in the area of fatigue failure under a given stress?
A. Yes, sir. This was the particular consideration as to why we wanted to reduce those stress levels.

Q. What observation of the HY-80 hull, such as SKIPJACK and ALBACORE, what's been the experience with respect to cracking during operations - hull cracking?
A. I don't feel I am personally knowledgeable enough and current on the situation regarding the hull surveillance records and reports. I believe there is an officer here today who is thoroughly knowledgeable of that whole program today. I am not, I feel, to the degree necessary to speak to this court.

Q. I am not interested in decimal points; I am interested in your general observation as an officer keenly interested in HY-80 and submarine hull construction. Have there been any incidents with respect to actual ships in operation involving cracking so that you might question the advisability of using HY-80?
A. To that I can speak. With respect to those instances I may have heard about or know about, either directly or by hearsay, there have been none that would honestly cause me to doubt the wisdom of HY-80 as a material.

Q. Now, I want to get into another area of your previous experience before you became primarily interested in HY-80. As you know, you have been undergoing re-investigation of the 616 class and the THRESHER class with respect to new engineering studies. How big an interest do the operators exhibit in these particular studies? By "operators" I mean the operational submarine staffs on both coasts.
A. I can't speak to that from any direct knowledge.

Questions by a court member, RADM Daspit:

Q. Commander Bryan, referring to the fatigue strength of HY-80 and HTS, can you briefly compare the yield strength, ultimate strength, and fatigue life of these steels under conditions of comparable loading as used in submarines? As I understand, they are designed so that they can be loaded comparable to a certain percentage of the yield strength. Can you compare the yield strength, the ultimate strength, and fatigue life under those conditions?
A. To use some nominal values as a comparative case, taking HTS of the thickness which has a minimum nominal yield of 42,000 PSI, its ultimate strength is in the order of 80,000 PSI. Those figures then for comparison with HY-80, which has a nominal minimum yield strength of 80,000 PSI and an ultimate strength on the order of 105,000 PSI. As these numbers indicate, in the case of HTS, the yield strength is not as close to the ultimate strength as related to the yield

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strength of HY-80 is to its ultimate strength. If, then, exactly the same structure, differing only in the material used in it, were stressed to the same percentage of yield, then in the case of HTS, this would be a lower percentage of the ultimate strength of the HTS than the HY-80, which would be stressed than a higher percentage of its ultimate strength. If one accepts the postulate that the fatigue strength of a steel is more closely allied to its ultimate strength than to its normal yield strength, then under these conditions of loading the two steels to the same percent of yield point--under those conditions it would follow that the fatigue life of the HTS specimen would be longer than the fatigue life of the HY-80 specimen. I might add, I don't know if this is a universally accepted theory, because this high-stress fatigue question is still in its infancy as far as the theorists are concerned in developing commonly accepted laws of nature governing this very complex phenomenon.

Q. While I can understand that we can't test a whole section that way, it seems to me that the high loading fatigue testing can be done on samples. Have any samples been run to compare HTS and HY-80?

A. Yes, sir. I would like to point out that this belief that the ultimate strength and the percentage of load in the ultimate strength is a more significant yardstick in predicting fatigue life and has some basis in experimental confirmation. In point of fact, there were some experimental indications that this might be true. It was the fact that, perhaps coincidentally, when the aircraft industry went to higher strength materials and loaded them very high in high vibration portions of the ship, they got into trouble. This was noted and was one of the reasons, in our review of HY-80, which led us to recommend that we initially and before the fact, look into the fatigue potential of submarine hulls. There is experimental verification, and there have been a number of experimental tests of comparative materials - HY-80, HTS, and even medium steel - and there seems to be at least some degree of a valid basis for the conclusion that the ultimate strength is an indicator of fatigue life.

Q. If this postulate is true and not considering anything other than fatigue strength, HTS would be a better material than HY-80 if the number of cycles is so small that it might affect submarine life.

A. I could only subscribe to that with another "if." If you were willing to load HTS to only that absolute number which the same percentage of its lower yield strength would permit. If you did that, then, yes, sir, it would follow that if its fatigue life were longer, it would be better.

Q. I don't follow your last "if." Can you explain that a little further?

A. Yes, sir. This is in context with some of the testimony and discussions of last Saturday--that if one wanted to make a b(1) submarine out of HTS, there were some comments and beliefs as to whether this could be done. If it could be done - and I believe I did state I doubted the practicality of being able to do it - but if you could do it, then indeed you would have made it out of HTS and that would have a longer fatigue life. I do not think it could be done, however.

Q. Yes, I meant to include that in my question. Now, in your testimony, when you referred to the report of the board of which Admiral Farrin was the senior member, on HY-80 in Submarine Construction, you indicated that the Bureau developed and implemented the preparation of the hull surveillance instructions.

Unclassified

For the record, could you give us the file number or other identification of the current instructions?

A. No, sir. I do not have those with me, and I am not prepared to speak on those. I do believe you have a witness available who does have that information. I do not have that information with me.

Q. Did I understand that the primary purpose of the hull surveillance is the early detection of fatigue cracks?

A. This was the primary purpose that led us to recommend and establish that program, yes, sir.

Q. We have heard little discussion about surveillance of hulls of earlier HTS nuclear submarines. Are they included as part of the surveillance program?

A. Yes, sir. This was one of the recommendations of the HY-80 investigation, that some already-built HTS submarines should be inspected. This was done. I do not recall, nor have with me, the details specifically of which ones nor the results. I believe a subsequent witness does have. To the best of my recollection, however, the NAUTILUS, I believe, was inspected in representative areas of her HTS pressure hull and tanks. I believe one of the TANG class boats was also inspected. I believe portions of either the GRAYBACK or the GROWLER were inspected. There may have been others, Admiral. I am not prepared to talk in detail to that. I simply don't have the information with me.

Q. In order to make sure we get the right witness, would you name the witness?

A. Lieutenant Commander Keays, I believe, is prepared to speak to that.

Q. You mentioned that two nuclear submarines built by Ingalls at Pascagoula were found to have a significant amount of weld metal omitted at a transition joint. For the record, would you give us the names of those two submarines?

A. Yes, sir. I believe the SCULPIN, SS(N)-590, and the SNOOK, SS(N)-592.

Q. When you were asked what recommendations were made as a result of the HY-80 in Submarine Construction report, you did not specifically mention that, as a result of this report the Bureau issued definitive instructions for fabrication and welding of HY-80 steel. You had discussed this earlier. Did the Bureau issue such instructions? And if so, can you tell us what the applicable instructions are currently?

A. First, if I did not mention it, it was an error of omission on my part in not identifying it when I recounted those recommendations, because it was definitely a recommendation as a result of that investigation and is in the report. I am aware in the general knowledge that there were developed and were issued comprehensive instructions on HY-80. Again, I am sorry, sir, but I am not prepared to tell you the specifics in this regard. There is, to my personal knowledge, a witness available in the anteroom in the person of a Mr. Griffin from Welding Code 634 in the Bureau who is knowledgeable in this area, and I would suspect he would have this information.

Q. Can you tell me from your own knowledge whether it has been necessary, in the interest of building our submarines, it had been necessary to delegate other persons outside the Bureau the authority to grant waivers to these instructions and procedures?

A. I do not know, sir.

Q. Would Mr. Griffin know about this?
A. In my opinion, he would, sir.

Q. I have one last question: Referring to the one-fifth scale model of THRESHER made and tested by the David Taylor Model Basin, I believe you stated that the frame spacing could be adjusted to eliminate the weaker end bay section of the juncture deformation, but that the Bureau did not make any changes in the design because the model did not fail until after the designed collapse pressure had been exceeded. Isn't it true that if we find that fatigue life is found to be a factor in the operation of submarines, that a maximum effort to equalize stresses, a sort of one-horse shay design, could minimize the possibility of having a submarine laid up because of early fatigue failure of one part of the hull?

A. The latter part of your question is true, yes, sir. Could I speak to the first part in amplification in order to clarify the situation? From a static collapse standpoint, the recommendations as recommended by the Model Basin for modifying the prototype structure were not followed. The prototype structure, however, was modified from its form in the model testing stage in two respects, which not only would effectively accomplish the same thing in reducing plating stresses, but also did something that the Model Basin recommendations would not have accomplished. The changes to the structure in the ship or in the design stage before the structure was finally built in the ship differed from that as tested in the model in one very significant way: the angle of taper of the cone at that intersection was reduced from 30 degrees in the model to about 22 degrees in the ship. This would have a measurable effect in reducing the stress concentration at that transition ring of the cone, which is experimentally the area most susceptible to fatigue failure in the model.

Questions by the president, VADM Austin:

Q. Commander Bryan, I believe you said that two steel companies now produce HY-80, is that correct?
A. To the best of my knowledge, yes, sir.

Q. Has there been, to your knowledge, any vested interest influence on the decision to use HY-80 steel?
A. Not to my knowledge, sir.

Q. Will you tell the court what your opinion is regarding the weakening of a hull built of HY-80 when access holes are cut in this hull during overhauls?
A. In my opinion, if access holes are cut in the pressure hull, in the proper geometry and shape as is prescribed in existing structural instructions and plans, if it is then replaced in accordance with existing instructions for the preparation of joints, maintaining circularity of the required procedures, and is adequately inspected and tested in accordance with existing procedures and capabilities which we have now, then, in my opinion, that portion of the pressure hull should be effectively as strong as it was before.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. Commander Bryan, you have testified as to the first planned deep dive

which was aborted in the case of THRESHER, and as to the second dive. Was there a third scheduled dive to test depths in this series which THRESHER was to accomplish?

A. You are speaking of the sea trial period after the abortive first trial period?

Q. Yes.

A. Yes. I had, in fact, made contingency plans in advance for every conceivable turn of events I could think of that might occur or anything that might be required during the development of the dives and even had planned to be prepared, whatever the result of this set of dives, if it wasn't going to turn out well, I even had plans made to have the next set of instrumented deep dives if they were required. In accordance with being prepared for everything I could think of, I had requested, and permission was granted, in the operational scheduling of the trial period, to give us three separate dives. These were as follows, and for the following purposes: An initial dive in increments to 700 feet and return to the surface to check the instrumentation, to check out my strain gauges and to evaluate my communication circuits, to also make a numerical check with those readings in the first abortive deep dive; and then if everything looked all right, we would proceed with Dive No. 2, which would be going to b(1) and return. Now, in many cases -- I can't say in most cases, because I haven't made every deep dive on a submarine, but I have made several and have measured the results of several, and one would normally expect in a new structure that had never gone to this depth before that you would experience the residual stress effects, and initial changes in rate of deformation until the structure takes it final form - and we are talking about numbers in micro-inches. But if this had occurred on the b(1) deep dive and if, when we came back up to the surface, it had come back elastically and linearly, that would have been all that we needed. However, if this result did not come about, then I would have wanted a third dive to insure that every strain gauge indicated that the pressure hull had taken its final geometry and was taking the stresses. At the end of the b(1) five, Dive No. 2, we came back up to the surface and we analyzed the data in the sense that I was requiring every strain gauge be plotted on the paper and that all necessary readings were taken so that we could understand fully what had taken place. The response of all of those gauges was essentially linear at that time. And there is a rational explanation for this. It had already been taken to b(1) and so it had already had a pretty good stress reliever dive. It apparently was a well-designed bunch of structure, because it was elastic and it stayed elastic. There was no useful purpose to be gained by a third one, so we did not have a third one.

Q. You are generally aware, are you not, that some amount of structural work was accomplished on THRESHER during her post shakedown availability?

A. Generally, yes.

Q. Based on your past experience, what would you expect, insofar as structural stress and strain is concerned, during the first cycle to deep depths after her post shakedown availability?

A. If it is that type of structural work that I would expect to be accomplished in a PSA, I would not expect that degree of work would have any significant effect, if it was properly done, upon the stress-strain established pattern of the hull as a whole. I would not expect this.

Unclassified

Q. Are you satisfied that there are adequate precautions as to instrumentation on initial deep dives?

A. I can only speak to the deep dives of which I know something about and those for which, at the time, I had responsibility and knowledge. Of those, yes, I was satisfied.

Q. Are there any recommendations that you would make as to the changes in our present practices of instrumentation?

A. If the practices of instrumentation now are the same as they were when I was last active and knowledgeable, then I know of none. If I had known of any, I would have had them done at that time on those ships.

REEXAMINATION BY THE COURT

Questions by a court member, CAPT Osborn:

Q. In the case of the 608, I believe it was, you ran into certain problems with respect to the deep dive and being able to fulfill it. What action did the Bureau take to insure that the ship did not go any deeper than it should go until the problem was under control?

A. The first deep dive of the 608, we found that the structural testing was completely adequate in confirming the pressure hull design with the exception of that area of the pressure hull in the way of missile tube pressure hull intersection. Even though it was the consensus of responsible people on the ship conducting that test and those in the Bureau that there was no danger of pressure hull collapse, it did appear to us that the stresses were too high from a standpoint of repetitive fatigue loading. They were extremely high, even though by demonstration the pressure hull was not in a collapse area. We felt there should be stress-reducing modifications in these areas. It was pertinent in the light of our recognized knowledge of the relative fatigue lifetime for high stresses. Therefore, upon return from that deep dive, the Bureau of Ships issued a 700 foot depth limitation on the SSBN-608 and all of the SSBN's of the class until an assured stress-reducing modification could be accomplished and verified by test. We further said that if it became necessary in the event of emergencies the ship could go below 700 feet: or, if it became necessary to take further tests to get data, that excursions below 700 feet could be made if they were previously approved and monitored by the Bureau of Ships. This instruction stayed in effect until we had developed the back-fit fix, and had experimentally verified it on a ship installation and had further confirmed it with a model test of that back-fit fix. After this was done, and the ships were modified, the 700 foot depth limitation was lifted.

Q. I was more interested other than the HY-80 problem, and you knew you had perhaps a safety problem with respect to restructing depth of the ships.

A. I can only speak with knowledge and authority to the pressure hull structure. My attention was focused all the time on that.

Neither 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 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.

Unclassified

The witness made the following statement:

THE WITNESS: First, of course, I appreciate the opportunity to appear and testify before this court.

There is one point I would like to make for the record, even though perhaps it has been made, but I would like to emphasize it; and it concerns the previous tests on THRESHER's structural hull design. It was conclusively stated by the Chief of the Bureau of Ships and by his agents on this, of whom I was one, that the requirement to establish beyond doubt the adequacy of the 593 hull was of paramount importance and should not be subordinated to any other requirement. This was reaffirmed by the Chief of the Bureau of Ships and through the Chief of Naval Operations and the Secretary of the Navy. This was, in fact, a guiding policy, to the best of my knowledge, in all of these structural tests, conclusions and recommendations.

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

The court recessed at 1155 hours, 6 May 1963.

The court opened at 1209 hours, 6 May 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 as reporter at this point by (b) (6).

No witnesses not otherwise connected with the inquiry were present.

Harrison S. Sayre, (b) (6), 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:

COUNSEL FOR THE COURT: Mr. Sayre, this is a closed session of the court and classified information may be divulged here.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Would you state your name, address and present occupation?
A. Harrison S. Sayre, Welding Engineer, Bureau of Ships, Code 634B, Head of the Machinery Unit in the Metals Section, Bureau of Ships. My home address is (b) (6).

Q. Describe briefly your duties at the Bureau of Ships?
A. At the Bureau of Ships I am responsible for the Machinery Unit, which covers the materials; fabrication, including welding; and inspection of items of machinery going into naval vessels. I am responsible for the preparation of the specifications and the interpretation.

Q. What were your specific duties in that field with reference to THRESHER?
A. With regard to THRESHER, there were no specific duties other than that the specifications were available on this.

Q. Describe briefly your professional background and experience in your field, please?
A. I was in the service during the war from 1941 to 1946 as an officer stationed at the Engineering Experiment Station, Annapolis, working in the field of high impact shock and in welding and metallurgy. Following the war I went on inactive duty, in August of 1946, and remained at the Experiment Station in the Welding Laboratory as the Head of the Physical Metallurgy Section there, working on welding and welding tests. In 1952 I transferred to the Bureau of Ships as a Welding Engineer under Mr. Thomas J. Griffin in the Fabrication Section. Subsequently, when Mr. Griffin became head of the Section, I became Head of the Machinery Unit which he previously headed.

Q. Directing your attention to April of this year, were you given an assignment in connection with certain records in the case of THRESHER's post shakedown availability period?
A. Yes, sir.

Q. Would you tell us what that assignment was?

A. On April 15th through 17th, I visited the Shipyard at the request of Lieutenant Commander Keays and Captain Kern from Code 525 of the Bureau of Ships, to review records and work which was done on the piping and the hull closures on THRESHER during the post shakedown availability.

Q. What was the purpose of doing that?
A. The purpose of the review was to advise Code 525 regarding our analysis of the work which had been done, and to keep them informed of what work had been carried out.

Q. How extensive was your review?
A. My review, in the case of the hull welds, of which I am not in the Hull Section at the Bureau -- I am in the Machinery Unit -- but my review of the hull welds was to determine for Code 525 whether the hull closures had been made in accordance with the requirements, whether circularity checks had been made, and to review the radiographs taken of the hull closures to determine their quality. With regard to the piping, I went over the complete records taken at the time of the availability on the ultrasonic inspection of brazed joints made in accordance with Code 525 confidential letter to Portsmouth for brazed piping surveillance. I also reviewed the radiographs made of the fifty-seven pipe joints which had been welded during this period.

Q. Did you make a report of your findings?
A. Yes, I did.

Q. Do you have a true copy with you?
A. Yes, sir.

Q. Would you produce it, please, and identify it for the record?
A. This report is Serial 634B-01 of 24 April 1963; subject: Review of welding and inspection on SS(N) 593 during PSA.

Q. And who signed it?
A. I signed it, sir.

A Confidential Travel Report, serial 634B-01 of 24 April 1963, was submitted to the party and to the court, and was offered in evidence by counsel for the court. There being no objection, it was received in evidence as Exhibit 154.

Counsel for the party, RADM Palmer, waived reading of the Exhibit.

Q. Referring to Exhibit 154, Mr. Sayre, and with reference to your paragraph "5", to your knowledge, did the Bureau have any records on those welds on which waivers were given for the seven day waiting period?
A. In discussion with Code 525, there is no record to our knowledge of any request for waiver at Bureau level. These were waivered locally by the Shipyard.

Q. Do you know of any Bureau directive which authorizes local waiver?
A. With regard to the HY-80 requirements and waivers, I do not claim to be an expert on this; these were obtained for the record of Code 525 and I prefer Mr. Griffin to comment on these requirements for HY-80.

Q. Referring now to subparagraph "b" under paragraph "5", and to the tabulated column of figures appearing therein, are these your figures or were they furnished to you by the Shipyard?

A. These were furnished to me by the Shipyard in Shipyard Internal Memorandum from Code 303B to Code 303 of 17 April '63, which gave the summary.

Q. Now you've drawn certain conclusions from those figures in this report of your review. I refer to your words: "On the basis of the survey made it is indicated that in the balance of the joints not ultrasonically inspected there could have been approximately 440 joints having an indicated bond of less then 40% and on the basis of the inherent errors in the inspection process this bond could have been as low as 30% or less."

A. Yes, sir.

Q. What is your evaluation of that condition that existed?

A. Well, this was based on the Shipyard information that there were 3,326 brazed joints, two inches and over in size, in hazardous systems in the ship. On the basis of the joints which were inspected, which were 145 joints actually ultrasonically tested, this represents only a 4.3% survey of the total joints. And of the 145 inspected, with twenty joints rejected, this represents a 13.9% rejection rate in those 145 joints. If we assume -- again, we probably should not assume -- but if we say we have a comparable rejection rate for the joints not inspected, this is the basis for developing this 440 possible joints which might be of a bond less than 40%. Now with ultrasonic inspection and workmen's error in reading the scope and the traces on the scope, there is an inherent personal error in developing this UT inspection. If we take the ten percent, as the Shipyard feels that they are capable of reading, this would bring it down. A forty percent reading could possibly be 30%; or if it is larger than ten percent, it could be less.

Q. Does the fact that there could have been approximately 440 joints of such low quality amount to a matter of concern in your mind?

A. In the joints which were read, specifically on the original joints, there is one joint which was rejected with a bond of five percent according to the records, and another which was rejected with a bond of eight percent. Now this is an extremely low bond for a brazed joint. If there were bonds of as low as eight percent in other joints in the system, I would be concerned, yes, sir.

Q. What size were those joints to which you have referred?

A. The five percent bond was on a two and a half inch joint in the 8,000 GPD system; the eight percent joint was in an ASW system, two and three-eights in size. These were taken from the UT records.

Q. In making this review of silver braze joints, did you form an opinion as to the adequacy of records of the tests conducted?

A. I feel that they had adequate records of the tests which were made; yes, sir. They cooperated fully in furnishing all information requested.

Q. Did you form any opinion as to the quality of the technique employed in making the tests?

A. I went out to the Yard and talked with the workmen and the UT teams. They appeared to be well-trained and capable. The Shipyard reported that they had two teams inspecting the majority of the surveyed joints. These teams appeared to be doing a conscientious effort on the job.

Q. Do you have any knowledge as to the degree of quality of silver brazed joints made in other submarines in Portsmouth during the period of construction similar to that of THRESHER's construction period?

A. On this basis, no, sir. Ultrasonic inspection has only recently been invoked as an inspection developed, and invoked as an inspection requirement. Previously it was a matter of visual inspection, which is a very nebulous sort of inspection for a brazed joint.

Q. Do you know whether the quality of brazed joints has improved in the past three years?

A. Yes, sir, it has.

Q. A[illegible] the quality of the inspection?

A. Yes, sir, the quality of brazed joints has increased greatly, largely due to the mandatory invoking of requirements which were there in requiring sizing and proper alloys and proper techniques since the BARBEL failure.

Q. Based on the records you were able to find, are you of the opinion that the quality of the original silver brazed joints in THRESHER made during her construction period were representative of joints made during that period in other submarines, or were better or were worse than such joints in other submarines?

A. I have no information to form an opinion that they are either worse or better.

Q. Now referring to subparagraph (2) under "5b" of your report, at the end of the first subparagraph you have observed: "It was noted that in a number of instances the pipe walls had been appreciably thinned by grinding of the weld surface or removal of the backing ring." Did your notation of that condition indicate to you that there was doubt as to the reliability of the joint?

A. No, sir. This is a secondary observation when inspecting a radiograph of a joint. The side view of the joint will show whether it has been thinned. It cannot be used as a means of measuring the actual thickness. The Shipyard reported, however, that the joints had not been thinned beyond the minimum required for the piping design.

Q. I think in paragraph 3c of your report, that you refer, in a summary form, to the same condition, to severe thinning noticed in a number of joints?

A. Yes, sir.

Q. Had you seen such severe thinning on a radiograph, would you have required that additional photographs be taken of the joint?

A. I would have requested that a survey be made as to the thickness of the material in that area to determine whether it had been thinned excessively. A radiograph can give you a distorted picture.

Q. Based on your review did you form an opinion as to whether adequate records were kept in the radiography of piping joints?

A. Yes, sir, the radiographs were well recorded and documented.

Q. Did you form an opinion as to the quality of the technique utilized in X-raying welded joints?

A. The quality of the technique at this time is satisfactory.

Q. Turning now to the radiography of the pressure hull structure, would your summary of the records and technique involved be characterized in the same way?

A. Yes, sir.

Q. In your review of the circularity measurements, you noted certain deviations from the specifications; did you not?
A. Not in the circularity measurements, no.

Q. In what?
A. That was in the radiographs and defects in the radiographs, as shown in paragraph 5a at the bottom of page 3.

Q. "The following defect indications were noted which were considered in excess of acceptance standards." Is that the phrase to which you refer?
A. Yes. As far as the circularity checks were concerned, these were submitted to Code 525 for their review with regard to their satisfactoriness and stability for service.

Q. Then you're not prepared to testify concerning them?
A. No, sir.

Q. Mr. Sayre, have new processes in silver brazing been discovered since the completion of THRESHER's construction?
A. Yes, sir.

Q. Referring to the processes which were in effect at the time of her construction, are you knowledgeable in the reliability of silver braze joints of that period?
A. A properly made silver braze joint will be as sound as the piping involved if it is properly sized, the proper alloys are used, and proper brazing techniques are employed.

Q. If there is a joint on which there is no silver brazing on the inner land of the joint, what would be the effect of a severe shock applied to that joint -- a hydraulic shock, for instance?
A. At the moment I do not have any test data with which I can back up a firm statement that it would either fail or not fail. If it was fully bonded on the outer land, which means fifty percent bond, I would not anticipate that we would get failure.

Q. Is it possible that such a joint wouldn't fail but would be weakened, so that with a cumulative effect of fatigue it might ultimately fail?
A. This would be a factor which would be based on the joint clearance, the bonding which is in there. If you had excessive clearance so that the joint was free to flex, then there's a possibility you might get a weakening of the bond progressively.

Q. I'm looking for more than a possibility, Mr. Sayre. I would like your opinion as to whether substandard silver braze joints made at the time of THRESHER's construction, if subjected to heavy shock thereafter, would be appreciably weakened thereby?
A. You are referring to a joint which is not properly bonded?

Q. Yes.
A. Yes, it would be.

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Q. It would be?
A. That is my technical opinion.

Q. Even if it didn't fail immediately, it might fail unexpectedly thereafter?
A. This is possible.

Q. What are the effects of fatigue in a silver braze joint?
A. We have had fatigue tests performed by the Electric Boat Division when we were developing ultrasonic inspection procedures. They ran fatigue tests, pressure cycling tests and static tests to determine the minimum bond required to withstand various types of testing. From these values we obtained a series of curves with regard to hydrostatic testing, hydraulic shock and bending fatigue to 150,000 cycles and 300,000 cycles to determine what the true bonding required would be for each test. It is on this basis that they found to withstand a 300,000 cycle bending fatigue, a true bond of 38% was required. Then putting in an inherent variation factor of approximately seventeen percent, they determined that in order to obtain a 95% confidence limit, an inspection limit of 59% bond would be required. In our ultrasonic brazing manual we have adopted 60% as the bonding limit. Since the issue of this document, there has been evidence that with experience, improvement of ultrasonic inspection equipment, and that this limit of 17% error can be reduced to, in some cases, 10% or less, but this required a trained operator and careful workmanship.

Q. Which of the two figures would you judge to be applicable to the personnel of Portsmouth Naval Shipyard, the ten percent or the seventeen percent?
A. I have no figures on which to base a firm statement as to this. The Shipyard reported that they feel it is within ten percent; however, they have made no tests to determine what this actual figure is. The ten percent is based on tests which they have made when training the ultrasonic testing personnel in the procedure and in the qualifying of brazers. This is covered in my report, I believe, at the top of page 5.

EXAMINATION BY THE COURT

Questions by a member, CAPT Hushing:

Q. Mr. Sayre, do you make frequent trips to naval and private shipyards in connection with your duties?
A. Yes, sir.

Q. In connection with sil-braze, do you find that all of the shipyards are about equal in their abilities, or do you find a variation between them at the present time?
A. At the present time they are all, I find, making a conscientious effort to upgrade their silver brazing to the requirements. This is in a direct contrast to what we found a few years ago.

Q. What did you find, say, three years ago?
A. Three years ago, although the specification requirements were out, we found that there was a great tendency to regard silver brazing as just another method of assembling a joint. Sizing of piping to obtain the required clearances was very loosely followed. And, in many cases, the men were -- well, we had found joints where the ring inside had not been melted at all and the man had used

a supplemental stick to feed a fillip on the outside with no internal bonding.

Q. Well, let's be specific. Could you compare the Mare Island Shipyard to the Portsmouth Naval Shipyard three years ago?
A. Three years ago?

Q. Yes.
A. About three years ago--- I can't quote the exact date -- I visited both Portsmouth and Mare Island to review the silver brazing at that time. At that time I would consider that Mare Island was taking more pains with their brazing than they were at Portsmouth.

Q. How about comparing Portsmouth to a private shipyard; could you make any such comparison approximately three years ago?
A. This, again, varies with the private shipyards. Some were making a conscientious effort; others were -- well, they had the attitude: "We have been brazing for years, we have known of no failures and, therefore, we feel that we are doing it satisfactorily."

Q. I would like to compare Portsmouth with Ingalls at Pascagoula?
A. I was not at Ingalls at that time.

Q. How about Electric Boat Division?
A. Electric Boat at that time was doing a very good job with brazing.

Q. Based on what you know from your inspections of shipyards approximately three years ago, would you have concern for ships with brazed systems which were built at Portsmouth during the period 1956 to 1960?
A. I do not have information on which I could form a firm opinion to say that they would be hazardous in any way.

