DEPARTMENT OF THE NAVY

UNITED STATES ATLANTIC FLEET
HEADQUARTERS OF THE COMMANDER IN CHIEF
NORFOLK, VIRGINIA 23511-6001

UNCLASSIFIED

5830
Ser N02L/C
24 APR 199

~~CONFIDENTIAL~~ (Unclassified upon removal of exhibits (19), (124), (129), (147), (168) and (170) to enclosure (1))

SECOND ENDORSEMENT on RADM W. Lewis Glenn, Jr. ltr of 7 Dec 90

From: Commander in Chief, U.S. Atlantic Fleet
To: Judge Advocate General (Code 33) (3)

Subj: COURT OF INQUIRY TO INQUIRE INTO THE IWO JIMA (LPH 2) ENGINEERING CASUALTY WHICH RESULTED IN TEN DEATHS ON 30 OCTOBER 1990

1. Forwarded.

2. The basic correspondence is a one-page letter with one enclosure. The enclosure is the Record of Proceedings of the Court of Inquiry; it includes a lengthy transcript and 195 exhibits. The first endorsement on the basic correspondence consists of nine pages and three enclosures. The pages of the first endorsement are hereby redesignated as pages two through ten, and enclosures (196), (197), and (198) are redesignated as enclosures (3), (4), and (5).

3. Exhibit (144) to enclosure (1) consists of two naval messages: USS IWO JIMA 301811Z Oct 90 and USS IWO JIMA 261752Z Sep 90. Both messages were classified when entered into evidence in these proceedings but are now declassified in accordance with the instructions of each, which provided for declassification on 30 November 1990.

4. The Judge Advocate General (Code 31) is requested to review the Record of Proceedings to examine the affirmative admiralty claims considerations of this incident in accordance with Chapter XII, JAGMAN.

5. Finding of Fact 393 is modified as follows. The current instruction which sets fleet policy on Quality Assurance is CINCLANTFLTINST 4355.1B. The instruction has been continuously in effect since 1 February 1983.

6.

BS

Subj: COURT OF INQUIRY TO INQUIRE INTO THE USS IWO JIMA (LPH 2) ENGINEERING CASUALTY WHICH RESULTED IN TEN DEATHS ON 30 OCTOBER 1990

BS

7. Finding of Fact 350 warrants comment. A system hydrostatic test verifies system integrity prior to return to operation following repairs or maintenance which breach system integrity. Failure to properly conduct a system hydrostatic test puts equipment and personnel at risk. Although the failure to utilize formal procedures to conduct the hydrostatic test did not directly contribute to the cause or severity of this casualty, the potential did exist and identifies the need for correction.

8.

BS

9.

10.

plants. Good engineering practice protects our people and ensures engineering readiness.

11.

OP.03 has good work in progress

B5

12.

13. Subject to the foregoing, the proceedings, findings of fact, opinions, and recommendations of the Court of Inquiry, as commented upon and supplemented by subsequent endorsement, are approved.

B-6

Copy to:
COMNAVSURFLANT
NAVSAFECEN
RADM Glenn

DEPARTMENT OF THE NAVY

COMMANDER NAVAL SURFACE FORCE
UNITED STATES ATLANTIC FLEET
NORFOLK, VIRGINIA 23511-5215

5830
Ser N003/C019
17 January 1991

CONFIDENTIAL -- Unclassified upon removal of enclosures (124), (129) and (144)

FIRST ENDORSEMENT on RADM W. Lewis Glenn, Jr. ltr of 7 Dec 90

From: Commander, Naval Surface Force, U.S. Atlantic Fleet
To: Judge Advocate General (33) (3)
Via: Commander in Chief, U.S. Atlantic Fleet

Subj: COURT OF INQUIRY TO INQUIRE INTO THE USS IWO JIMA (LPH 2) ENGINEERING CASUALTY WHICH RESULTED IN TEN DEATHS ON 30 OCTOBER 1990

Encl: (196) COMNAVSURFLANT NORFOLK VA 271900Z Dec 90
(197) COMNAVSURFLANTINST 5040.2C, Tab AL
(198)

B6

1. Forwarded.

2. During mid-October 1990, USS IWO JIMA was experiencing a number of difficulties with her engineering plant. To effect necessary repairs, a decision was made to send the ship to Bahrain where she could go pierside and shut down her boilers. Among the various pieces of equipment to be repaired were main steam valves 1MS-7 and 2MS-7, because steam leaked by one or both of them, thereby preventing two valve protection to be achieved. Two valve protection is required if routine maintenance is to be accomplished on either boiler if the other is lit off.

3. On 20 October 1990, USS IWO JIMA notified Ship Repair Unit Detachment Bahrain (SRU Det Bahrain) of the parts and repairs requested. SRU Det Bahrain in turn requested USS IWO JIMA provide technical documentation and parts status in order to determine necessary repair resources. USS IWO JIMA responded, identifying valves 1MS-7 and 2MS-7 as six inch globe valves, and provided additional repair detail. Based on this information, a surveyor from SRU Det Bahrain prepared work specifications for the valve repairs. The repair contract was awarded to Bahrain Shipbuilding and Engineering Company (BASREC).

4. On 28 October 1990, Mr. a civilian, non-English speaking worker employed by BASREC, arrived on board USS IWO JIMA and proceeded to disassemble valve 2MS-7 by removing all of the fasteners which held the valve bonnet to the main body of the valve. These fasteners consisted of steel studs and nuts.

B6

Subj: COURT OF INQUIRY TO INQUIRE INTO THE USS IWO JIMA (LPH 2) ENGINEERING CASUALTY WHICH RESULTED IN TEN DEATHS ON 30 OCTOBER 1990

USS IWO JIMA's Chief Engineer and B Division Leading Chief Petty Officer visually inspected the valve and, observing no steam cuts, cracks or other flaws, the Chief Engineer directed the valve to be reassembled.

5. Mr. [redacted] determined the fasteners which he had removed were in too poor condition to be reused. He approached an unidentified USS IWO JIMA crewmember in the fireroom and communicated to him that he needed new replacement fasteners. The crewmember led Mr. Patel to a parts bin in the fireroom from which Mr. Patel took four bolts, eight studs and 20 nuts and used them to reattach the valve bonnet to the valve main body. He told USS IWO JIMA personnel he had finished the job, and left the ship. No one from USS IWO JIMA, SRU Det Bahrain or BASREC properly inspected the valve after reassembly.

6. Fires were lighted in USS IWO JIMA's Number 1 and Number 2 boilers during the early morning hours of 30 October 1990. Sometime between 0630 and 0720, valve 2MS-7 was opened, permitting steam superheated in excess of 800° and at 600 psi pressure to pass through the valve and pressurize the valve bonnet. USS IWO JIMA was underway at 0756. At about 0812, the Boiler Technician of the Watch reported a steam leak behind Number 2 boiler. Almost immediately thereafter a loud boom was heard. The bonnet of valve 2MS-7 had literally blown off under the extreme pressure. Superheated steam flooded the fireroom. By midnight of 30 October 1990, ten USS IWO JIMA crewmembers who had been in the fireroom were dead from thermal injuries. One crewmember who had been in the fireroom's upper level, close to an exit, survived.

7. The Court of Inquiry left no doubt as to the direct cause of this tragedy. When Mr. [redacted] reached into the parts bin for replacement fasteners, he unwittingly selected a number of brass nuts, similar in outward appearance to steel nuts. Brass nuts lose their tensile strength at high temperature and as the superheated steam passed through the valve, it heated the brass nuts to the point where they failed. The high pressure steam blew the bonnet off the valve.

8. Valve 2MS-7 is part of the ship's main steam system, ergo the "MS" designation. Because of the high steam temperature and pressure, the main steam system of a ship is considered to be hazardous to personnel due to the remote possibility of catastrophic failure and at the same time is vital to the mission of the ship. It therefore carries what is known as the highest Level of Essentiality. The Level of Essentiality for production repair work and maintenance refers to the degree of regulation and control required to assure reliable repair and maintenance of the system. The Level of Essentiality is

categorized into four levels of control, the highest being Level I control. Level I control encompasses those systems in which maximum confidence is required in the reliability of repairs and maintenance. In the repair of Level I systems, the use of certified Level I Material is a requirement as specified in the Controlled Work Package. Identifying the appropriate level of control and ensuring all required control procedures are carried out constitutes Quality Assurance (QA). QA are those measures taken to provide a high degree of confidence that repair or maintenance actions are done properly and comply with established standards. The magnitude and complexity of QA procedures is a function of the Level of Essentiality and can be extremely detailed or relatively simple. It is quite clear that Level I systems demand very precise QA.

9. A formalized QA program must not be viewed as a stand-alone entity. It is one part of an overall system of maintenance and repair management requiring the application of sound engineering practices, common sense and, on occasion, more precisely defined measures. Before any maintenance or repair action, sound engineering practices and common sense would dictate that all required or anticipated replacement parts, cleaning and lubricating fluids, and the like, be identified and obtained and that a person qualified to accomplish the maintenance or repair action be designated. If appropriate, a supervisor or inspector who can ensure the action has been properly accomplished would be assigned. On Level I systems, additional, precisely defined measures, such as use of a controlled work package, must also be followed. QA is defined as being a component of maintenance and repair management, in much the same way as in the Preventive Maintenance System (PMS).

