

Subj: INVESTIGATION TO INQUIRE INTO THE EXPLOSION IN NUMBER TWO TURRET ON BOARD USS IOWA (BB 61) WHICH OCCURRED IN THE VICINITY OF THE PUERTO RICO OPERATING AREA ON OR ABOUT 19 APRIL 1989

Captain, but logic fails at this point. First, there was no way to be certain the modified packet would be the one placed in the powder train. Secondly, ' ' could not reasonably predict the magnitude of the explosion and therefore could not guarantee his own safety in the magazine. There was nothing uncovered to indicate he had suicidal tendencies or was willing to risk death. Accordingly, virtually no credence has been placed in the probability that he caused the explosion to collect the insurance money.

15. This left the Gun Captain, Hartwig, as the principal suspect. He had the opportunity to place a detonating device in the barrel, and it is probable that he knew how to make detonating devices. It also appears by equivocal personality analysis that he was emotionally capable of committing suicide, probably with the intent of killing others also. As Gun Captain, it was his gun-loading responsibility to give directions to the Rammer Man. The rammer had been extended 21 inches beyond the position where it would normally have been had the powder bags been properly rammed. With the powder bags so far up the barrel, proper ignition by the primer was virtually impossible and would have resulted in a misfire. But if a pressure or timer-actuated detonator had been placed between the first and second bags (perhaps concealed in the silk bag of the lead foil packet), and the rammer slowly extended under the direction of Hartwig, he could have ensured that the necessary pressure was obtained to initiate such a device or that the ramming process was delayed long enough to enable the detonator to activate before the breech was closed.

16. The most telling evidence is found in exhibit (266) of enclosure (285). When the investigating team began to consider the possibility of deliberate ignition, the scientists constructed and tested compact compression-actuated and timer-actuated devices which could be easily substituted for the lead in the silk packets and inserted between the first and second powder bags. Thirteen feasibility tests demonstrated that both types of devices could cause the required ignition. Furthermore, a timing device purchased off the shelf from a nationally known electronics store was tested to determine if it could be used as a detonator in conjunction with batteries and the primers readily available to a gunners mate on USS IOWA. The tests proved the device could ignite the powder and cause the explosion.

17. To determine if evidence of such a device could be found in USS IOWA's center gun, the rotating band near the base of the 16"

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projectile lodged in the barrel was analyzed. The rotating band is made of a soft copper alloy. It acts as a gas seal when the gun is fired. As the projectile moves forward, the band engages the rifling of the barrel and the outer lip of the band folds back against the body of the band. In this fold back position, particles in the expanding gases behind the projectile are embedded and entrapped under the soft copper. Thus, it is possible to determine if foreign material, such as a timer and batteries, was present in the chamber at the time of firing by microscopic and gas spectrum analysis of debris found under the rotating band. Comparison was made between projectiles used in normal firings and projectiles fired with detonating devices in the powder train.

18. Recent discussions with Captain _____, on the team investigating the projectile, indicate that debris under rotating bands taken from projectiles used in firings with a detonating device in the chamber was compared with projectiles fired without a detonating device. This, in turn, has been compared with the band taken from the USS IOWA projectile. Elements found in the timing device and associated batteries were found under the USS IOWA rotating band and under the bands of projectiles test fired with a detonating device. These elements were not present under the bands fired without the detonating device. Enclosure (286) provides independent expert opinion regarding the scientific techniques and analytical approaches described in exhibit (266) of enclosure (285). Molecular tests are ongoing to precisely ascertain the origin of specific foreign elements identified.

19. Although, further tests are being conducted, there is compelling evidence that the explosion in Turret Two on 19 April 1989 was caused by a detonating device placed in the powder train, probably between the first and second powder bags. The cumulative evidence from both the administrative investigation and that conducted by NIS, enclosure (285), points to GMG2 Hartwig as the individual who had motive, knowledge and physical position (access) within the turret gun room to place a device in the powder train. Accordingly, I concur with the investigating officer's opinion that the explosion was the result of a human act committed with the intent to cause the explosion, and that GMG2 Hartwig most probably committed the act.

20. Concur with recommendations 1 through 7. Recommendation 2 has been implemented. With respect to recommendation 6, pending formal revision of procedural documentation by Commander Naval Sea Systems Command, Commander Naval Surface Force, U.S. Atlantic Fleet (COMNAVSURFLANT), by enclosure (287), has provided specific

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guidance to be followed in the event of a ripped, torn or damaged powder bag or ignition pad.