Q. In other words, you feel they would be suspect?
A. They could possibly be suspect, yes, sir.

Q. Would you consider it prudent then to extensively sample the products of the Portsmouth Naval Shipyard of that period in this way?
A. I think it would be prudent to sample the products of any of the submarine building yards during that period.

Q. Can you explain in a little more detail your feeling that the silver braze process and techniques have been improved over the past three years to the present time?
A. Well, as far as shipyard workmanship is concerned, yes. Brazing depends upon its bond to capillary action of the molten brazing alloy, in the joint. A number of years ago we specified ring insert type joints as a means of inspection of a joint; that is, if the ring had been melted, and alloy has flowed from the ring to the outer surface, we have a visual indication that there has been flow of the alloy. A face fed joint would not necessarily furnish this information. A filler could be applied around the outside of the joint with very little penetration. Within the last few years there has been a conscientious effort to size the joints to the requirements of the specifications to obtain the required capillary action. There has been an effort to insure that they have the proper alloys in the joint, that the joint is properly cleaned, and that the man is sure he has brought his alloy from the ring out to the surface prior to any

additional metal being applied to the joint. Recently we have been doing a great deal of work in the development of automatic brazing processes, but these are just beginning to come into use in production work.

Q. Do I understand then, from your observation of the Shipyard, that you feel that the brazing process has been improved and that the products thereof have been improved?
A. Yes, sir.

Q. What kind of competence level do you have in brazed systems at this time?
A. A brazed system, with ultrasonic inspection and careful workmanship, I feel is a fully reliable joint.

Q. Has the Bureau of Ships sponsored or encouraged interchange of information on ultrasonic testing between shipyards?
A. Yes, sir.

Q. Has the Bureau organized audit teams and dispatched them to the various shipyards to determine the level of adequacy of testing?
A. Not to my knowledge, sir.

Questions by a member, CAPT Osborn:

Q. Mr. Sayre, you mentioned the BARBEL report. To your knowledge has a detailed summary of lessons learned from the BARBEL been published by the Bureau with respect to various shipyards and various operational personnel?
A. I do not know of any detailed summary. On the basis of what was found on the BARBEL, there was a review of the brazing at the various yards to determine were they sizing, were they using proper alloys, were they training their people properly. At that time it was found that in many instances this was not the case.

Q. How do you think an officer on a ship would have available to him specific information with respect to this particular process in order to adequately assure himself that the proper procedures were being taken care of in the construction of the ship?
A. He would have to rely on ultrasonic inspection at the present time. Prior to this it was visual inspection, and visual inspection gives you no indication as to the percent of bond you actually have.

Q. During the construction of THRESHER was ultrasonic inspection available?
A. No, sir.

Q. On your review of a sampling process of 4.3 percent, 3,326 possible hazardous joints of two inches and above, did this cause you any alarm?
A. Yes, sir.

Q. If you had any alarm on something, what would you do?
A. I would recommend a further inspection of the system, sir.

Q. To whom would you make this recommendation, had this been possible?
A. To Code 525 of the Bureau.

Q. With respect to the clearances involved on the old standards prior to your

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new sil-braze instruction, what were the instructions with respect to fitting the pipe clearances?

A. They were the same as they are today, sir.

Q. They are still eight thousand?
A. Yes, sir.

Q. Even in the first three years were they eight thousand?
A. Yes, sir.

Q. No change in that?
A. No, sir.

Unclassified

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

Questions by a court member, RADM Daspit:

Q. Did I understand you to say that visual inspection is no indication of the percentage of bond?
A. No, sir.

Q. What about the visual inspection if there has been no face feeding?
A. If there has been no face feeding, it will give you an indication--and you have used an insert ring--this will give you an indication that you have melted the alloy in the ring and drawn it to the surface through the outer land; there is enough alloy in the ring, if a joint is properly fitted, it will fill the ring, will have filled the gap approximately three times--There is enough excess in the ring itself.

Q. What are the current Bureau instructions for ultrasonic testing? Do they require it if a joint can be inspected visually and it has a complete circle and no face feeding?
A. They require it for certain systems, sir?

Q. What systems?
A. I will refer to my notes.

COUNSEL FOR THE COURT: Identify the instruction please.

A. Let me make sure this is it. This is NAVSHIPS 250 637-2, July '61. Instructions for Torch Brazing of Ferrous and Non-Ferrous Metals. "Brazing of Joints over two inches IPS in subject sea water systems which are brazed in position on the ship, shall be radiographed or subjected to approved nondestructive test." Since this has come out, ultrasonic test has been accepted as an approved nondestructive test.

Q. But this is applicable to joints which are newly made up?
A. Yes, sir.

Q. Now referring back to old joints which are being re-inspected, I believe the last letter--
A. There is a letter, I believe which Code 525 or 648 has issued, yes, sir.

Q. What would be the date of that letter?
A. That I do not know sir. The only letter I have available is the letter regarding the survey of the THRESHER joints, which was in August of 1962.

COUNSEL FOR THE COURT: Is this the letter to which you refer? (Handing letter to witness)

A. Yes, sir. I have seen this. It is a Code 648 letter.

Q. Would that letter, the instruction itself in this particular letter, require only a visual inspection if the visual inspection is satisfactory?
A. This I could not say. I am not familiar with this particular letter.

Questions by court president:

Q. Mr. Sayre, how laborious is this ultrasonic testing procedure? Does it require a long time to inspect the joints?
A. No, sir.

Q. How many joints would you estimate that a normally proficient ultrasonic testing team should be able to do in one day?
A. A great deal of this depends upon the accessibility of the joint for inspection, the condition of the surface of the casting of the fitting. If it is a rough casting, it must be smoothed off to obtain a good ultrasonic contact for inspection. And then it has to be marked and recorded, and I could not give you a firm figure as to how long it would take for any individual joint. It depends on the size of the joint, location, and condition of the fitting itself prior to inspection.

Q. Well, assuming normal conditions on a ship of the THRESHER class, would you say that such a team should do one joint per day, five joints per day, or ten joints per day--average throughout a large number of joints, some of which would be found to be smooth and so forth?
A. Any answer I give is an estimate. With a qualified team, plus helpers who could go around ahead of time removing the lagging, smoothing the joints if necessary--

Q. Assuming no lagging has to be removed.
A. --and marking the joints for inspection, the actual ultrasonic inspection team should be able to inspect a joint, I would say, within an hour. This is a rough estimate.

Q. Now I believe I noted in your report, Exhibit 154, that there was one of some 57 welded joints that did not appear to be completely satisfactory when you examined the radiographs?
A. The joint itself I cannot say was unsatisfactory. The radiograph was not suitable for interpretation.

Q. I see.
A. Just by the nature of the type of joint which was involved.

Q. I believe you mentioned severe thinning?
A. Yes, sir.

Q. Is severe thinning likely to result as a consequence of repeated attempts to get the same weld to pass?
A. No, sir. The thinning, in general, results from a smoothing of the weld surface prior to radiography, so that the weld ripples and weld discontinuities do not create an image in the radiographic picture which may possibly obscure internal defects.

Q. I rephrase my question then, how does thinning normally occur?
A. Only by mechanical grinding.

Q. Mechanical grinding?
A. Yes.

Q. When is mechanical grinding done?
A. It is done to remove the roughness of the surface of the weld prior to taking your radiograph and at that time, when you are trying to remove the weld surface, naturally your grinding wheel tends to move over into your adjacent base material.

Q. But isn't this then a result of repeated attempts to make a given weld pass a given test?
A. No, sir, it may be purely the result of grinding that one weld prior to the inspection. The weld is all completed and, in general, there is no grinding done on this weld surface until the welding is completed.

Q. In other words, a single inspection could require sufficient grinding process to result in excessive thinning?
A. It could result in thinning, yes, sir.

Q. If the machinist were a little careless?
A. Yes, sir.

Q. If the same machinist, however, were required to prepare for radiographic inspection a given weld, not once, but three times, would not the chance of thinning be increased thereby?
A. If a weld has been inspected and there are defects found, these defects, in general, are localized defects. That local area would be ground or gouged for the repair and a repair made which would again bring the weld back to its original contour over the surface. Then this would be removed again, yes, sir, but it would be a localized--in general--would be a localized action not continuous around the whole pipe surface.

Q. Yes, but localized thinning then could be generated by repeated tests?
A. It could be, yes.

Questions by a court member, RADM Daspit:

Q. Is grinding, to smooth off the weld prior to radiography, required on salt water piping in the reactor compartment?
A. Yes, sir.

Q. Is it required on the salt water piping in the ballast tank?
A. Not by specification, sir.

Q. Please say that again?
A. Not by specification.

Questions by a court member, Captain Hushing:

Q. Mr. Sayre, comparing the Navy Standard for radiography on submarines, for example piping systems, to commercial standards, do you say they are much below commercial standard, average, or above, or at the top of the spectrum?
A. At the present time, sir?

Q. At the present time.
A. At the present time, the Yards have the authority to--with regard to porosity--the adoption of what is commercial standard, the ASTM standard for porosity, as far as slag is concerned, there is a slag curve which is slightly more stringent than the ASTM commercial standard. The commercial standards

are fairly wide open in certain areas with regard to slag. Neither code, however, permits any cracks.

Q. Well comparing the total requirement for Navy work, on submarines, to normal commercial practice, would you say that Navy requirements are below, at the same level, or above?

A. I would say they are above.

Q. They are above?

A. Yes, sir.

Q. Is this generally the highest grade of commercial welding?

A. Pressure vessel and power piping, yes, sir. They both have a standard.

Q. So that we are talking about the highest commercial standards?

A. Yes, sir.

Q. How about the standards of radiography itself, rather than the standards of defects allowable in the piping?

A. With regard to radiography itself, the Navy has out about the only actual standard, specifying radiographic quality and techniques. The commercial standards are fairly open in this regard.

Q. Would you say then that the Navy has better radiography than most commercial activities?

A. Today, I would say so, yes.

Q. Does the higher requirement for radiography tend to show more flaws in piping systems than a lower standard of radiography?

A. Yes, sir. The more definitive your radiograph is, the more defects you will reveal. A few years ago our radiography, or the radiography supplied by the Navy and the Navy vendors was extremely low. I have seen radiographs which I would say they were exposing film rather than taking a meaningful radiograph which could be adequately interpreted.

Q. But you feel now, that we in the Navy do have adequate radiography?

A. Yes, sir.

Q. Is there, and has there been, considerable debate about the advisability of grinding welds prior to radiography?

A. Yes, sir.

Q. If good radiography requires grinding, what is the basis for not grinding?

A. The possibility of thinning the pipe, the added costs in required grinding of welds, This is a fairly time-consuming and expensive operation, grinding all the welds to remove the surface, and the question of the ability to interpret a radiograph, and decide whether it is, in effect, surface indications or subsurface indications.

Q. Has this particular issue gone back and forth in the specifications over the past several years?

A. In the specifications we have not required grinding of welds. It is done by some of the yards as an internal requirement in order to obtain more definitive interpretations. It is required by the nuclear specifications.

Q. Has the Bureau of Ships instituted audit team procedures in connection with radiography in the Shipyards?
A. Yes, sir. The shipyards have been audited with regard to their radiography and their interpretation. We have had representatives of supervisors and the shipyards in the Bureau on two or three different occasions for meetings, to review the work which was done.

CROSS EXAMINATION

Questions by counsel for RADM Palmer, a party:

Q. Mr. Sayre, would you explain, briefly, the purpose of, or reasons behind, the required seven-day waiting period with regard to welds?
A. I would like to say that on this particular subject, it is in the area of the HY-80 hull structural welding, of which I am not intimately acquainted. I would prefer to defer this to either Mr. Griffin who is my supervisor in the section, and who is fully familiar with HY-80 welding.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. Mr. Sayre, you have testified to at least one difference in the standard specifications for nondestructive testing and pipe welding between systems in the reactor compartment and elsewhere on the ship. As a welding engineer, are you satisfied that the nondestructive standards and specifications for pipe welding applicable to THRESHER, other than in her reactor compartment, were perfectly adequate to insure reliable welded pipe joints.
A. Yes, sir.

Q. On what do you base that?
A. Knowledge of the specifications, knowledge of what is commercial practice, and what has been done in our piping systems both on surface ships and more recently in submarines within the past few years.

Q. Bearing in mind those specifications, has it been your experience that in practice, they are regarded by the workmen who weld the joints in submarines as being unnecessarily stringent?
A. Referring to the workmen themselves?

Q. Yes.
A. Again this is based on what discussion I have had with workmen in the yards. There is always a tendency of a workman, when he is required to meet stringent standards, to look at a small defect and question whether there is a need for going into his weld, which he feels he has taken pains with, and removing what appears to him a very small inconsequential spot on a film.

Q. But our practices, including our nondestructive test practices, are adequate or not adequate to insure that we get reliable welds of pipe joints in submarines?
A. It is my technical consideration that they are adequate.

RE-EXAMINATION BY THE COURT

Questions by the court president:

Q. Mr. Sayre, if we had one thousand joints in two and a half inch piping, five hundred of them were brazed and ultrasonically tested to present Bureau Standards; the other five hundred are welded in accordance with present Bureau of Ships standards, would there be--in your opinion--any difference in the reliability between the 500 brazed and the 500 welded?

A. We are talking about joints in sizes below say four inches?

Q. Yes.

A. I feel that the brazed would be equally adequate or comparable to the welded joints, yes, sir.

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

The president of the court informed the witness that he was now 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: There is only one thing that I would like to bring up and this is a matter of, I reviewed the hull closure radiographs. At that time, reading of radiographs, of course we realize that there are differences of interpretation. Our piping project committee has indicated that there is a difference between readers. I read these radiographs to the best of my ability and the indications, which I viewed and which are listed in the report, are there for information purposes.

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

The court then recessed at 1320 hours, Monday, 6 May 1963.

The court opened at 1447 hours, Monday, 6 May 1963.

All persons connected with the inquiry who were present when the court recessed were again present.

No person not otherwise connected with the inquiry was present. Lieutenant Commander Keatinge Keays, 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 of the Uniform Code of Military Justice, was sworn and examined as follows:

COUNSEL FOR THE COURT: This is a closed session of the court and classified information may be given here. At the conclusion of your testimony, I shall ask you what classification you would accord to your testimony taken as a whole.

Unclassified

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, grade, organization and present duty station.
A. My name is Keatinge Keays, Lieutenant Commander, U. S. Navy. I am attached to the Bureau of Ships, Code 525.

Q. How do you spell your name please?
A. K-E-A-T-I-N-G-E K-E-A-Y-S.

Q. Briefly describe the nature of your duties at the Bureau of Ships?
A. My title is Technical Assistant for Hull, Machinery and Electrical. I have as one of my major responsibilities, HY-80 Project Engineer. I also work with, in a coordinating fashion, the major technical problems in either hull, machinery, or electrical field.

Q. What is your naval and professional background and experience?
A. I graduated from the Naval Academy, received a naval engineer's degree from Massachusetts Institute of Technology; I am a registered professional engineer in the state of California. I have had about seven years experience in submarines and submarine hull structures.

Q. How long have you had your present billet in the Bureau of Ships?
A. Almost two years.

Q. Will you very briefly outline your knowledge of the research effort and tests which went into the Bureau inquiry in the use of HY-80 steel in submarine hull structures?
A. Prior to 1960, quite a little effort was expended by the Bureau checking the physical properties of HY-80 and trying to define the limits of the knowledge at that time. Most of the information I have is subsequent to the 1960 date. The efforts of the 1960 date are summed up in a publication "HY-80 in Submarine Construction." At that time an HY-80 project officer was established in the Bureau of Ships. It is the billet I now hold. I relieved a Lieutenant Commander Hoffmann.

Since the February, 1960 date, I cited, the Bureau has had an extensive fatigue model program. In this particular program they tested one model at eight-tenths scale here at Portsmouth. Another is now testing. A third and fourth model are planned. The model which has been tested has the critical hull details for the 585 and 598 class incorporated in it. The model which is under test now has modifications to these details in an attempt to improve the fatigue characteristics of those details we don't consider to be satisfactory completely from a fatigue standpoint.

We plan to test a b(1) which will include 593 class details, 608 class; 616 class details. We have also tested one-third scale models of the 595, 598 class details. They are almost exact duplicates of the eight-tenths scale model. This program was not only to--the one-third scale model program--was not only to get more information on fatigue life of these details but also to get some correlation between the large scale results and smaller scale results so that eventually we hope we can from small specimens, be able to accurately predict fatigue life.

In addition to this, the Bureau has headed a PF model series. It is an hourglass series that has two cone cylinder details. It looks like a dumbbell in shape. These are approximately one-tenth to two-tenths scale. The object of this particular series was to try to correlate thickness of plate as to what scale effect this has on fatigue life, since we know on low cycle fatigue--which is all I am addressing myself here today--scale has a decided effect upon the number of cycles, a certain detail will see. Now this, in general, has been the model test program. We have done a number of laboratory specimen tests. In addition, the HY-80 program has had another area of concern, and another area of interest in surveying existing ships.

Q. Would you describe the hull surveillance program of the Bureau of Ships for submarine hulls constructed of HY-80 steel?

A. Yes, sir. This is one portion of the HY-80 program. The surveillance program is outlined in Bureau of Ships Instruction 9110.48. This consists of--or the instruction calls out for each class--these details which the Bureau considers to be very important or critical from a fatigue standpoint. These are evaluated as to which are the more critical and which will probably have the longer fatigue lives, and not only is the area of inspection called out, but the period between inspections is indicated in the instruction. And this is to be almost all the inspections require drydocking. The only inspection method which we have today is magnetic particle inspection and this is the surveillance program as it exists today.

Q. Did that program, as you have described it, apply to THRESHER?

A. Yes, sir.

Q. Do you have information as to the results of the hull surveillance of THRESHER?

A. Yes, sir.

Q. On how many separate occasions was THRESHER surveyed?

A. She had three hull surveillances. The first surveillance was in June of 1960. The second surveillance was completed prior to 13 September 1962. In fact, as I remember, it was conducted during the pre-shock test availability at Electric Boat Division in May of 1962. And the final one was done during THRESHER's post shakedown availability at Portsmouth before March of 1963.

Q. Will you identify the reports of each of those surveillance inspections?

A. The first is as an enclosure to Portsmouth Naval Shipyard Letter 252A SSN593 Class/9110. I am sorry this copy does not have a date. The form, however--no the form doesn't give a date either.

Q. What was the date of the actual inspection?

A. 6-1-61.

Q. Refer to that inspection, as long as you have it there. Please report the highlight results of that inspection?

A. There was minor cracking found. The maximum cracking, on any one detail was approximately one per cent incident in cracking, and we define "incident of cracking" as a parameter to tell how much cracking you have, and the way we arrive at this number is to divide the linear length of cracking by the number of feet which you inspect, so one per cent would be about one foot of crack, and in one hundred feet of welding inspected, there was nothing to distinguish it particularly. The incidence of cracking was low.

Q. The incidence was low, taken as an average of linear feet. Were there any serious cracks found at that time, however?
A. No, sir, there were not.

Q. Will you now identify the second surveillance of May 1962, and report the chief results?
A. This was forwarded as an enclosure to a Supervisor of Shipbuilding, Groton, Connecticut, letter, Serial 253-948H, dated 13 September 1962.

Q. The tests were conducted in May of 1962, is that correct?
A. The dates on the form show it was April 17, approximately; they vary.

Q. I see. What were the results of those tests?
A. Again, there was practically no cracking. Let me flip through briefly, here. Sea chest area, they report approximately six inches of cracking in forty-six and a half feet inspected. The rest of these are showing no cracking. Cracks--this is the torpedo impulse tank--approximately six inches in 276 feet inspected. These are typical of that inspection.

Q. Again, the results of the surveillance were reassuring?
A. Yes, sir.

Q. Identify the last surveillance, and briefly give the high points?
A. This was forwarded to the Bureau on a Portsmouth Naval Shipyard letter 252A SSN593/1910, dated 7 January 1963. In this report, most of the cracking, where it was indicated, ran about six-tenths of one per cent or four tenths of one per cent with the exception of two areas. One of them were the penetrations in the after elliptical bulkhead, and this ran approximately 14 per cent. An b(1) tank indicated cracking approximately 13 per cent incident of cracking.

Q. Can you give us in some greater particularity the details about the cracking?
A. The b(1) tank, according to the best information which I have, which is not included in these reports--this only indicates the location of the crack--but the b(1) tank did have reported some slag inclusion and lack of fusion which would be a defect within the weld which would probably not be picked up during building, but as the structure flexed, would develop cracks. On the after elliptical bulkhead I have no particular information. It's in the area around the shaft tube penetrations, steering rams, and we know that this is a reasonably restrained area, and it is a detail that we intend to correct by SHIPALT when we have proven a means of improving the restraint, lowering our strain area.

Q. Did surveillance indicate any cracking problem in the PUFFS hydrophone well?
A. Surveillance did not. After the ship completed the shock tests, and I returned to the Bureau of Ships, we received a message that they had detected a leak in the area of the PUFFS hydrophone well. The ship was restricted as to her operating depth until she returned to Portsmouth.

Unclassified

I don't recall the actual figure of the restriction, but it was imposed. When she got to Portsmouth, they tried to find a crack but could not. The PUFFS hydrophone well was cut out of the ship. I came to Portsmouth from the Bureau to view this. It was on the dock when we got here and we were unable to find, with prods or with magnetic yoke and magnetic particle inspection, any crack in the weld. The PUFFS hydrophone well was removed to the shop. We got magnetic prods and were able to pick up a very small crack, approximately one-quarter inch in length, in the area in which the ship had reported the leak. It was subsequently sectioned. I have pictures of the weld. We could not see any cracking as such in the weld but there was a large amount of slag entrappment and apparently a full patch was formed from sea, and we hypothesized that the shock worked some of the slag loose and allowed water to weep in.

Q. Then that was not a fatigue problem at all?
A. No, sir.

Q. Was a new plate welded back?
A. Yes, sir, the PUFFS hydrophone well was not replaced in the ship. Instead a patch of the same configuration was replaced in the hull.

Q. On the basis of your experience, is fatigue a problem in operating THRESHER Class submarines?
A. We have too little experience to really state that fatigue is or is not a problem because, according to our model tests, we have not enough cycles, enough operating experience to get into the area of what we consider to be low cycle fatigue life. We anticipate, however, from model tests, that the flat plate structure until it is altered, will have a relatively low [illegible] fatigue life. Our model tests tell us something of the order of 7,000 cycles. We expect that until we get into the Toroid conical sections, that in the cone cylinder intersections we will probably have some fatigue cracking. This will be probably three or four times the number of cycles that will appear on the flat plate.

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Q. Is there any relationship between dives and fatigue cycles?
A. Yes, sir. We have done quite a bit of work in this area. I cannot give the court a firm answer to what an equivalent cycle is. We estimate, based on the records of operating SSN's and trying to correlate cracking data with model date, that on operating SSN for instance, on current operating schedules and so on, is encountering something in the order of five hundred equivalent cycles a year.

For the present, we have two different definitions of an "equivalent cycle" and these correlate pretty well, but we can't tell you which is right. One of them is any excursion below four hundred feet for a (b)(1) boat, and b(1) boat, we count one equivalent cycle and any depth change below in this range. The other one has been a computer study in which they try to assess, for each stress level, a fatigue life. For instance, if you go to one stress level that would give you a seven thousand cycle life; you have used up one seven-thousandth of a life. If the next time, you go to one which will give you a five thousand cycles you have used up one five-thousandth of a life. These two correlate not badly. They are in the same ballpark.

Q. Focusing your attention, specifically, on THRESHER now, at the end of her period of post shakedown availability, can you estimate THRESHER's fatigue life and the number of cycles she had already expended?
A. We have made an estimate on this, yes, sir. We had a magnetic tape aboard her to record depth. And we found that she had, between the period of May, 1962, and August 1962, gone to test depth six times. We went to the smooth deck log and counted the number of depth excursions entered in the log below four hundred feet from the time she was commissioned, until May 1962, and we got a number on the order of a hundred and five or a hundred and six times below four hundred feet. We checked the number of times they had entered in the log "rig for deep depth" and found that this was on the order of half the number of times we found the below four hundred foot entry in the log, or around 50 times. Based on using this data then, and extrapolating it from the number of times we found them changing the depth below these depths, we estimate it should have been somewhere between 250 to 300 cycles, and we feel that this is very conservative number. She probably had less than this, but at the outside we do not believe she could have experienced more than that.

Q. And again, THRESHER's estimated cycles for her entire fatigue life --
A. Would be less than the two numbers 250 to 300.

Q. What did your figure of seven thousand cycles represent?
A. This 7000 cycles is approximately the fatigue life of stiffened flat plating designed by Bureau criterion used prior to 1961, and I used it once -- I had a hypothetical example on the one seven-thousandths for instance.

Q. I haven't got it clear in my mind then, Commander. THRESHER used up between 250 and 300 cycles of her fatigue life based on conservative estimate. How much was spent out of what sized bank account? How much was left?
A. Fatigue life is an engineering technological term for the failure of a specimen in a laboratory on a model. The Bureau, I'm sure, does not intend that we allow any submarine to run around with known cracks in it, and therefore, you can't use fatigue life on a submarine the same way you would use it for a model. Therefore, fatigue life, as we use it, is a measure of how long you can go between

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major hull repairs. We find that fatigue cracks apparently appear anywhere from one-third to say two-thirds of the fatigue life of the specimen, and therefore, perhaps for flat plate structure, we would begin to pick up fatigue cracking, really due to a fatigue-low cycle fatigue-in approximately ten times the number of cycles I quoted to you.

Q. Ten times the number?
A. But this would be fatigue cracking in what we estimate to be the weakest fatigue detail in THRESHER, to the best of our knowledge.

Q. How extensive was the hull surveillance given THRESHER during her post shakedown availability here?
A. I can tell you how many, in fact it is probably easier -- I have a sketch of the number of areas inspected and it shows where they were. Would you like to pass that around the court. I think it will be a clearer answer. (Hands paper to counsel)

The cited paper was then offered in evidence by counsel for the court. There being no objection by the court or counsel for RADM Palmer, a party, the document was received in evidence and marked as Exhibit 155. Counsel for RADM Palmer waived the reading of the exhibit at this point.

Q. Referring to Exhibit 155, would you characterize a surveillance inspection of that extent as minor, moderate or an extensive hull surveillance?
A. That's an extensive hull surveillance.

Q. When cracks are found are a result of a surveillance like that and are rewelded, -- welded or rewelded -- what effect does that have on the fatigue life of the affected part?
A. All of our fatigue tests, to date, indicate that a crack, once ground out and repaired, the repair restores the detail to its original fatigue characteristics. In other words, if it failed at 7000 cycles, once repaired, it will not fail for seven thousand more cycles.

Q. As a result of the repairs made on THRESHER after the hull surveillance inspection at her post shakedown availability, could she then look forward to another 250 or 300 cycles before another surveillance would be required?
A. In my opinion, yes.

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

Q. You told us about the information that you had compiled on the subject of fatigue life in HY-80 hull structures; to your knowledge, has such information been promulgated beyond the Bureau of Ships?

A. Would you restate the question?

Q. Has information concerning the life of HY-80 submarine hulls been promulgated outside of the Bureau of Ships?

A. Yes, sir; not widely, but it has been promulgated outside of the Bureau.

Q. Can you explain the status of your present efforts to collect the data and disseminate it?

A. Yes. Prior to the THRESHER loss, by approximately two or three months, we started a presentation to CNO as a status report. Unfortunately, this was finished just before THRESHER loss, but was not presented until about two weeks thereafter. We have, in addition, promulgated advisory panel meetings in which the data, as it comes to light, is disseminated to most interested activities, and let me refer here, to refresh my memory as to who we promulgated this to. (The witness referred to some papers.) We need a great deal of improvement in the manner of getting this information out into the field. The last conference report was sent to all the persons who attended the advisory panel meeting, plus the other Bureau codes. It would have included Portsmouth, but it did not include, for instance, other shipyards.

Q. Based on your experience and knowledge in this area, would you describe the relationship of various types of hull penetrations to fatigue failure?

A. In general, the small hull penetrations have not seemed to destroy or adversely affect the fatigue life of the hull structure. However, the larger penetrations, such as sea chests, the shaft tube penetrations, for instance, on the SKIPJACK, and the steering and diving aft penetrations on the massive bulkheads; these are massive pieces, and the welding of these into the bulkhead at the time these ships were built, we did not have the ability and did not have anyone who could qualify to cast HY-80, so these were welded. They are extremely highly restrained. It was very difficult to weld it in without experiencing cracking during the welding. Once you have attained a crack-free weld, we find that every time we survey them, they have cracks again. They do adversely affect fatigue life, I'm sure. They are quite a difficult structure.