10. The Court of Inquiry, in opinion 20, states, "...

B5

Concur with this opinion. The application of sound engineering practices and common sense, fundamental to effective maintenance and repair management, should have alerted the Commanding Officer and Engineer Officer that a very important and uncommon foreign shipyard repair effort was going to take place. Components of a Level I main steam system were going to be disassembled and worked on by foreign contract personnel. They were not part of a U.S. Intermediate Maintenance Activity (IMA) or a Tender Fly Away Team, and therefore not bound by the same QA requirements and potentially did not possess the same level of training or experience. They were foreign workers opening up the main steam system.

11. COMSERVFORSIXTHFLT Instruction 4700.2B alerts commanding officers that a foreign contractor will very likely not be familiar with the particular make or model of the equipment he will be repairing on board U.S. ships. The following actions would have been appropriate:

a. The Commanding Officer and Engineer Officer of USS IWO JIMA should have directed closer oversight of the repair effort, regardless of who they believed had QA responsibility;

b. The Engineer Officer should have read the specification shown to him by the SRU Det Bahrain surveyor;

c. After the Engineer Officer and BTC examined the disassembled valve, it should not have been reassembled without first repacking it and replacing the gasket;

d. Mr. should not have been allowed to obtain fasteners from within the fireroom;

e. The Engineer Officer should have personally witnessed the hydrostatic and operational pressure tests on valve 2MS-7.

The USS IWO JIMA Engineering Department Organization and Regulations Manual (EDORM) requires him to witness quality control tests, as appropriate, to assure correct work completion. It was definitely appropriate for him to do so in the case of a main steam valve. Had he witnessed the tests, he would have seen that the valve had been prematurely lagged and would have required the lagging to be removed. He might then have noticed the improper combination of studs and bolts connecting the bonnet to the valve, and the brass nuts might have been discovered, although the probability is remote under that scenario. A weeping valve bonnet when subjected to operating pressure (water test) may have alerted him to look further into the repair action.

12. Having stated that the application of sound engineering practices and common sense should have prevented this accident; the deficiencies in QA aboard USS IWO JIMA require examination. While no program involving human discretion is perfect, an effective QA program would have been the best guarantor against error:

a. All ships in SURFLANT are directed to implement a QA program to meet requirements set forth in the COMNAVSURFLANT QA Manual. Training in the QA program afloat is mandated, as are internal and external QA audits. All work requests requiring Level I controls must be properly identified and applicable supporting documentation provided to the maintenance or repair activity.

B-6

b. Current training associated with QA centers on material presented at Surface Warfare Officer School (SWOS) and at the Senior Officer Ship Material Readiness Course (SOSMRC) highlighting the QA requirements for Level I systems. The guidance and training needed to establish an effective QA program on board USS IWO JIMA were provided to the Commanding Officer. Responsibility for failing to implement the Type Commander's QA program in meaningful fashion devolves to him.

c. The Engineer Officer had enough experience to properly cope with the disassembly, inspection, repair, reassembly, and testing of valve 2MS-7. It is also clear that he did not attend SWOS Department Head Training or SOSMRC. In that regard, a thorough review of NMPC assignment policies that permit Limited Duty Officers to assume department head assignments without the formal training afforded Unrestricted Line Officers should be made. All department heads should be trained at SWOS. Chief Engineers of plants in big ships like LHA, LHD, LPH, LKA, and Tenders, should attend SOSMRC.

13. In response to the President of the Court of Inquiry's Executive Summary, and to better ascertain the true state of QA programs throughout SURFLANT, I directed a QA QUICKLOOK, and established a QA Evaluation Team. One hundred fifty-six ships responded to the QUICKLOOK message, enclosure (196), which requested information on their level of knowledge in QA, use of the COMNAVSURFLANT QA Manual, QA training and QA audits. The QA Evaluation Team inspected 16 ships in depth. The response from most ships was that the QA Manual is on board, and QA personnel are designated by letter or ship's notice, but that the requirements of the manual are not always being carried out in day to day maintenance and repair actions. In addition, routine training in QA is not always being accomplished, nor are all required audits. The QA Evaluation Team visits confirmed the results of the QUICKLOOK and also indicated that the deckplate level of knowledge of QA and sound maintenance practices is low, and that the supervisory level of knowledge of QA is likewise lower than it should be. The use of references and specifications to ensure correct materials are used in maintenance and repair is lacking, apparently due to a lack of training. The above information is counter to the fact that in over 100 ships' annual command inspections (administrative) not one discrepancy in QA was ever identified. There are exceptions. The gas turbine maintenance program, the PMS program and ordnance handling programs, all of which contain their own QA procedures, are being carried out effectively.

14. The President of the Court of Inquiry is correct in stating "the failure of USS IWO JIMA to maintain a viable QA program is a tragic example of a greater systemic QA deficiency extant in the non-nuclear Naval Surface Warfare community." This deficiency is

in the process of being corrected. The COMNAVSURFLANT QA Manual is being rewritten to simplify and clarify the ships force QA responsibilities, particularly when repair work is being accomplished on board by foreign contractors. A QA handbook is being prepared which will provide every sailor with an easy to read, pocket-size guide to QA. The QA checklist in the COMNAVSURFLANT Command Inspection Program is being rewritten to provide a more meaningful tool to assess the status of the QA program and the level of QA knowledge on each ship. Required QA audits are being emphasized and will be closely monitored.

15.

BS

16

17.

19.

B5

20.

21.

22.

23.

Subj: COURT OF INQUIRY TO INQUIRE INTO THE USS IWO JIMA (LPH 2) ENGINEERING CASUALTY WHICH RESULTED IN TEN DEATHS ON 30 OCTOBER 1990

a.

B5

CONFIDENTIAL UNCLASSIFIED

Subj: COURT OF INQUIRY TO INQUIRE INTO THE USS IWO JIMA (LPH 2) ENGINEERING CASUALTY WHICH RESULTED IN TEN DEATHS ON 30 OCTOBER 1990

27

B5

26.

29. Subject to the foregoing, the proceedings, findings, opinions and recommendations of the Court of Inquiry are approved.

J. S. DONNELL III

Copy to:
JAG (Advance)
NAVSAFECEN

UNCLASSIFIED

07 DEC 1990

From: Rear Admiral [redacted], Jr., U.S. Navy,
/1110
To: Commander Naval Surface Force United States Atlantic Fleet

Subj: COURT OF INQUIRY TO INQUIRE INTO THE USS IWO JIMA (LPH-2) ENGINEERING CASUALTY WHICH RESULTED IN TEN DEATHS ON 30 OCTOBER 1990; REPORT OF

Ref: (a) COMNAVSURFLANT ltr Ser. N003/12442 of 5 Nov 90

Encl: (1) Subject Record of Proceedings

1. As directed by reference (a), a Court of Inquiry was convened on 13 November 1990 and completed on 28 November 1990. The original record of proceedings and two complete copies are forwarded herewith as enclosure (1).

s attached as enclosure (2).

All B6

Executive Summary

This report of the Court of Inquiry is submitted in compliance with COMNAVSURFLANT letter serial N003/12442 of 5 November 1990, appointing a Court of Inquiry to inquire into the circumstances surrounding a fireroom engineering casualty and resulting deaths which occurred on board USS IWO JIMA (LPH-2) on 30 October 1990. The results of the Inquiry, distilled into findings of fact, opinions, and recommendations follow this summary. A sequence of events leading up to and immediately following the accident are listed in TAB A.

The cause of the casualty was a major steam leak resulting from the catastrophic failure of valve 2MS-7, a component of the main steam system of the propulsion plant of USS IWO JIMA, located immediately forward of the number 2 boiler in the fireroom. Failure of the fasteners holding together the bonnet and body of the valve caused the bonnet of the valve, which was subjected to steam pressure of 640 pounds per square inch, to blow away from the main body of the valve, releasing superheated steam at a temperature of 865 degrees fahrenheit into the fireroom, almost immediately engulfing the entire space in deadly steam. Five sailors managed to escape from the fireroom; however, four of those sailors succumbed to thermal injuries aboard the hospital ship USNS COMFORT (T-AH 20) several hours later. Only one sailor escaped injury. The remaining six sailors were overcome by the intense heat and succumbed to thermal injuries in the fireroom. Their delay or inability to exit the fireroom immediately upon the occurrence of the casualty may have been due to their attempts to shut down the steam plant in accordance with applicable casualty control procedures.

The catastrophic failure of valve 2MS-7 resulted from the use of brass nuts to fasten the valve bonnet to the main body of the valve following an inspection of the valve internals during an inport repair availability of the IWO JIMA in Bahrain from 25 - 30 October 1990. Inspection of the valve occurred because of the inability to achieve two-valve protection for the number 2 boiler and the desire to conduct maintenance of that boiler while the other boiler was on line. The inspection and reassembly of the valve was an "add on" to more pressing repair requirements for the IWO JIMA's propulsion plant. It was not a maintenance item that was required to be accomplished prior to the ship's early deployment as part of OPERATION DESERT SHIELD.