21. Concur with recommendation 8. A review of Combat System Assessment procedures has been completed. The format now includes formal spot checks using a worksheet to ensure uniformity and to record discrepancies. Copies of completed worksheets are delivered to the ship upon completion of the assessment.
22. Concur with recommendation 9.
23. Recommendation 10 has been implemented by enclosure (288).
24. Concur with recommendation 11.
25. Concur with recommendation 12. Enclosure (289) forwarded enclosure (279) to Commanding Officer, Naval Education and Training Support Center, Pacific, for review and implementation as a Navy wide Personnel Qualification Standard (PQS). This recommendation has been concurred with and developmental action initiated by enclosure (290). Target completion date is 15 August 1989. Furthermore, enclosure (279) has been forwarded to the Commanding Officers of USS IOWA and USS WISCONSIN (BB 64) directing implementation until receipt of a formal, validated PQS for Turret Officer.
26. Concur with recommendation 13. Pending formal revision of applicable directives, interim guidance with respect to the manning of Repair VI was promulgated by enclosure (287).
27. Regarding recommendation 14, by enclosure (291), COMNAVSURFLANT has taken action to address the specific requirements necessary to rescind the 16"/50 caliber firing restriction. USS IOWA satisfactorily completed all specified elements of the Safety Stand-down on 3 June 1989, prior to her current deployment. USS WISCONSIN completed the Safety Stand-down on 6 June 1989. A Plan of Action and Milestones for the correction of deficiencies has been initiated to ensure the specified intent of the Safety Stand-down is achieved. Projected completion date for all discrepancies is 30 September 1989. Concur with the recommendation to lift firing restrictions when all battleships report completion of recommended safety stand-down actions.

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28. Compliance with recommendation 15 has been directed by enclosure (288).

29. Concur with recommendation 16.

30. Concur with recommendations 17a, 17b, 17c and 17e. Implementation of recommendation 17d should be reserved for training exercises and Pre-Action Calibration Firings only. The urgency of real world Condition I manning dictates that gun crews be capable of bringing main batteries to bear as rapidly as possible. Pausing to conduct on station safety briefs could actually jeopardize the safety of the ship and her crew. The spirit and intent of recommendation 17d is appropriately satisfied by proper training, implementation of a viable PQS program and properly conducted pre-fire briefings. Implementation of recommendations 17a, 17b, 17c and 17e will be accomplished by revision of the present BB 61 class Combat Systems Doctrine. Recommendation 17e is also addressed in enclosure (287).

31. Concur with recommendation 18. Current allowances of Emergency Escape Breathing Devices (EEBD) for USS IOWA and USS WISCONSIN are 2400 each. These allowances are not sufficient to provide EEBD's in the turrets. A request to raise the allowance to 3070 has been submitted, and action has been taken to provide EEBD's from decommissioning ships.

32. Concur with recommendation 19 and 20.

33. Concur with recommendation 21. The heroism displayed by the named individuals and others was exceptional. COMNAVSURFLANT will work closely with Commander, Cruiser-Destroyer Group 8 (COMCRUDESGRU 8) and USS IOWA to identify and appropriately recognize all who are so deserving.

34. Concur with recommendation 22, in part.

a. While the Commanding Officer is clearly accountable for the lack of an effective Personnel Qualification System, and poor adherence to explosive safety regulations and ordnance safety aboard USS IOWA, his failure of leadership in this regard is a marked departure from otherwise outstanding performance. The character of, and circumstances surrounding, the leadership oversights stated do not, of themselves, warrant judicial or disciplinary action. However, this failure on the part of Captain [redacted] cannot be overlooked or accepted. Accordingly, upon final review of this investigation by higher authority, COMCRUDESGRU 8 will be directed to review the findings and

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opinions of the investigating officer concerning Captain [redacted] performance, and to consider the appropriateness of a special report of fitness to document his marked deficiency in command oversight. Detachment for cause is unwarranted.

b. Upon final review of this investigation by higher authority, intend to direct COMCRUDESGRU 8 to conduct hearings in accordance with Article 15, Uniform Code of Military Justice, for Commander [redacted], USN, Commander [redacted], USN, Lieutenant Commander [redacted], USN and Master Chief Fire Controlman (SW) [redacted], USN, to determine appropriate administrative or judicial disposition of the charges set forth in enclosures (281), (282), (283) and (284), and make detachment for cause recommendations, if appropriate. COMCRUDESGRU 8 will also be directed to administratively caution Commander [redacted], USN, Executive Officer, USS IOWA, Lieutenant junior grade [redacted], USN, G-1 Division Officer, USS IOWA, and Ensign [redacted], USN, G-3 Division Officer, USS IOWA, with respect to their duties.

c. Concur with recommendation 22k. Upon final review of this investigation by higher authority, intend to administer nonpunitive censure in writing to Captain [redacted].