The only alternative we have here, and we do now have the technology to do it, is to put in castings, for instance, things that will allow us to soften the weld without cracking.

Q. Taking into account the good things and bad things which accompany the use of HY-80 steel in the construction of pressure hulls, in your judgment, would it be more desirable to build a THRESHER class submarine out of HTS steel?

A. Just based on the technology of welding the submarine, also the metal characteristics of the submarine, I would say no, sir. It would be very disadvantageous to try to make it out of HTS, for several reasons. First, in going back into the history with the people I work with in the Bureau, I find that HTS in its early days was not without many, many welding problems. My

experience on the waterfront in San Francisco replacing HTS plating in submarines has proven to me that, even here in relatively thin slabs, we still had cracking problems in trying to weld them into place. On just the construction alone, if we tried to build a THRESHER out of HTS, we would be forced to go into plate thicknesses exceeding the plate thicknesses we now use in HY-80, and I am told by the Materials Code in the Bureau of Ships that they could not provide us with any process to weld this without more cracking than we are now encountering in HY-80. From a fatigue standpoint, fatigue is primarily a design problem. We can design crankshafts, we can design pressure hulls; if we design, keeping fatigue in mind, we can design a low enough stress level and with details which will have low enough concentrations, to permit us to have any desired fatigue life we may set. On toughness, we know that on a structure as large and as complex as a submarine, we are going to have some cracks. if we make it out of steel and we weld it. HTS has a tendency to fracture very brittly when we get into temperatures that we might have in the Arctic Ocean, for instance. HY-80 is an extremely tough material and it will not propagate cracks. Under explosive loading, HTS will shatter; HY-80 will merely bulge and deform. So, in these three areas, I think HY-80 is still our best bet if we are talking submarines of the THRESHER's characteristics.

Q. Can you cite the specific instruction on the construction and welding procedures for HY-80 steel?

A. For the construction and welding of HY-80, it is NAVSHIPS 250-637-3.

Q. I show you Exhibit 154 before this court, entitled, "Review of Welding and Inspection on SS(N)593 during post shakedown availability," signed by Mr. Harrison Sayre of the Bureau of Ships. Are you familiar with this?

A. Yes, I've seen it.

Q. I refer to page 3 of the report and to the subparagraph under paragraph 5, relating to waiver records, indicating that the use of a forty-eight hour minimum waiting period was approved at the Portsmouth Naval Shipyard for specified jobs. Were you aware of the fact that such waivers had been issued prior to the submission of this report?

A. No, sir.

Q. What instructions were existent with regard to the granting of waivers in such a case?

A. Contractually, today these waivers can be granted locally. At a meeting held in the Bureau of Ships on the 19th and 20th of February, and later sent to the field, all shipyards and shipbuilders, by letter, it was stated that all waivers should be granted by the Bureau, and they should be referred to the Bureau on a seven-day wait period. Contractually, if this was a private yard, for instance, if it is still not in the contract, I do not know what legal complications would be in a Naval Shipyard.

Q. The requirement, however, came out on the 17th of February 1963?

A. 19th and 20th of February, 1963.

Q. Prior to that, was there any clear-cut requirement that waivers would be granted only by the Bureau and not by a Shipyard?

A. No. It was very clear that these could be granted locally.

Q. Until February of '63?

A. Yes, sir.

Q. Have you been able to determine if these waivers were granted by the Shipyard prior to receipt of the instruction?
A. No, sir, I have not investigated as to whether they were, or were not granted before.

Q. I refer now to the last subparagraph appearing on the same page of Exhibit 154; "The radiographs of all closure welds were reviewed. However, the following defect indications were noted, which are considered in excess of acceptance standards." Have you reviewed those defect indications?
A. No, sir; I've read them but I've not reviewed them in detail.

Q. Are you prepared to give us any information on them, in addition to what Mr. Sayre could give?
A. No, sir. Mr. Sayre actually viewed the radiographs and is also a qualified radiographer; I am not a qualified radiographer.

Q. Are you able to give us any additional information with regard to the circularity checks which you made?
A. According to Mr. Sayre's report, partial circularities were made. The sketches I saw which accompanied that report indicated that the deviations in some cases were up to a quarter to five-sixteenths of an inch. THRESHER was, at this time, still under the building specifications, and patch removal, I gather, and I'm somewhat inexperienced in this, so I can't say with absolute certainty, but I gather that patch removals during building periods, after they are put in they are usually given a full circularity; so the problem has not really arisen before, of making the repair requirements applicable to the building portion of the ship. What I'm trying to say here is we have a document, BUSHIPS Instruction 09110.3C, which requires all repair yards, when they remove a patch, to do one of two things. First, they may take a partial circularity before they remove the patch, and this is a template in which you take measurements on the hull. Remove the patch. When they weld it back in place, they put the same template in the same place and take another set of readings. Now, if these measurements do not deviate by more than one-eighth of an inch, they assume that this duplicates the original geometry of the ship, and no further circularity check is made. If it deviates by more than one-eighth of an inch, then the document requires that they hold that area suspect and they must take a full circularity check to make sure that they stay within the assumptions that went into the design of that section.

Q. That is for a repair job?
A. Yes.

Q. Now, was THRESHER's status during the post shakedown availability that of a ship undergoing repairs?
A. She was still under the builder's specifications, as I understand it.

Q. Under builder's specifications, can you find any requirement that if you cut a hole and replace a patch, or place a patch in it, you have to take a full circularity test?
A. No, I cannot find that requirement written anywhere for a ship in THRESHER's status.

Q. Based on your knowledge of circularity requirements, would you say that the information contained in Exhibit 154, with regard to the deviations from circularity, would have serious implications, or not?

A. It could have serious implications. I do not know whether or not any further checks were made after those partial circularities. The deviations in the partial circularities I saw in Mr. Harrison Sayre's report indicates up to a quarter of an inch deviation which would require, under a repair situation, that they go back and check circularity. I do not believe that this would be serious at test depths, for instance. In fact, of all the circularities which I have seen, which are possibly one hundred, or that order, where they deviated from the original geometry by more than one-eighth of an inch. I have only seen one case in which the full circularity showed thay moved beyond the permissible limits of eccentricity, and this was on a very thin skinned ship; it was one of our shallow boats in World War II.

Q. The probabilities with regards to THRESHER were what?
A. I would say that the probabilities had no effect; and if checks were made, I feel confident that the geometry was still all right.

Q. Now, turning your attention to the shock tests performed on THRESHER in June of 1962; what was your connection with them?
A. I was the Bureau of Ships representative at the shock tests until I was relieved at approximately the halfway point by Commander Woolston, and I stayed on and assisted him during the latter shocks.

Q. I would like to trace, through your testimony, the formation of the ultimate decision with respect to the ultrasonic testing of silver-brazed joints in THRESHER. First, with reference to the authorization to do work on the silver-brazed inspections before the shock test at the Electric Boat Division. Can you tell us the background of that authorization?
A. Yes, sir. During the SKIPJACK shock test, we had several reasonably serious silver-brazed failures. One of them was in the hydraulic main. The one that was the most serious, to my way of thinking, was the one which occurred on the final shock. It was the failure of two one-half inch lines in the immediate vicinity of each other, and connected to the hydraulic accumulators. One of the half-inch lines was from the discharge side of the accumulator, and another half-inch line was on the air side adjacent to the accumulator. and the two formed an atomizer. which filled the entire engine room with an atomized hydraulic oil spray. As the result of this, we decided that it was very prudent that we do as much as we could to check out sil-brazed on THRESHER prior to her shock tests, particularly in the area of the hydraulic accumulators, the hydraulic lines.

Q. When you say, "we," to whom are you referring?
A. This would be Code 525, Bureau of Ships. I can't designate any particular party.

Q. Was this decision to inspect silver-brazed joints in THRESHER based solely on the results of the report of failures in SKIPJACK, or was it based in part on the lessons learned from the BARBEL investigation?
A. This was triggered, primarily, from the SKIPJACK experience. BARBEL --here I can only give hearsay evidence, in that I get this from the boy I relieved. He was the gentleman who gave me the information, who left me with this impression, that after the BARBEL incident, THRESHER was still in the building stage, although in the late part of it. Not only was a great deal done on BARBEL to try to prove the integrity of her systems but, likewise, a number of actions were taken on THRESHER, including the welding of all salt

water piping between the hull and backup valves. Mr. Sayre's report indicates that this information apparently was in error for all systems; but this was the information I had and was confirmed by my contacts at Portsmouth, so that it was the opinion in the Bureau that the THRESHER was probably the best submarine that we had so far as sil-braze piping was concerned.

Q. As a result of the sil-braze inspections performed at the Electric Boat Division prior to the pre-shock test, did you receive any report of what they had found?

A. I beg your pardon, is this at the Electric Boat Division?

Q. Yes.

A. During the pre-shock test availability, or just before it concluded, we were forwarded the report very expeditiously. We had it in our hands actually before the availability was complete. It indicated that they had tested approximately 115 joints, all of them in the 2-1/2 to approximately one-inch sizes. They had only found three which were below the bond requirements of that day, which was 40 per cent bond. In fact, only one of them was below the total bond requirement. The other two had almost one hundred per cent bond on one land--if you're familiar with an insert type fitting--and no bond on the other land which would indicate probably that there was no insert ring; so we had them cut out all three joints and replace them.

Q. There was nothing in the report, then, that you received as a result of the pre-shock test inspection of silver-brazed joints to cause you any undue alarm?

A. No, sir.

Q. Did you receive a report after the shock test?

A. I was on THRESHER during shock test, and during shock test observed a number of joints fail. It was at this point that I, at least, formed the opinion that silver-braze was probably THRESHER's weakest link. All of the failures were in small diameter piping. I remember offhand, without checking my notes from the trials, only one salt water involvement. This was the drain to the PUFFS hydrophone weld, the same weld that later exhibited the defective weld in the hull. All the others were to sometimes minor things, like constant vent system vents; sometimes to major things like hydraulic piping. But, still, we had no reason to suspect the large diameter sea water piping in THRESHER. Our concern was mainly still in the area of hydraulic piping and your smaller piping.

Q. At about this time, the end of May, the beginning of June 1962, was there correspondence between the Chief of the Bureau of Ships and the Commander of the Portsmouth Naval Shipyard, concerning the inspection of silver-braze joints in THRESHER?

A. Yes, sir, we received a letter from Portsmouth Naval Shipyard, and this letter indicated that since they had already taken a number of actions to the THRESHER as a result of the BARBEL incident, they thought that there would be no more inspections required on the instructions in the [redacted] letter.

Q. I show you this letter. Can you identify it? Is that the one to which you refer?

A. Yes, sir. This is Commander Portsmouth Naval Shipyard serial 0114-62 of May 9, 1962.

Q. The subject is,"Pipe joint inspection of U.S.S. THRESHER," signed by S. R. Harris, Jr., by direction.
A. Yes, sir.

The cited letter from the Commander, Portsmouth Naval Shipyard to the Chief of the Bureau of Ships was offered in evidence and, there being no objection, it was received as Exhibit 156. Counsel for RADM Palmer, a party, waived the reading of the exhibit at this time.

Q. In your position in the Bureau of Ships at that time, did you draft a reply to Exhibit 156?
A. Yes, sir, I did.

Q. I show you a letter from the Chief, Bureau of Ships, dated 29 May 1962, addressed to the Commander, Portsmouth Naval Shipyard, serial 525-1325, subject, "Piping joint inspection, U.S.S. THRESHER," signed by J. Woolston, by direction. Is this the letter which you composed?
A. Yes, sir.

The cited letter from the Chief, Bureau of Ships to the Commander, Portsmouth Naval Shipyard, was offered in evidence and, there being no objection, it was received as Exhibit 157. Counsel for RADM Palmer, a party, waived the reading of the exhibit at this time.

Q. Exhibit 157 has three references; the first, a Portsmouth Naval Shipyard letter already introduced as Exhibit 156; and the second, a BUSHIPS letter of 13 February 1962; the last being a BUSHIPS directive. With reference to the BUSHIPS letter of 13 February 1962, I ask whether you are familiar with it?
A. Yes, sir, I am.

Q. I show you BUSHIPS letter of 13 February 1962 to Distribution List, dated 13 February 1962, 648X-160 and signed R. L. Mohan, Assistant Chief of Bureau for Design, Shipbuilding, and Fleet Maintenance, Acting. Do you recognize that as the reference?
A. Yes, sir.

The cited letter from the Chief, Bureau of Ships to Distribution List, dated 13 February 1962, was offered in evidence, and there being no objection, it was received as Exhibit 158. Counsel for RADM Palmer, a party, waived the reading of the exhibit at this time.

Q. Referring to (157), the letter which you have already testified that you drafted, and to paragraph 3 thereof, I read the following excerpt, a sentence in paragraph 3: "The ultrasonic testing and X-ray listed in enclosure (1) of reference (b)," and I interpolate that reference (b) is Exhibit 158, "does not apply to THRESHER, since applicable piping joints between hull and back-up valves are of welded construction." At the time that was written, did you know that some of the back-up valves, some of the joints between the hull and back-up valves in THRESHER were not of welded construction?
A. No, sir, I did not.

Q. Would you refer to Exhibit 157; read it in relation to the paragraph in (158) to which you referred and explain the meaning of the sentence: "The ultrasonic testing and X-raying listed in enclosure (1) of reference (b) does not apply to THRESHER since applicable piping joints between hull and back-up valves are of welded construction."

A. Paragraph 3 of enclosure (1) says, "Checked by non-destructive tests all silver-brazed joints between and including hull valves and back-up valves which can be done without major removals of machinery, piping, foundations or hull structure to same criteria as above" and it gives the criteria above. When I wrote this, since my understanding of THRESHER's construction indicated that all piping between the hull and the back-up valves was welded, I meant that obviously paragraph 1(c) of enclosure (1) did not apply.

Q. However, you said that Exhibit 157 said that paragraph 1 did not apply. In paragraph 1, I read subparagraph (b), "Examine by non-destructive test methods, either radiography or ultrasonic any joint which fails on visual" and it then lists the criteria. Was it your intention to include that procedure in the proscription mentioned in (157)?

A. No, it was not my intent.

Q. Is it fair to say that it could be so interpreted in a quick reading?

A. It is.

Q. Thereafter, on 28 August, the Chief of the Bureau of Ships, by Exhibit 115, directed that certain inspections of silver-brazed joints in THRESHER be conducted on a "Not to delay vessel" basis. Are you familiar with Exhibit 115, the background in the Bureau which led to its preparation?

A. Yes, sir.

Q. Did you prepare it?

A. Yes, sir.

Q. Would you explain, first, the nature of the limitations on testing imposed by Exhibit 115, and what the reasoning was which went into imposing those limitations?

A. The shock test experience on THRESHER indicated pretty clearly to those of us in 525 involved that we did have problems with silver-brazed piping. We knew from the nature of the problem, as we had experienced it over the past two or three years, that many ships were involved. We were now faced with the problem of what action can we take to correct this situation. We had had some failures that were reasonably serious; certainly, BARBEL was one. We had taken action to take the large piping, but now we were faced with all the little piping, or so it seemed, so that was an attempt at a pilot run to try to set up a hull surveillance instruction, so that we could go at the critical piping, joint by joint, over a period of years, realizing that to go at it, or at least it was our technical opinion, that if we stopped everything right now and went at it joint by joint on an every-shift basis today, it would be many years before we completed the shift, not operating even, that we had better knock this stem; identify each joint and, as the ships became available, go through certifying them, the most critical first, from the highest to the lowest priority. This was what was intended by this letter, to show up the pilot run test.

Q. The letter, then, was based on no concern that the vital systems in THRESHER, which contained silver-brazed joints, were in dangerous condition?
A. No, sir; we didn't; we didn't have any reason to believe that she was dangerous, but the shock tests made us believe that perhaps--probably we had uncovered these joints that were most prone to failure, and that the others were probably better than the ones that failed.

Q. That accounted for the designation of priority for ultrasonic tests, and the fact that they were ordered to be performed on a "Not to delay vessel" basis?
A. Let me refresh my memory as to the priority (the witness consulted his papers). I think that's a fair statement, yes, sir.

Q. The letter directs, with reference to the inspection team, that there shall be one inspection team, at least one--"Employ a minimum of at least one ultrasonic test team throughout the entire assigned PSA to examine, insofar as possible, the maximum number of sil-braze joints." Now, referring to your intentions as drafter of the letter at the time of the drafting; would you estimate the number of joints which it was contemplated would be inspected by at least one ultrasonic testing team working through the period of the post shakedown availability?
A. This was one of the things that we were trying to ascertain. Ultrasonics is a new tool in this application. We had indications that some of the activities were getting on the order, for one ultrasonic test team, from four to eight joints per day. We had no idea for sure what an ultrasonic test team could develop insofar as the number of joints they could cover. This is one of the things we were trying to ascertain by this instruction.

Q. Could you state whether the indications of from four to eight joints per day per team included the unlagging and testing of unlagged pipe joints?
A. This is only testing of joints; the same people would not be involved in removing the lagging that would be involved in doing the testing.

Q. The response to the letter designated Exhibit 115 was the Portsmouth Naval Shipyard letter of 5 October 1962, which is before this court as Exhibit 114. Will you examine it and refresh your recollection of it?
A. Yes, sir.

Q. That letter stated what the Portsmouth Naval Shipyard proposed to do in implementation of Exhibit 115; did it not?
A. Yes, sir.

Q. Was that considered satisfactory by the cognizant personnel of the Bureau of Ships?
A. It was not considered unsatisfactory by me; I can't speak for the other personnel.

Q. Were further directives issued to the Commander, Portsmouth Naval Shipyard after receipt of that?
A. None, to my knowledge.

PRESIDENT: Let us see that.

Exhibit 114 was handed to the court for examination. After perusing it, the court returned it to counsel for the court.

WITNESS: To answer exactly as to whether or not there were other directives, I was on TAD from the Bureau for the last two months of last year; Commander Woolston would be the one to tell you whether or not there were any directives subsequent to that.

Q. Do you know whether any further reports from Portsmouth Naval Shipyard on any results obtained from such ultrasonic testing in THRESHER were received prior to April, 1963?
A. I saw none. To the best of my knowledge, none were received in the Bureau.

Q. Would this be in an area of your cognizance, so that in the normal course of business you would have seen them, had they arrived?
A. Yes, sir.

Q. On or about the 1st of April 1963, did you take any action to request such reports?
A. Yes, sir. I wrote a letter to Portsmouth, requesting such a report.

Q. I show you Chief, BUSHIPS letter Serial 525781 of 1 April 1963, subject "U/T of silver brazed piping"; is this the letter to which you are referring?
A. Yes, sir.

Q. Is that your signature on it?
A. Yes, sir.

The cited letter from the Chief, Bureau of Ships to the Commander, Portsmouth Naval Shipyard, dated 1 April 1963, was offered in evidence, and there being no objection, it was so received as Exhibit 159. Counsel for RADM Palmer, a party, waived the reading of this exhibit at this time.

Q. Was a reply received to your letter of 1 April, which has been marked Exhibit 159?
A. Yes, sir.

Q. I show you a letter from Portsmouth Naval Shipyard, dated 22 April 1963, signed C. J. Palmer; is this the reply that was received in the Bureau?
A. Yes, sir.

The Portsmouth Naval Shipyard letter dated 22 April 1963, cited above, was offered in evidence and, there being no objection, it was so received as Exhibit 160. Counsel for RADM Palmer, a party, waived the reading of Exhibit 160.

Q. Referring to Exhibit 159, which evoked the response of Exhibit 160, was your request, Exhibit 159, based on any concern for the actual safe state of the silver-brazed fittings in THRESHER, or was it motivated by some other consideration?
A. It was not motivated by concern for the safe state of the THRESHER, but by the fact that we had coming into overhaul, boats earlier than THRESHER. We were anxious to get a surveillance, a pipe surveillance inspection started, and one of these results was to get on with the show and when we would have it.

Q. Your request was based on the need for information, so that you could get out an instruction governing other ships; is that correct?
A. Yes, sir.

EXAMINATION BY THE COURT

Questions by a member, CAPT HUSHING:

Q. Returning to the hull surveillance program; is it a planned program, during which certain areas of a ship are inspected each surveillance, or is it a rotating plan, where there are other areas surveyed each time there is a surveillance inspection?
A. It has elements of both in it. The very critical areas, for instance, will be inspected once every six months. If they find one of these critical details, which has a per cent of crackage greater than one per cent, this automatically triggers an expansion in the plan to go to similar details to make checks to see that we are also getting a large incident of cracking here. In addition, we have items that are called out for inspection at twelve-month intervals, and one-year intervals, and two-year intervals, so that it is rotating, in that maybe every other time we will catch certain details. It is expansive, in that, when we encounter cracking in one detail, we go checking all the similar details in the ship.

Q. So, it is a sampling plan, then, that triggered action when defects above a certain percentage are found in the sample?
A. Yes, sir.

Q. And it is also a complete program when taken in the aggregate because, eventually, it will cover the entire ship?
A. As the plan exists now, there are areas that may not be covered, primarily due to complete inaccessibility. We are trying now to develop techniques which will permit us to inspect the areas where we have extreme inaccessibility.

Q. Are these high stress areas so inaccessible, that you are talking about?
A. I know of no high stress areas that are not now covered; no, sir.

Q. I believe that you mentioned earlier that in February of this year, or thereabouts, you asked the various shipyards to come to the Bureau for waivers on the seven-day delay in inspection?
A. Yes, sir.

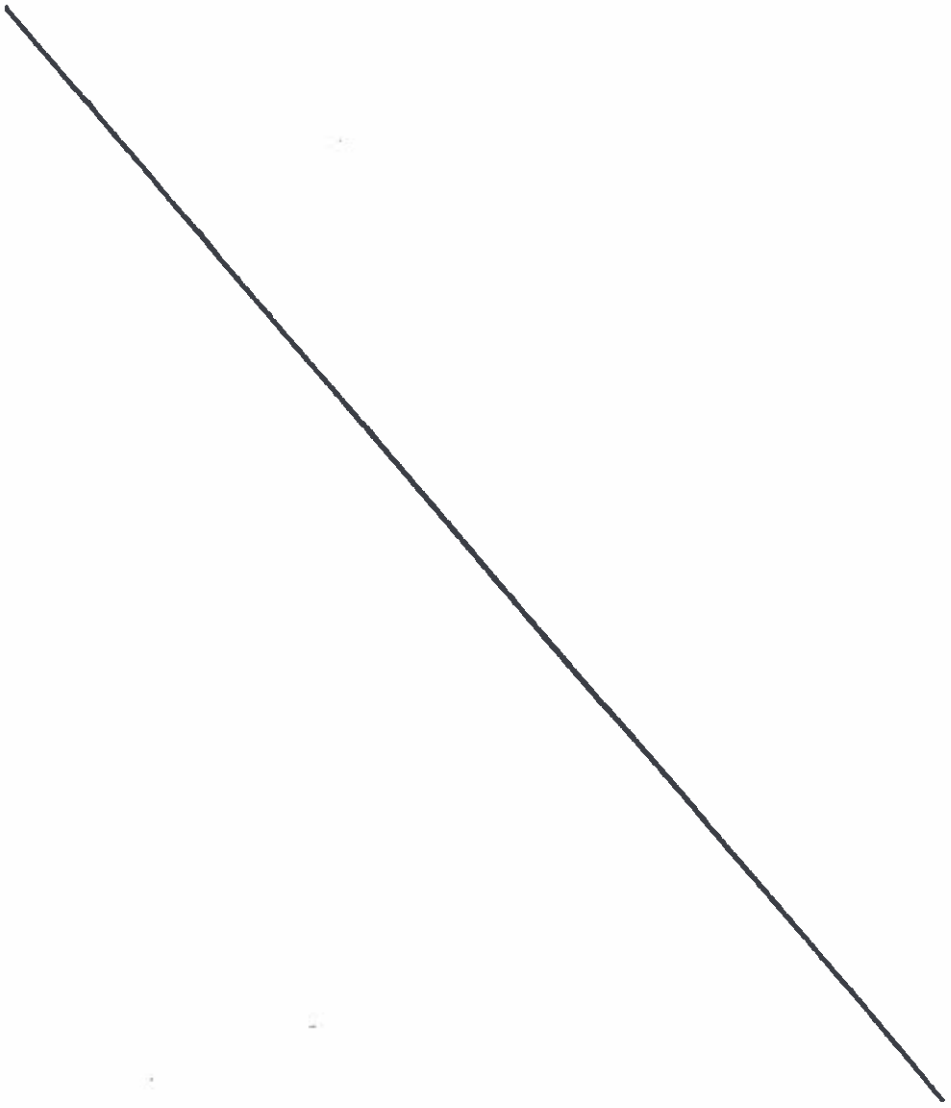
Q. Can you define your reasons for doing that?
A. During the 19/20 meeting, it became quite apparent to me that different activities were granting different numbers of waivers; some of them indicated that they were granting a lot of waivers. It did not seem logical to me that with proper planning, this was necessary. I had a two-fold purpose in mind; No. 1, to alert myself to what the problems were here, and how come we were having at some activities so many seven-day waivers; and the second was to make some of the activities do better planning, just by virtue of the fact that now they will have to justify to a third party why they are granting waivers. This was the reasoning for it.

Q. Have you made any analysis of the waivers that have been requested by the various activities?

A. Since that day, I have received only seven requests for waivers.

Q. Do they fall in any pattern?

A. No pattern. All of them are on ships that are in operation. They have to meet a docking date and they are usually small patches for electrical fittings, for instance, or they are late repairs on tanks--no particular pattern--just things that fall late in an availability, and due to perhaps cracking that was discovered in the final inspection, they have to repair a short area and then go back and reinspect seven days later.



Q. I believe you mentioned earlier some experience with the HTU plating replacement program during the early 1950's; did you not?
A. No. I know of this only by hearsay, through some of my seniors.

Questions by a court member, CAPT Osborn:

Q. How did the Bureau look at the BARBEL investigation from a standpoint of the process involved, was it an indictment against the silver brazed process, or was it an indictment against the Portsmouth Naval Shipyard?
A. I'm sorry; I'm not qualified to answer that, sir; I was not in the Bureau, either at the time of BARBEL, or at the time the investigation went through. I don't know that I have ever heard of anyone making an official statement on it.

Q. Well, what information necessarily did the person whom you relieved turn over to you?
A. He told me that the incident had occurred and that there was quite an investigation afterwards. He described the joint that failed; he turned over to me NAVSHIPS 256-48-8, which was direct outgrowth of the investigation, as far as trying to find out what other pipes might be defective. Also, a Portsmouth Naval Shipyard report of their investigation into silver brazed, so far as strength of joints was concerned.

Q. Did this bring any questions in your mind with respect to the silver braze process?
A. Yes, sir.

Q. Now, can you describe for me the actions that went on during the post shakedown availability of the SCULPIN at Mare Island involving silver brazed joints?
A. Yes, sir. On about Armistice Day, 1961, we got a call in the Bureau and Admiral Moore, Commander Jones and I went to Mare Island to attend a conference on silver brazed joints in SCULPIN. In that particular conference there were a number of joints on exhibit which were taken from the reactor compartment as a part of a SHIPALT to weld the joints in the reactor compartment. These joints showed various degrees of poor workmanship, poor bond, fit-up, etc., and the conference was set up to determine what should be done from here to make the system in SCULPIN adequate so far as water tight integrity was concerned. As an outgrowth of the conference, I'm a little hazy on exactly the actions that we planned, but as I recall, the Portsmouth impulse test was to be used. They were to ultrasonically test every joint between hull and back-up valves on the sea water system. I believe some welding of joints of three inches and above, for instance. Commander Jones can give you the direct action, as he is preparing himself on that line. He was also there. There were visual inspections required, and these were carried out. To the best of my knowledge, on SCULPIN, they have proved to be reasonably successful. I believe her reliability since that date has improved. In fact, I have not heard officially or unofficially of any sil-brazed joint failure that they have had since that day.

Q. Now what do you think led Admiral Rickover to the conclusion to take the silver brazed joints out of the reactor compartment, and where do you think he got his information from a standpoint of questioning the process? Does he have any additional information that you don't have?
A. I don't know, sir.

Q. Now the SCULPIN requested a complete test out there of the engine room and the vital systems, involving some 320 joints, which was later cut down to about 60; do you know anything about this?

A. No, sir, I'm afraid I don't. Do you know who cut this down? Was it cut down by the Bureau or by the shipyard or by SUBPAC? I was not aware that it was cut down.

Q. This was cut down on the basis of Admiral Moore's visit, and the decision was made at that time at the conference.

A. I don't remember this; you may be correct.

Q. Now, was this information on the status of the joints examined at Mare Island in SCULPIN, promulgated either to the operational forces or to the other shipyards, on the basis of a formalized report?