Brass nuts are inappropriate for application on any main steam system or components where temperatures greater than 400 degrees fahrenheit are experienced. Brass softens and loses its tensile strength at these temperatures, and, in this instance, the temperature of the superheated steam passing through valve 2MS-7 was approximately 865 degrees fahrenheit. The combination of high temperature and steam pressure approximating 640 psi caused the brass nuts to soften and the threads in the nuts to

give way, resulting in the bonnet violently separating from the main body of the valve.

The brass nuts used in the reassembly of valve 2MS-7 were installed by a pipefitter employed by Bahrain Shipbuilding and Engineering Company (BASREC), a local civilian contractor which had been engaged to conduct specified repairs aboard USS IWO JIMA during the inport availability in Bahrain. The pipefitter, contrary to the repair contract specifications for work on the valve, obtained the nuts, bolts, and studs used to reassemble the valve from a parts bin of spare nuts, bolts, and other fittings located in the fireroom aboard the ship. The nuts chosen and used by the pipefitter were not visibly distinguishable as brass, because the manufacturer had applied a black coating to the nuts, which gave them the appearance of ferrous metal. Although the pipefitter was experienced and knew that brass was not a proper fastener to use in such a high temperature application, he did not realize that the nuts were, in fact, brass. Likewise, neither the Navy Ship Repair Unit surveyor overseeing the work of the local contractor, nor ship's force supervisory personnel noted the use of brass nuts when they observed the valve following reassembly.

USS IWO JIMA's steam plant and propulsion system are some 28 years old, predating the more modern steam systems (1200 psi systems) for which high level quality control and assurance maintenance and repair procedures were developed. Nevertheless, the quality control and assurance procedures applicable to these newer systems also apply to repairs and maintenance of systems aboard Navy ships that employ temperatures 775 degrees fahrenheit or greater. These procedures, which were applicable to IWO JIMA, are known as "Level I" quality control and assurance procedures, and, had they been followed in the maintenance and reassembly of valve 2MS-7, this accident could have been avoided.

The opening, inspection, and reassembly of valve 2MS-7 according to proper Level I quality control procedures required close supervision of all aspects of the work on the valve, by the local contractor, the Navy Ship Repair Unit surveyor, and ship's force personnel. Furthermore, Level I quality assurance requirements demanded use of specified types of materials, tightly controlled and accountable from the manufacturer down to the ultimate user, as well as periodic inspection of the work on the valve at certain "checkpoints" throughout the work progress.

Failure to follow the applicable Level I procedures in this instance was the result of a combination of several factors. The Ship Repair Unit Detachment Bahrain, which was responsible for drafting the work specifications for the contract with the local contractor, and for supervising the work done, failed to recognize that the work to be accomplished on the valve required application of Level I quality assurance controls and procedures. This failure is partially attributable to the failure of the IWO JIMA'S ship's force to clearly identify valve 2MS-7 as a "Level

I" valve when submitting its work requirement to the SRU Detachment, resulting in the drafting of an inadequate work specification.

The failure also was partially attributable to assigning ship repair surveyors to prepare the repair specification who were unfamiliar with Navy shipboard steam systems, specifically with Level I requirements applicable to those systems. Assignment of these surveyors was also occasioned by the dramatic increase in the workload of the SRU Detachment Bahrain due to the rapid buildup of Navy forces in the area as a part of OPERATION DESERT SHIELD, commencing in August, 1990. Additionally, the failure of the local civilian contractor to adequately supervise the work of its employees and to ensure that the requirements of the work specifications contained in the work order were met were key factors contributing to the cause of this tragic accident. There is no evidence whatsoever, however, to suggest that intentional or criminal acts by any person, living or deceased, directly or indirectly caused this tragic accident.

The foregoing failures were an outgrowth of divergent interpretations of applicable Navy directives governing the quality assurance program by SRU Detachment Bahrain personnel and ship's force personnel. On the one hand, ship's force personnel were of the view that quality assurance responsibility lay primarily with the SRU Detachment and the local contractor as is the case with shoreside maintenance and repair activities in the United States (Shipyards, SIMAs, IMAs, & Tenders). Conversely, SRU Detachment personnel considered ship's force personnel primarily responsible for quality assurance, because the SRU Detachment was not considered by them to be a depot-level maintenance activity (voyage repair only). These divergent views led to several fatal "assumptions" concerning quality assurance responsibility, which ultimately resulted in inadequate quality assurance and control procedures being employed, as well as inadequate supervision of the work on the valve by SRU, local contractor, and ship's force personnel. Finally, the absence of an effective quality assurance program aboard USS IWO JIMA was a factor contributing to the accident notwithstanding the inadequacies of SRU Detachment Bahrain and the local contractor. Had IWO JIMA had an effective quality assurance program in effect, the BASREC pipefitter would not have been allowed to gather the inadequate fasteners from the parts bin, and reassembly of the valve would have been closely supervised by ship's force personnel.

The failure of USS IWO JIMA to maintain a viable quality assurance program is a tragic example of a greater systemic quality assurance deficiency extant in the non-nuclear Naval surface warfare community. The inquiry revealed that deficiencies exist in schooling, training, and NEC emphasis and direction on quality assurance, as opposed to that existing in the aviation and submarine communities. Skill schools, such as the Valve Maintenance "A" School, should include quality

assurance training. Intermediate Maintenance Activities (IMAs) should make meaningful quality assurance training readily available to afloat units so that all responsible shipboard personnel can attend. All NEC schools should include quality assurance training, rather than reserving such training for those personnel destined for IMAs. Finally, more attention needs to be focused on quality assurance training by the leadership of the surface warfare community.

The problem of brass fasteners being improperly used in high temperature applications is not new to the Navy. As early as 1977 the danger associated with use of black-coated brass nuts was disseminated to the fleet by the Naval Sea Systems Command. Subsequently, the Naval Ship's Technical Manual on Threaded Fasteners was amended to reflect the concerns over brass fasteners in general and the potentially catastrophic confusion due to the existence of black-coated brass nuts in the Navy supply system. Nevertheless, black coated brass nuts continue to be used in the Navy, and, as long as they are aboard ships, the potential exists for another tragedy such as that aboard USS IWO JIMA. Navy leadership should ensure that these type nuts are removed from the Navy's inventory entirely.

Although many deficiencies and negatives are detailed above, a number of positive aspects were also revealed by the Court of Inquiry. There were many acts of bravery and good judgment under extremely stressful and dangerous conditions. Concern for shipmates was a common thread present throughout the tragedy. Some individual acts of bravery and concern for fellow shipmates should be noted: Lieutenant , the Main Propulsion Assistant, waved BT1 away from valve 2MS-7 (an action which probably saved the life of BT1), and expressed continuing concern for personnel remaining in the fireroom notwithstanding his fatal injuries. BT1 took immediate action to secure the plant by closing the steam stops, an effort which probably prevented extensive damage to the boilers and to the propulsion system. The Machinist's Mate of the Watch, Chief Machinist's Mate performed a quick-thinking departure from standard casualty control procedures in order to draw steam away from the fireroom immediately upon the casualty. The Officer of the Deck, LTJG , and the Commanding Officer, CAPT prevented further damage to the ship and possibly additional personnel casualties by expertly slowing the ship and dropping anchor after propulsion and steering control were lost. The Engineer Officer, LCDR effectively and efficiently controlled the situation immediately following the casualty and conducted casualty control efforts in a thoroughly professional and caring manner. Finally, the investigative teamwork of MM3 ; and MM3 , who were the first personnel to enter the fireroom following the casualty and who endured intense residual heat and the trauma of finding dead shipmates, was professional in all respects. The medical care afforded the injured personnel was uniformly outstanding, from initial first aid rendered on the

all B6

mess decks, to preparation and triage in IWO JIMA's medical ward, to the care afforded aboard USNS COMFORT.

The Inquiry highlighted the professionalism and dedication demanded of Navy engineers, and the constant vigilance required of them under all circumstances. It is for the protection of our hard-working and dedicated individuals that the Navy has set in place strict engineering standards and procedures. Our managers and leaders must ensure that proper training and supervision of these personnel are conducted in regards to these standards and procedures. It is hoped that the recommendations contained in this report of the Court of Inquiry will enable the Navy leadership to better focus attention in these important areas, and so help ensure that an accident such as the one that occurred on board USS IWO JIMA on 30 October 1990 is not repeated.