35. Subject to the foregoing comments, the proceedings, findings of fact, opinions and recommendations of the investigating officer are approved.

15 July 1989

--Unclassified upon removal of enclosures ~~(4)~~, (30), (43),
(46), (56), ⁽⁷⁶⁾(100), (102), ⁽¹⁰⁷⁾(103), (173), (174), and (272).

From: Rear Admiral ⁽¹⁰⁷⁾ U.S. Navy,
To: Commander, Naval Surface Force, U.S. Atlantic Fleet

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Ref: (a) JAGMAN

Encl: (1) COMNAVSURFLANT ltr Ser N003/04731 dtd 27 Apr 1989
(Appointing Order)
(2) Technical Investigation of USS IOWA (BB-61) 16"/50 Caliber
Breech Propellant Initiation (NAVSEA Report) of 12 May 1989
w/addenda dtd 19 May 89, 25 May 1989, 9 June 1989, 15 June
1989, and 22 June 1989
(3) Aerial Photograph of USS IOWA (BB-61)
(4) Graphic of Cross-section of Turret II
(5) Graphic of Turret Booth and Gun House
(6) Sworn Statement of LTJG dtd 24 May 1989 with Graphic
of Loading Sequence
(7) Glossary of Acronyms and Abbreviations
(8) Second Fleet Battle Watch Log of 19 April 1989
(9) Interview of GMG3
(10) Interview of GMG3
(11) USS IOWA 191413Z Apr 89 (Oprep-3 Navy Blue, Initial) (C)
(12) Interview of LCDR w/Article 31 Warnings
(13) Interview of CDR w/Article 31 Warnings
(14) Sworn Statement of LT dtd 15 May 1989
(15) Unsworn Statement by LT
(16) Unsworn Statement by BMCS
(17) Unsworn Statement by OS1
(18) Graphics Depicting Blast Damage by Turret Level
(19) Photograph of Damage to Center Gun Turret II
(View of Breech)
(20) Photograph of Damage to Center Gun Turret II
(Breech and Cradle)
(21) Photograph of Left Gun Room Door, Turret Officer's Booth,
Turret II
(22) Photograph of Deck Aft of Center Gun Room Door, Turret
Officer's Booth, Turret II
(23) Photograph of Right Sight Setter Booth, Turret II
(24) Photograph of Right Side of Center Gun Room, Turret II
(25) Photograph of Burnt Powder Bag Residue on Passing Scuttle in
Powder Flat, Turret II
(26) Photograph of Burnt Powder Bags on Left Gun Loading Tray,
Powder Flat, Turret II

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- (27) IOWA Deck Log 19 & 20 April 1989
- (28) Log of Events Kept by OS2 19 April 1989
- (29) Interview of FN
- (30) DIR AFIP WASH DC 081700Z May 89 (C)
- (31) Federal Bureau of Investigation Positive Identification List
- (32) Interview of CDR
- (33) Interview of SR
- (34) Interview of SA
- (35) Interview of BM2
- (36) Interview of SN
- (37) Interview of SR
- (38) Interview of SA
- (39) Interview of SR
- (40) Interview of SA
- (41) Interview of SA
- (42) Interview of SN
- (43) CTF TWO ZERO 291231Z Dec 88 (FLEETEX 3-89 LOI) (C)
- (44) Excerpt from COMSECFLT Staff Notice 5400 dtd 08 Feb 1989
- (45) Sworn Statement of LCDR dtd 14 May 1989
- (46) USS IOWA 181425Z Apr 89 (PRE/EX EVT 19020A) (C)
- (47) Interview of LT
- (48) USS IOWA Notice 8000 dtd 18 Apr 1989
- (49) Excerpt from COMNAVSURFLANTINST 3500.2E dtd 22 Jun 1988
- (50) Written Statement of CAPT , CO IOWA
dtd 30 Apr 1989
- (51) Interview of GMG2
- (52) Interview of GMG3
- (53) Interview of SN
- (54) IOWA Plan of the Day and Gold Sheet for 18 April 1989
- (55) Interview of ENS
- (56) USS IOWA 222142Z Mar 89, 022024Z Apr 89, 140015Z Apr 89
(CASREPs on Left Gun Turret III) (C)
- (57) Interview of GMC
- (58) Interview of CAPT CO IOWA w/Article 31
Warnings
- (59) Interview of LT w/EEBD Gen Spec
- (60) Interview of GMG2
- (61) USS IOWA 271215Z Apr 89 (Ammunition Transaction Report)
- (62) Interview of GMG1
- (63) Interview of GCM(SW) w/Article 31 Warnings
- (64) Excerpt from SW300-BC-SAF-010 Safety Manual for Clearing
Live Ammunition From Guns
- (65) Interview of CDR XO IOWA w/Article 31 Warnings
- (66) Interview of ENS
- (67) Excerpt from OP2165 Volume 2
- (68) Excerpt from OPNAVINST 5100.19A (CH 12)
- (69) Ammunition Data Card for 16"/50 Caliber Powder Charge,
Full Lot Number CRA87B001-001
- (70) Sworn Statement by LI dtd 1 May 1989
- (71) Photographs of NALC D846 Powder Cans with Warning Label (2)
- (72) Interview of FCCM(SW) w/Article 31 Warnings
- (73) Interview of CDR