A. Yes, sir, it was; certainly to the other shipyards. I believe that SUBLANT and SUBPAC were also on the distribution. I believe that Commander Jones will have the report with him.

Q. Now on the basis of that investigation, and the results of that investigation, when you wrote your instruction with respect to piping inspections on the THRESHER, did it remotely enter your mind that conditions of silver brazed and the technology involved at the time the THRESHER was built, and the conditions prevailing at Portsmouth at that time ---

A. As I pointed out, it was my understanding from the boy I relieved, that a number of actions had been triggered by the BARBEL incident in Portsmouth, in order to correct the situation that must have existed, because conditions were the same for both BARBEL and THRESHER.

Q. It's fairly obvious to me that an investigation beginning the 1st of April '61, with a ship completing August of '61, could hardly be expected to generate any great change in the construction of the ship; don't you think?

A. As I say, the information that I received indicated one action, that they had welded all of the piping between the hull and the back-up valves in the sea water system.

Q. This information has later proved to be erroneous?

A. Yes, sir, but I had no reason to suspect that it was.

Q. Do you know on the SCULPIN test at Mare Island on hydraulics cycling of the sea water piping, that any bad joints were detected?

A. No bad joints were detected.. In fact, in the test of the cycling rig on which they put no known bad joints in it, they managed finally to fail a piece with, as I recall it, literally no bond, and they also managed to crack a welded joint. As an outgrowth of that, it was decided that the impulse test was not a good test to try to pinpoint defective silver braze.

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

Questions by a court member, CAPT Osborn:

Q. Then in the impulse test which did not prove satisfactory on the SCULPIN with respect to proved sil-brazed joints, it more or less is implied that the impulse test involved a shock test, which is the same type employed for testing joints in THRESHER during her shock test.
A. No, the two are different, sir. The major action on the piping and joints in the shock test were mechanical shock and not hydraulic; the vibration of the system and the high accelerations that result from the shock wave were to me--

Q. You mean the mechanical was far more overriding than the pure pressures involved?
A. Yes, sir.

Q. Do you think, involving small diameter pipes that you observed fail in the shock test on THRESHER, that if it were shocked at deep depth that the larger pipes would be more likely to fail?
A. Yes, sir. To illustrate my point on the mechanical shock, I remember one case in the engine room in the last shock, we had one pipe which did not fail at the sil-braze joint but actually sheered. It is a very severe test.

Q. Did you make any observations with respect to the THRESHER's shock test that we should better shield our switchboards and electrical equipment?
A. I don't believe I can answer that. I am not aware of such a decision.

Q. Are you familiar with the sil-braze joint that failed on the U.S.S. ETHAN ALLEN on her initial sea trials?
A. No, sir, I am not.

Q. You have no report of this?
A. I don't remember such a report.

Q. This involved shorting out of some b(3) 10 USC 130 panels.
A. Do you remember the approximate date?

Q. It's about the spring of 1961. Perhaps about the first of January. I will get the incident report on it and check it out for sure.
A. At this time the primary responsibility for silver-braze in the Bureau of Ships rested with Commander Jones. He may have seen this. I don't know. I did not see it.

Q. Are you primarily responsible for this right now, silver brazing?
A. No, sir.

Q. It still rests with Commander Jones?
A. Yes, sir - Piping and Valves, Code 648.

Questions by a court member, RADM Daspit:

Q. Referring to the welding of HY-80, I understand the Bureau's instructions have been issued in NAVSHIPS 250-637-3.
A. Yes, sir.

Unclassified

Q. And in connection with that instruction, you have discussed the waivers and where they could be granted for the seven-day aging process after welds had been made. In the interest of getting ships completed, was it necessary to delegate to persons outside the Bureau the authority to grant waivers in other areas of these welding instructions?

A. I can't think of any other areas I have run into that we are granting waivers on, right off-hand.

Q. Waivers, for example, about doing magnetic checks where you weld next to a frame for a distance of two or three feet and you can't get the whole length that is required by the instruction.

A. None of these have come to my attention, sir. They may be granted locally without my knowledge, but I don't know what is being done.

Q. Does the instruction provide that the supervisor have authority to grant waivers or to further delegate the authority down the line?

A. The supervisor is the Bureau's representative in the field and acts for the Bureau in most cases, unless specified otherwise, and we do not specify that they cannot do this. So the answer to your question is yes, that other waivers can be granted.

Q. On this chart, Exhibit 155, there are a number of defects which were found on THRESHER during her surveillance trials. What was the most serious defect which was found?

b(1)

A. The two areas which exhibited the most cracking were the tank and the shaft tube diving and steering ram penetrations.

Q. I believe you have testified that some of these areas exhibited cracks on continuing surveillance checks. How many cycles can you get in before these are repaired if they are cracked again?

A. If they are true fatigue cracks, you can go approximately the same number of cycles, but if they are construction cracks, which are cracks that occur in areas of high concentration, on these, very often you go in and you find a little cracking, you repair it and hydrostatically test it, and you repair it again, and it becomes a never-ending process, unless you make a design change. In the case of the penetrations in the after bulkhead, you will have small cracks, I am sure, in one or two or three dives after you have repaired them.

Q. Were any of these failures true fatigue failures?

A. It is our opinion they were not.

Q. We have (b)(1) boats built both of HTS and HY-80 steel.

A. Yes, sir.

Q. What would be the two boats most comparable in size and loading built of different materials?

A. Let me check here just a moment. (The witness examined some papers in his possession.) Let me refresh my memory on the early ships. I really can't answer that directly. I am hazy on the hull diameters here, but I suspect it might be the SKIPJACK and the NAUTILUS. NAUTILUS was used in the early pre-1960 checks as a control to check HTS as against HY-80.

Q. This is what I was leading to. Could you compare the results of the surveillance checks then on these two ships? SKIPJACK would be much larger in diameter than NAUTILUS, but there would be some comparison.

A. There was very little cracking on NAUTILUS, as I remember it, and there was quite a bit, on later inspection, on SKIPJACK. SKIPJACK was the first ship we ever built of HY-80. During much of her early life we didn't know much about pre-heating. Some yards used it and some did not. After you weld it, it will crack in the construction process; so you have a lot of repair to accomplish. The techniques have changed since then. As we repair the areas, we are getting better material, more weldable electrodes. We are also trying to change the design. I don't think it is really fair to make a comparison between NAUTILUS and SKIPJACK, because in NAUTILUS you are comparing HTS, which we have been using for twenty years.

Q. How about the latest ship of the SKIPJACK class?

A. I can show you a comparison of what our hull surveillances have revealed by class, and you will find that the later ships are showing a very, very small amount of cracking compared to SKIPJACK - slightly more than you have in NAUTILUS. Here is a chart we made up (The witness produced a chart in his possession and submitted it to the court for examination.) This shows the incidence of cracking, and these are the various classes. On the last THRESHER report, the last SKIPJACK surveillance, and on the last inspection that we've had going back to find out which of the class exhibited the most cracking, we have indicated that there on this chart.

Q. The 588 is the SKIPJACK class?

A. It is a modified class of SKIPJACK. It's the SCAMP, basically a SKIPJACK class. With the 598 class it's not fair to make a real comparison here, because they are not capable at the moment in Holy Loch of doing as nearly a complete surveillance as we are doing on our stateside ships.

Q. There are no figures on the NAUTILUS in here (referring to the chart furnished the court by the witness). Where would that compare?

A. Nearly down at the base line.

Q. Would you repeat that?

A. It would be nearly at the base line - less than any of those there. I will have to check the exact figures on that, which I will have to do by telephone call.

Counsel for the court indicated that he would recall this witness at a subsequent time for the purpose of introducing the aforementioned chart after the witness had included the information relating to the NAUTILUS.

Questions by the president, VADM Austin:

Q. Commander Keays, you indicated that when the Bureau letter specified that at least one ultrasonic testing team would be used so as to explore the maximum number of joints in THRESHER, that it was so specified in order to insure that you got a good indication from the THRESHER's integrity of piping tests that would give you some guidance with respect to similar ultrasonic testing on other ships.

A. Yes, sir.

Q. And you indicated that your thinking was that an ultrasonic team would normally do from four to eight joints per day. Taking the midway point of six joints, that would have enabled them to do, in the time available in THRESHER's originally scheduled overhaul, somewhere short of 1,000 joints. They actually did roughly 125. Was it somewhat of a disappointment to the Bureau of Ships when you received the report and found that they had done only this smaller number of joints?

A. Yes, sir. We had hoped they would be able to field more than one team but did not feel it fair to compel them to do so.

CROSS-EXAMINATION

Questions by counsel for RADM Palmer, a party:

Q. Commander, I understood you to testify that you estimated at 7.000 cycles the fatigue life of the flat plate structure. Did I hear you correctly?

A. Yes, sir.

Q. Is there any flat plate structure that is normally subjected to deep submergence?

A. In the THRESHER?

Q. Yes.

A. Yes, sir.

Q. Do you have an estimate, aside from such flat plate structure subject to deep submergence pressure, as to the estimated fatigue life of the 593 structure normally subjected to deep submergence?

A. Other than flat plate?

Q. Yes.

A. No, I don't think we do. We believed that would be the shortest fatigue life tank. We have not tested any of the other 593 tanks as yet.

Q. I believe you said that on the 19th and 20th of February of this year there was a meeting in the Bureau in which it was determined that there would be a Bureau permission required for waivers on the seven-day waiting period for inspection of welds?

A. Yes, sir.

Q. My question is, can you help us as to the date in the period following that meeting when this word was finally promulgated by the Bureau to the field?

A. Yes, sir. Here is a letter, it is serial 525-222 dated 26 February 1963 that gives the minutes of the meeting and gives this requirement.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. You have testified that in the Bureau it was hoped that the Portsmouth Naval Shipyard could utilize the services of more than one team for the ultrasonic testing required by the Bureau's letter of 28 August 1962, Exhibit 115 before this court. After you received the reply to that letter, Exhibit 114, a letter from the Shipyard dated 5 October 1962, were there any telephone conversations between the Bureau and the Portsmouth Naval Shipyard which indicated to the Bureau the progress being made in the course of ultrasonic testing?

Unclassified

A. None until the day of or the day before my follow-up letter, in which I called a Mr. Bragdon here at Portsmouth to find out whether or not they had sent the inspection report yet, and he inquired for me and reported that it had not been sent, and he indicated that they had inspected something on the order of 250 joints, but did not indicate any information, because he did not hold it. I asked him, but he indicated to me that he didn't know what the results were. This was somewhat out of his area. I transmitted this information to my boss, and he directed the follow-up letter.

Q. The follow-up letter to which you refer is dated 1 April 1963, Exhibit 159 before this court?

A. Yes, sir.

Q. At the time you drafted the letter of 28 August 1962 requiring the ultrasonic testing of silver-brazed joints in THRESHER, our Exhibit 115, were you aware that during the builder's trial THRESHER had experienced shocks sufficient to cause her trim line piping, which was designed for b(1) yield strength, to expand an amount of approximately seventy one-thousandths inches?

A. I had understood - again this being prior to my time in the Bureau - that some problems had existed with hydraulic hammer during the trials and that the Portsmouth-devised test was used in order to set the timing on the closing and opening of the valves. The figures you quoted, I was not aware of.

REEXAMINATION BY THE COURT

Question by a court member, RADM Daspit:

Q. In earlier testimony Commander Bryan expressed the view that the primary purpose of the hull surveillance was the early detection of fatigue cracks. In view of the experience which you had and found there has been practically no indication of fatigue cracks, wouldn't you say that the most important reason for it today is the detection of welding cracks in these highly stressed areas?

A. It is to detect cracks, Admiral. I don't think that you can differentiate. In the document which originally set this up, I believe that the words they use are on the order of, "to insure the safety of our operating ships." And this is the aim of the surveillance program, as I understand it.

Neither the counsel for the court, the court, nor counsel for RADM Palmer, a 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 warned concerning his testimony and withdrew from the courtroom.

Unclassified

The court recessed at 1640 hours, 6 May 1963.

The court opened at 1655 hours, 6 May 1963.

All persons connected with the inquiry who were present when the inquiry recessed were again present in court.

No witnesses not otherwise connected with the inquiry were present.

(b) (6) , civilian, a former witness for the court, was recalled as a witness for the court, reminded that the oath he had previously taken was still binding, and was examined as follows:

COUNSEL FOR THE COURT: Mr. (b) (6) , this is a closed session of the court. You can divulge classified information.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. You are employed at the Portsmouth Naval Shipyard, in Code 272A, the Design Division, in the Electrical Section; is that correct?
A. Yes, sir.

Q. You have previously testified concerning possible effects of electrical power interruption on the loss of air bank control valves. Based on further study of the electrical and mechanical time responses, could you provide additional information which would shed light on the possible effects on the air bank control valves of a dead short circuit on the engine room AC switchboard, for example, the b(3) 1 switchboard installed in THRESHER?
A. Yes, I can.

Q. Would you please do so, then?
A. A result of a fault or a dead short circuit on the b(3) 1 switchboard, we find this is connected through a back-up circuit breaker on the b(3) switchboard. A dead short on this b(3) 1 switchboard would drop the voltage to b(3) 1 of the rated voltage. This would bring the voltage down from b(3) 10 USC 1 volts. The back-up circuit breaker will clear this fault in approximately b(3) 10 USC 13 This fault then will occur along the b(3) 10 USC 130 bus. I am talking about the b(3) 1 rated voltage which would begin to initiate an action in the transfer switch. The action in the transfer switch would start its operation but only occur for the duration of the fault and then the b(3) 10 bus would return to its normal voltage. Therefore, the transfer action would not complete itself. It would go back to the b(3) 10 USC 130 bus. But at the same time you also have a reduction of voltage through the system beyond the transfer device which would -- you have a bank of transformers beyond this transfer device and you have b(3) 1 volt power. This power at this time would be reduced to approximately b(3) 10 U volts. And this voltage would occur at the IC switchboard, the ballast control panel, affecting the air valves. These air valves are fail-safe at approximately 30 volts.

Q. At approximately 30 volts?
A. Yes, sir. The duration of this fault -- as I say, the circuit breaker takes approximately six cycles to clear this fault. The response of the air valves is from one-tenth to one half a second. Therefore, at one-tenth of a second, equal to six cycles, it is possible that these air valves could fail safe.

Q. When you say "fail safe," they would fail at no matter what position they were in?
A. Yes, sir. Three of them would fail shut.

Q. That would be Banks 2, 3 and 4?
A. Yes, sir.

Q. A voltage drop would occasion such a fail safe. Would a drop in cycles do the same?
A. To the best of my knowledge, no. A lowering of the frequency would not do this.

EXAMINATION BY THE COURT

Questions by a member, CAPT Osborn:

Q. I have one question, Mr. (b) (6) , with respect to the time response on the b(3) circuit breaker. In the event I have the wrong terminology, I am talking about the b(3) 1(amp circuit breaker. I would like to know the time response between that circuit breaker and the b(3) 10 USC breaker?
A. Yes, sir. (The witness looked at papers in his possession.) The time response in seconds on the circuit breaker that you mentioned, the back-up circuit breaker on the b(3) switchboard, is b(3) 10 USC 130 the time response of the b(3) 10 USC breaker is b(3) 10 USC 130

Q. And that has an under-voltage trip and a frequency trip as well; is that correct?
A. Yes.

Q. Would you give me those, please?
A. The b(3) 10 USC breaker?

Q. Yes.
A. The under-frequency on the b(3) 10 USC breaker, this is b(3) 10 USC plus or minus one.

Q. And the under-voltage trip?
A. This breaker does not have an under-voltage trip on it.

Questions by a member, CAPT Nash:

Q. Mr. (b) (6) , your statement concerning the fail-safe action on the air valves, is your conclusion based on a design study or is it substantiated by any test you have conducted?
A. No, sir, it has not been tested. This is by a design study. We have taken the maximum tripping time of the circuit breakers and the minimum time on the air valves.

Questions by counsel for the court:

Q. You have testified as to the possible effects of a dead short circuit on the engine room switchboard. Could such a short circuit be caused by flooding or splashing of salt water?
A. Yes.

Questions by a member, CAPT Osborn:

Q. I have one question with respect to that. On shorting of that switchboard, with respect to those people around the switchboard, would they be around a pretty hazardous condition with respect to shock?
A. This is possible because of the amount of water that would be in the area.

Q. If you had people to take action around the board and had a lot of water on that board, the people would be in a hazardous condition from the standpoint of electrical shock?
A. In my opinion, yes.

Questions by the president, VADM Austin:

Q. Mr. (b)(6) , would a half-inch line be enough to provide the salt water to cause this switchboard to malfuction?
A. A half-inch line?

Q. At test depth -- at or near test depth?
A. Based on seeing the test that was performed in the dry dock here the other day and the amount of splashing that would go on from a failure of that nature, in my judgement I would think that this could be possible because if it was close enough to be splashed in the air it would be.

Q. The splash was atomized from a slightly larger hole in the dry dock?
A. Right.

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 adjourned at 1710 hours, 6 May 1963.

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TWENTY-FIRST DAY

Portsmouth Naval Shipyard
Portsmouth, New Hampshire
Tuesday, 7 May 1963

The court met at 0930 hours with closed doors.

All persons connected with the court who were present when the court adjourned were again present in court, with the exception of (b) (6), who was relieved as reporter by (b) (6). RADM Palmer, a party, and LCDR Hecker, a party, and his counsel, waived their right to be present at this session of the court. Counsel for RADM Palmer was present.

No witnesses not otherwise connected with the inquiry were present.

The court was cleared at 0931 hours, 7 May 1963.

The court was opened at 1025 hours, 7 May 1963.

All persons connected with the court who were present when the court was cleared were again present in court, and the following proceedings were conducted behind closed doors.

Lieutenant Commander Keatinge Keays, U. S. Navy, a former witness for the court, was recalled as a witness for the court, reminded that the oath he had previously taken was still binding, and examined as follows:

COUNSEL FOR THE COURT: Commander Keays, this is a closed session of the court and you can divulge classified information here.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Commander Keays, when you were testifying yesterday you undertook to obtain a presentation showing the results of the surveillance inspection of the HTS submarine which served as a control for comparison with results of surveillance inspection on HY-80 hull submarines. Do you have that with you?
A. Yes, sir.

Q. Yesterday, I believe, your testimony was to the effect that the control submarine was NAUTILUS. Have you investigated that aspect?
A. Yes, sir, I have. I found that it was originally planned to be NAUTILUS, but that actually the HARDER was chosen in the interests of time since it was going to be available for a year to eighteen months earlier than NAUTILUS, so that the hard tanks flat plate structures on HARDER were used as a control, and this inspection was conducted in late 1960.

Q. Does your chart show HARDER then?
A. Yes, it does.

The above-cited chart was submitted to the party and to the court, and was offered in evidence by counsel for the court. There being no objection, it was received in evidence as Exhibit 161.

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Questions by the president, VADM Austin:

Q. Is that interpreted as meaning zero cracks?
A. Yes, sir.

Questions by a member, RADM Daspit:

Q. Is the HARDER of nuclear propulsion?
A. No, sir, she is not a nuclear propulsion ship. She is, however, a (b)(1) HTS submarine.

Q. One of the points we are concerned about in fatigue strength is that nuclears make many more excursions up and down than a battery-propelled submarine does, so that probably there are very few cycles on the HARDER as compared to the nuclear boats. Have we any figures on comparable cycles on these two ships?
A. Not to my knowledge, sir. It's a point well taken.

Questions by counsel for the court:

Q. Where was the surveillance inspection of the HARDER HTS submarine performed?
A. At Charleston Naval Shipyard.

Q. To your knowledge, had Charleston Naval Shipyard had experience in this type of surveillance inspection previous to its inspection of HARDER?
A. To the best of my knowledge they had no experience prior to this inspection.

Q. How would you assess the degree of reliability of its inspection as a basis for comparison with the other submarines?
A. I question the reliability very highly.

Q. Do you know whether it is intended to run such a surveillance inspection again on an HTS submarine for comparison purposes?
A. Officially, the Bureau at this moment does not have such an intention. But I intend to start taking action on this when I return to the Bureau -- to run another controlled experiment on the HTS submarine.

Q. Would you read the brief notation on Exhibit 161 for the record, please?
A. Yes, sir. It is entitled, "Summary of Hull Surveillance Inspection." "SSG577 hangers, SSN585 and SSN593 results are for the latest inspections." "The information for the submarine classes reflects the maximum incidence of cracking at any previous surveillance inspection for remaining ships of the class." "SS568 (HARDER) was HTS "control" for surveillance results. Flat plate, hard tank structure was inspected. Incidence of cracking was essentially zero."

EXAMINATION BY THE COURT

Questions by a member, CAPT Osborn:

Q. You had the SWORDFISH in the Mare Island Naval Shipyard for a rather extensive shipyard availability that was recently completed. Did you make any hull survey on her at all?
A. I'm sure a hull survey was conducted, but I do not know the results of it at the moment.

Q. You might not perhaps be able to conduct your control survey, but you

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might get an inkling with respect from the SWORDFISH on the degree of cracking on the HTS?

A. What's the hull number of the SWORDFISH, sir?

Q. 579.

A. Well, I'm sorry. I thought this was one of the HY-80 ships. 579 should not have been an HY-80 ship. When I answered I thought SWORDFISH was, but 579 was not, so no surveillance was conducted. We will have to set up -- make special arrangements to inspect an HTS submarine by a building activity which is familiar with the HY-80 cracking and has proven its ability to find cracks.

Q. Do you think your learning curve is such -- now we're comparing a rather advanced line curve in the case of HARDER with respect to a sort of a primer, or first grade learning curve, with respect to HY-80, which is pretty well substantiated in fact by the rate of decline of cracks as you get more experienced under more controlled conditions. Do you think, based on just an estimate, that you will be able to cut down the cracking in HY-80 by process control?

A. On construction cracking, yes, sir. I think, however, that on certain details on submarines -- this isn't aircraft now -- as long as we have high performance submarines built with any steel material, we are going to have a fatigue problem and we are going to be probably conducting a surveillance inspection for all our operating lines. What the intervals will be as we learn more, I can't say; but this is my opinion.

Q. Obviously in an investigation involving a loss like this, it's very easy to take assets from, say, a close surveillance, and say putting them into silbraze or piping joints in this case, that you'd certainly recommend against that, would you not?

A. I don't understand your question.

Q. We have a certain number of assets with respect to accomplishing piping tests, hull surveillance -- we have to keep every bit of hull surveillance at the present time?

A. Yes.

Questions by a member, RADM Daspit:

Q. Commander, we have had an opinion expressed that HY-80 is not a suitable steel for submarine construction, that if it is necessary to constantly inspect this steel for cracks, and there's some doubt about it, we should go back to HTS. We have had other testimony that indicates, in the opinion of the Bureau, HTS is just as subject to cracking as HY-80 and that the incidence of cracking while we were building submarines of HTS was just about as high. However, this is not borne out by the Bureau's concern in conducting surveillance test only in HY-80 ships, and this I find difficult to understand.

A. If we're talking high performance submarines of b(1) approximately THRESHER dimensions, if we go to HTS we're going to have to go to thicker material. If we go to thicker material it is my opinion, based on the technical information available to me at the Bureau, that our cracking problem with HTS will be as much if not more as in HY-80.

We will also then have lost the great advantage of HY-80 in two areas. First, in the toughness of HY-80. This was the main reason HY-80 was developed, high strength and great toughness. This was an outgrowth of concern for brittle

Unclassified

fracture -- cast-off fracture of structures which you would have with HTS material quite possibly if you were operating in areas where the water is cold and if you're below your non-ductility temperature, and this can happen -- so that if you do have any cracking incident to construction, or fatigue, or for any purposes, and you get into an area in which you're operating at test depth with HTS below the non-ductility point, and a crack begins to propogate, with HTS there's no ability in the material to stop this cracking. HY-80 has this ability and it's one of the greatest advantages in the material.

Under explosive loading it will deform. If it tears, it takes great energy to propogate the tear through the material. The second advantage we'd lose by going to HTS for submarines of the THRESHER class is in the weight we're putting in the hull.

Fatigue itself is a design problem; you can design out of fatigue. It's learning how and putting your lessons to work to lower your stress levels. In short, in my opinion, we know of no better material today to build high performance submarines out of than HY-80. It takes care; it's not an easy material to use because it is a heat treated material. But we do not know of a better one to use.

I talked with the experts in 634B, our metallurgists, and they tell me that in the reactor portion, for instance, their recommendations upon request were not to use HY-80 for several reasons. One of them is that the operation temperatures are such that you're no longer in a non-ductility range of HTS. This material is reasonably ductile. The second reason is that when you operate HY-80 at temperatures comparable to, say, the operating temperatures of the steam plant, you will begin to lose some of the properties, since it is a heat treated material, if you do this for a long period of time; so that in this area HTS is a better material. But for the hull I firmly believe that HY-80 is our best choice.

Q. Well now, you have limited your comments to high performance submarines, submarines that go down to the depth of b(1) But as I understand, in the design of b(1) submarines, you stress the hull material to the same load if it's the same thing. In other words, a b(1) boat is stressed to the same extent at b(1) as a b(1) boat is stressed at b(1)

A. On the basis of the percentage of the yield of the material. This is how we designed it. If we built it of HY-80, for instance, and made it b(1) then our criteria for a structure, say, this is for hypothesis, and we said at test depth we were going to stress it b(1) of the yield, if we designed the material of HY-80 we'd stress it b(1) pounds per square inch; if we built it of HTS, we'd stress it b(1) psi roughly.

Q. But then from a fatigue failure point, a b(1) foot submarine could be just as vulnerable as a b(1) foot submarine?

A. An HTS or --

Q. No, no. An HY-80, a b(1) foot HY-80 would be just as vulnerable to fatigue as a b(1) foot HY-80?

A. Built of the same materials -- but with one qualification thrown on that, sir. As we go to thicker materials, the residual stresses left by welding appear to be higher because you have higher restraint. And by "residual stress" now, I mean the stress as you lay a molten weld bead in and it begins to solidify

Unclassified

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and the co-efficient of thermal expansion takes over and begins to pull as the material cools, If there's no latitude for movement in the structure, then you're building up a residual stress stretching weld metal. Now all of our indications to date are that this is a very strong factor in the fatigue life of any detail. So that if we get into thicker HTS structures, for instance, it may be that we will find we have as short a fatigue life in HTS as we do in HY-80.

This is one of the reasons I believe it very prudent that we go back and look at an HTS submarine once again by someone who knows what a fatigue crack or a construction crack looks like and has proven the ability to find it.

The engineering curves of stress versus cycles indicate that on an initially unstressed specimen, if you take stress as a percent of fatigue life, or stress as a percent of yield stress, then for the same percentage of yield stress the fatigue life of HTS will be slightly longer than for HY-80. But residual stresses can change this whole pattern and there is no one that I know today who can tell you exactly what this change will be, whether it will change it in favor of HY-80 or in favor of HTS.

But all of our cycles on submarines to date have been lower than the cycles at which we began to pick up fatigue stresses on our models. So, therefore, there's a sincere doubt in our minds that we're really running into the fatigue cracking on the ships yet.

Q. As I gather from what you just said, you stated that because of the greater thickness needed by HTS there is doubt in your mind as to whether it's as good as HY-80 from a fatigue angle, that the stresses that you lock up in welding of thicker material may overbalance perhaps the greater fatigue life of HTS. Is that correct?

A. I think that this is a possibility, yes, sir.

Q. Now let's limit our remarks to b(1) submarines and forget any b(1) boats?

A. All right, sir.

Q. The Bureau is concerned in conducting surveillance tests of (b)(1) HY-80 boats. They are finding a large number of welding cracks But they are not exhibiting the same concern in HTS ships. And I know that the HTS ships are not as thick because their hull sections are not as big. But I cannot understand why the Bureau is not concerned about surveillance on the HTS if HY-80 is really a better material. The opinion has been expressed that HTS is a better material, at least for the (b)(1) boats.

A. I can't answer for the Bureau, sir. I think you're correct. I think perhaps people may have been fooled by the HARDER report. Maybe the HARDER report is correct, but there is enough doubt in my mind that, as a technical assistant, I'm going back and advise and press for a further look into the HTS.

Questions by a member, CAPT Osborn:

Q. You mentioned "brittle fracture"; will you give us an idea of what the brittle fracture temperatures and pressures are for HTS and HY-80?

A. They measure this in terms of non-ductility temperature. In other words, what temperature is it when the energy which is released as a metal begins to

Unclassified

Unclassified

fracture is enough to make the crack run all the way through, in other words, drive it through the material. HTS non-ductility temperatures will run, not infrequently, from say, as high as sixty degrees Fahrenheit to sometimes down in the area of thirty to twenty degree Fahrenheit, maybe a little lower.