SEQUENCE OF EVENTS

21 October 1990	-	CTG 150.6 decides to bring IWO JIMA to Bahrain on 25 October to effect emergent repairs on #1 Boiler Pilot Safety Valve and #2A Forced Draft Blower. 1MS-7 and 2MS-7 are added to work package.
24 October 1990	-	SRU Det, Bahrain indicates that 1MS-7 and 2MS-7 will be scoped upon arrival as part of IWO JIMA repair package.
25 October 1990	-	IWO JIMA arrives Bahrain. Met by SRU surveyor and NAVSEACENLANT Tech Rep.
28 October 1990		
0800	-	Commenced disassembly of 2MS-7
1602	-	Inspected 2MS-7. Valve in good condition. Disassembled 2MS-7 bypass and commenced relapping the bypass.
1900	-	Repairs to 2MS-7 bypass complete. Valve and bypass reassembled.
(various)	-	Attempts to Hydro #1 Boiler. (Evidence is conflicting concerning hydro of 2MS-7.)
29 October 1990	-	
0332	-	Hydro "sat" on #1 Boiler.
30 October 1990		
0218	-	Fires lighted on #1 Boiler.
0340	-	#1 Boiler on line.
0556	-	Fires lighted on #2 Boiler.
0600	-	Set Special Sea and Anchor Detail.
0630	-	Preps made #1 SSTG
0630-0720	-	(Time unclear) 2MS-7 opened.
0635	-	Opened #2 Boiler Main Steam Stop.
0647	-	Boilers in parallel.
0730	-	Rolled #1 SSTG.
0745 (approx)		Watch on #1 SSTG showed minor steam leak on MS-8 to B Division Officer who showed leak to MPA.
0750 (approx)		BT3 Casey noted smoldering lagging on 2MS-7. Suspected burning lagging paste. No steam noticed. Discussed with MM3 Dewhurst and BT2 Parker.
0754	-	Main Control reports ready to answer all bells.

0755 (approx)		MM3 relieved on #1 SSTG by MM3 , suffering effects of exertion in hot Fireroom, assumed duties on #2 SSTG in cooler Engineroom.
0756	-	Underway
0811	-	Main Control reports steam leak to Bridge and requests permission to secure #2 Boiler.
0812	-	Main Control reports major steam leak in Fireroom and requests General Quarters.
0812 (approx)		BT1 leaves fireroom through Ellison door to messdecks. (is uninjured.)
0813	-	Helm control is lost.
0813 (approx)		BT2 evacuates to messdecks via escape trunk and walks toward Medical.
	-	LT , EM3 and BTFA evacuate onto messdecks via normal access
0814	-	Helm control regained.
	-	Medical response team called to spaces above Engineroom. first aid administered.
0816	-	Dropped port anchor.
0817	-	Dropped starboard anchor.
0835 (Approx)		First two investigators enter Fireroom. Locate and identify 6 personnel showing no signs of life.
1037	-	Four critically injured personnel MEDIVAC'd to USNS COMFORT.
2330	-	Last survivor dies aboard USNS COMFORT.

all B6

Preliminary Statement

By appointing order serial N003/12442 dated 5 November 1990, Commander Naval Surface Force Atlantic Fleet convened a Court of Inquiry to inquire into all the facts and circumstances connected with the USS IWO JIMA (LPH-2) engineering casualty which resulted in ten deaths on 30 October 1990. The Court of Inquiry conducted a thorough investigation into all facts and circumstances surrounding the casualty, the damage resulting therefrom, and deaths of and injuries to naval personnel, performed the duties of an inquest, and, as appropriate, fixed responsibility for the incident. No opinion as to the line of duty and misconduct status of injured personnel is necessary, since there were no injured personnel requiring a detemination of line of duty/misconduct. Recommendations concerning disciplinary action, as appropriate, are included in the recommendations section of the report of the Court of Inquiry. All reasonably available evidence was collected and each directive of the appointing order has been met.

This investigation was conducted and prepared in contemplation of litigation and for the express purpose of assisting attorneys representing interests of the United States in this matter. The Force Judge Advocate, Naval Surface Force Atlantic Fleet should be contacted for direction and guidance as to those matters pertinent to anticipated litigation.

Members and counsel (Counsel and Assistant Counsel) for the Court of Inquiry were informally advised on 1 November 1990 that a Court of Inquiry would be convened by Commander, Naval Surface Force Atlantic Fleet to inquire into the circumstances surrounding a major steam leak and resulting casualties that occurred aboard USS IWO JIMA (LPH-2) on 30 October 1990. Following the signing of the Appointing Order on 5 November 1990, Counsel for the Court travelled from Newport, R. I. to Norfolk, Va. and conferred with the President of the Court on 6 November 1990. Assistant Counsel for the Court had been previously dispatched from Rota, Spain to Bahrain, arriving on 7 November 1990, where he met with staff members of RADM , preliminary inquiry team, obtained copies of the preliminary inquiry and supporting documentation, as well as several statements collected by agents of the Naval Investigative Service. Counsel for the Court departed for Bahrain on 6 November 1990, rendezvoused with court reporters from NLSO, Naples, in Naples, Italy on 7 November, and arrived in Bahrain in the early morning hours of 8 November 1990. Thursday and Friday, 8 & 9 November 1990, were devoted to reviewing the preliminary inquiry and NIS statements, determining recommended parties to the inquiry, securing billeting for members and counsel, and locating a suitable site for the Court of Inquiry hearings. By the time that the Court of Inquiry members arrived in Bahrain on the night of 9 November 1990, arrangements for billeting aboard

B6

USS IWO JIMA (LPH-2) had been accomplished, a location for the Court of Inquiry hearings had been identified, and recommendations for designation of parties had been prepared. The detailed court reporters had also volunteered to assist the Naval Investigative Service in transcribing statements taken by NIS agents as part of a separate, independent investigation. These statements proved to be invaluable to Counsel for the Court of Inquiry in identifying potential parties, other necessary witnesses, and the overall direction that the Court of Inquiry should take in its fact-finding efforts. NIS was also instrumental in obtaining and safe-guarding items of real evidence that were essential to a thorough investigation of the accident by the Court of Inquiry. Special Agents and cooperated fully with Counsel for the Court of Inquiry, provided absolutely invaluable information and assistance, and are to be highly commended.

Copies of the Preliminary Inquiry, NIS Statements, and supporting documentation were made available to the members of the Court of Inquiry on 10 November 1990, and to counsel for the parties on 11 November 1990. Provision of this material to the Court members was to allow the Court to gain an overview of the circumstances surrounding the accident, and to take advantage of their engineering expertise to assist Counsel in identifying witnesses and documents that should be considered by the Court during the formal fact-finding sessions. The Court members reviewed these materials between 10 - 13 November 1990, when the Court formally convened in open session. Court members also took informal tours of the engineering spaces on board USS IWO JIMA during this period. This unorthodox approach to preparations for the Court of Inquiry was adopted for two reasons: (1) The Court members are recognized experts in steam engineering systems; their advice and assistance in identifying witnesses, documentary evidence, and issues to be examined, was absolutely essential to Counsel for the Court to prepare for the orderly and thorough presentation of relevant evidence to the Court; and (2) Time constraints and an austere quasi-combat environment precluded Counsel for the Court from independently acquiring the necessary expertise, seeking out relevant evidence and witnesses, and preparing all the evidence and witnesses for presentation to the Court in the timeframe allotted for getting the Inquiry hearings underway.

As reflected in the record of proceedings, this approach generated extensive voir dire examination of the Court Members, resulting in challenges for cause of all the members. Although the challenges were not sustained, and it is abundantly clear from the record that the impartiality of the members was not affected by having reviewed this material prior its introduction into evidence, the approach adopted in this instance is not recommended for future Courts of Inquiry.

B-6

Technical expertise prior to and during the formal proceedings was provided to Counsel for the Court and counsel for the parties by CDR , USN, Staff, COMPHIBGRU TWO. Public Affairs advice and assistance was provided by LCDR , USN, Staff, CINCLANTFLT. Absolutely superb administrative and logistical support was graciously provided by the Administrative Support Unit, Bahrain, Commander, Naval Logistics Support Force, Central Command, and USS IWO JIMA (LPH-2).

Formal proceedings commenced at 1300, 13 November 1990 at Bahrain International School, consisting of sworn testimony, introduction of documentary and real evidence, and admission of sworn and unsworn statements. The Court, after hearing arguments of counsel, closed at 1011, 28 November 1990. Court deliberations on the findings of fact, opinions, and recommendations continued during the period 28 November - 7 December 1990, when the Court, with the assistance of Counsel, completed, signed, and authenticated this report.

Notwithstanding the fact that this Court of Inquiry was conducted in an austere, quasi-combat environment, no significant obstacles were encountered in the conduct of these proceedings. Cooperation and support by the Naval Investigative Service, Commander Amphibious Group TWO, Commander Logistics Support Force, Central Command, the Judge Advocate General of the Navy, Naval Legal Service Office, Naples, the Commanding Officer and crew of USS IWO JIMA (LPH-2), and the Bahrain International School, were outstanding in all respects throughout the preparations for, and the conduct of these proceedings.

The findings of fact are presented in this report in chronological order, starting with the repairs to valve 2MS-7, the testing of the valve, the steam leak casualty, casualty control and medical treatment, and the resultant damage to USS IWO JIMA. The findings of fact then address more general subjects of quality assurance and the respective responsibilities therefor by Navy commands, and civilian repair activities. There then follow sections addressing the opinions and recommendations of the Court of Inquiry.