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- (74) IOWA Fire Control Smooth Log 4 & 7 November 1988
- (75) Interview of GMG3
- (76) NAVSWC Dahlgren VA, 090115Z Dec 88 with References (Provided by FCCM as Authorizing Documentation for R&D)
- (77) Interview of YN3 1
- (78) Interview of FC2
- (79) Video of IOWA Gun Shoot of 19 Apr 1989
- (80) Interview of FC2 :
- (81) Excerpt from SW330-AA-MMA-010
- (82) Interview of FC3
- (83) Interview of FC3
- (84) Interview of LCDR
- (85) Maneuvering Board Relative Wind Solution
- (86) Weather Report and Observation Log for 19 April 1989
- (87) Interview of LT
- (88) Mathematical Simulations of Possible Event Scenario (NAVSEA Preliminary Report dtd 1 May 1989)
- (89) Excerpts from SW030-AA-MMO-010 w/Photos of Lead Foil Packet (2) and SW330-AA-MMA-020
- (90) Interview of GMG3
- (91) Interview of GMG1
- (92) Interview HM1
- (93) Photographs Taken from Video of Turret II Explosion
- (94) Photograph of Turret II Explosion (Showing Damage to Gun Bucklers)
- (95) Photograph of Turret II Gun Bucklers After Explosion
- (96) Photograph of Tail Hatch with the Hatch Missing
- (97) Photographs of Ventilation Duct Damage on Medical Decks (2)
- (98) Interview of GMG2
- (99) 16"/50 Caliber Propelling Charge Inventory by Lot Number dtd 28 April 1989
- (100) USS IOWA 281900Z APR 89 (C)
- (101) NAVORDSTA INDIAN HEAD MD 291300Z APR 89
- (102) WPNSTA YORKTOWN VA 251930Z APR 89 (C)
- (103) Various IOWA Manning Messages and Documents (C)
- (104) Sworn Statement by LT , dtd 18 May 1989
- (105) Ship's Manning Document
- (106) GQ Manning Bill from Turret II (Undated)
- (107) Interview of CDR with CSA documentation attached (C)
- (108) NAVLEGSVCOFF NORFOLK VA 031930Z MAY 89
- (109) USS IOWA NAVGRAM ser 11/013 dtd 04 May 1989
- (110) IOWA Muster Report for 19 April 1989
- (111) Letter from LCDR , JAGC, USN
- (112) Memoranda from Armed Forces Institute of Pathology dtd 9 and 26 May 1989
- (113) Diagram of Deceased Location in Turret II by GMGC
- (114) LTJG P. E. Buch Autopsy Report dtd 23 April 1989
- (115) Interview of ENS r
- (116) GMCS(SW) R. O. Ziegler Autopsy Report dtd 21 April 1989
- (117) Description of Deceased Location in Turret II by ENS
- (118) GMG1 E. E. Hanyecz Autopsy Report dtd 21 April 1989