Q. On the work stress?

A. This is not stress, this is independent. It's a crystalline change in the matter. This is non-ductility temperature, that temperature at which if you generate a notch on a piece under stress, it will propogate.

Q. Well, usually our brittle fracture limits with respect to reactors are specified for a high MOLY steel, which is a reactor vessel, at say, b(3) 10 USC 130 We usually limit our pressure so we do not get our metal into a ductile state. All I would like to know is in terms of sixty and thirty-two degrees, are stresses involved in, say, a (b)(1) boat, or a b(1) boat, sufficient to cause your hull to enter the ductile state and have a crack propogate?

A. Well, the insidious thing on a structure as large and as complex as a submarine hull is that if you have a crack you immediately have a stress raiser which is above the design stress to which you've designed the hull. Residual stresses will give you stresses well in excess of what you have numerically designed the hull to. Any penetrations will give this. So that we know we are going to have areas that at one time in our life, and certainly on the first dive, are going to be in the plastic range. On HTS and on most steels, they'll adjust, hopefully without cracking. This is why we go back and check for cracking. But they will adjust. And from that point on it will stay within the elastic limits provided it's not a stress region. A real high stress point, such as the concentration at the toe of a crack, may plastically deform each dive and then we have plastic fatigue. So that it's very important that we stay above this non-ductility temperature because we know this has to exist or we have to find some way of designing a submarine with absolutely no stress concentrations, which is beyond the state of the art.

Q. Yes, Mr. Keays, that's exactly the question I'm trying to ask you. But it's pretty difficult to try to control the temperature of the ocean. I'm trying to ask you whether we are in this range or not?

A. I didn't get a chance to finish the question in regards to non-ductility temperature of HY-80. It's specified that it shall be at least -- the highest maximum non-ductility temperature is minus one hundred degrees Fahrenheit. We are well below this.

Questions by a member, RADM Daspit:

Q. What is the maximum for HTS? Did I understand it might be as high as sixty degrees Fahrenheit?

A. Yes, sir.

Q. Can it be controlled so that you could make the specification and keep it above, say, ten degrees Fahrenheit?

A. Because of the nature of the material we can't control the process well enough to get it below the range we're talking. On a case basis we may, but we may reject ten lots to get that one lot that's cold.

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.

Commander John Woolston, U.S. Navy, a former witness for the court, was recalled as a witness for the court, reminded that the oath he had previously taken was still binding, and examined as follows:

COUNSEL FOR THE COURT: This is a closed session of the court, Commander Woolston, and you may divulge classified information here.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. In your position in the Bureau of Ships, have you made a review of the defects in the PUFFS inserts in THRESHER?

A. Are you speaking about the original PUFFS insert or are you talking about the replacement during PSA?

Q. The replacement during post shakedown availability.

A. Yes, I have. The question that was under investigation was that of circularity. The deviations shown on the condition sheet indicated deviations as much as five-sixteenths of an inch. In researching this in the shop, it was reported that these were taken based on a design circularity rather than on a before repair circularity. This is only reasonable since the before condition involved a very large heavy insert and a hole which was in the top of the PUFFS well. I have also looked at the original circularities in the area and it appears that the hull circularity as built was very close to design circularity of the design of the hull; consequently, deviations of five-sixteenths of an inch at a point very close to the center line seam and a quarter inch for some distance away are well within the half inch allowed. Therefore, I would say that the circularity at that area was satisfactory.

Q. In testifying on this point, were you making reference in part to the report submitted by Mr. Harrison Sayre as a result of his visit to the Shipyard?

A. The condition report to which I referred was attached to that report, yes, sir.

Q. For the record will you identify that as Exhibit 154?

A. Yes, sir.

Q. Have you also conducted a review of changes in structure to THRESHER during her post shakedown availability period?

Unclassified

A. Excuse me, before I go on with that -- but to make it perfectly clear, the condition report to which I refer is an inclosure, Serial Number 11-593-20.

Q. Thank you. My last question was, "Have you also made a review of changes in the structure of THRESHER during her post shakedown availability?"
A. Yes, sir.

Q. Would you report the highlights of your review, please?
A. The highlights of the structural changes in THRESHER were those involved with accomplishing the change order to stiffen flat plate structure to decrease the effects of fatigue loading.

Q. So far as your review would indicate, were they performed satisfactorily?
A. Yes, sir.

Q. Have you made a study of the likely order of implosion of compartments and appurtenances in THRESHER at crush depth.
A. Yes, sir.

Q. Would you give us the results of it, please?
A. Well, inasmuch as order of implosion is very complex, particularly where it gets into flat plate structures, I have divided the types of structure into areas which might go at roughly the same time. I have reviewed information relative to Captain Leahy's findings at Norfolk and, because these were not very precise in pinpointing a series of closely spaced implosions, I haven't tried to get too refined. But, basically, the first series would be the major compartments. The second item would be a bulkhead.

In my opinion, at crush depth, if any one compartment went, then immediately the remainder of the ship would go from internal bulkheads. The question as to which space would go first is almost impossible to answer since it involves not only the design strength, all of which run in the vicinity of between b(1) and b(1) feet, but also individual details of workmanship and specific hard spots.

Shortly after the compartments went, I would next expect the sphere to go. The sphere was designed to have a collapse depth equal to the hull without any benefit of stiffening from the MONEL inserts for the transducers. The escape trunks would go at about the same time. We have a series of hard tanks: the forward trim, the two auxiliaries, after trim, two WRT's and two large sanitaries and a small sanitary tank, which would go, I think, in a fairly slow mode of implosion as compared with the hull, which essentially collapses. These I would expect the plate to bulge in and drip so that the noises emanating would be considerably less than they would be from a collapsed major compartment.

Q. Would you state what you meant by "WRT's"?
A. Water Round Torpedoes. There are two small areas in the area just forward of the reactor space which are voids, know as the pipe trunks. These go through the area between Frames 51 and 52 outboard. Garbage ejector should go well below collapse depth. We have three items: torpedo tubes, periscope and ECM mast, which may very well not have gone at all. If there was any distortion around the middle of the tubes, they would have gone. It is quite conceivable that they deformed somewhat and did not completely collapse. The reason for this is that the torpedo tubes and the mast are designed against hydraulic shock

Unclassified

and damage from depth charge rather than just the hydrostatic pressure.

There are some small items, such as magazines, that might have popped as soon as the ship was flooded. The steam generators may either have imploded or have flooded. I would anticipate that they probably flooded. There are miscellaneous flasks and bottles on board which would go at very many different depths. The main air banks wouldn't have gone at all, but they probably flooded finally from the other end. Freon bottles, which are normally around 225, probably went as soon as compartments flooded. We have some internal oxygen flasks, a very small emergency flask, which probably went very near the end. These, basically, are the items. I can't pin them down much more closely than this simply because there isn't enough information in, I think, to really draw any conclusions on. We haven't imploded square items or items with flat bulkheads to the best of my knowledge.

Q. Can you tell us whether there are any plans afoot in the Bureau of Ships to provide better protection of vital switchboards from leaks from a high pressure water line that could directly take out a b(3) 10 U bus in the switchboard?

A. Yes, sir. This is new, so I can't give you any status on it.

Q. The court has heard testimony which questioned the use of high pressure hydraulics systems, particularly in the light of the small clearances in the valves which are susceptible to malfunction by even minute particles of matter. Would you state your view as to the desirability of changing over to a low pressure hydraulic system in a deep diving submarine, such as THRESHER?

A. Yes. There is a very definite difference of technical opinion as to whether hydraulics systems should be built in the vicinity of (b)(1) or whether they should be built at (b)(1) or even back down to 600. There is no question that for high performance, light weight items which are necessary for deep diving submarines become even more necessary as the depths go down, that high pressures must be maintained. Studies have been made looking particularly closely at the area between (b)(1) since for any particular system that's been studied to date, the minimum weight seems to be somewhere between those two figures. The decisions for (b)(1) in the internal systems and (b)(1) for the external systems were made some time ago based on the information available at that time. I would not change these decisions today.

As far as the valves are concerned, jamming of valves by very small particles is an item which should not occur if the valve is properly designed. The problem of fine clearance valves in general has been that the operators were not designed to cope with the valve in what is known as a "silted-up condition." Regardless of clearances, whether they are extremely fine for low leakage Navy type valves, or considerably larger for missile handling service, for instance, which have clearances as much as ten times as great as the Navy low leakage type valves, the silting time in a normally dirty oil is comparable. The flushes necessary to break loose a spool which has been silted for a given time are also comparable. Consequently, we gain by having the fine clearance valve by not having to have as much leakage. For instance, we did make a study informally at one time of using a clearance about ten times as great in our valves to see if we could cut the cost and increase the reliability. The answer we got was we wouldn't increase the reliability, we would hardly touch the cost, and we'd have to add at least one more hydraulic pump. The original valves that we used on THRESHER did have a problem in that, in the spring offset valves where you have to balance the spring force to move the pilot one way, against the solenoid force to move the pilot the other

Unclassified

way; in a fully silted condition they were marginal. These were changed during the PSA so that the valves would operate even in the fully silted condition. That is, you could leave them in a dirty system for six months and they would operate. This is to the best of my understanding of tests that were run and knowledge of the background of getting at that particular valve.

Q. Were you aware of the fact that THRESHER suffered difficulties in the reducing valve from the (b)(1) high pressure air system due to clogging as a result of dirt right up almost to the end of her post shakedown period of availability?

A. From personal knowledge I was not familiar with the problem of these valves during the latter part of the PSA.

Q. Based upon your testimony that this would not occur in a well designed valve, would you make any comment as to the design of the Marotta valve used as a reducer?

A. You just shifted from hydraulics to air, sir.

Q. I believe I said "high pressure air."

A. If someone were to show me what had happened, I might make an opinion. I don't know what the problems were during the latter part of the PSA or if there were problems, to my personal knowledge.

EXAMINATION BY THE COURT

Questions by a member, CAPT Osborn:

Q. On the subject of high speed control, you are faced with a problem of large plane areas at low speeds. Yet, exceptionally fast reaction time is required for high speed operations. Do you think it would be better to use a flipper type control with respect to high speeds and reserve the large planes and large speeds for more emergency action rather than primary control?

A. This is a possibility and would have to be evaluated in terms of an overall design. It would be quieter in almost every case to operate the main plane rather than small tab or flipper on it. This also would affect (b)(1) ,

To compare the use of the plane with a flipper at high speed you have to consider, since it is a safety measure, how you are assuring that the main plane is to be kept in position while you use the flipper, how you can break it out in the event that for some reason you wanted to use it in emergency; then, in comparison, look at possibilities for controlling the movement of the main plane in something even more reliable than what we think is a reliable hydraulic system.

Q. Well, just look at an airplane, for instance. We don't use the concept of moving the complete wing under any conditions. Yet, this is halfway the concept that we have in our sail planes on a submarine.

A. Technically I can't agree with you, sir. The wing is not like a control surface on an airplane; it has another function. But the tab versus the aileron, this has been looked at; it is much more complex and involves the double linkages of operating through the plane stack and then operating on a control tab. There are advantages to it; it has been looked at; so far it hasn't appeared to be advantageous enough to go to it.

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Q. My primary interrogation of the operators really pins down -- I think the number one advantage of a b(1) boat is the gravy factor that you have with respect to plane casualty. All I'm trying to look at from the practical point of view, is there some method involving plane high speed control that you can keep the inertia off the ship, and what have you done to look into this area?

A. You touched on one point which I think I will state I don't agree with. This is not the only area that is important, that is, gravy for a plane casualty. There are advantages to going to b(1) feet besides getting there in an accident. But have we looked into plane casualties? Yes, we have looked into plane casualties. Several kinds of approach have been taken. One is a matter of trying to increase the reliability of the system that we have. The second is failure mode of the system so that you can pull in a second system immediately in order to recover your planes.

We have made studies on ALBACORE, looking at her high speed operation, particularly with this last phase she's going into now, to see what the effect of various recovery measures might be; recovering the use of the planes, particularly with the external; parachutes; blowing main ballast; installing rockets; slowing the ship down; reversing the screws; dive breaks; many other things like this.

The thing that we have in THRESHER class as an active system today is the hydraulic system back-up, plus your power to stop.

Q. Certainly the testimony of Commander Axene with respect to the ship -- he said he had not seen any evidence of increased sonar performance at deep depth -- certainly in light of our knowledge that we have gained from investigation of the THRESHER, it appears very marginal whether we'll ever be able to get to slow enough speeds to really capitalize on advance sonar performance without minimizing control, or possible control of flooding. Have either of these two things changed your mind with respect to deep depths and operating procedures and technical capability?

A. Very obviously, from the standpoint of recovering from damage, you shouldn't be going slow. But the question about deep depths as it relates to sonar performance involves the percentage of the volume of the area around you that you can see -- her, I should say -- rather than the actual range that you could get. This is, as you go deeper down to a maximum of approximately b(1) feet, the area about that you can cover listening increases.

Q. I am primarily concerned, Commander Woolston, of whether we're going to get to b(1) feet or not. I am certainly familiar with the converging studies in the area. I am interested in, do adequate controls and necessary operational measures that we have to employ really make us take a serious look at this whole problem in terms of speed required and how far we can get?

A. Quite obviously we were not very far in the studies about recovery from serious flooding casualties at the time of THRESHER. We do know that we can gain in the use of the depth. Quite obviously, also, to increase the range at any depth, we have got to quiet the ship; and the slower she goes in general, the quieter she will be. The advisability of going slowly or hovering at deep depths is not very high from a safety standpoint, and it certainly looks a lot worse today than it did a month ago. Our studies involving safety involve,also, a look at what we can do with speed so that it can become an operator's decision as to what speed he uses, knowing the balance he has at any time between safety and performance.

Q. Well, this leads me right back into another question, which I'm primarily interested in. Do you think to some extent that we'll probably end up having something like an operational band at which we have almost unrestricted operations with respect to speed, quietness, securing of machinery, and anything you want to look at; but a band that's deeper than this that you can capitalize on that you only proceed to under very, very special conditions; one, to protect yourself against plane casualty going in a down direction; and, two, with enough speed to insure that you have a reasonable capability to cope with a flooding casualty?

A. I think this is quite possible. I would think that normally a commanding officer would have this in his mind during normal operations. He would set it for himself. But I would expect that it would be very definitely documented within a matter of not too many weeks as operational doctrine in both Forces.

Now I might say a little bit more on this subject -- that, on the completion of the Bureau's study of all submarines we will be able to come out with a measure of how far we think we can go in making each ship safe, and I am sure we are going to come into a situation of taking these time-dollars and equating them to increased safety for some of our ships.

Q. I am not trying to put you on the defensive or criticize your design, Commander, which I think is a good one. The only thing I'm trying to get clearly across is that the ship cannot be operated independent of design, and in most cases, when you decide in Design, you have already fixed the way the ship will be operated. Do you agree with this?

A. To a certain extent this is so. I think that both designers and operators have been very slow to understand that.

Questions by a member, RADM Daspit:

Q. Commander Woolston, counsel asked whether the Bureau of Ships is taking any steps to better shield electrical switchboards from things like the effect of water leaks. As I understood your answer, you said yes, but it was so new that you weren't aware of exactly what was being done. Was that correct?

A. Yes, sir.

Q. What do you mean by "so new"; do you mean since the THRESHER incident or before?

A. We have had requirements before, Admiral, which involved strictly those like if you spilled some water on the top of switchboards you're not going to short it out -- drip-proof equipment. As a result of THRESHER the idea of extreme protection is being looked at. Now, in between, we have general locations, and that's about all. We have had open bottom switchboards over lines, which, if they burst, might very well knock out the switchboard.

Q. I believe the Bureau had a recommendation as far back as the Fall of 1961 which recommended that the Bureau look into this. Am I to understand from your answer that they paid no attention to this recommendation at all?

A. I'm not familiar with the particular request, Admiral.

Questions by a member, CAPT Osborn:

Q. Commander Woolston, I know that the THRESHER design has been a subject of study and re-engineering in certain areas of which at the time prior to the THRESHER casualty were considered to be marginal or could be improved. Could you elaborate in a brief way on what areas were covered in this particular thing and what additional areas you expect to cover more in detail as a result of this casualty?

A. Almost all systems were studied as to engineering, all internal systems. The thing that has happened with the THRESHER casualty is not so much an area of new items with the main exception of a real hard look at what we can do seriously to further protect our electrical system against flooding, which can become extremely serious even if it's a small hole. There is a change in balance of desirability, quite obviously. That is, we will spend more now today in going back into the systems that were re-engineered a few months ago to increase the capability of the ship to recover, mainly from a flooding casualty. There would be incidental gains on control directly from these measures. Further looks are being made into the possibility of limiting down angles -- I shouldn't say "down angles" -- I should say dive angles on the stern planes, mechanical means of limiting.

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

Q. All I am particularly interested in--we are looking into a lot of areas--with respect to this particular casualty, involving safety, mainly air capacity, blow rates, hydraulic systems, air systems, electrical systems integrity with respect to flooding--this type of thing. Were these areas looked into very much in detail and solidified with respect to the improvements to be made in THRESHER?

A. During the re-engineering, you mean?

Q. Yes.

A. All these systems were looked at for re-engineering, yes. Safety is one of the items. In particular, the increased blow rate problem has been recognized and is incorporated into the re-engineered ships.

Q. Do we have any formalized particular procedures on the way for designing ships with respect to accommodation of air capacity, blow rate, depth of operation, time to flood, half-life of air banks, all of those set up in a certain complicated form to tell us what margin we're getting into as time goes by, rather than say, designing the air banks with the ability to surface twice and shoot all torpedoes without having the banks below b(1) pounds? Are we a little bit more advanced in terms of criteria we need for designing ships today?

A. Yes. The criteria that we are working for at this point is a criteria that says at test depth, at certain speed, with a certain bubble, and neutral buoyancy, we can recover from a complete failure of the largest water line on board. That is what we're working for.

Q. You'll probably build a submarine around a set of air banks under those conditions.

A. This is not necessarily so. Now, this is a very ambitious criterion. It involves a combination of blow-rate, air capacity, automatic sensing devices, automatic closing devices, other combinations; and it involves help from the operators, on account of I don't think we have yet an operator who wants to blow main ballast tanks automatically. These are the things that are going into it. This, incidentally, is the criterion we are looking at the older ships with. What would it take in order to reach this state? It's going to come out very expensive as back fit. For new ships, knowing that we already need an increased blow rate--significantly increased blow rate--and knowing that we've got to be able to shut some of the valves faster, the amount involved is not so terribly great.

Q. Are some of the ideas, like for instance, in the main circ line, substituting say 50 per cent capacity when you don't need the whole line, are you looking into some of these valves?

A. Yes, indeed. Such ideas as automatically controlling a sea valve so it is no further open than necessary to give the cooling that you need. This is one of the ramifications of the system. As Admiral Daspit mentioned earlier, the possibility of even dumping solid lead, dumping ballast as a matter of getting immediately increased buoyancy, is another possibility. There are also--we have got to look a little bit further into it because having the capability of blowing the tanks in a hurry, you also see the problem that somebody may blow them at precisely the wrong moment, and the wrong moment for a ballast tank is such that it will get you almost on the surface at a very high vertical speed with a tank almost dry and still blowing. You have got to withstand this pressure.

Questions by the court president:

Q. Commander Woolston, you did mention among the things being considered, installing rockets?
A. Installing rockets, yes. This was relative to the ALBACORE studies.

Q. Can you tell the court how far this study has gone?
A. The main things that were looked at, Admiral, were those involved in what is the gain in installing these things, and some--I am not familiar with all the details of the tests that were run--but using two REGULUS boosters in the forward part of the ship to take off an up angle and slow the ship down, were very much less effective than using full planes or using the dorsal rudder; or the most effective single item was a parachute that would pop out behind the sail to slow down and bring in an up angle. One other one--and incidentally it goes back to this business of very rapid ballast tank blow--even instantaneous de-ballasting of all ballast tanks, was a small item for recovery compared to the inherent stability of the ship.

Q. Commander Woolston, on 13 September 1961, subsequent to the BARBEL flooding incident, there was a dispatch sent from Deputy COMSUBLANT to BUSHIPS, and in that dispatch, COMSUBLANT said that although recognizing that nature of problem was such that immediate and complete solution was not possible, the type commander must emphasize that in spite of corrective measures, LANTFLT salt water piping incidents continue to occur with alarming regularity. And then he cited a number of examples. Then this dispatch later on said, "Continued dependence upon such tenuous and fortunate circumstances particularly when considering additional hazards imposed under wartime conditions, is obviously unacceptable. COMSUBLANT appreciates efforts expended and results already achieved by BUSHIPS in improving the situation. However, it is considered that urgency of problem and inherent danger of disaster must be brought more forcibly to attention of all concerned and that corrective/preventive action must be pursued even more aggressively than has been done. To this end it is requested that BUSHIPS take the following action on a top priority basis:--" And then among those things that they wanted to take action on as a top priority matter was--I don't want to read all of these, there are quite a few here; I'll just read the one that I want to get your answer to.

"In new design, reduce wherever possible potential hazard of salt water spray damage"--it wasn't any drip-proof thing--"salt water spray damage to electrical equipment by physical separation, shielding of salt water lines, provision of watertight closures for electrical equipment, or other appropriate means."

Now in view of the fact that that dispatch was sent in September '61, I am a little surprised that you say that this is a new item of interest in the Bureau of Ships, this matter of better switchboards and better protection. Can you clarify that?
A. I am not sure directly what was done as a result of that particular item in that line. And in the re-engineering, which started somewhat after that and getting ready for the new boats, particularly since the time scale was hooked to the SSBN604, and I did not sit in on the particular sessions involved with switchboards, I cannot say from personal knowledge, either whether this was considered, or what the impact of the salt water system was.

Q. Would you tell the court who would be the proper one in BUSHIPS to testify on this point?
A. Lieutenant Commander Rasmussen was the officer who was running re-engineering for these ships and Captain Cross. I could produce an individual name with a phone call.

Q. Would you undertake to let us know--
A. Yes, sir.

Q. --when you have determined who would be best able to testify on this point for us?
A. Yes, sir.

A copy of a dispatch from DEPCOMSUBLANT to BUSHIPS date/time group 131410Z of Sep 1961, was then offered in evidence by counsel for the court. There being no objection by the court or counsel for RADM Palmer, a party, the message was received in evidence and marked as Exhibit 162. Counsel for RADM Palmer, a party, waived the reading of the exhibit at this point.

Q. Commander Woolston, are you, in general, cognizant of the tests which have been conducted pursuant to a request by this court on the air blowing rate in THRESHER type and other deep submergence submarines?
A. I'm not sure what ones have been asked for by the court, no, sir. I am familiar with the information that we have gotten in so far on the--

Q. On the TINOSA:
A. Yes, sir, I have seen that.

Q. Well that's the one that we initiated the request for and then, pursuant to that, other requests have been made, but that fundamentally is the one that has heightened our interest in this subject. Have you had an opportunity to analyze that problem at all?
A. Only on the surface. We have to make other tests to determine all the ramifications of this. We-the Bureau-has asked Mare Island to run some tests. We have some preliminary results in from two ships at Mare Island. You are familiar then, I assume, with the first thing that was found wrong with the TINOSA system?

Q. Yes. The strainers, you refer to?
A. Yes, sir. The next test that is to be run we will take the reducing valve out of the system and we can see what is the effect of this. From the standpoint of increasing the capability of the systems of the ship now for the operators that are out, I want them to give a series of shots to see whether, if there is a small build-up, we can get more air out in a short time in a series of shots than the other. As we find out more, as soon as we can pump the banks up, we will check further. The long run solution to this problem is quite obvious; it's what we have already planned, but have not implemented, which is the short circuit blow.

Q. Which would not be very expensive nor take very long to do?
A. Not terribly, no.

Questions by a court member, Captain Osborn:

Q. You represent 525 Bureau of Ships, which is the Submarine Type Desk. How many officers do you have at 525?
A. Nine.

Q. How many ships have you got under construction at the present time?
A. Oh, we must have about 50.

Q. How many different building yards?
A. Mare Island, Portsmouth, Bethlehem--Quincy, Electric Boat Division, New York Ship Corporation, Newport News, Ingalls--seven.

Q. Do you think your personnel--adequacy of response of senior people in the Bureau, adequate response from forces afloat, with respect to assisting you in the problems, is adequate at the present time, inadequate, or totally unsat?
A. I very definitely feel that we could do a better job if we had more people. I personally feel that we could do a better job if we had more naval officers. We need, in my opinion, both the submarine-oriented engineering duty officer which we have in somewhat short supply, and we need operators who are right in from the fleet and will go back to the fleet. We can get a cross-germination which is extremely important. I realize in the latter need we are in real tight competition with the needs of the fleet itself. We could, of course, do a better job with more people, with better background, and chase down more of these problems to put a personal finger on the final solutions where they take much too long and have not sufficient attention with the detail and development. I am not apologizing for the Bureau of Ships. I think the Bureau of Ships is doing a good job in getting out the things that they are getting out. This kind of a building program involves a lot of cooperation from a lot of people, but if you had more and better people, I think we could do a better job. Whether or not this had a direct bearing on the situation with THRESHER, obviously, no one knows.

Q. I realize that the help you get is more a matter of quality than certainly one of volume.
A. Yes.

Q. Both from the operational view and the assets of submarine EDO's that you have present to put on the problem.
A. Yes, sir.

Q. With respect to the total shipbuilding problem, in general, the total number of ships being built in terms of assets being allocated to that shipbuilding program, is the submarine representation and support at the Bureau proportional to that effort?

A. I think the high level support of the submarine people, as far as understanding and trying to carry out their requirements in changes and money, has been good. The sympathy for the things that we press, we--the type desk--being as an area in the Bureau that forwards these, from the standpoint of increase in personnel, we don't do any better than anybody else. From the standpoint of men per dollars, although we are a large code, a large type desk, we also have a tremendous program.

Q. I have often heard it said, and have said it myself many times, it was the help from outside that almost killed me and kept me from doing my job adequately. Do you find this the case--is it the case right now?

A. Are you speaking about the last few weeks?

Q. I am talking about since April the 10th.

A. Since April the 10th, the normally tough situation and trying to support the requirements of several boards, plus the obvious necessity of taking most expeditious action on the things that we had previously thought we should do, and the new things that are turned up, of course, it is difficult. There isn't that much time in any one day.

Questions by a court member, RADM Daspit:

Q. Do you have any officer in your office who has ever had any operating experience in nuclear submarines?

A. Only in trials or visiting. Not as a member of the crew.

Q. To your knowledge, has the submarine desk ever had anyone?

A. I don't know of any, Admiral.

Q. Do you know of any plans which would provide you with this experience in the future?

A. No, sir, I don't know that such plans don't exist; I don't know of them. It is an obvious need.

Questions by a court member, Captain Rushing:

Q. I believe you mentioned that there were approximately nine officers in the type desk?

A. Yes, sir.

Q. Do these officers not only handle the new construction problems but the maintenance of all the operating submarines in the United States Fleet, both Atlantic and Pacific?

A. Yes, sir. Every bit of business that touches the Bureau of Ships except those handled exclusively by 1500.

Q. So that this is the total available headquarters type desk effort for the total submarine operation and building program in BUSHIPS, is it not?

A. That is correct.

Questions by the court president:

Q. Commander Woolston, in addition to the nine officers, do you have civilian engineers?
A. Yes, sir.

Q. How many?
A. It's approximately 28. I am not sure of the exact number, plus clerical help.

Q. Commander, do you and the other officers normally find it necessary to work six days a week?
A. It varies whether we work six days a week, work long hours or what. Almost everyone in the code spends at least eight hours a week extra, and the average runs ten to twenty, not counting trips.

Q. Does the personnel limitation mitigate against timely addressing of problems such as that which was posed by COMSUBLANT in Exhibit 162?
A. There's no question about it. I might say also that in my position, I should be able to answer all the questions relative to the re-engineering. I should, I feel, have had time to sit in on all of these and did not, because of the requirements of the basic job of continuing the building program on the 593 class.

Q. What would be your estimate of the cost, overall cost, in very broad figures of the 50 ships for which Code 525 is responsible on the BUSHIPS side for construction?
A. Four billion dollars. I want to make sure I have my decimal point in the right spot. This is new construction and this is based on roughly a little better than 60 million dollars apiece for a 593 class and the FBM submarines are running closer to a hundred. This is total cost.

Q. Now what would be the rough approximation of the cost, the replacement cost of all of the other submarines for which you have BUSHIPS responsibility regarding repairs?
A. To replace them with a ship that is approximately the same capability, I would say it would be somewhere over ten, probably over fifteen billion dollars for equivalent ships.