FINDINGS OF FACT

The Court, after inquiring into all the facts and circumstances connected with the incident which occasioned the inquiry, and having considered the evidence, finds as follows: THAT:

B-6

2MS-7 REPAIR

1. Valve 2MS-7 is the root valve supplying main steam (600 psi, 865 degrees F) from Number 2 boiler to Number 1 Ship's Service Turbine Generator (SSTG) (Exhibits 84, 126).

2. Valve 2MS-7 was located behind Number 2 boiler, port side, Frame 75, immediately below the upper level deck plate. It is positioned between two steam lines with its bonnet positioned 90 degrees from the vertical and pointing to starboard, parallel to the back of Number 2 boiler (p 85, Exhibits 74, 121).

3. The 2MS-7 turbo stop valve was fitted with a bonnet drain. It had a dunce cap on its local handwheel to which a remote operating cable was attached that went to a remote operator on the upper level between the two boilers (p 159, Exhibit 126).

4. The installed 2MS-7 turbo stop valve was a 4 inch gate valve, rising stem, bolted bonnet, butt welded, carbon steel, manufacturer Crane (pp 77, 158, 927, 928, Exhibits 123, 125, 126).

5. There was confusion between the ship and SRU Detachment Bahrain as to what type of valve was installed as 2MS-7 (pp 537, 813, 912, Exhibit 19).

6. USS IWO JIMA was familiar with SRU Detachment Bahrain's capabilities since earlier in her deployment BASREC had accomplished some main condenser repairs (p 120).

7. USS IWO JIMA message 200538Z Oct 90 is CASREP 90133/Turbo Steam Stop NR 2 boiler. It lists an APL of 882046785 and references NAVSEA Technical Manual S9221-A7-MMO-010. The CASREP states, "....repair of 2MS-7 is crucial to ship's force ability to properly isolate NR 1 SSTG and provide for two valve protection when affecting repairs or conducting routine maintenance to the boiler...." AIG 71 and 438 are listed as action addressees (Echibit 19).

8. USS IWO JIMA message 200539Z Oct 90 is CASREP 90132/Turbo Steam Stop NR 1 boiler. The verbiage is the same as for CASREP 90133 (Exhibit 19).

9. SRU Det Bahrain message 210845Z Oct 90, in part, states, "CASREP 90133 requested SRU Det arrange for valve 2MS-7 repairs. SRU Det requires technical documentation and parts status prior to determining necessary repair resources...." (Exhibit 19).

10 CTG 150.6 (COMPHIBGRU TWO) message 211647Z Oct 90 addressed emergent repairs in case of USS IWO JIMA with CTF 150. This message in part states, "current material condition of USS IWO JIMA warrants immediate corrective action requiring cold iron plant condition in order to effect repairs. NR 1 boiler pilot safety valve (CASREP 90128) requires Fly Away Team (FAT) to reface drum flange. Unable to obtain two valve protection due to leak-by of valves (CASREP 90132 and 90133), thereby necessitating plant shut down. Repair at anchorage not prudent in view of casualty to one of two diesel generators (CASREP 90121). Additional casualty occurred during start up of forced draft blower for NR 2 boiler...." (Exhibit 19).

11. CTG 150.3 (COMLOGSUPFOR - ASU Bahrain) message 231224Z Oct 90 responds to COMPHIBGRU TWO request for repairs on USS IWO JIMA. It states in part, "....Tender FAT to reface drum flange.... Arrangements are being made with BASREC vice Tender FAT. Tech assist for FDB inspection/repair: SRU Det technicians to meet ship upon arrival....". There are no references made to the 2MS-7 valve in this message (Exhibit 19).

12. LCDR and Mr. were involved in SRU Detachment Bahrain decision to not use a Tender Fly Away Team (FAT) for repairs to the pilot valve flange on NR 1 boiler. This decision was based on a perceived urgency to complete USS IWO JIMA repairs to free up the power barge for use by USS LA SALLE during her PRAV 28 October 1990 (p 751).

13. USS IWO JIMA message 231430Z Oct 90 answers SRU Det Bahrain's request for 1MS-7/2MS-7 turbo stop valve information. This message states in part, "....1MS-7/2MS-7 turbo stop manufacture: Anchor. No APL support. Valve is six inch globe valve, rising stem, bolted bonnet, butt welded, carbon moly steel...." The message provides repair details, material support and schedule for other work requested (pp 921, 922, Exhibit 19).

14. SRU Det Bahrain message 240830Z Oct 90 states in part, "....SRU Det Bahrain will provide tech and contractor assistance to repair 2A FDB. In regards to repairs on 2MS-7 turbo steam stop, job will be scoped upon arrival.... SRU Det Bahrain surveyor, Mr. , will meet ship upon arrival...." (p 527, Exhibit 19).

15. USS IWO JIMA message 241048Z Oct 90 to CTG 150.3 (COMLOGSUPFOR) responds to his 231224Z Oct 90 message and discusses power and schedule requirements. This message states in part, "....in conjunction with repairs to four steam cut flanges/valves on NR 1 boiler, originator intends to conduct EDTA cleaning of same. Additionally, both turbo steam stops 1MS-7 and 2MS-7 require repairs. ....intend to maximize valve maintenance to correct a myriad of small packing and flexitallic leaks...." (Exhibit 19).

all B-6

16. The work specification for 2MS-7 repair was written against USS IWO JIMA CASREPs 90132/90133 by the SRU Detachment Bahrain surveyor, Mr. He had not been given a copy of the original CASREP messages which contained the APL and other technical document information (pp 507, 520, 754, 921, Exhibits 130, 145, 188).

17. The APL and technical document information contained in the CASREP for 2MS-7 could have been obtained by SRU Detachment Bahrain through phone/fax to SRU Naples or COMNAVSURFLANT (p 775).

18. Mr. informed his supervisor, Mr. , that he had never before written specifications for repair or replacement of valves (p 922).

19. The work specification written by Mr. was reviewed by his supervisor, Mr. Both individuals stated they were not aware that the valve was in a Level I system and subject to Level I repair controls (pp 507, 519, 520, 898, 921, Exhibit 188).

20. Mr. does not have Level I training in steam systems (Exhibit 188).

21. Mr. stated he was not familiar with the type of steam plant on USS IWO JIMA but is familiar with Level I control requirements (pp 508, 537, 540).

22. Mr. and Mr. thought they were repairing a Level III steam system valve. Neither could state what constitutes a Level III valve application (pp 886, 924).

23. Mr. assigned Mr. to write the USS IWO JIMA work specifications because he was the only surveyor available at the time (pp 515, 516, 921).

24. The writing of the USS IWO JIMA work specifications was complicated by the fact that the contract had to be awarded by noon Thursday, 25 October 1990, to avoid losing repair time over the Bahrainian weekend (Thursday/Friday) (pp 518, 519, 922, 926).

25. Because of time constraints in awarding a repair contract, Bahrain Shipbuilding and Engineering Company (BASREC) was sole sourced for repairs aboard the USS IWO JIMA (p 519, Exhibit 145).

26. The arrival conference for USS IWO JIMA took place on 25 October 1990. In attendance were LCDR (AOIC SRU Det Bahrain), Mr. (Surveyor SRU Det Bahrain), Mr. (NAVSEACENLANT), LCDR (NAVLOGSUPFOR Maintenance Officer), Engineer Officer (IWO JIMA), MPA (IWO JIMA), BTCM (NAVSEACENLANT) and BTC (IWO JIMA) (pp 752, 763, 922, 936).

all B6

27. During the USS IWO JIMA arrival conference, no mention of Level I requirements on any job under consideration was made. The forced draft blower repairs, boiler EDTA, drain valve repairs and time line for repairs were discussed (pp 752, 763, 922, Exhibit 188).

28. During the arrival conference, LCDR was informed by the Engineer Officer that the ship did not have replacement parts for the 2MS-7 valve (pp 756, 923).

29. There were no operational time constraints placed on the USS IWO JIMA to quickly complete repairs and return to sea. (pp 114, 152, 699, 810, 859).

30. At the arrival conference, ship's force was asked for additional technical documentation and material availability to support all work contracted (pp 812, 823, 925, 936, Exhibit 188).

31. According to Mr. , the USS IWO JIMA Engineer Officer was given copies of all four work specifications at the arrival conference (p 922, Exhibit 188).

32. According to the Engineer Officer, he did not receive copies of the work specifications during the arrival conference . He said he only glanced at them because he thought they were preliminary to a ship check being conducted (pp 812, 833, 853).

33. The work specification for the replacement of four - 1/2 inch socket welded globe valves on NR 1 boiler was designated as: Serial - BH-1409; Item - 001; Location - Number One Fireroom; Reference- NAVSEA Standard Item 009-12; GFM - Ship's force provide valves. Mr. wrote the work specification. No level of QA controls annotated (p 922, Exhibit 145).