- (119) GMG3 J. E. Thompson Autopsy Report dtd 22 April 1989
- (120) GMG3 J. D. White Autopsy Report dtd 23 April 1989
- (121) BM3 T. C. McMullen Autopsy Report dtd 21 April 1989
- (122) Interview of HM3
- (123) BMSN R. J. Gedeon Autopsy Report dtd 21 April 1989
- (124) SN B. R. Jones Autopsy Report dtd 22 April 1989
- (125) Prefire Check Off Sheet for Turret II dtd 18 April 1989
- (126) GMG2(SW) R. E. Lawrence Autopsy Report dtd 23 April 1989
- (127) GMG2 C. M. Hartwig Autopsy Report (Undated)
- (128) GMG2 C. M. Hartwig Enlistment Contract
- (129) GMG2 C. M. Hartwig Page 5
- (130) GMG3 R. W. Backherms Autopsy Report dtd 21 April 1989
- (131) SN R. L. Johnson Autopsy Report (Undated)
- (132) BM2 G. J. Fisk Autopsy Report dtd 21 April 1989
- (133) Interview of BM2
- (134) GMG3 M. R. Price Autopsy Report dtd 22 April 1989
- (135) GMG3 M. F. Devaul Autopsy Report dtd 22 April 1989
- (136) GMG3 G. S. Schelin Autopsy Report dtd 21 April 1989
- (137) SA B. W. Gendron Autopsy Report dtd 22 April 1989
- (138) BM2 M. R. Williams Autopsy Report dtd 21 April 1989
- (139) Location and Identification Chart by Pathologist at Dover AFB
- (140) GMGSN J. R. Y. Young Autopsy Report dtd 22 April 1989
- (141) GMG3 P. E. Bopp Autopsy Report dtd 22 April 1989
- (142) GMG3 H. E. Stillwagon Autopsy Report dtd 22 April 1989
- (143) GMG3 W. S. Blakey Autopsy Report dtd 22 April 1989
- (144) GMG2 J. P. Cramer, Jr. Autopsy Report dtd 22 April 1989
- (145) SA L. A. Everhart Autopsy Report dtd 22 April 1989
- (146) SR T. E. Miller Autopsy Report dtd 21 April 1989
- (147) SR J. L. Goins Autopsy Report dtd 22 April 1989
- (148) Interview of GMG3
- (149) SR R. J. Bradshaw Autopsy Report dtd 22 April 1989
- (150) SA S. A. Holt Autopsy Report dtd 22 April 1989
- (151) SA N. C. Jones Jr. Autopsy Report dtd 21 April 1989
- (152) EM3 D. L. Hanson Autopsy Report dtd 22 April 1989
- (153) GMG2 S. J. Weldon Autopsy Report dtd 22 April 1989
- (154) YN3 List of Personnel in Turret II Powder Flats
- (155) GMG3 D. A. Ogden Autopsy Report dtd 22 April 1989
- (156) SA E. E. Casey Autopsy Report dtd 22 April 1989
- (157) Interview of HM3
- (158) SN M. S. Justice Autopsy Report dtd 22 April 1989
- (159) SN R. R. Peterson Autopsy Report dtd 23 April 1989
- (160) SN E. T. Kimble Autopsy Report dtd 21 April 1989
- (161) SR R. M. White Autopsy Report dtd 22 April 1989
- (162) SN O. L. Moses Autopsy Report dtd 22 April 1989
- (163) SA J. L. Martinez Autopsy Report dtd 22 April 1989
- (164) SR T. T. Tatham Autopsy Report dtd 21 April 1989
- (165) SR H. E. Romine, Jr. Autopsy Report dtd 22 April 1989
- (166) PCSA R. J. Lewis Autopsy Report dtd 23 April 1989
- (167) FC3 T. T. Adams Autopsy Report dtd 22 April 1989
- (168) EMFA D. C. Battle Autopsy Report dtd 22 April 1989
- (169) LN1(SW) M. W. Helton Autopsy Report dtd 22 April 1989