Q. So that in round figures, Code 525 in BUSHIPS, which has nine officers, not one of whom is nuclear-submarine experienced, is responsible for the construction and repair, from a Bureau angle, of roughly fifteen billion dollars worth of submarines?
A. That's right, Admiral. The particular requirements of the nuclear plant are taken care of by another code in the Bureau.

Q. By 1500?
A. Yes, sir.

Q. Are there not, however, considerations of design, construction and repair, which cannot be isolated from Code 1500's work? In other words, do you not have to take into consideration many factors that are introduced by the fact that we have nuclear propulsion in these ships?
A. Oh yes, indeed.

Q. If you and your fellow officers in Code 525 knew nothing about the requirements imposed by nuclear propulsion, would it be practicable for you to do your job properly?
A. No, I think definitely we would be quite incapable of doing our job properly.

Q. Would experience in the actual operation of nuclear submarines add to the overall competence of your group to do its job, in your opinion?
A. Yes, and this could be done in several ways. I think it would be very valuable for those of us who have been in nuclear submarines for a fair length of time, to have an operator to help us. It would have been valuable, I know to me, to have spent half my time on a diesel boat and half my time on a nuclear boat. Either kind of approach -- it helps.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. Notwithstanding the limited number of officers serving in Code 525 and the heavy load of their duties, is it a fact that at least one of those officers within your own recollection, has been called away from his duties in the Bureau of Ships to sit on a selection board for a considerable number of weeks?
A. Yes, sir.

Neither counsel for the court, the court nor counsel for RADM Palmer, a 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 made the following statement:

THE WITNESS: There are several items that crossed my mind thinking over the previous testimony. Point one, my testimony before and this time is [redacted] unclassified ~~Identical~~ with the exception of the items relating to things heard by Captain Leahy. I am not sure whether this is considered secret or higher at this point.

PRESIDENT: Yes, Captain Leahy's data was secret.

WITNESS: On the trim suction test for THRESHER, where we had the failure on the first deep dive at test depth, I think I stated that it was poor judgement on the part of the people who signed the test memo to have done this, and I think I was probably one of those people, and this is one that I verbally asked them to correct, and was a little shocked to find it hadn't been done, but it was my responsibility; I failed to get it done. On the question that was posed by the Shipyard Commander's counsel on ASW versus trim and drain system failures, I hope I was clear. In looking at my testimony, it did not look clear; that is, a sil-brazed joint failure on the trim and drain line would result in much less damage--and I would be much less worried about it--than one on the ASW system. However, from the standpoint of looking at the joint and saying this was evidence of good or bad workmanship in the Yard, I would not differentiate between the two because the workmen should have the same standards on trim and drain as on ASW.

One other item, in general, on the first presentation that I made relative to design, if there is any question that anybody in the court has relative to how much was my personal knowledge and how much had I absorbed by osmosis, I would be happy to explain, if there is a question. If not, the other item is relative to the air valves. I am familiar with the problems that we had with this particular valve early in the operation of the system when we first put it in commission back before the ship first went to sea. If you are interested in that area, I have info what happened. At the end of PSA, no, because they were redesigned since then.

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

The court then recessed at 1207 hours, Tuesday, 7 May 1963.

The court opened at 1348 hours, 7 May 1963.

All persons connected with the inquiry who were present when the court recessed are now present, except for (b)(6), who was relieved as reporter by (b)(6).

(b)(6) was called as a witness for the court, was informed of the subject matter of the inquiry, was advised as to 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 can be divulged.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address and present occupation.
A. My name is (b)(6); present address, (b)(6), . My occupation is Marine Engineer, presently assigned to the Machinery Design Division of Bureau of Ships as a Project Coordinator for submarines.

Q. Would you briefly describe the nature and extent of your duties in your present job?
A. My present job duties encompass all machinery systems for new design submarines, exclusive of the nuclear primary system.

Q. What is your background and experience in your profession?
A. I have been in this present job for approximately four years. I've worked as a Marine Engineer, mainly in the piping field, since 1942 for the Bureau of Ships; part of this time was spent in a type desk, namely, the piping field.

Q. What is your educational background?
A. Mechanical Engineer.

Q. In connection with your present duties, have you made a flooding recovery capability study with specific reference to THRESHER?
A. Yes, sir, these studies were made really by Electric Boat Division, under our contract.
Q. Have you familiarized yourself with the study and its conclusions?
A. Yes, sir.

Q. Do you have it with you?
A. Yes, sir, I have some viewgraphs which summarize the study in not too much detail.

Q. Will you proceed, then, to make a presentation of that study.
A. Before we go into this, perhaps some background. We have been looking into this problem for all ships for over a year in the Bureau. The impetus for going into this study came up due to some evidence of some weaknesses in the salt water system, also by request from forces afloat for facilities for pressurizing compartments on board the ship, and also in connection with the decision that had to be made to leave air on, or take air off, BM's when the

Unclassified

missiles were changed to not require so much air. In any event, the criteria that we used for designing these ships, that is, the 593 and, basically, the 586, the 580, and the 585, is represented by this:

(At this point the witness started showing viewgraphs on a screen.)

To provide sufficient air to empty the ballast tanks when they are on the surface twice, and also fire all torpedoes. This requirement here is for BM's only, so it's not pertinent to our present discussion. After the true ballast flows are made and firing torpedoes are done, our criteria is that we will still have b(1) pounds left in our air banks. This b(1) pounds was considered sufficient to create a reasonable size bubble, or buoyancy in the tanks after these evolutions. As I say, we looked at this criteria. We found it wanting and we embarked on a study program, which soon became evident that we would have to use the computers that were available to us. The computer studies had to take into account all these variables here. I think most of them are obvious and, inasmuch as they all are interrelated, it represented a problem that was completely unsolvable by manual means.

Q. If I may interrupt. Will you mention the variables, so that the record will show them?

A. Yes, sir. Direct variables are hole size, the location of the flooding, the depth of the ship at which the accident occurs, the time to secure sea valves, the ship's speed at the time of flooding, the ship acceleration, due to either its buoyancy or if it is available, the initial air bank pressure, the time of delay before initiating blow, the effect of pressurizing compartments simultaneously with blowing tanks, the amount of air we have stored on board, the blow rate and the ship motion during the maneuver following flooding. All these variables are interrelated.

Looking at all these variables, and looking at the 593 in particular as one of the ships that we studied, we have come up with some curves here, which shows the results of the studies and would predict what the 593 would do with the systems as installed. This is only if this system was arranged to give us optimum flow rate. This chart here is based upon a continuous flooding assumption; that is, the sea valve is not closed. The hole size is really an orifice at the hull of the ship. Therefore, any real pipe failure within the ship would give a flooding less serious than indicated here. The initial depth of the ship is indicated here. At design depth, for instance, in the 593, we would expect to get a blow rate approximately this amount.

Q. Would you mention that blow rate?

A. b(1) , initial blow rate, b(1) flask on board. charged to b(1) pounds.

Q. And the design depth is what?

A. b(1) This indicates that we could tolerate approximately a 1-1/4 inch pipe hole and still recover. It also indicates that a 1-1/2 inch pipe hole, we could not recover at that depth.

CAPT HUSHING: Let me interrupt. We are not talking about pipe holes; we are talking about orifice holes.

WITNESS: That is true.

CAPT HUSHING: Well, then, will you use the term orifice when you mean it instead of pipe holes?

WITNESS: Yes, sir. The hole size referred to as orifice at the shell of the ship. This does indicate another effect, which I will cover more fully on another chart. It shows how much better off a ship is with an initial speed of ten knots. In this case, at test depth, we could tolerate a hole in the side of the ship about 2-1/2 inches. You can also glance at the other various depths and note the degree of improvement for the shallow depths. A more realistic condition, perhaps, is where the operators are available to close sea valves in a reasonable amount of time; maybe I shouldn't say, "realistic," but a more reasonable assumption for ship's recovery.

Here we have plotted the time allotted to secure valves, whereas before with a continuous flooding we indicated that a 1-1/4 inch hole could be tolerated, here, if the valve was closed in thirty seconds, we would indicate that approximately a 3-1/2 inch hole could be tolerated; and this is where the thirty second time for the operator to make his decision and take action to close that valve. At the 400 depth, for instance, it would indicate that if a six inch valve were closed in thirty seconds, the ship could recover. Again, with these other assumptions of the b(1) blow rate. We had this curve plotted to show the effect of a ship's initial speed. This curve is out of step; it's the 608 curve, but perhaps it will illustrate the effect.

There is a 593 curve in there. (The slides were changed to one for the 593.) This curve here shows a "Go" and "No-go" condition for the 593 with again the maximum blow rate, the blow initiated in fifteen seconds, and indicates that the recovery condition, the ship's motion with regard to depth, which is indicated on this scale, that for sixty seconds after the flooding occurred, there was no appreciable movement of the ship. It also points out the fact that the operators could hardly be expected to realize the difference between a 1-1/4 inch hole and a 1.7 inch hole. In other words, to say that this is not serious, and this is serious.

Q. Do you mean 1.4 inches, rather than 1-1/4 inches?

A. No, sir. This 1.4 opening corresponds to a 1-1/4 ips size. This is iron pipe size hole. The reason why we drew this curve was to illustrate, to make the point that if a flooding is discovered, the immediate reaction should be taken either to close valves and to blow, and to analyze the trouble later. I have some 608 curves showing similar, with which you could make some degree of comparison.

However, as a result of these studies on this ship and others, we came up with what we might call a target for improvement to existing ships and new design. If you wish, this is the criteria which we are looking at for the 593. In order to recommend modifications to the existing design. If you wish, I can show this. As I say, the results of this investigation, of course, becomes obvious. The lessons are that we must maintain air bank pressure high when your ship is at deep depths. Special precautions have to be taken. It is highly desirable to maintain some speed at these deep depths, and if a casualty does occur, quick action is required to secure the flooding, to blow main ballast tanks, and, where possible, to apply additional propulsion power. Also, our studies indicated that where the operators would attempt to pressurize a compartment, such as the engine room, that they would soon deplete their air banks and make a possible recovery impossible. This is what we are designing to, today. We intend to provide a ship flooding recovery capability

sufficient to cause the ship to surface after any single sea water piping casualty, assuming the following conditions: The ship is at test depth; the ship has zero speed, zero trim, neutral buoyancy. For the back fit of existing ships, the operators have advised us that this is perhaps too severe a condition to meet; so, again, for evaluation purposes, we are looking at the five knot initial speed. This flooding recovery capability will be based upon definite procedures for recovery maneuver. Ballast tank blow will be initiated fifteen seconds after the casualty. The air bank pressure will not be below b(1) The sea valves are undamaged. Operating personnel are available at normal watch stations. The sea valves are secured after thirty seconds delay for personnel decision, plus the time to close, based on the valve size, type, location and the access to controls. Where this manual closing time of thirty seconds is not adequate, this is based upon an achievable blow rate to counter the flooding, the valve opening will be restricted before going to deep depths. This is similar to "rig for deep dive" philosophy. For automatic positioning, device will be installed to partially or fully close valves in case of a casualty. We say partially because, in the case of the main propulsion valve, we would be reluctant to close them fully and thus lose propulsion power, which might help us. The ship does not go below collapse depth during this recovery maneuver. For instance, some of our studies have indicated that the ship takes on an initial down-velocity and then would recover; but, of course, if this down-maneuver took it below collapse depth, we would consider it a no-go.

The ballast tanks are not over-stressed. The ship angle does not exceed thirty-five degrees during the recovery, and propulsion power not available if the piping casualty in question could affect main propulsion. That's all I have here.

Now I have some 608 curves. The 608 shows up a little better than the 593. At the zero speed conditions with continuous flooding, we could tolerate a 2.3 inch hole. On the 593 it was 1.4. For the thirty second delay in valve closing, we can go up above five inches. The effect of addition ship speed is shown. The 608, however, has a higher blow rate, b(1) and its additional displacement and inertia; it doesn't respond to a flooding as fast as 593. So these things help us. This is a continuous flooding curve, similar to the one I showed you on the 593. It just illustrates much more graphically the effect of depth. Let's say at 300 feet, the 608 could tolerate a six or seven inch opening, with continuous leakage. The 608, again, shows that this approximate two inch hole, two inch pipe hole this time, how much improvement you would get with, say, ten knots; you would double, in size and diameter, the tolerable hole in the shell of the ship.

We looked into the effect of delaying the ballast blow. Some of the operators we talked to indicated that according to their experience they didn't think they could blow in fifteen seconds. They would like to wait longer. However, this indicates, on the 608 again, where we could tolerate the two inch opening if you initiate a blow instantaneously; and I believe this is the fifteen second mark that our other curves are based on. If we waited until one minute was over, we would be down to the 1-1/2 inch opening. The slope of these curves are essentially the same, regardless of speed.

RADM DASPIT: This curve is still based on continuous flooding?

WITNESS: Yes, sir, this curve is. This is a curve representing the maneuvering of the 616 for a procedure which we blow tanks only, and then for procedure which simultaneously we attempt to pressurize the engine room. The criteria on this ship was the same, insofar as initial pressure was concerned b(1) We initiated blow fifteen seconds after the casualty, but the 616 has some 915 cubic feet of air versus the b(1) of air that the 593 had, so this curve represents what happens to the ship with a five-inch, continuous hole flooding. The ship is at test depth; the flooding occurs fifteen seconds after that. The initial reaction of the ship is to go down. After about a minute, we then come up, and for a while both these curves would indicate recovery. At this point here, however, 770 feet, due to pressurizing the compartment, we would run out of air and the air bank pressure becomes less than sea pressure, and we go down.

CAPT OSBORN: Where is this flooding--in the engine room?

WITNESS: This is in the engine room, yes, sir. This is a schedule, really, an internal schedule for flooding studies, which represents the computer timing and the dates at which we expect to be able to come up with similar curves on all these ships. This is the study on existing ships and this is the study of what can be done to meet the new criteria with a reasonable SHIPALT program; so the key dates, these are completion dates. At this date here, the Bureau would expect to be in a position to produce these curves to the operators, CNO or SUBLANT, and let them decide their own limitations.

That is all the viewgraphs I have. I have other curves available in a little package here, but this represents, I believe, the meat of them. One point about all these curves is that it brings out the need, possibly, for a change in philosophy of some of the operators that we talked to. Their past experience has been, in plotting the curve again, the limited amount we talked to, was to send somebody back to look at the leak and determine if it's serious or not, and then take corrective action. That's all I have.

Q. I show you a study entitled, "Preliminary report on submarine floodings and recovery capabilities." Does this produce in legible form the slides in the presentation that you just made?

A. There are a few curves which have been generated since this went to press. I shall attach them.

The cited study entitled, "Preliminary report of submarine floodings and recovery capabilities" was offered in evidence and, there being no objection, it was so received as Exhibit 163.

Counsel for RADM Palmer, a party, waived the reading of the exhibit at this time.

Q. Mr. (b)(6), when were the studies, which you have presented to us, commenced in the Bureau of Ships?

A. The computer studies really began some four or five months ago. Prior to that, we had made hand studies and realized that we had to go in as fast as we could into a more complete definition of the problem.

Q. What was the purpose of the studies?

A. The purpose was, really--we realized that our present criteria was not good enough. In fact, that when the Fiscal '62 593 design came along, we had increased the air capacity on that ship, but what became of the plan? As time went on, capacity was not really the crux of the problem; it was blow rate.

Unclassified

Q. Then, the over-all purpose--was it contemplated to make these studies available to the operators of submarines in the command line?
A. Yes, sir.

Q. Was that ever done?
A. Well, it was done. A version of that document there, that was dated April 25, was actually signed out of the Bureau on the 9th of April, but it had to be returned for printing, and because it was not quite suitable, the version that was going to be sent out at that time really had curves and data associated with more of the 616 class, and it was felt that this data would not be of immediate help to the operators of the ships. So, this version was re-edited and we contacted the force commanders and CNO and determined that the fastest way to get this material to them was to call them in. We had a meeting; I believe it was the 25th of April, at the Pentagon, in which we gave them the results similar to these curves here.

Q. Was the data on the old report based on the same blow rate?
A. Yes, it was, but the data in the old report was mainly what could be done with a new design ship and, therefore, perhaps it was inappropriate--especially so, due to the circumstances.

Q. Would you confirm that every time you mentioned a hole size or diameter in your presentation, you were referring to a perfect orifice open to the sea?
A. It is an orifice with a discharge coefficient of 1. When we say 1-1/2 inch opening, we are not referring to 1-1/2 inches, but to the corresponding hole size with a 1 ~~psi~~ IPS pipe.

Q. Referring to your experience in the Bureau of Ships at the time of preliminary design of THRESHER, would you explain the background designing which resulted in a choice of a b(1) stowage for the high pressure air, but not a b(1) blow system for it?
A. Well, the Bureau preliminary design report at that time indicates that the package was sent to Portsmouth for them to look into the details of such a system, and noting that b(1) air could be used. This decision, then, was up to the Bureau to make, but I make this slight distinction. The reason for retaining the b(1) part of the system was that the previous design, say, the SKIPJACK, had just gone from b(1) blow system to b(1) blow system. The SKIPJACK had air stowage to b(1) and used b(1) to blow tanks. This part of the system was well developed hardware when the design was laid out. The reason for going to the b(1) stowage was basically to get more air in on the limited amount of space that was available for the stowage of air flasks in the ballast tanks.

EXAMINATION BY THE COURT

Questions by a member, CAPT NASH:

Q. Mr. (b) (6) , have you progressed far enough on the design work under the new criteria to know what modifications need to be made to the 593 class?
A. No, sir, we don't. We are going to require, I think, until June the 5th, according to our schedule. We know what the existing 593 will do and we know what blow rate we would like to put in on the ship, but we don't know what is feasible to put in on the ship. For instance, our first preliminary look at her would indicate that we would require a blow rate that is quite out of question insofar as we can conceive it. So, what we will have to do

is look for all the space that we can to put air bottles, design a blow system to give the utmost in capability, and then go to the other side of the question and look at what valves on that ship have to be provided with some degree of closing, or how to close them faster to meet that blow rate. This is a series of computer studies, and on the basis of priority, the schedule you saw there represents the thinking at the time; that is, get the information out to operators now.

Questions by a member, CAPT HUSHING:

Q. Mr. (b)(6) , I believe you testified that the Bureau started studies relative to blow rate and so on about four months ago?
A. No, sir. The question was: "When did you start the 593 studies?" Actually, the studies--

Q. I show you a copy of BUSHIPS serial 5256124 of 15 August 1962. Would that refresh your memory as to time?
A. As I say, Captain, the studies, the basic studies of all the ships were looked at briefly; the wide problem was looked at over a year ago, but the emphasis for the EB and air computer time was on a 616 class, and the bulk of the work we have received in is on a 616 class.

Q. But I'm asking about when it was started.
A. It's difficult to say when it was started.

Q. Let me rephrase the question. When did the Bureau ask that the work be done?
A. We had this lined up over a year ago, but when we told EB actually, "Don't do this; do the 593" is another point. For instance, now we can say, "We have started the studies on all the ships" but we really haven't.

Q. You have directed that studies be made, but they haven't actually been started in all cases. Is that right?
A. Yes.

Q. Have you witnessed any tests of high pressure air systems?
A. No, sir, not for fifteen years.

Q. Then, why do you use for your casualty control studies the full capacity of the air banks in 593, say?
A. The full capacity, sir; you mean all four air banks?

Q. Yes.
A. We were trying to find out what could be achieved.

Q. This would be the best possible?
A. Yes, sir.

Q. Do you have any knowledge of freeze-ups in high pressure air systems when they are on continuous blow?
A. This was certainly not anticipated on the basis of our past knowledge of such systems.

Q. What does the past knowledge consist of?
A. Well, for instance, three thousand relief valves discharging to atmosphere freeze up. Joule Thompson effect, depending upon which co-efficient you

use, would indicate, say, a temperature drop of maybe 20°, b(1)
reducing valves, I think, depending upon which co-efficient you use, because, admittedly, this is not a perfect known figure for our conditions, especially when you get up to the acoustical flow; but there have been no indications of reducing valves freeze up, of course, with our previous flows.

Q. Were there no indications, or just no test?
A. Well, the reducing valves were tested in the manufacturers' plants; or that is what we were told by our valve people. They were tested, supposedly for minutes of duration and not seconds; therefore, minutes, and no freezing occurred.

Q. So that, as far as you are concerned, you are taking the word of the valve people in the Bureau relative to the lack of freeze-ups?
A. Relative to the lack of testing, perhaps.

Q. But how about when relief valves are put into systems; doesn't the germination of the adequacy of a system come within the province of Code 430, BUSHIPS?
A. This is so, but we never had a release valve freeze up. I would say from personal experience that I have seen them frost up on the outside. Now, perhaps with a really wet air, it would have frozen up, but with dry air it wouldn't and, to my knowledge, it hasn't.

Q. What kind of air does a ship leaving the shipyard after an extended availability normally have in the banks?
A. Well, if they had just charged their banks, and assuming that the banks were dry before they charged them, the air should be relatively dry. It's probably the case that after a long period of charging and recharging, where the water will gradually build up in the flasks and is not drained out, that is the more probable condition for getting wet air.

Q. What would your estimation be of the condition of the air banks of a submarine that has been operating for five months and has just charged up prior to going to sea?
A. Well, Captain, I don't know. There are drains provided on the flasks for purging a flask of any water or oil that may be there. If these are used periodically, and I don't know what the instructions are; I believe it's at least once every week, they should be reasonably dry, and the ships, of course, with dehydrators, you are that much better off. But, even with ships with dehydrators, the water will build up in the flasks and, unless the drains are used, it will accumulate.

Q. Have you, as a Bureau of Ships Marine Engineer in this field, ever asked for a test which involves blowing down the air banks of any of our submarines completely through the air system installed?
A. Not until recently; within the past week.

Q. But, say, about a month ago?
A. No, sir, I never asked for it.

Q. Isn't this the kind of test that we need to have done to insure that a system can be utilized to capacity for which it is built?
A. Well, what we would learn from such a test, and I'm certainly in favor of it, would be what degree of wetness can you tolerate in air before a valve

Unclassified

freezes up, or a strainer freezes up because it catches the snow as it forms. The goal so far has been to achieve the dry air to begin with. I can't help but agree with you. We should have had the foresight to request such a test.

Q. In open court, testimony was given, as indicated in the newspapers, to the effect that one of the last messages received from THRESHER had the words something similar to this: "Experiencing minor difficulties. Have positive up angle. Am attempting to blow." The last phrase, "Am attempting to blow." What did it mean to you, as a person connected with the design of air systems?

A. Well, there are several things that might have happened to abort this effort. I am not really prepared to say that it was freezing, dirt, or a malfunction of any part of the system, or what. I don't know.

Q. But, didn't it excite your curiosity or your interest?

A. Oh, definitely.

Q. What were the kinds of conjectures that you went through after you received this information? Did you think about how this could have happened?

A. You mean, what picture did I establish?

Q. Yes.

A. Well, this was just conjecture in my own mind, but I had a picture of electrical failure, valve closing, other bank coming on, something hitting that and stopping it. Freezing, or that type of thing, didn't enter my mind.

Q. Did anything else but electrical failure enter your mind?

A. Other than a complete flooding that squelched everything.

Questions by a member, CAPT OSBORN:

Q. Have you made any calculations with respect to saturated air, when it cools in temperature to about -50°, and do you think it's possible to have dry air under the conditions of blowing a complete bank dry?

A. Saturated air at b(1)

Q. Say, you blew the tank down to b(1) pounds?

A. This is one method that we use for drying air. We expand it from the high pressure to the lower pressure and the relative humidity drops in proportion.

Q. What happens in the bank?

A. The bank pressure, if it's dropped fast enough, would show a temperature drop. If it's adiabatic expansion, it can be calculated.

Q. That is true. But what will you have in the bank under those conditions; if I take saturated air, say, at 50° and I cool it to minus 50°, what do I have happen in the bank?

A. Well, if you cool it that much, the moisture would freeze up.

Q. I'd have rain all over the place; is that correct?

A. Yes.

Q. It would be going right through the air lines to the valves; would it not?

A. Yes, if it cooled that much.

Q. Just offhand, do you think if you had a straight blow for b(1)
you would get to those temperatures?
A. I don't think so.

Q. Adiabatic would give you temperatures of that order of magnitude?
A. I haven't calculated this.

Q. Why, in most of your calculations, with respect to air blow capacity, have you also used isothermal expansion?
A. You mean, prior to the work we are doing now?

Q. Yes.
A. Well, prior to the work we are doing now, the blow rate was so slow it was felt that there would be heat exchange between the sea and the valves.

Q. Do you think that now?
A. There still is heat exchange, but the question you are asking is: How much? and I'm really not prepared to state.

Q. Well, an engineering problem of any kind is difficult to get answers of in a transient status. Don't you predict the most pessimistic on one side, which would perhaps be an adiabatic expansion; and the most optimistic on the other, with respect to an isothermal expansion, and come to a compromise that the real answer is some place between the two?
A. Yes, sir, this is being done.

Q. Is it being done in retrospect, or is it being done in, say, prospect view?
A. Our studies have been going over the past year have attempted to define a problem more exactly.

Q. Did you have any thoughts in your mind with respect to the departure of THRESHER on 9 April, with respect to that report, to flooding rates, and to what information the Commanding Officer had in his mitts when he was taking that ship to sea?
A. There was certainly personal fault finding. The question was at the time--each point that we reached indicated that we had information to give out, but questions were raised, for instance, on the degree of accuracy--what is this temperature? Okay, so we sent it back for another computer run to find out. Time marches on. We're fighting Polaris priority for this type of thing. We were trying to get this information out, and it didn't get out in time. Whether it would have had an effect on what happened, I don't know. The point is, today we are not finished with what we would like to get on the 593.

Q. Having been in the Polaris program, myself, Mr. (b)(6) I know that the Polaris program doesn't have any monopoly on brains, because I know most of the people in it; but it doesn't give everybody else the license not to think.
A. No, sir, the thought was going on; I was talking about competition for the computer times.

Q. One other question. Have you investigated the advisability of dehydrators, and using some system very similar to our Polaris air systems, in the THRESHER class submarine?

A. Well, the installation of dehydrators, of course, is in the design. The idea of recirculation, of flushing the flask out, was not looked at actively before this incident, but it has been.

Q. Do you have any indication that the dehydrators in the Polaris ships are doing what they are intended to do, and would they have been any help in this case?

A. They would, certainly--well, the indications are that the dehydrators do work, and the indications are that some don't; but a dehydrator, if it were working, and there were lots of reports that it should, on aircraft carriers and on submarines, but it would certainly decrease the frequencies with which the crew would have to go to these vents and purge these systems.

Q. I've had many complaints from my auxiliary men with respect to dehydrators on the ship, and I had enough resistance to resist the ability not to use them. Do you think they ought to be installed in the ships?

A. I think so, definitely.

Q. With respect to air drains on the bottles from a standpoint of draining the air bottles down with water in them, where do you think you would drain them?

A. You are referring to the low location of the ship, or the point of take-off from the bottles?

Q. If I departed on a sixty day patrol, how would I drain them down?

A. Well, I can speak more familiarly with new design.

Q. I'm not talking about new design; I'm talking about the ones that were in the THRESHER.

A. These valves should have been accessible. I don't know where they were.

Questions by RADM DASPIT:

Q. Was there any Bureau instructions as to how often an air flask should be drained down as a routine matter; drained of water, that is?

A. I'm sorry, sir. I can't answer that.

Questions by the President:

Q. Mr. (b)(6), how many people in the Bureau of Ships address themselves to the problem of high pressure air systems in submarines?

A. Well, Admiral, there are very few people who address themselves to that problem, as their sole problem.

Q. Are you one of the people that are particularly assigned in this area?

A. No, sir. I am the submarine project coordinator. My familiarity with this problem is matching the sea system and the other things to the blow rate of the ship. We have, in the Design Division, now, three people who you can say are working more or less continuously on this problem. If you include our computer people, this is five that are working on this problem continuously. This does not include the technical code in the piping section who, of course, are working on hardware aspects, and it does not include people working at EB on our computer programs up there.

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

Q. So you have five people in the design and computer area who are associated with the problem that we have been discussing and similar problems on other ships?
A. Well, I would say these five people are working in this particular area at this time; they are not working on similar problems, Admiral.

Q. In other words, working on the THRESHER problem?
A. No, sir - on a submarine problem.

Q. On a submarine high-pressure air blowing system and storage capacity, as it were?
A. Yes, sir. We have, of course, solicited help from the yards in supplying us with the actual piping data. This is coming in. This requires a survey of all the working plants, and we will go through the systems piece by piece. Also there has been a Commander who is assigned to this task at BUSHIPS as his sole duty to ride herd on it until a solution is found.