34. The work specification for 1MS-7/2MS-7 valve repairs was designated as: Serial - BH-1409; Item - 002; Location - Number One Fireroom; Title - Globe and globe stop check valves, inplace repair; Identification - Quantity (2), 6 inch globe valves, rising stem, bolted bonnet, butt welded, carbon moly steel; Manufacturer: Anchor (p 922, Exhibits 130, 145).

35. The work specification for the assist on technical repairs of 2A forced draft blower was designated as: Serial - BH -1409; Item - 003; Location - Number Two Fireroom (in reality is in FDB Flats for Number One Fireroom); No GFM as support services only to be provided. Mr. wrote the work specification (p 922, Exhibit 145).

36. The work specification for pilot safety valve flange repair was designated as: Serial - BH-1409; Item - 004; Location - Number One Fireroom; Title - NR 1 boiler drum pilot safety valve repair; Reference - NAVSEA Standard Item 009-12; No GFM, no post

see 8b

repair testing required. Mr. wrote the work specification (p 922, Exhibit 145).

37. The USS IWO JIMA Engineer Officer was aware that 2MS-7 was a Level I valve by application, a Level III valve as designed, and that it would require Level I support if major repairs were required (p 833).

38. On 25 October 1990, following the arrival conference, Mr. accompanied ship's force in an inspection of the repair jobs. 2MS-7 was still hot and lagged which prevented visual determination of valve type (p 923, Exhibit 188).

39. On 26 October 1990, the USS IWO JIMA assigned surveyor (Mr.) was changed to Mr. by Mr. (pp 523, 700, 924, 925, Exhibits 175, 188).

40. Mr. turned over all documentation he had on the four work items to Mr. the afternoon of 26 October 1990. He also informed him of what work was in the contractor's yard and that the ship was assembling what repair parts/technical documentation they had for SRU use (pp 924, 925, 926, Exhibit 188).

41. The new SRU surveyor (Mr. stated that ship's force did not show him any technical documentation for contracted repairs after relieving Mr. p 930, Exhibit 175).

42. USS IWO JIMA had a complete set of NAVSEA Valve Maintenance Manuals (S9253-AD-MMM-010 to 140) available for reference in their technical library (pp 698, 810, Exhibit 151).

43. The COSAL listing under the APL for valve 2MS-7 itemizes only the gasket and packing material as supportable material (Exhibit 123).

44. As part of the turnover between Mr. and Mr. , the two surveyors toured all work sites in the fireroom of USS IWO JIMA (p 926).

45. Mr. does have knowledge of Level I systems and controls on diesel and oxygen generation systems but not on steam systems (p 925).

46. The SRU surveyor (Mr. was under the impression that ship's force was responsible for quality assurance of BASREC work (p 929).

47. LCDR as Assistant OIC testified that he was under pressure from NAVLOGSUPFOR and USS LA SALLE to free up the power barge prior to USS LA SALLE's PRAV (pp 751, 759).

ace B6

48. SRU Detachment Bahrain Supervisor Surveyor testified that he was under the impression that USS IWO JIMA repairs needed to be completed quickly for operational reasons (p 550).

49. The major job of concern by SRU Detachment Bahrain on USS IWO JIMA was the 2A forced draft blower repair. It had the longest repair requirements (pp 752, 760, 910).

50. At the time Mr. was assigned as USS IWO JIMA's surveyor, he was also providing oversite on several other ships' repairs (pp 524, 926).

51. The only written modification made to the original work specification (item 002) was the cancellation of 1MS-7 from the work item (Exhibit 146).

52. The 2MS-7 work specification did not list any references in support of the repair procedures. It stated that new fasteners were to be installed , and no government furnished material was to be provided (pp 522, 922, Exhibit 130).

53. Had the work specification, as written, been applicable to the type valve installed, then all check points and tests would be mandatory for completion (p 403).

54. Once valve 2MS-7 was determined to be a gate vice globe valve, the work specification should have been changed. Once work was started on 2MS-7 bypass valve, a work specification change should have been made. Once direction was given to reassemble 2MS-7 vice further repair checks, a work specification change should have been made (pp 412, 450, 531, 538, 539).

55. SRU Detachment Bahrain does have a generic gate valve repair and test work specification (non-Level I). It does not list references, does require liquid penetrant test, blue test, hydro leak test and ship's force to conduct operational test. The specification requires renewal of fasteners (Exhibit 137).

56. The SRU surveyor (Mr.) was aware that the 2MS-7 work specification required changing once the valve was found to be a gate vice globe valve. This was not done because of time constraints, and due to the fact that the valve was not repaired, merely reassembled (p 929).

57. LCDR provided a repair status brief of USS IWO JIMA to LCDR when he returned to Bahrain 27 October 1990. The major topic was problems with the forced draft blower job (pp 753, 911).

all B6

58. LCDR is familiar with Level I procedures and controls from experience as a 1200 psi Engineer and as a nuclear Machinist's Mate. He did not associate Level I requirements with the 2MS-7 repair and had not seen the 2MS-7 work specification (p 954).

59. The OIC, SRU Detachment Bahrain testified that he discussed the 2MS-7 valve with SRU Naples on 28 October 1990. At that time he concluded that it was a Level III valve installed in a Level I system (pp 886, 912).

60. Once LCDR reassumed his OIC duties, LCDR as NAVSEACENLANT Technical Coordinator shifted his attention to the USS IWO JIMA forced draft blower repairs (p 755).

61. SRU personnel involved in the generation of the 2MS-7 work specification and SRU/BASREC personnel involved in the actual work accomplishment testified that they did not equate main steam with Level I work (pp 412, 507, 519, 520, Exhibits 130, 145).

62. Ship's force was periodically monitoring the four BASREC work items (pp 949, 952, Exhibits 186, 187).

63. Amendment P00002 of the Master Agreement for Repair and Alteration of Vessels with BASREC (N68171-85-H-0031) requires at least one English speaking person on board the U.S. Navy vessel whenever work is being accomplished (Exhibit 140).

64. Mr. was BASREC's English speaking surpervisor assigned to work on the USS IWO JIMA (pp 452, 580, 939).

65. The pipefitter who worked 2MS-7 and its bypass was an Indian national who had 10 - 11 years of pipefitter experience, the last seven of which had been with BASREC Shipyard. His name was Atishbhai R. Patel (p 469).

66. Mr. identified the valve he disassembled/reassembled as 2MS-7 and the valve he repaired by lapping as the 2MS-7 bypass valve (p 470).

67. When Mr. was first shown the repair job on 2MS-7, he was with his foreman (Mr.), his supervisor (Mr.), and the SRU surveyor (Mr.) (pp 493, 927, Exhibit 175).

68. Mr. disassembled 2MS-7 by removing 12 studs and 24 nuts (3/4 inch diameter) from the body-to-bonnet seating area. These fasteners were difficult to remove due to corrosion (pp 167, 471).

69. When BASREC personnel worked on 2MS-7, the valve handwheel with dunce cap was still attached to the remote operating cable and the handwheel was physically off the valve stem (p 485).

all B-6

70. Mr. witnessed Mr. removing several nuts on 2MS-7 the morning of 28 October 1990 but was not present when the valve was pulled apart. He was also not present when 2MS-7 and its bypass were reassembled (p 582).

71. Mr. provided a second BASREC worker (Mr.), to assist Mr. in 2MS-7 disassembly (p 582).

72. The damaged studs and nuts were placed on top of the remote operator for 2MS-1 (pp 123, 167, 486, 861, Exhibit 121).

73. During BASREC's disassembly of 2MS-7 there were no ship's force personnel in attendance (p 471).

74. After Mr. removed the 2MS-7 bonnet assembly from the valve body, the gate was removed and shown to the Engineer Officer and SRU surveyor (Mr.) who were in the fireroom (pp 348, 471, 702, 814, 927, Exhibit 175).

75. Ship's force personnel (Engineer, BTC) visually inspected the gate and valve body seating surfaces. Based on conditions found, the Engineer Officer told the SRU surveyor to reassemble 2MS-7 and open the 2MS-7 bypass valve (pp 472, 473, 928, Exhibits 175, 186, 187).

76. During 2MS-7 disassembly and reassembly there were no liquid penetrant or blue checks accomplished on the seating surfaces (pp 472, 476, 928).

77. During the reassembly of 2MS-7 a new soft iron gasket was not installed. The old gasket was reused (it was imbedded in one side of the valve body-to-bonnet groove) (pp 493, 928, Exhibit 127).

78. When 2MS-7 was disassembled, the soft iron gasket should have been replaced (p 170, Exhibit 130).

79. During 2MS-7 disassembly, the BASREC workers did not remove the packing gland or stem from the valve bonnet (pp 98, 141, 162, 215, 485, 585).

80. During 2MS-7 reassembly no valve bonnet parts were replaced by BASREC (other than fasteners). The valve was not repacked and no inspection of bonnet parts was conducted (pp 98, 141, 485, 486, 488, 585).