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- (170) LN1(SW) R. K. Morrison Autopsy Report dtd 21 April 1989
- (171) SN T. D. Foley Autopsy Report dtd 22 April 1989
- (172) Excerpt from NWP 10-1-10
- (173) IOWA Gunnery Casualty Report Summary as of 21 April 1989 (C)
- (174) Underway Material Inspection Results of USS IOWA
dtd 06 April 1989 (C)
- (175) INSURV Discrepancy 2 Kilos for WGO2
- (176) PMS cards A-637/025-37 W-1R, M-1, A-637/045-96 W-1R, M-1 with
Equipment Guide Lists
- (177) Quarterly Planned Maintenance System (PMS) Board for WGO2
21st Quarter
- (178) Consolidated Ship's Maintenance Project List for Work
Center WGO2
- (179) Excerpt from NAVEDTRA 10054-F (Damage Controlman 3 & 2),
1986 Edition
- (180) Sworn Statement by LT dtd 29 April 1989
- (181) Excerpt from SW330-AA-MMA-020 (Maintenance Manual for 16-Inch
Three Gun Turrets BB-61 Class)
- (182) Interview of 1st LT
- (183) Photographs of Firefighting Effort on IOWA's Starboard
01 Level (2)
- (184) Photographs of Firefighting Effort on IOWA's Port
01 Level (3)
- (185) Interview of DC1
- (186) Interview of LCDR
- (187) Interview of BM2
- (188) Interview of BM1
- (189) Video Tape of Firefighting Effort on IOWA's Turret II
- (190) Interview of CAPT r, USMC
- (191) Interview of LTJG
- (192) Interview of HT1
- (193) Interview of HT3
- (194) Interview of EM3
- (195) Interview of BM1 w/attachment
- (196) Interview of FR
- (197) Interview of MR3
- (198) Interview of ENFN
- (199) Interview of MACS
- (200) Unsworn Statement of LCDR MC, USN
- (201) Unsworn Statement of LCDR MC, USNR
- (202) Unsworn Statement of LCDR NC, USN
- (203) Unsworn Statement of LT , MSC, USN
- (204) Unsworn Statement of HMCS(AW)
- (205) Cost of Retrograde, Inspection, Renovation, and Return
Memorandum dtd 14 May 1989
- (206) NAVEDTRA 43100-1C, PQS Managers Manual, Jan 1987
- (207) USSIWAINST 3500.1B dtd 14 August 1988
- (208) Excerpt from OPNAVINST 3120.32B
- (209) USSIWANOTICE 1301 dtd 08 March 1989
- (210) USSIWAINST 5400.4 dtd 17 October 1988
- (211) Interview of CDR w/ Article 31 Warnings
- (212) Written Statement of CDR dtd 30 April 1989

- (213) Interview of ENS
- (214) NAVEDTRA 43415, PQS for 16"/50 Caliber Three-Gun Turret, Sep 1983
- (215) NAVEDTRA 43415A, PQS for 16"/50 Caliber Three-Gun Turret, Dec 1988
- (216) Training Readiness Evaluation for USS IOWA dtd 02 September 1988
- (217) USS IOWA NAVGRAM ser 03/016 dtd 22 November 1988
- (218) USS IOWA NOTICE 3500 dtd 07 November 1988
- (219) COMNAVSURFLANT 210400Z OCT 88
- (220) Interview of GMC
- (221) Interview of GMC
- (222) Interview of FCCM
- (223) Unsworn Statement of GMCM dtd 4 May 1989
- (224) Interview of GMG3
- (225) Summary of Qualification Status of Turret I on 19 April (w/Page 4 and PQS Signature Sheets Attached)
- (226) Excerpts from PQS Book for Magazine Sprinkling Systems (NAVEDTRA 43386A) of GMG2 Lawrence
- (227) PQS Book for Magazine Protection Systems (NAVEDTRA 43386) of SN Bopp
- (228) Excerpts from PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of SN Bopp
- (229) Excerpts from PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GM GSN Young
- (230) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG3 Price
- (231) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG3 Thompson
- (232) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG3 Devaul
- (233) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG3 J. White
- (234) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG3
- (235) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG3 Ogden
- (236) Excerpts from PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG2 Cramer
- (237) Excerpts from PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG3 Schelin
- (238) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG2 Hartwig
- (239) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG3 Blakey
- (240) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG3 Stillwagon
- (241) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMG2 Lawrence
- (242) PQS Book for 16-Inch .50-Caliber Three-Gun Turret (NAVEDTRA 43415) of GMCS Ziegler
- (243) PQS Status Chart for Turret II