Questions by a court member, CAPT Osborn:

Q. In retrospect, and I know you've been asking a lot of people about this problem in terms of what the operators, say, in the Washington, D. C. area, what's been your general opinion of the answers you've been receiving from these people? Have they been close to the ball park, fairly informed, or have a complete misunderstanding of the problem?
A. Well, our sampling, Captain, was so few that we probably arrived at extremes. For example, the 400-foot boat operators indicated alarm that anybody would initiate blow in that short amount of time. The other people indicated that it they know the flooding is serious, they would close every sea valve and blow as soon as they knew this, without hesitation. But by the same token, they implied they wouldn't feel they had to set special watches over valve control stations in that type of thing when going deep in the past.

Q. The most basic thing in this investigation has been the word "if": "If" a joint is made satisfactorily, it's a good joint; "if" you know what to do, then you can do it. How do you get rid of the "if" with respect to flooding casualties and what will you recommend in retrospect when you start on the basis of the studies you have seen?
A. Well, in our summary - and this was again not attempting to come out with any limitations on the ship - we merely point out that if you do not feel you can close a valve in 30 seconds, you had better operate at a certain depth or put a man by that valve. I think it is implicit.

Q. Were most of the people you talked to generally shocked at the lack of time you applied to this problem?
A. They had to be sold on its necessity. Let's put it that way. They were shocked at the size of hole which the ship could tolerate. They were perhaps shocked with the definition of serious flooding in connection with their experience.

Q. Have you found any operator who had the complete picture on this problem? What I mean, an operator and not a designer of the system, a guy who operates submarines.

PRESIDENT: May the court inquire who is an "operator"?

Unclassified

COURT MEMBER, CAPT OSBORN: A guy who has been on submarines and a guy whose primary duty is to serve on them.

A. I can't think of his name, but one officer was the ex-executive officer on the THRESHER. He seemed to have-- he was the one that listened to our 25th of April presentation. He seemed to have a good appreciation on it. Again, I think he was surprised at how serious a small leak was. As first presented, he seemed to be alarmed by the necessity of taking such rapid action.

Q. My general observation is that everyone would be an outstanding stud poker player if they could see the fifth card. I think that's the case here.
A. I see.

REDIRECT EXAMINATION

Questions by counsel for the court:

Q. Do you think that over a long period of time a dehydrator will prevent the air in the banks of a submarine from reaching saturation?
A. Not over a long period of time. It will build up at a slow rate.

Q. Must you not, then, handle the air system at all times as if it were saturated for air bank temperature?
A. This may be necessary. It depends upon the air usable out of the banks. If you are using enough to purge them, then you don't need this.

Q. Turning to a new subject, but in your field as Submarine Project Coordinator in Machinery Design: We have heard that provision was made for automatic shift from fast to slow operation on main coolant pumps in NAUTILUS. Why was this feature not incorporated into the design of THRESHER?
A. Well, my direct contact with that problem was not in my part of the job, but when I worked in 648, in the NAUTILUS and SEA WOLF, the trend at that time was toward a fully automatic plant. In fact, in the SEA WOLF we had a design laid out which called for push button starting, where the air reject would cut into the system. The design had reached the point where this was phased on paper, and we had a conference at E.B., at which time we received a telephone call from the Admiral, and that knocked out the trend towards automatic.

Q. When you say "E. B.", you are referring to the Electric Boat Division?
A. Yes, sir.

Q. From what Admiral was this telephone call received?
A. Can I take the Fifth on that? It was from Code 1500.

REEXAMINATION BY THE COURT

Question by court member, CAPT Osborn:

Q. Why don't you be more specific and say Admiral Rickover?
A. Well, as a matter of fact, I did not take the phone call personally.

Questions by a court member, RADM Daspit:

Unclassified

Q. Mr. (b) (6) , you mentioned the former executive officer of THRESHER in your testimony. There were two former executive officers of THRESHER. Would it help you to remember his name if I mentioned Lieutenant Commander Cowhill?
A. Yes, sir.

Q. Is that the one that you remember?
A. Yes, sir.

Questions by a court member, CAPT Osborn:

Q. There is one other thing I think is extremely important that I think we should get a fairly good handle on: the general idea when they were designing the reactor was to go to complete automatic systems. This was later discarded with respect to more hand operation, but automatic in some systems.
A. Right, sir.

Q. Now, I would like to ask this question: Do you think, in view of your studies in terms of valve closures, things of this type which require such fast reaction time, that we may be forced to automatic closure systems?
A. Yes, sir - closure and/or positioning to a partially closed position.

Neither 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 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.

Roger P. Dilts, 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. Dilts, this is a closed session of the court, and classified information can be given here.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address, and present occupation.
A. My name is Roger P. Dilts, (b) (6) . I am presently a Marine Engineer, tentatively assigned in the Bureau of Ships to the Emergency Machinery Design Division, and associated for the last eight years in the Power Piping Unit of the Machinery Design Division in the Bureau of Ships.

Q. Briefly describe your present duties in the Bureau of Ships?
A. Tentatively - and this is only a tentative assignment - but for the last

eight years I have been in charge of the fuel, lubricating oil, and water systems for all naval ships in the design area.

Q. Would you spell your name for the record, please?
A. D-I-L-T-S.

Q. Describe briefly your professional and educational background in your present line of work.
A. I had three years of junior college and industrial art school education, wherein I worked three years outside in the Marine field, and I went back to the Maritime Academy in Fort Schuyler, and spent two years in the Bearing Section in the Bureau of Ships, and transferred in 1956 to the Design Division.

Q. In 1957, in the Bureau of Ships, was a study conducted of the utilization of fresh water cooling of auxiliary systems in submarines?
A. Yes, sir, there was.

Q. Are you familiar with that study?
A. Yes, sir.

Q. Can you recount the significant features of that study for us now?
A. Yes, sir.

Q. Please do so.
A. At this time, in 1957, the study that was made of the intermediate fresh water system for the auxiliaries in the 593 was made by Code 431, not the code with which I am associated now. However, the man that made the study has since transferred, and I have been asked to give you a review of what was done at that time, which I will go into a little later on. This study was made based on a turbo-electric plant, not a turbine gear plant. This was at a time when we weren't sure of the power plant. The heating loads that we had to renew in the turbo-electric plant approximate the heating load that we have on the auxiliary systems of the 593. We estimated - and I'm speaking of the Design Division - that there would be b(3) 1 coolers of approximately b(3) 1 feet in length, b(3) 10 US feet in diameter, b(3) 10 U excuse me. I think I said b(3) 1 coolers. There are b(3) 10 coolers, b(3) 1 sea water pumps serving each heat exchanger, and b(3) 1 intermediate fresh water pumps. The sizes of the fresh water pumps were estimated at b(3) 10 U GPM. The size of the salt water pumps were b(3) 1 GPM.

Q. That's gallons per minute?
A. Gallons per minute, yes, sir. We made a switch of this in the machinery compartment, as it was known then, of the 593, wherein we laid out heat exchangers vertically. We placed the sea water pump and the fresh water pump between heat exchangers on the vertical foundation. This added eight feet in length to our machinery box. The urgency of an intermediate system wasn't known at that time. It was recommended by Code 430 to Code 425 that this not be installed, because of the additional expense involved in adding eight feet on to the machinery box. This, as far as I know, was the end of this study. What transpired from that time on, I don't know. This was signed out of Code 430 on April 15, 1957.

Q. Could you compare the advantages and the disadvantages of this system.
A. May I refresh my memory with some notes I have?

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Q. Yes, you may refresh your memory provided you testify from your own knowledge.

A. The intermediate system would minimize the high-pressure piping. We could eliminate secondary heat exchangers, such as reactor fresh water coolers, which I would like to say something about later on with respect to a study we are working on. Another advantage was the elimination of double tube sheets on secondary heat exchangers. The greater reliability of secondary heat exchangers, the greater the system. We could eliminate stand-bys to hydraulic coolers, and so forth. We could possibly eliminate pumps associated with secondary heat exchangers. We could ease the inspection requirements somewhat, b(3) 10 USC 130

and, of course, it would reduce deterioration because we would be using fresh water instead of salt water.

Q. Would it enhance the integrity of the ship?

A. Yes, it would.

Q. And the disadvantages?

A. The disadvantages, based on our study as to how we would operate at these temperatures, contacts we have made recently with vendors, and so forth, would require machinery to operate at slightly higher temperatures, perhaps 5 to 10 degrees higher in temperature. The total system weight increase, and we have comparisons at what depth the weight of a fresh water system would become more practicable then a salt water system. It would require more space and volume for the intermediate heat exchangers. There would be more power required because of the intermediate pumps. It would increase the number of stand-by pumps, and perhaps with minimizing the salt water side of the system, it would make it difficult for you to flexibly maintain the salt water pump unless we went from b(3) 10 USC 130 pumps. And then, of course, it would require continually topping off the system at the expansion tank. This is related both to the study that was made in 1957 and to another study which I would like to tell you about for your information that we have consummated in the last three months.

Q. Did you make another study in 1957 on the use of fresh water cooling in the main condensers?

A. Yes, sir, there was a brief study made in January of 1957 of utilizing fresh water systems. This was a proposed main turbine and condenser with separate SSTG sets in their respective condensers. At this time the combination of the condensers wasn't known, and we had envisioned a partial bulkhead immediately aft or forward of the machinery space wherein this would be a full-pressure bulkhead. We would put around the periphery two pressure hulls in which we had installed fresh water tubes to and from the condenser by intermediate fresh water pumps going through these tubes back to the condenser by b(1) a circulating pump to circulate water around the periphery of these two hulls. This was very inefficient. The estimated water flow was from 47,000-plus gallons of water per minute, which would roughly approximate the size of a carrier condenser circulating pump, and we felt it was too large, and with little experience b(1) this, too, was discontinued. Now, the Design Division - I did not personally do this - but the Design Division looked into a trunk alarm through the internal part of the ship back to the shell alarm and overboard. I didn't find any calculations supporting flow pressure drop, or what-have-you, in regard to this.

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Q. Will you tell us about the present study of the reactor fresh water coolers that you mentioned earlier?

A. Just briefly, gentlemen, and this is only as a matter of interest and is not relative to the 593, but we have recently made a study on the AGSS(N), the 2,000, 4000 and 6000 foot boats, wherein we have to be very cautious as far as resiliency is concerned. We have to cut weight to a minimum. We made a study of the ASW systems, using a basic 593 plan, with b(3) 10 USC 130 flow, b(1) b(1) , the cooling requirements of the reactor fresh water system, b(1) and we have concluded that this is very feasible, and the size of the heat exchangers which we had proposed would be approximately b(3) 10 US in length and b(3) 10 USC 13(in diameter, with heat exchanger set for b(3) 10 USC 13 load. We had b(3) sea water pumps of b(3) gallons per minute. This would cool all the heat exchangers, with the exception of the air conditioning condensers, existent on the 593, not like the usual systems which we have. We feel that-- I don't have any slides or anything like that with me, and I will have to testify from memory. On this system the pressure would go down-- There would be a slight rise in temperature of about b(3) 10 US degrees, but this would reduce the size or thickness of the tubes and allow for the elimination of tubes, and we actually save weight and volume. This curve here (indicating on a chart in his possession) is rather new. It hasn't been checked out yet. It shows that at approximately-- This curve indicates the reaction on the sea water system if we were to go down to b(3) 10 USC 13(We were interested primarily on the basis of this study in minimizing weight, and this is the point of the intersection that we found (indicating on chart). It is a rough estimation, but it is a good ball park figure to reflect that if we went above b(3) 10 USC we definitely should have an intermediate fresh water cooling system.

Q. Do you have any other information to give us with regard to those studies?

A. There have been some very minor studies made looking into other aspects. A Doctor Zino from Newport News, approximately three years ago, looked into the feasibility of putting a condenser outside the hull in the after plane and having an internal system, so to speak, but this was a very minor study. There have been still other studies involving wrapping tubes around the hull for cooling, but these have been very brief studies which have not been detailed.

EXAMINATION BY THE COURT

Questions by a court member, RADM Daspit:

Q. In regard to your study in April of 1957, I was a little confused as to the number of pumps you had. You said you had b(3) 1(coolers and b(3) 1(sea water pumps. Is that b(3) 1(pumps per cooler, or a total of b(3) 1(pumps.

A. That's a total of b(3) 1(sir. The reason we went to b(3) 1(as I said, the length was some b(3) 10 US and we were restricted to a 28-foot hull diameter in that area.

Q. So you had a total of b(3) 1(coolers, b(3) 1(salt water pumps and b(3) 1(fresh water pumps?

A. Yes, sir. In that regard, sir, I would like to say that the cooling load then was approximately b(3) 10 US BTU's per minute compared to our figure of b(3) 10 US BTU's per minute on the 593.

Questions by a court member, CAPT Hushing:

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Q. Has any investigation or inquiry been made into a low-pressure salt water system in which there is an energy let-down device connected directly to the inlet side of the salt water system? By this I mean a turbine which could be driven by the pressure of the water, drop down to some given operating pressure within the boat, and pump back up to go over the side with a convertor in the pump of some sort?

A. No, sir. We have talked to this casually, but there have been no studies made of this that I know of.

Questions by a court member, CAPT Osborn:

Q. My observation from a standpoint of cooling calculations from air-conditioning requirements, they are continuously under-estimated, sometimes by a factor of 300 per cent, and the condenser or cooling requirements are over-estimated by about the same requirement. Have you ever rationalized your actual computations with what is actually done on the ships at sea and whether the real design criteria we use are realistic in the areas of the world we are going to operate in?

A. Captain, Commander Jackson, who will follow me, I'm sure--and I may be speaking out of turn here, but I understand he was to be here and probably detail the condenser design. In the 1957 study of the fresh water system, we designed our heat exchangers for b(3) degrees, and that study was made in 1957. There was no compromise made for approximately 75 per cent power, which could be made with b(3) degrees on the main condensers and with no margin added for that, seeing that full power could be met with b(3) degree water. So this could have been reduced somewhat, but it wouldn't affect the over-all size.

Q. I realize these particular calculations are not something that are easy to make when you start to get into film coefficients that differ with each degree, but to me it would appear to be, from a standpoint of condenser volume and cooling volume, pretty much on the pessimistic side and a lot larger than we need on the ships under most operating conditions.

A. Captain, Mr. Garneau, I think will be in a better position to answer this question. However, I agree that there should be a standard design condition for all equipments on a submarine.

Neither 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 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.

Leo A. Garneau, 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. Garneau, this is a closed session of the court. Classified information can be divulged here.

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DIRECT EXAMINATION

Questions by counsel for the court:

Q. State your name, address, and present occupation.
A. My name is Leo A. Garneau. (b) (6) Presently employed by the Bureau of Ships.

Q. Would you describe, please, your title in the Bureau of Ships and the nature of the duties which you perform there?
A. My title in the Bureau of Ships is Supervising Marine Engineer, Bureau of Ships, Machinery Design Division, Power Piping Unit. My duties there are the preparation of contract designs for all types of ships, including submarines - specifically, detail specifications and contract guidance plans.

Q. Briefly outline your educational experience and your background for your present duties.
A. I was graduated from Marquette University in 1928. Insofar as my Government experience is concerned, I spent three and a half years at the Naval Torpedo Station in Newport, and seventeen years at the Boston Naval Shipyard. I have been with the Bureau of Ships for eight years.

Q. What were your responsibilities with respect to the design of THRESHER?
A. My responsibilities were to make the preliminary feasibility studies which were entered into a feasibility design report, which in turn ultimately was forwarded to the Portsmouth Naval Shipyard for preparation of the contract design on the SS(N)-593.

Q. How did the concept of THRESHER's auxiliary sea water system develop and what significant developments were included in the contract design?
A. The SS(N)-593 primary studies concerned increased depth and also one of the most important features was quiet operation. In this manner, it was necessary to reduce, for example, the noise of the circulating sea water pumps. As an example, this affected the main sea water circulating system and the auxiliary sea water systems. Basically, the systems in themselves on the SS(N)-593 original class are essentially four systems. They consist of what we call the after system, which serves the main machinery room and the auxiliary machinery room; the air conditioning system in the auxiliary room; the forward air conditioning system, which serves the high-pressure system; and an additional system forward, which serves the diesel engine. In going to do these plan studies, b(1)

b(3) 10 USC 130 pumps wasn't possible because of the size of the flexible joints that would have to be considered. b(3) 10 USC 130

b(3) 10 USC 130

so this was one of the decisions that led to placing these components, specifically the main air rejector SSTG air cooler and lube oil cooler, to the more constant pressure auxiliary seat water system. This was nothing novel, because the SS(N)-597, which was previous to this design, had this system. There was quite a lot of thought given to this, and there was a lot of support given to keeping the main sea water circulating system clean. In setting up the preliminary feasible studies, which ultimately entered into the preliminary design

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report, which went to Portsmouth originally, we considered a so-called single main, or "Christmas tree" system as we knew them in the older submarines. This package was delivered to Portsmouth for preparation of the contract design. This report included certain information on system components, such as increased submergance, preliminary information on hardware. Portsmouth prepared the plans for contract design which were returned to BUSHIPS for circulation and review. During the circulation of the contract design, because of the importance of some of the vital components placed in the auxiliary sea water system, comment was brought up that the single main was considered to be too vulnerable, and that for that reason, this led to utilizing b(3) 10 USC 130 loop. This loop was split up through the contract design, was so valved, so as to permit-- the system was primarily intended as a normally open system; this is, the entire loop was not intended to be segregated. The valve was intended to permit isolation of certain parts of the section in order to continue operation. One of the things that was quite important was to keep this plant going. This, of course, was intended to permit isolation of small leaks.

Q. What was the concept in the event of a major casualty?
A. I do not know that answer. It was not approached from that position so far as contract design was concerned.

Q. Was system operation, including the normal valve line-up, a part of the concept of contract design?
A. No, sir, it was not.

Q. What thought went into the employment of the system, the action to be taken with regard to the system in the event of a major casualty at any stage of the design?
A. I do not recall how this was handled at that time. We did not go beyond the system in the valving as it developed. We did not go into the situation of a major valve alignment.

EXAMINATION BY THE COURT

Questions by a court member, CAPT Osborn:

Q. Don't you think, Mr. Garneau, that when you put your basic outline system down involving cross connections, involving out-lets to the sea and a contractual design print, that the essential operating procedures are almost frozen at that time?
A. I do not know at this point; that is, our contract guidance plans are subject to development. For example, I might like to add, if I may, that up to this point, ASW, or auxiliary sea water systems up to the (b)(1) boats were normally locally operated. Subsequent to the contract design at that time did not include remote control for the ASW, sea chests, sea suction valves and overboard discharges. These were developed after release of the contract plans and specifications as developments. As the problems developed, these things entered the picture, sir.

Q. When the system was finally developed, was the concept of isolating the system loops from two stations - namely, one located in the AMS and one located in the engine room - reviewed by your shop and the disadvantages cited?
A. Not at that time, no, sir, it wasn't. It followed the practice of previous submarines, more or less.

Q. Has it been reviewed since that time?
A. It has, subsequent to contract design, yes, sir; after the technical control passed from the Design Division there was additional review by others, such as "tech" codes and type desk and the approval of the plans, but once the technical control passed from us, we do not get back into it very much more.

Q. I am interested in determining the responsibility from contract design to design agent to the actual operating instructions as they are used by the ship? Now, when you put out contract design prints from BUSHIPS, you more or less tie the Yard's hands on what they have with respect to the system.
A. These, sir, are guidance plans and represent a concept which does not limit the yard; this is, if they have something on which they can improve, this is permissible. Guidance plans, of course, are different from the contract plan. In some instances some plans in the contract stage do not permit any change except without proper authority. In the case of the sea water system, they are guidance plans, which is a method, but is subject to additional detailed changes.

Q. I noticed in one instance with respect to the ASW system, your contract design plan was not followed in that it indicates the elimination of bulkhead valves. Was this brought to your attention, and if so, what did you do about it?
A. I don't know, sir. I cannot answer that question. I don't know the answer. I never knew specifically at the time why the bulkhead valves were eliminated. This was done during the tank development and the subsequent tank working diagrams, sir.

PRESIDENT: The court will interrupt the testimony at this point. Mr. Garneau, you are warned, or requested, not to discuss your testimony in the interim during this short recess, and we will resume your testimony in just a little bit. There is an emergency call for a member of the court here.

The court recessed at 1545 hours, 7 May 1963.

The court opened at 1605 hours, 7 May 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 as reporter by (b) (6).

No witnesses not otherwise connected with the inquiry were present.

Leo A. Garneau, civilian, the witness under examination at the time the court recessed, resumed the stand as a witness, was reminded that the oath previously taken by him was still binding, and was examined as follows:

EXAMINATION BY THE COURT

Questions by a member, CAPT Osborn:

Q. Mr. Garneau, I'm trying to translate just exactly what you did with respect to Portsmouth after the contract design plans and essential laying down of the system was completed at BUSHIPS. Just what was your responsibility after that?
A. No responsibility after the signature of contract plans and specifications. The technical control then moved from the Machinery Design Division to the Type Desk.

Q. What do you think of the design of the ASW system?
A. Well it was certainly considered to be a more flexible system than the so-called Christmas Tree or single line system. It is possible that it needs certain additional valves, and by valves I do mean where it increases flexibility, hydraulically operated valves which would permit further segregation of the system. This would mean -- to permit further isolation. That is, you could split it and quarter it. This would be a chance to better control.

Q. Did you take a look at the system components which you are cooling and determine transit times, with respect to how long they could run without the ASW system in operation?
A. Not in detail, sir. We have discussed it, but not in great detail.

Q. Did anybody do this?
A. Not that I recall.

Q. How do you think it should be done?
A. I don't know.

Questions by a member, CAPT Hushing:

Q. Did you discuss the damage control features of the ASW system in the Machinery Design Division of the Bureau?
A. At the time, yes, sir. These things, in a preliminary way, do come up during the preparation of this. However, these designs are widely circulated around the Bureau for review and comment. These include Damage Control Section, Type Desk, Tech Codes, and so on.

Q. But when the Contract Guidance Plan leaves Code 430 in the Bureau of Ships, it is 430's responsibility to insure that the damage control aspects of the design are included and well known?

A. We do include, as a result of the -- to the best of our ability we do include and do rely on sections and Codes who have some of these responsibilites. These come back to the Design Division in the form of comments, and these comments are further resolved with the Codes. 638 might be an example; 648 is another one. They comment on these things, and sometimes it concerns the position of the valves for damage control reasons, but normally each of these comments are fully resolved and then applied to the plans, and then specifications and plans are critically reviewed and the specifications read line by line by many of these Tech Codes who are there to clear these points. So the opinions are not the opinions of any single man. They are detailed specifications -- are very closely reviewed.

Q. My question still applies relative to responsibility. Isn't it the responsibility of Code 430 to insure that there is a balanced design at the time of the completion of the Contract Guidance Plan?

A. My personal opinion is, I would say, yes it is, sir. Rather than not knowing, I would say yes to that.

Q. Is damage control a part of balanced design in an ASW system to your way of thinking?

A. I don't know, sir.

Q. How about the consideration of the consequences of various kinds of casualties; was this considered during the contract guidance design of THRESHER's ASW system?

A. We do run a preliminary design -- discuss these things -- in a way, to some degree, in our own opinion; however, as previously mentioned, some of this -- valving, for example -- we rely to a certain extent upon some of our Tech Codes and some of our Damage Control Codes to appraise some of these areas. We are not able to put our fingers on the exact valve. We start out and discuss and this is as far as we can generally go. The Contract Guidance Plans, as they are signed, are sometimes further changed. This appears to have been true in this case. Certain valving was changed, the reasons for which I don't know. So it does appear that during the development of design these things can be further changed. They can be improved, really, in the way of improvement.

Q. Let's talk for a few moments about Contract Plans?

A. Yes, sir.

Q. Do you know the purpose of Contract Plans?

A. A Contract Plan is a plan which, if the Bureau prepares a detailed design and there are some areas which it does not want to have changed -- in other words, they can only be changed by the design agent, by discussion with the Bureau, by letter of authority, or change order, it is firmed up.

Q. Are the Contract Plans the plans on which shipbuilders make bids for building the ship?

A. This is right, sir. Contract Plans -- may I include the term Contract Guidance?

Q. Yes.

A. Yes, sir, this is true.

Q. Is there any obligation on a shipbuilder to provide anything more than the Contract Plans and the Contract Guidance Plans required?
A. I don't know, sir. I do not know.

Q. If the ship is built in accordance with the Contract Plans and the Contract Guidance Plans, would you, in Code 430 of the Bureau of Ships, feel a responsibility for the ship as built?
A. No, sir, I would not.

Q. Why not?
A. Not on the Contract Guidance Plans, because the Contract Guidance Plans require additional development, detailing, and many times additional engineering work. The Guidance Plans in themselves are merely guidelines; they do not size; they do not give information on components. This is generally covered by the specifications. They are purely guidelines for guidance and for interpretation by reputable design agents who, when they bid on these things, for example, come back in the form of bidders' questions. Quite frequently they uncover some areas that are not too clear. These are further cleared.

Q. You feel no responsibility for the product of Code 430 of the Bureau of Ships as regards implementation of Contract Plans and Contract Guidance Plans?
A. We feel responsibility insofar as the -- yes -- I may correct that. I think we must say that there is a responsibility. We are responsible for the final -- what appears in the specifications as a result of circulation comment and review; and, insofar as guidance plans are concerned, we realize, of course, there are some areas that need additional looking. There is a responsibility. I wish to be corrected. There is a responsibility by 430.

Q. Have you reviewed the THRESHER plans, as built, against the Contract and Contract Guidance Plans?
A. No, sir.

Q. Why haven't you?
A. We have had occasion to, at various times, look at -- call for the working diagrams. We do not have those plans and sometimes some change order will come up which is initiated by the Tech Code and the Type Desk and these -- on change orders sometimes we have to get the working plan in the particular system. But normally the working plans are not approved by Code 430, because the technical control of the design has then passed on to the Technical Codes.

Q. I understand this very well, Mr. Garneau; but after the THRESHER was lost on April 10th, didn't you want to find out whether the ship's ASW system was built in accordance with the Contract Guidance Plans which you provided?
A. I, of course, naturally, was interested. But as I mentioned before, like the ASW system, we were aware that sometime back that developments had been made in the plans; in other words, certain valves had been added as a result of detailed design development which we did not get involved in. We did notice that -- for example, the ASW valves are now hydraulically controlled, as an example. But since our work does -- we are in their particular unit in the piping design, we do cover most of the new contract designs. And we do not specifically stay with submarines all the time -- I would like to mention this -- which probably does not give us a chance to follow -- to live with it too closely. Some of the areas, of course, do. Machinery Arrangements themselves, there are areas within 430 that are interested in submarines.

Q. Specifically, after April 10th, did you send for or attempt to obtain the working plans of the ASW system of the SSN-593?
A. No, sir, not beyond a training booklet which happened to be available from the Submarine Arrangement boys, which gave us a pretty good idea of how this system was set up.

Q. Did you prepare the training booklet for the Contract Guidance Plans?
A. Yes, sir.

Q. Do you think the ship, as evidenced by the booklet of plans, was as good as, or better than the Contract Guidance Plan; what was your opinion of the ship as built?
A. The elimination of certain valves, I was unable to -- for example, bulkhead valves had been removed. Another thing that I noticed, that the overboard discharge connections on the main loop was interconnected; whereas, when we went out on the Contract Guidance Plans they were not interlooped with the sea water system. These were things that I noticed.

Q. Were they improvements?
A. I would not say that they were improvements.

Q. Well were they disadvantageous from any standpoints?
A. Removal of the bulkhead valves might have been disadvantageous; however, these, at that time, were all manually controlled valves, and, in an emergency, hydraulically controlled valves would probably be more suitable. There have been more hydraulically controlled valves come out since the time of the 593. What I mean by that is, there seems to be some requirements sometimes for additional remote control valves, which we don't get into too much. I understand the Technical Codes have gotten into this more than we have.

Q. From your review of the booklet plans, would you say the ASW system as built was adequate for the purpose?
A. I am not familiar with all -- that is, the material status of the ship.

Q. From the design standpoint?
A. From the design standpoint. I do have some opinions on it; however --

Q. I'd like to have your opinions on it.
A. I would like at this time to come up with, certainly the materials used were adequate. The test pressures were adequate, the test pressures of the system. Barring a major catastrophe type of break in some component, the system appeared to be adequate. There was a problem of fabrication which others more qualified, I believe will probably cover this. I refer to the silver brazing and the welding. At the time -- I would like to mention that at the time of the 593 there was never -- that is, there was not the demarcation between welding and silver brazing up through that point. However, the yards, such as Portsmouth, I understand, and Electric Boat, had a more or less demarcation point. I'm not certain which one it was, but it was four inches for one and five inches for the other, something of this type. Certainly if the systems were -- the integrity of the systems from the standpoint of submergence pressures was certainly adequate. But in the event of a catastrophe type of break, this would be most difficult to appraise -- very difficult to appraise so far as any of our work was concerned, this would be most difficult for any one individual to appraise this fully. These are personal opinions. I mention them as they come to mind. This is probably all that I can add at this point.