81. BT1 , assisted Mr. in the 2MS-7 bypass valve disassembly (pp 348, 473, 928).

all B-b

82. BASREC personnel lapped the seating surface of 2MS-7 bypass to remove a steam cut (p 474).

83. A blue check of the 2MS-7 bypass valve seat was accomplished by BASREC personnel and checked by BT2 Vantine prior to the valve reassembly. The SRU surveyor did not witness the blue check (pp 475, 1100).

84. The reassembly of the 2MS-7 bypass valve was accomplished by BASREC personnel using the studs and nuts originally removed (pp 349, 482).

85. Because the fasteners removed from 2MS-7 were not considered reusable by Mr. , he asked an unidentified enlisted man on USS IWO JIMA if he had replacement fasteners. Note - English was not used during request (pp 477, 487, Exhibit 175).

86. The USS IWO JIMA sailor took Mr. to the spare parts (nuts/bolts/studs) bin located on the second level of the fireroom and told him to select replacements from the bin (p 477).

87. No instruction was provided to ship's force fireroom personnel concerning limitations on the use of material taken from the spare parts bin (pp 984).

88. Mr. selected 4 bolts, 8 studs and 20 nuts from the fireroom parts bin as replacement fasteners. Neither ship's force nor the SRU surveyor were present during the actual selection. (pp 160, 477, 479, 488, 489, 492).

89. It is not good engineering practice to mix studs and bolts in the reassembly of a main steam valve (pp 159, 587, 588, 602, 639, 856).

90. Valve 2MS-7 was reassembled in such a manner that at least one brass nut was attached to each stud or bolt on the body-to-bonnet assembly (p 160, Exhibits, 85, 86, 88-96, 98-101, 126, 193).

91. The mechanical failure of 2MS-7 was caused by the use of brass nuts in reassembly (pp 122, 163, Exhibits 85, 86, 88-96, 98-101, 126, 186, 193, 957).

92. Mr. identified Exhibit 100 (bolt from bonnet) and Exhibit 89 (stud from bonnet) as similar to the studs and bolts he removed from the fireroom parts bin to reassemble 2MS-7 (p 487).

93. Mr. thought the nuts/bolts/studs he selected were of mild steel based on his experience as a pipefitter. No testing

ald

B-6

(filing, magnet) was used to verify metal content (pp 478, 484, 489).

94. The correct material fasteners for the reassembly of 2MS-7 should be B-16 studs and grade 4 nuts, which meet Level I requirements (pp 159, 169, 193, Exhibits 80, 131, 136).

95. Appropriate fastener materials for use on 2MS-7 can be identified by consulting technical documents available on board USS IWO JIMA and at SRU Detachment Bahrain (Exhibits 80, 81, 135, 136, 163).

96. Mr. 's foreman ( ) did not inform him that any parts were to be provided by BASREC (pp 481, 489).

97. Mr. . knew that 2MS-7 was installed in a high pressure steam system and that it required steel fasteners. He did not know what Level I meant as applied to USS IWO JIMA's main steam system (p 478).

98. Mr. knew that brass fasteners should not be used in a high pressure steam system (p 484).

99. Brass fasteners are unacceptable for use on high temperature steam systems. Brass has a maximum temperature limitation of 400 degrees F, after which tensile strength is lost (pp 161, 188, 332, 589, 769, Exhibits 126, 135).

100. Mr. did not have a copy of the SRU work specification for the repair of 2MS-7. His supervisor, Mr. did have a copy (pp 479, 581, 591).

101. Mr. , with his BASREC co-worker, reassembled 2MS-7 with the fasteners he had selected from the fireroom parts bin. Ship's force did not assist in the reassembly (pp 478, 479).

102. After 2MS-7 was reassembled, including the attachment of the remote operator, Mr. contacted ship's force, the SRU surveyor and Mr. (all present by switchboard in fireroom) to inspect the valve (p 480).

103. When Mr. finished the reassembly of 2MS-7, the valve was left in the open position. Position of the 2MS-7 bypass valve was unknown (p 496).

104. Mr. was told by the BASREC employees Patel/Sirfras, that they had obtained the replacement 2MS-7 fasteners from the ship. He did not personally check the fasteners for applicability (p 583).

all B-6

105. The SRU surveyor (Mr.) stated in his unsworn statement that he did not find out that the contractor had obtained 2MS-7 replacement fasteners from the ship until after the accident. This statement is contrary to his NIS statement which stated he knew about the fasteners before the accident (p 930, Exhibit 175).

106. The SRU surveyor (Mr.) and an unidentified ship's force khaki went behind Number 2 boiler to inspect 2MS-7 and its bypass. The visual inspection was satisfactory since Mr. and his assistant were told they could leave (pp 484, 492, 493).

107. Following the report by BTC that 2MS-7 was reassembled, the Engineer Officer went behind the boiler and looked in the direction of the valve. It appeared intact, and he did not make a close inspection (p 815).

108. On the evening of 28 October 1990, the SRU surveyor (Mr.) informed AIRMAC lagging personnel that they could lag 2MS-7. The lagging took place on 29 October 1990 (pp 355, 605, 928, 948, Exhibit 175).

109. During Mr. examination of Exhibit 97 (a sampling of nuts from the USS IWO JIMA fireroom parts bin), he identified the silver nuts as of the steel family but was unsure of the dark colored nut (p 483).

110. Mr. identified the dark colored nut in Exhibit 97 as similar to the nuts he used in the reassembly of 2MS-7 (p 483).

111. After BASREC completed the repair of 2MS-7, USS IWO JIMA personnel did not disassemble or perform any other maintenance on the valve (pp 742, 851).

112. During cold plant checks, BT1 cycled 2MS-7 using the remote handwheel the evening of 29 October 1990. The valve was cycled from closed to open to closed (p 354).

113. Mr. did not feel a hydro check was accomplished on 2MS-7 since his workers were released from further work before a hydro could be conducted. He had told Mr. to ensure a hydro was accomplished (pp 583, 584).

114. Mr. equates U.S. Navy Level I systems to high pressure steam systems which require high tensile steel components (p 592).

115. Mr. had complete faith in Mr. ability to repair a high pressure steam system valve (p 595).

all B-6

116. Mr. equated any person in khaki as being a ship's Chief Engineer. He could not specifically identify the USS IWO JIMA's Chief Engineer, LCDR (pp 491, 495, 496).

117. A certification of completion and acceptance of work performed form for USS IWO JIMA, Ship Repair Unit job number BH-1409, Items 001 - 004, Contractor - BASREC was signed off on 30 October 1990. The certification was signed by Mr. (pp 534, 555, 559, 562, Exhibit 146).

118. The SRU surveyor (Mr. stated that he was told to sign the USS IWO JIMA Repair Work Completion form the morning of 30 October 1990 after he had learned of the casualty (p 930, Exhibit 146).

119. SRU Detachment Bahrain was provided funding based on work assignment estimates on USS IWO JIMA job number BH-1409. Work items annotated were 001 - 004. These funds would be used to pay for work satisfactorily completed (Exhibit 150).

120. Concurrent with four BASREC work items, ship's force set a highly ambitious valve maintenance plan in both M and B Divisions (pp 299, 809, 845, Exhibits 157, 164).

2MS-7 TESTING

121. A Hydrostatic Test is a test where the system or portion of the system is pressurized above maximum operating pressure to a specified hydrostatic test pressure and inspected for leakage and visible permanent deformation (Exhibit 190).

122. An Operating Pressure Test is a test where the system or portion of the system is filled with its normal fluid medium, pressurized to maximum operating pressure, and inspected for joint leakage (Exhibit 190).

123. Only an Operating Pressure Test of valve 2MS-7 would have been required provided replacement parts met applicable requirements and specifications (Exhibit 190).

124. NAVSEA Standard Item 009-54 for the in-line repair of a bolted bonnet steam valve requires only an Operating Pressure Test following repair (Exhibit 134).

125. Mr. , head of the fluid systems and components branch of NAVSES Philadelphia, stated that, in his opinion, a hydrostatic test of valve 2MS-7 would not have revealed the fact that incorrect fasteners were installed (p 173).

126. Paragraph 3.5 of the SRU Det Bahrain repair specification for valve 2MS-7 required a post maintenance hydrostatic test be conducted (Exhibit 130).

127. The requirement for a hydrostatic test of 2MS-7 in the SRU Det Bahrain Repair Specification did not indicate the purpose of the test (i.e. tightness, strength, seat leakage), the required test pressure, or the test boundaries (Exhibit 130).

128. The SRU Det Bahrain surveyor, Mr. , stated that he told the Engineer Officer, LCDR , that the hydrostatic test required by the Repair Specification was a 150 percent test (p 928).

129. BTC was assigned the reponsibility for conducting a hydrostatic test of 2MS-7 (p 819).

130. BTC did not consult a technical manual to confirm the requirements for post-maintenance testing of 2MS-7 or to determine a hydrostatic test pressure (p 981).