- (244) Summary of Qualification Status of Turret II on 19 April
(w/Page 4 Sheets Attached)
- (245) Summary of Qualification Status of Turret III on 19 April
(w/Page 4 and PQS Signature Sheets Attached)
- (246) Turret III Division Officer's PQS notebook
- (247) PQS Status Chart for Turret I
- (248) Officer Distribution Control Report
- (249) USSIOWAWEAPSNOTE 3500.1 Undated
- (250) Written statement of CDR . IOWA Executive Officer
- (251) Interview of GMCM
- (252) COMNAVSURFLANTINST 8023.4D dtd 06 May 1986
- (253) USSIOWAINST 8023.1A dtd 08 March 1988
- (254) OPNAVINST 8023.2C dtd 29 January 1986
- (255) SO300-BA-HBK-010/BB61 CL, Battleship 16"/50 Caliber Gunnery
Handbook, 15 May 1988
- (256) 16" Gunfire Test at YUMA Proving Grounds 22 APR 1989
- (257) Interview of BM1
- (258) Interview of MM3
- (259) Excerpt from SW330-AA-MMA-010
- (260) Photograph of Retrieved Primer X-ray (Three Views)
- (261) Photograph of Spark Producing Items from Deceased Personnel
in Turret II
- (262) Interview of SN
- (263) Interview of SA
- (264) Interview of GMG3
- (265) Interview of GMG3 .
- (266) Interview of SN .
- (267) Interview of PFC
- (268) Interview of Mr.
- (269) Interview of GMM3 -
- (270) Interview of SN
- (271) Excerpt from Instructor Guide for 16"/50 Caliber Gun System,
10-03-83
- (272) USS IOWA 140117Z JUN 89 (Statement of Qualification)(C)
- (273) Unsworn statement of Mr. (former IOWA
Turret II, center gun. Gun Captain)
- (274) Interview of
- (275) GMG3 C. M. Hartwig Page 4
- (276) Excerpts of GETTING EVEN
- (277) Excerpts of TM 31-210
- (278) NAVSEASYSKOM ltr 8300 OPR:JDM Ser 06X/17 dtd 28 JUN 89
- (279) Draft of Turret Officer PQS
- (280) Charges on CAPT F. P. I
- (281) Charges on CDR R. D.
- (282) Charges on CDR R. J.
- (283) Charges on LCDR K. M.
- (284) Charges on FCCM(SW)

EXECUTIVE SUMMARY

On 19 April 1989 at 0955 local time, as the center gun crew of the USS IOWA (BB 61) Turret II loaded five 94-pound bags of smokeless powder from NALC D846 into the gun's open breech, the powder exploded. The force of the explosion drove a 2700 lb Blind Loaded and Plugged (BL&P) projectile about three feet one-inch into the rifling.

Instantaneously, fire and blast of extreme velocity, pressure and temperature spread throughout Turret II. The blast blew back through the gun house into the Turret Officer's booth, into the left and right gun rooms, and down through the powder trunks and vents to the lower levels of the turret.

Within seconds, a second explosion occurred when an unknown number of powder bags detonated (low order) and burned in the powder handling flat, filling the turret with smoke. Subsequently, a third detonation (low order) occurred between time GQ plus eight and nine.

All forty-seven (47) servicemen in Turret II (proper) at the time of the explosion died instantaneously or nearly instantaneously of either blast, blunt force and/or thermal injuries. All were positively identified by dental records and/or fingerprints. Medical evaluation of the deceased servicemen discloses no evidence of drug or alcohol use. Twelve personnel in Turret II's annular space and magazine at the time of the explosion survived without injury. No personnel outside the turret sustained injuries as a result of the explosions.

At the time of the explosion, IOWA was in the North Puerto Rico Operating Area (PROA) participating in FLEETEX 3-89 (ADVANCED). Specifically, IOWA was engaged in Open Ocean Naval Gun Fire Support (NGFS) training her Marine detachment in calling missions and spotting rounds, training gunnery personnel in delivering fire against a point target, and verifying operability of the Main Gun Battery.

In commencing the 19 April 1989 NGFS exercise, the firing sequence for the Main Gun Battery was to begin with Turret I firing single round salvos, reduced charge, from each gun. Turret I's firing sequence began with the left gun misfiring. Proper misfire procedures were immediately initiated in left gun Turret I. The center and right guns both fired two single round salvos with the left gun misfiring again after the first two rounds and the second two rounds. The firing sequence proceeded to Turret II. The misfire in Turret I had no direct relationship to events that followed in Turret II.

Material Condition Zebra had been reported as set in Turret II, yet post-incident inspection indicates Zebra had not been uniformly set throughout the turret. Material Condition Zebra was specifically broken and reset to permit a powderman to exit the powder handling flat and the turret.

Subsequent to this, the order to load was passed. Despite written prohibitions and warnings against using NALC D846 with 2700 lb projectiles, Turret II was scheduled to fire ten rounds using five full charge bags of powder from NALC D846 with 2700 lb projectiles. One round of NALC D846 consists of six bags (nothing more or less). Five bags is an abnormal and unauthorized load configuration.