Q. How long have you been with 430 in the Bureau of Ships?
A. Eight years, sir.

Q. During that time have there been adequate measures for information feedback on the adequacy of your designs to you?
A. Yes, Probably not as much as there should be. It is a big place. It's like the Navy Yards. Communication is not always good. But, if I may, since having been in Code 430 - I mention that we have gone through, to mention some of the submarines, 585, the 588, the 597, the 586, the 597, the 593, 608, 616, and so on and so forth. Not entirely. This has been experiencing all these submarines. So each submarine comes along there are always developments. So far as I can tell at the time of the 593, from looking back, we put in the best known -- the very best things went in, the very best hydraulic control valves went in at the time. There were some weaknesses, but this was brought out. Sea valves, new valves had to be brought out. Flexible connections were a special project by the components people. So that these projects have all been given a lot of thought, not only by our own Code, experienced people, but normally when we bring these in we try to have people who are experienced in this from some of the yards. I've worked with Portsmouth people; I've worked with Electric Boat people. We all have mutual respect for each other and whenever we turn out the detailed specs and plans they are the best thinking at that time. We have learned a few things, of course, with the episode of silver brazing. There are bad situations in the past couple of years. I would rather not talk on this because I believe there are other people more qualified who specialize in this area.

Q. When you say you've been through this list of ships that you have just enumerated, do you mean that you were involved in the design of them?
A. Very much on the order of the others, of course. These specifications and plans, sometimes the jobs are farmed out, but they always come in for review and comment, and normally, the areas of certain parts of the specifications, ultimately we resolve the final comments and coordinate them, and what is done in the specification is circulated through the Design Division, and this is true of all machinery and electrical.

Q. Have you visited any of these ships to see how these designs turned out in practice?
A. No, sir.

Q. Have you been visited by any of the people who have had to build them or operate them?
A. Not personally, no, sir. I can't say that. We do a bit on surface ships. But I can't say, other than some of the project officers that come into 43C, submarine officers, of course, normally surface experienced people.

Q. So then your total source of feedback information, I assume, is through correspondence and the officers who pass through the Bureau of Ships?
A. Past experience, and employees that we bring in on loan from these yards.

Q. Do you think this is adequate feedback information to insure that we have proper in-balance designs?
A. I could reasonably state that there would be some doubt, some good chance that this could be improved. There is always chance for improvement. Information feedback, communication, could be improved in a lot of our areas. It is very hard to communicate in many cases. I think this is an area that would certainly help tremendously.

Questions by the president, VADM Austin:

Q. Mr. Garneau, you, I believe, are Supervising Marine Engineer. What is your classification?
A. Supervising Marine Engineer, yes, sir, of the Power Piping Unit within the Machine Arrangement --

Q. Mr. Garneau, if you would just please try to answer the questions. I have noted in your answers to questions a great deal of indirectness. If you would please, if you do not understand the question, ask for clarification, but then try to address yourself to the question. When you have finished answering the questions I will give you an opportunity to say whatever you wish. But in the interim, please confine yourself to the questions. I asked the question, "What is your classification?".
A. Supervising Marine Engineer, GS-14.

Q. GS-14?
A. Yes.

Q. As a Supervising Marine Engineer in the Power Piping Unit, who is your immediate supervisor or superior?
A. My immediate superior, sir, is the Head of the Code, Code 430, Mr. George F. Fonger.

Q. Do you essentially coordinate the plans of your division or does Mr. Fonger have time to personally address himself to the plans of your particular power piping unit?
A. I didn't understand it too well.

Q. All right. Do you,more or less, do the final coordinating, or do you just prepare staff work for Mr. Fonger?
A. I do the coordinating, yes, sir.

Q. You are the coordinator?
A. That's right, sir.

Q. At your level you are the one who takes the various comments from the various Technical Codes and other Codes and grind out the final plan?
A. Yes, sir, this is right.

Q. Now in your testimony you indicated that your main concern was "to keep the plant going." As you designed this ASW system you were mainly concerned with "keeping the plant going." I believe I quote that correctly.
A. This is right, sir.

Q. Now at a later time you said that in retrospect you recognized that perhaps the ASW system needed certain additional valves in the case of THRESHER?
A. Yes, sir.

Q. You also, in answer to questions regarding your concern for damage control features, seemed a bit hazy about any responsibility resting with Code 430 for damage control feasibility of this system; and then later you indicated that you think that you had a responsibility for a balanced plan, which would include damage control feasibility. The word "responsibility" seems to be fairly lightly used here. You seem to depend, if I understood your answers correctly, mainly on

various Technical Codes in the Bureau to catch anything that might go wrong with the plans from a damage control viewpoint. Do you think that that is consistent with a proper appreciation for your responsibility?

A. Perhaps -- may I ask to have that question again, please? I didn't hear the last part of that, sir.

Q. Well it's simply this, Mr. Garneau. You have enumerated a number of ships, of submarines, for which you have been responsible for the ASW systems, and yet in this particular one you seem to have washed your hands of it as soon as you put out the Contract Guidance Plans. And if you do not concern yourself in a continuing way with the problem of how feasible these plans are from a damage control viewpoint, how are we to have much confidence in the Contract Plans permitting of proper damage control measures? That is my question.

A. Well I did not wish to minimize the responsiblity; however, the over-all responsibility for the work that leaves Code 430 is partially -- maybe I have used too broad a term on this insofar as I am concerned. While I am responsible at the head of this unit, I am responsible for conducting this work and assembling this work for the Head of our Section, who I mentioned a few minutes ago; and he, in turn, is responsible on up the line to the Head of Code 430, who is a military officer. So I may have misquoted the responsible area. It does not end where I am.

Q. Who is the military officer? Who heads Code 430.

A. May I give his name?

Q. Yes.

A. It is presently Captain Weisert, sir.

Q. How long has Captain Weisert been Head of Code 430?

A. About two -- a little better than two years, sir. I think he started in December.

Q. And you have been there eight years?

A. That's right, sir.

Q. Captain Weisert would normally lean fairly heavily, I would think, on a GS-14 who has been in the Code for eight years, would he not?

A. Yes, sir, I consider that to be true.

Q. Should he not be able to depend considerably on you to turn out for him a plan that is sound and majestic in consideration, all of the major things that should be considered about that plan, because the Contract Plans, as one of the other members of the board pointed out, sets the perimeters within which the ship is to be built? It's true there are detailed plans after that, but the Contract Plans really leave not too much latitude for changes, and every change is costly, is it not?

A. Yes, sir, that is right.

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.

Captain William Edward Weisert, 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 against self-incrimination, was duly sworn, and examined as follows:

COUNSEL FOR THE COURT: Captain Weisert, this is a closed session of the court. Classified information can be divulged.

DIRECT EXAMINATION

Questions by counsel for the court:

Q. Would you state your name, rank, organization and present duty station?
A. William Edward Weisert, Captain, United States Navy, Bureau of Ships, Head of Machinery Design Branch, Code 430.

Q. What are your duties at the Bureau of Ships?
A. I am responsible for the preparation of preliminary design, contract design plans for certain parts of the ships that we build.

Q. What is your naval and professional background, please?
A. I am a graduate of the Webb Institute of Naval Architecture. I also attended the Massachusetts Institute of Technology, taking a course in Naval Engineering. I've had duty twice before as Design Superintendent at the Philadelphia Naval Shipyard and San Francisco Naval Shipyard. I've had duty as Chief Engineer, Aircraft Carrier USS BENNINGTON (CVA-20).

Q. How long have you been in your present billet in the Bureau of Ships?
A. Since the 15th of December, 1960.

Q. How do you spell your last name, Captain?
A. W-E-I-S-E-R-T.

Q. You alluded to "certain parts of the ships that we build." Would you specify them?
A. In the case of non-nuclear ships, the Machinery Design Branch is responsible for the selection of the main propulsion machinery, all the piping attendant thereto, the air-conditioning system, the fire main, high pressure air systems, and in general the piping systems which were at one time known as the hull piping systems. In the case of nuclear submarines, generally -- rather, in the case of lead ships, prototypes, our field of operation is usually restricted to such areas as ventilation, air-conditioning, perhaps the evaporator plant; it seems to vary from ship to ship. There is usually a formal written agreement between our Code 400, Assistant Chief of the Bureau for Shipbuilding, and Admiral Rickover, Code 1500, as to which parts he will be responsible for and which parts we will be responsible for. This is very clearly laid out. Each of us has the opportunity to usually review the other's work.

Q. With particular reference to the sea water systems of submarines, are possible casualties, such as major flooding, considered in the development of Contract Guidance Plans?
A. Yes, they are.

Q. In this process do you consider valve line ups in different areas of operation in drawing up the Contract Guidance Plans?
A. Yes, we do.

Q. In the preparation of Contract Guidance Plans, are operative ability and reliability considered important elements of the system of design?
A. They are uppermost in our minds always.

Q. Are damage control features, including limitation of spread of damage and recovery of full operations, design considerations in your branch?
A. Yes, they are.

Q. How are such considerations incorporated in your Contract Guidance Plans?
A. After we have completed our preliminary design layout of the system, we attempt to envision different casualties that may be imposed on this system and how the system may be used to either isolate the casualty or in some manner permit the ship to operate, perhaps at a reduced rate, but nevertheless to give the ship some opportunity to overcome this casualty.

Q. How do you supervise the personnel in your Code to insure that such considerations are incorporated into Contract Guidance Plans?
A. For the most part this is done through the proper indoctrination and training of project coordinators. Within our Machinery Design Branch we have a number of officers and civilians who we feel are very competent people, who conduct a detailed review of all the plans and specifications that we assemble. These people try to envision different situations that the ship may be subjected to, and design a system so that it has enough flexibility that the ship should be able, having proper knowledge of the system, proper training, the ship should be able to handle the situation. There are some perhaps, that are beyond the limitation of the ship.

Unclassified

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

Q. Taking, for example--just as an example--Mr. Garneau in Code 430, how would supervision be employed to insure that damage control considerations, such as we have mentioned, are incorporated into the design of the sea water system for which he prepared the contract guidance plans?

A. Well, first, of course, he would review the work of his own people and discuss with them perhaps the limitations.

Q. I was referring to the review of the work of Mr. Garneau after he had done that?

A. His work would again be reviewed by his supervisor, who is the head of the Machinery Arrangements Section. At the same time, a very detailed review would be going on with the project coordinators that I have spoken of. The project coordinators are supposed to, and do, get very much into the details of each system that we design and attempt to tie together all the various systems that are eventually put together in Code 430. Our organization is along functional lines so that we find in some sections we will have perhaps sanitary system, and in another section fire main. People are in a sense working independently on these systems but tied together through the project coordinator.

Q. What sort of a person, what sort of background and rank would the person be who is project coordinator, involved in reviewing the contract guidance plans of an auxiliary sea water system for nuclear submarines of the THRESHER type?

A. We had such people as Mr. (b) (6) who testified here a little earlier, and we have had, I think, very competent submarine officers of the rank of Lieutenant Commander and Commander assigned to the machinery branch.

Q. Would you also review such contract plans?

A. Yes, I do. All the plans and the specifications that we prepare for all of our ships, I review enough to satisfy myself that my project coordinators have conducted a detailed review and understand the system.

EXAMINATION BY THE COURT

Questions by a court member, Captain Nash:

Q. Are you acquainted with the flooding and recovery study which Mr. (b) (6) conducted or which he presented to us?

A. Yes, sir, I am familiar with it, not quite in detail as much as Mr. (b) (6) , but I do know in general what the study consists of.

Q. On the basis of his study and the information determined therein, what would you estimate is the size of a leak at b(1) which might be disasterous to the submarine?

A. The study which he has presented to you envisioned a hole in the side of the ship, the hole being an orifice with a co-efficient discharge of about unity and this was about a perfect hole. This indicated that hole could not be any larger, as I recall, than one and a quarter inches. Now we do know that for every length of pipe, for every fitting that exists between the rupture and the sea chest in the ship that there is a pressure drop, and this may be quite considerable. So to answer your question precisely, we would have to know exactly where the hole is, in order to decide how big a hole at that spot the ship could safely survive.

Q. Could this be so located that a two-inch opening might be sufficient?
A. May I answer the question this way. We have computed that with an equivalent of piping on the order of a hundred feet--and in determining this equivalent you must consider the length that say an elbow is equivalent to in straight pipe--but an equivalent of a hundred feet would bring about a fifty per cent reduction in water flowing into the ship. Now, if you would assume the break to occur one hundred equivalent pipe lengths from the skin of the ship, then the size of the hole would be one and a quarter times the square root of 2, which as I recall would come out pretty close to two inches, perhaps a little bit less, but a lot depends on where the break is, the position of the valves, the restriction of the valves, and such things as this.

Q. Now can you answer the question yes or no?
A. No, I can't answer it yes or no because I don't know where the break is.

Q. Is this information known to the other members of the Code?
A. Yes, it is known to other members of the Code; it is not known by all members of the code.

Q. Do you think it would be of value to them?
A. Of course it would.

Questions by a court member, Captain Hushing?

Q. What analyses relative to THRESHER have you made since the THRESHER was lost on April 10th?
A. Analysis of what, sir?

Q. I am giving you a chance to say what you have done in reviewing the THRESHER situation.
A. We have reviewed the emergency recovery capabilities which Mr. (b) (6) has presented to you.

Q. Is that all? Have you reviewed, for example, the operational consideration inherent in the ASW system as it was designed?
A. Yes, we have. We've thought a lot about this.

Q. Well what are your opinions now as to its adequacy?
A. We felt the ASW system, the design concept was adequate. We did feel, however, in later ship designs, that perhaps we had a better arrangement.

Q. Do you want to describe that for us a bit?
A. I'm afraid I can't describe that to you in detail.

Q. How is the damage control aspect of a system such as ASW actually considered within Code 430--by conference?
A. Yes, it would be by conference, if you call a group of people talking about this thing a conference. It wouldn't be subjected to a formal conference but the project coordinator in conjunction with the people who are working on the system, would have a conference of the kind you would find in a drawing room with people leaning over a drawing board discussing various aspects of the system.

Q. Well one aspect of an ASW system, I believe, is the amount of heat to be removed in BTU's per minute, is it not?
A. That is correct, sir.

Q. Another aspect might be the maximum size of a particular component that would be utilizing water from an ASW system, wouldn't it?
A. Yes, it would, sir.

Q. Would consideration of damage control aspects be another consideration?
A. Yes, it would, sir.

Q. Is it a normal checkoff item within Code 430 before a design is finally approved?
A. It's a normal checkoff item; it isn't written into an instruction, or it isn't on a checkoff list which says this is one of the things that you should do, but it is inherent in our design procedure. It is part of our design procedure.

Q. Suppose the man in charge of the design forgets to check it to make sure that it is?
A. I think that the design is subject to--not only of course--not only is it subject to review within Code 430, as well as people without 430, but to answer your question, certainly in my review I would ask these questions to insure that these considerations had entered into the design of the system. Now, again I don't have a formal checkoff list because this, and many other things, are part of our review.

Q. That is why I am asking you--there are so many things--whether or not you have either a formal or informal checkoff list?
A. I don't have an informal checkoff list; I don't have a formal checkoff list. I believe these things are part of our design process. They are things which we normally take care of in the design of the ship.

Q. Do you keep design histories on projects such as this?
A. Yes, sir, we do.

Q. What do the design histories consist of?
A. The design history is a compilation of studies that we have made in connection with the design, decisions which we have made regarding sizes of components, conditions that are imposed on these components, and the arguments or decisions leading up to these decisions. I would say normally the design history deals with things that are not in our normal design process. They are, perhaps, different things that affect this design, not the many routine things that go into any design.

Q. In connection with development, do you have conferences with Bureau technical codes and other Bureau codes?
A. Yes, we do continuously. We have conferences with them and with the type desk.

Q. Do you keep conference reports or have conference reports made?
A. Yes, sir, we do. We don't have conference reports of all conferences because many of these we consider so informal that they are not necessary, but when important decisions are made, there are normally conference reports; the names of all those attending are appended to these conference reports.

Q. Do the results of the conferences and reports find their way into the design history?
A. No, sir, not all of them, but there is a file for each design with these kind of papers in it within Code 430, but they are not a part of what we call the formal design history.

Q. Has anyone in 430 reviewed this file and the design history on THRESHER since she was lost.
A. Yes, they have, sir.

Q. In this review were any opinions or ideas generated which might assist this court in determining the cause of the loss of THRESHER?
A. None that I know of, no, sir.

Questions by a court member, Captain Osborn:

Q. What would you consider a damage control study in your section anyway?
A. An assumption that perhaps a certain part of the line had parted and what could we do about it. Can it be by-passed?--Is it possible to secure whatever it is that's coming through this system?--Do we have a bulkhead stop valve to isolate this?--Do we have a hull valve that can isolate this?

Q. Is it more in a line of a degree of flexibility than it is control of damage?
A. Well the two would certainly be part of each other. Certainly, we'd want to design a system with enough flexibility to sustain damage and hope and know that you could continue the service.

Q. Let us assume that you had a comedown from engineering officer of the BENNINGTON, to engineering officer of the THRESHER; describe for me how you would line up the ASW system?
A. Would you repeat the question again, sir?--I don't think I can answer it.

Q. Let us come down from being engineering officer of the BENNINGTON and you are now engineering officer of the THRESHER, and departing on a deep dive 220 miles east of Boston; line up the ASW system the way you'd operate it.
A. I would probably--I don't think I can answer that, sir.

Q. Do you think that you can adequately consider damage control studies unless the fundamental premise, which you have based those studies on, is how the system is lined up?
A. No, you must consider this. This is why we have some such concept as split plants in our surface ships.

Q. I am not talking about surface ships now; I am talking about the THRESHER.
A. I realize that, sir.

Q. Do you have split plant concepts in terms of THRESHER?
A. As I recall, the ASW system is laid out so that it can be split. There are two valves at each end of the loop that can be secured, and the ASW system can be operated b(3) 10 USC 130

Q. Do you think an engineering officer not particularly schooled in salt water systems or having the benefit of a large design section to advise procedures, would be in as good a position to recommend procedures, based on the design assumptions, as you would?

A. We attempt to give our concept design, certainly in our piping manuals, to show that these valves can be secured and the system can be operated as a split plant.

Q. It has been practically a universal assumption by everyone asked the question in this courtroom, that the detailed objective of the system is to isolate the leak. How would you isolate a leak in this system--shut all the valves?

A. No, You can shut all the valves but--certainly this is one way. No, you'd have to find out first where the leak is.

Q. Having looked at those curves that Mr. (b) (6) showed you, does this ring a bell with you with respect to what you would do?

A. You don't have much time to consider which valves you're going to close; I realize that, sir. You don't have much time.

Q. Now in the design of your particular system, have you looked into the particular piece of machinery that you supply cooling water to, and looked at a system whereby you could secure all of the valves, and how much time you have to secure them before you run into a dangerous condition?

A. This study has been going on and is going on now.

Q. Had this study been going on before the THRESHER was lost?

A. I don't know to the same degree that it is going on now. I wasn't a party to that design.

Q. To any degree that you are familiar with?

A. I can't answer that, sir.

Q. What would be the limiting thing in your system, the limiting thing--not the limiting thing--the limiting piece of equipment in the loop that the ASW system, b(3) 10 USC 130 , supply?

A. The limiting size?

Q. No, the limiting piece of equipment that would cause you to have to restore cooling water the fastest?

A. In THRESHER, as I recall, we've tried in the main lube oil coolers as well as the main air ejectors into the ASW system. Certainly, if you had a leak, one thing you would want is the capability of going fast, if you could, and coming to the surface. How long you could operate without the main air ejector pulling air out of the condensers is something that we have conjectured. I don't know how long, because you soon lose vacuum, so that this part of the system, you'd probably have to activate very, very promptly, if you could.

Q. Very, very promptly--how promptly--seconds, minutes?

A. Well, I don't know, sir, how fast air leaks into the system and how long you could continue to operate a main condenser without an air ejector in operation.

Q. How long could you do it on the BENNINGTON?
A. I would say a matter of minutes. Now I can't tell you whether it is two minutes or ten minutes.

Q. "Minutes" is defined as something more than two for minutes.
A. Well we are on the same wire. I never tried to run the plant without the main air ejectors in operation. I don't have really a feel except an inherent thought that this would be a matter of minutes before we lost vacuum.

Q. Now, essentially, you people in the contractual design section, unless it's a matter of utmost urgency at the shipbuilders hands, from a standpoint of cost and money bids with respect to building the ship, and certainly with respect to the equipment you put in the contract design prints, the major portion of the operating procedures associated with that system--because it's equipment on which operating procedures are based upon--do you assume any responsibility for these?
A. Certainly we do. We do that, sir, and we also attempt to give the shipbuilder what we feel is as much flexibility as we can and still have the kind of a ship that we're looking for. We're trying to get the shipbuilder, the ship designers, the man who prepares the detailed design, to exercise his ingenuity and the ingenuity of the people that he has in order to improve this design.

Q. I'm interested if there has been any ingenuity displayed in the use of this system from cross-connection to split plant operation, and give me some specific examples of that in terms of THRESHER?
A. I'm not sure I understand your question, sir.

Q. We'll proceed in very slow speed. On the valve lineup of the system normally, the system is the loop, b(3) 10 USC 130 are cross-connected. Do you consider this good practice?
A. I believe I would operate it with a split loop and it can be operated with a split loop.

Q. Do you think it also has an option of cross-connection with the air conditioning system--would you cross-connect the air conditioning system?
A. I can't answer that, sir.

Q. Do you have the possibility of operating b(3) 10 USC 130 from the AMS or b(3) 10 USC 130 from the engine room--how would your valve lineup work with respect to those particular valves with respect to the discharge with respect to deep submergence?
A. b(3) 10 USC 13 are the pumps in the Auxiliary Machinery Space.

Q. AMS pumps b(3) 10 USC 130
A. They are the pumps in the Auxiliary Machinery Space?

Q. Yes.
A. b(3) 10 USC 130 are in the main propulsion.

Q. In the engine room.
A. As I recall the system is designed to operate on b(3) 10 pumps, can be operated with b(1) pumps to take the ship up to full power. The system can be split with b(3) 10 USC 130 the load being so distributed that b(3) 10 USC 13 will function properly.

Q. How would you operate it?
A. In this manner.

Q. Would you have the valves open in the AMS and valves open in the engine room?
A. Are you talking about the cross-connection valves?

Q. I am operating split plant, suction and discharge. I am operating split plant.
A. I'm not sure, sir.

Q. Now a particular minor detail of operating on three plants which you do at an b(3) degree temperature--something about as practical as something I can't imagine--you seem to be very familiar with, yet a detail of valve lineup with respect to maximizing damage control, you seem to be very, very hazy about. Can you explain this?
A. Yes. It's certainly lack of my detailed knowledge of this particular ship. As you know, sir--well, never mind that.

Q. Captain Weisert, I am not trying to give you trouble with respect to yourself. I am trying to save submarines and how do we save them; and I am not particularly happy that we lost one.
A. I don't think any of us are, sir.

Q. And I know that you're not either. I know that if we look hard enough, and we look at ourselves hard enough, some of the pictures that we see won't be as pleasant as we would like to see. We're trying to explore every possibility we can, and naturally our particular thoughts on the matter are a lot better in view of hindsight than they are in terms of foresight.

Questions by RADM Daspit:

Q. Captain Weisert, were you head of the Design Section 430 when the contract plans for the THRESHER were prepared and signed out?
A. No, sir.

Q. In some respects the ASW system is a big improvement in damage control. It has hydraulically controlled sea valves.
A. Yes, sir.

Q. However, it is such that if the b(3) 1 loops b(3) 10 USC 130 are connected and the valve was operated and you spring a leak in the engine room, people in the auxiliary machinery room must shut valves to control a leak in the engine room.
A. Yes, sir.

Q. This seems to be a weak point in the damage control. Has this been corrected in later ships or is it still being used?
A. Sir, in later designs we have adopted a header system where the b(3) 10 USC 130 pumps discharge into one--shall I call it a header--a pipe that runs longitudinally between the auxiliary machinery space and main propulsion space, and a bulkhead stop valve in this case so the two systems can be segregated.

Q. Is this a hand-operated bulkhead stop valve.
A. I don't know, sir.

Questions by court president:

Q. Captain Weisert, did your branch, in designing this ASW system, so concentrate your efforts on certain criteria that you might have been less familiar with other criterion than you might otherwise have been?

A. Sir, that's certainly a question which is very possible, yes, sir. At the time of the THRESHER, of course, the design of the THRESHER, we were concentrating on noise reduction, sir. We do attempt to keep all facets of design on an equal basis. I suppose it's--I can't speak for those who did it--but I do know now in progressing a design, certainly right at this particular time, damage control capabilities would be given a very strong upcheck. Perhaps this is a human failing but it is nevertheless something we are all guilty of.

Q. In your testimony you said "We" visualize various casualties; "We" have tried to provide a system that both has the flexibility and the safety features that are the happiest combination. The "we" there, I take it means all cognizant personnel in your branch who have to do with a particular plan?

A. Yes, sir.

Q. Well Garneau seems to depend largely on people outside of your branch to catch the damage control features of the ASW system. Could you explain this for us?

A. Was he referring to our damage control section, sir--Code 638?

Q. He mentioned 638 by number.

A. Yes, Yes, sir. Code 638 is--and I believe that is the correct number--is the Bureau code who technically, shall I say, is primarily responsible for damage control. But like many things we deal with, although there is a code who is primarily responsible, certainly all people that deal with these things have an input to them, and must consider them. Many times the technical codes are used in this manner--should we consider this kind of a casualty, or how many of this kind of casualties have we had in the past several years?--to try to stress the importance of them. And of course, as we continue producing designs and difficulties arise--sometimes those which we hadn't envisioned--these become a part of our catalog of things that we look for.

Q. How many officers do you have under you in your branch, Captain?

A. Admiral, this is a bad time to ask me. I only have two, sir.

Q. You and two others?

A. I have two officers, yes, sir.

Q. How many GS-14's do you have?

A. You want an exact figure, sir?

Q. Approximately.

A. Approximately,--about 16, sir.

Q. Do you have any civilian personnel senior to a GS-14?

A. Yes, sir.

Q. Could you tell us what their classifications are?
A. I have three GS-15's, sir, and one--the technical director--is designated by Public Law 313, sir.

Q. Does this constitute the bulk of your engineering talent available to assist you in your assigned tasks?
A. Sir, we also have a number of GS-13's, if you want to consider them. I do consider them as part of my engineering staff. We have a number of them that are very competent engineers.

Q. How many would you say, roughly?
A. Roughly about 30, sir.

Q. About thirty?
A. Yes, sir.

Q. But personnel below the GS-13 level you would not consider in the engineering category. They are more draftsmen and people of other--shall we say--capabilities than engineers?
A. Yes, sir. They are clerks, trainees, such people as that.

Q. Stenographers and clerks?
A. Yes, sir.

Q. Do you find that you are adequately staffed, personnel-wise in the engineering part of your branch?
A. Normally, I am, sir.

Q. Normally you are.
A. At this particular time, and this is perhaps a one or two month lull, I'm at a low in staff engineering and I believe this is a consequence of the manner in which people are being transferred. I expect additional officers this summer.

Q. Do you consider yourself and two officers adequate in officer complement for your branch to appropriately insure the professional naval flavor to the plans generated by your branch?
A. No, sir, and this is recognized. And as I said, sir, this will be corrected as soon as the transfer of officers is effected this coming summer.

Questions by a court member, Captain Osborn:

Q. How many officers are you getting this summer that are going to solve your problems?
A. I don't think I could have enough officers to solve all of my problems.

Q. That is exactly what I think.
A. But at least we are going to try to keep on top of our problems.

Q. How many, in number, is this summer deal going to be?
A. It is not going to be our full allowance but something short of this. I expect perhaps two more officers.

Neither counsel for the court, the court, nor counsel for RADM Palmer, a party, 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 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.

The court was cleared at 1730 hours, 7 May 1963.

The court opened at 1800 hours, 7 May 1963.

All persons connected with the inquiry who were present when the court was cleared were again present.

No person not otherwise connected with the inquiry was present.

PRESIDENT: We will adjourn until tomorrow morning at 8:30.

The court then adjourned at 1801 hours, 7 May 1963.