131. BTC stated that he was not informed that the surveyor had specified a 150 percent hydro for 2MS-7 (p 981).

132. The Engineer Officer and BTC concluded that a 100 percent hydrostatic test would be adequate (pp 817, 981).

133. The Engineer Officer stated that the 100 percent hydrostatic test pressure for valve 2MS-7 was 655 psig (p 851).

134. BTC stated that the 100 percent hydrostatic test pressure for valve 2MS-7 was 650 psig (p 955).

135. BTC stated that valve 2MS-7 and its by-pass were hydrostatically tested to 648 psig (pp 942 thru 945).

136. BTC stated that, based on his experience, the two pound difference between actual and required pressures would not make a difference (p 955).

137. ENS stated that BTC had mentioned to him, prior to boiler light-off, that he was conducting a hydrostatic test of the main steam system (pp 705, 729).

138. The Engineer Officer stated that BTC indicated to him that a hydro of 2MS-7 had been conducted; however, the test pressure was too low (p 820).

139. The Engineer Officer stated that an Operating Pressure Test of 2MS-7 would be conducted because the hydrostatic test "was 10 pounds shy of 655" (p 851).

all B-6

140. Both the Engineer Officer and BTC stated that if they had noted a combination of studs and bolts on the bonnet of valve 2MS-7, they would have questioned that as a proper installation (pp 856, 970).

141. BTC stated in testimony that he did not inspect valve 2MS-7 during the hydrostatic test. The inspection was conducted by BT1 , a deceased member of the crew (pp 968, 971, 990, 991).

142. In a sworn statement to NIS on 4 Nov 90, BTC stated several times that he looked at valve 2MS-7 while the valve was under hydrostatic test (Exhibit 187).

143. The Engineer Officer stated that BTC had reported having inspected valve 2MS-7 during the hydrostatic test (p 844).

144. A hydrostatic test of Number 1 boiler was documented as having been accomplished in the Engineering Logs, in the Boilerwater Chemistry Worksheet Logs and in the Fireroom Cold Iron Logs for 28 and 29 Oct 90 (Exhibits 30, 38).

145. There was no documentation in any engineering log that a hydrostatic test of valve 2MS-7 had been conducted (Exhibits 30, 38).

146. BTC stated that the hydro of 2MS-7 was conducted in conjunction with the hydro of Number 1 boiler; by opening the 1MS-1 and 1MS-7 by-pass valves (p 942).

147. BTC stated that after 2MS-7 had been hydrostatically tested, the by-pass to valve 1MS-1 was shut so that Number 1 boiler could be tested to 655 psig (p 943).

148. While attempting to hydro Number 1 boiler it was determined at about 2239, 28 Oct, that the 1MS-1 by-pass valve leaked by its seat (p 945, Exhibits 30, 38).

149. BTC stated that no one else had information concerning the hydrostatic test of valve 2MS-7 because he was the only one left alive who was on the "hydro team" (p 954).

150. BT2 was in the fireroom from about 0730 until about 2400 on 28 Oct (pp 1098, 1107).

151. BT2 was involved in the hydrostatic test of Number 1 boiler but was not aware of a hydrostatic test of 2MS-7 being conducted (pp 1099, 1100, 1109, 1110).

152. BT2 stated that the 1MS-1 by-pass valve was shut while Number 1 boiler was being hydrostatically tested between 2030 and 2230 (p 1110).

all BL

153. The Engineer Officer stated that BTC reported that he and BT1 had conducted a visual inspection of valve 2MS-7 with full steam pressure against the valve (pp 821, 844, 855).

154. Lagging had been installed around the bonnet of valve 2MS-7 before an Operating Pressure Test could be conducted (p 355, 968).

155. BT1 stated that he was not aware of any tests or inspections of valve 2MS-7 with steam pressure applied (pp 615, 616, 970, 971).

156. BTC stated that he ordered BT1 Fehlberg "...to check all the jobs we had done..." and thought that BT1 Fehlberg had checked valve 2MS-7 (p 971).

157. BTC stated that he opened the by-pass valve around 2MS-7 to apply steam to both sides of the valve, but he did not open valve 2MS-7 (p 958).

158. BTC s action to open the 2MS-7 bypass was not in accordance with EOSS nor did he inform the BTOW that he had opened this valve (pp 969, 970, 1103).

159. Valve 2MS-7 was required to be in the open position to conduct an Operating Pressure Test (pp 168, 169, 855, Exhibit 190).

160. Valve 2MS-7 was opened by the Number 1 SSTG watchstander, using the remote operator between 0630 and 0720 on 30 Oct (p 240).

MAJOR STEAM LEAK

161. BTC supervised the light off of Number 1 boiler at 0218, 30 October 1990 (pp 969, 972, Exhibit 39).

162. The B-Division Officer, ENS directed BTC to call him prior to lighting fires in Number 1 boiler (p 709).

163. The B-Division Officer was not called by BTC prior to lighting fires. ENS awoke at reveille and was told by BTC that "everything went fine and there was no need for [him] to be there. BTC stated that he forgot to wake ENS prior to lighting fires in Number 1 boiler (p 709, 967).

all B6

164. The upstream side of valve 2MS-7 was initially pressurized with steam at 0353, 30 Oct 90 when the main steam stop on Number 1 Boiler (1MS-1) was opened (pp 1076, 1081, Exhibit 38).

165. Valve 2MS-7 was opened sometime between 0630 and 0720 on 30 Oct while starting Number 1 SSTG (p 241, Exhibit 38).

166. After valve 2MS-7 was opened, the bonnet would have pressurized with steam thus heating up the fasteners, including the brass nuts, more rapidly (pp 162, 169, Exhibit 125).

167. Number 1 SSTG was rolled with steam at 0730, 30 Oct 90 (p 240, Exhibit 38).

168. Between about 0730 and about 0745 on 30 Oct 90, MM3 and BT3 noticed what appeared to be smoke emanating from the lagging on valve 2MS-7 (pp 244, 286).

169. BT3 reported the smoking lagging on valve 2MS-7 to the Boiler Technician of the Watch (BTOW), BT2 (p 286).

170. At about 0800, BT2 relieved BT1 as the lower level watch so that King could pick-up the mail for the division (p 356).

171. At 0756, USS IWO JIMA was underway from Bahrain (Exhibits 20, 38).

172. At about 0745, MM3 , with MM3 under instruction, relieved MM3 as the Number 1 SSTG operator because was suffering from the heat. MM3 then took the Number 2 SSTG watch in the engineroom (pp 245, 246).

173. At approximately 0812 on 30 Oct, the BTOW, BT1 , reported to the EOOW that there was a steam leak behind Number 2 boiler at the turbo stop valve. BT1 requested permission to secure Number 2 boiler (p 822, 1092, Exhibit 38).

174. Upon receiving a report from the BTOW of a major steam leak, the Engineer Officer via the 21MC, informed the Officer of the Deck of the leak and requested permission to secure Number 2 boiler (pp 220, 822).

175. Even if Number 2 boiler had been secured quickly, valve 2MS-7 would not have been isolated from Number 1 boiler because valve 1MS-7 was open (pp 959, 1098, Exhibit 84).

176. Once 2MS-7 started leaking, isolation would have required either shutting both boiler main steam stop valves 1MS-1 and

all B-6

2MS-1; or shutting 2MS-1, Number 1 boiler turbo steam stop 1MS-7, and one of the engineroom bulkhead stop valves 1MS-2 or 2MS-2 (pp 959, 1089, Exhibit 84).

177. Immediately after requesting permission to secure Number 2 boiler, the Engineer Officer "heard a loud boom" and felt the engineroom vibrate. He informed the OOD there was a major steam leak in the fireroom and requested general quarters be sounded (pp 222, 822).

178. When the major steam leak occurred, the provisions of the Restricted Maneuvering Doctrine (Exhibits 35 and 37) were in effect (pp 222, 821, 842, Exhibit 38).

179. During restricted maneuvering, the Engineer Officer/EOOW is required to delay casualty control actions which involve slowing the engine and/or loss of power to a switchboard, until permission is obtained from the OOD (Exhibits 35 and 37).

180. When requested by the Engineer Officer, general quarters was sounded (p 222, Exhibits 20 and 38).

181. Upon realizing that a major steam leak had occurred in the fireroom, the Engineer Officer, as recommended by the MMOW, ordered the throttles opened wide to reduce the amount of steam escaping into the fireroom (p 823, 1092).

182. The MMOW ordered the Number 2 SSTG watchstander not to secure the TG to help minimize the amount of steam escaping into the fireroom (p 1093).

183. The EOOW ordered the fireroom to be mechanically isolated. On the recommendation of the MMOW, the main steam bulkhead stop valves were left open to bleed steam out of the main steam system (p 1093).

184. The EOCC major steam leak/rupture in propulsion plant procedures, ID No. MMSLR, requires the throttle to be shut and the SSTG to be tripped (Exhibit 36).

185. At about 0812 on 30 Oct 90, BT1 , the Duty Oil King entered the fireroom to obtain boiler samples (p 319).

186. Upon entering the fireroom upper level, BT1 noted approximately four people looking at valve 2MS-7. One was the MPA, LT ; one was probably BT2 , and the other two cannot be positively identified (p 320).

187. BT1 noted steam blowing from valve 2MS-7 which was accompanied by a loud sound (p 321).

all B-6