In preparing to fire multiple rounds, the powdermen in the magazine passed approximately forty-one (41) 94-pound bags of powder into the annular space where other powdermen passed forty (40) of those bags through to the powder handling flat of the turret. Fifteen bags were in the guns and twenty-five (25) on the powder handling flat at the time of the explosion.

In preparing for the 19 April 1989 gunnery exercise, IOWA held prefire briefs on 18 April 1989, to cover firing plan specifics. To minimize the number of personnel at any one brief, the ship held two separate briefs, the "pre-prefire" and the "prefire" briefs. The ship, however, did not take musters at either, and approximately half the people required to be present were absent. The Commanding Officer did not attend either of the prefire briefs.

With respect to training and qualification, applicable Personnel Qualification Standard (PQS) directives require the Commanding Officer, Executive Officer, Training Officer, PQS Coordinator, Department Heads, Department PQS Coordinators and Division Officers to establish, maintain, and supervise a formal PQS program for qualifying personnel on various shipboard watch stations. Turret watch stations are not excluded from this program. Training received by IOWA gunnery personnel, however, is suspect.

Personnel within the turrets came from two basic sources, the Weapons and Deck Departments. Deck Department personnel assigned to Turret General Quarters or Condition III watch stations were not PQS qualified by either the Deck Department or Weapons Department. Deck Department personnel assigned to turret crews were trained almost exclusively during gun firing evolutions, but this training was not documented.

Of the fifty-five (55) watch stations actually manned in Turret I on 19 April 1989 which required formal PQS qualified watch standers, four (4) personnel were PQS qualified. In Turret II, thirteen (13) out of fifty-one (51) personnel were PQS qualified and in Turret III, nine (9) out of sixty-two (62) were PQS qualified. ENS Effren S. Garrett, IV, USN, was the only officer in Turret I after being onboard for only sixteen (16) days. He was not familiar with turret operations, safety or misfire/hangfire procedures.

PQS Boards in all three turret divisions were not reviewed weekly. The Training Officer/PQS Coordinator did not submit monthly PQS progress reports to the Commanding Officer as required. Neither the Commanding

Officer, Executive Officer, Weapons Officer nor the Gunnery Officer knew of the large number of watch stations being manned by personnel not qualified under the PQS program.

In contrast to the poor PQS training program, the damage control efforts of the ship's crew were extraordinary. Crew members led by BM2 [redacted], USN, on main deck, and BM1 [redacted] USN, on the O1 level, quickly responded to General Quarters. Charged hoses were spraying Turret II from outside, shooting water through open hatches, around the gun barrels and in through vents within minutes of the explosion. Although many members responding to the mass conflagration were not in full battle dress and were unfamiliar with the physical layout of Turret II, they nevertheless fought the fire valiantly and effectively.

CAPT [redacted], USMC, and 1ST SGT [redacted] USMC, were quickly on scene and, in an effort to rescue any Turret II survivors, quickly forced open an emergency escape hatch. Within time General Quarters plus eight. FN [redacted], USN, ENFA [redacted], USN, FR [redacted], USN, and MR3 [redacted] USN, all members of repair V, entered Turret II gun house and fought the fire from within. Protected from the extreme interior heat by recently delivered one piece fire fighting ensembles and OBA's, their brave efforts quickly brought the fire in the gun house under control.

GMGC [redacted] USN, GMG1 V [redacted], USN, and HT1 [redacted], USN, immediately entered behind the first four servicemen and took control of the fire fighting efforts from within, applying Aqueous Film Forming Foam (AFFF), and setting reflash watches. At great personal risk, these three servicemen stayed in Turret II, almost continuously, until all fires were extinguished. Although too numerous to list in this summary, in helping to save their ship and attempting to rescue their shipmates, many IOWA crewmen distinguished themselves.

Many possibilities for the cause of detonation have been investigated. The burning ember theory has been ruled out. The primer was removed and had not fired. Questions of static electricity generated sparks (ESD) or electromagnetic radiation (HERO) as a source of ignition have been tested and available data rules them out.

Although the powder used in Turret II had been temporarily stored at Naval Weapons Station, Yorktown, Virginia, in barges from April until August 1988 without temperature or humidity records, controlled tests of powder from the same lot number, including powder from the magazines of IOWA Turrets I, II, and III, indicate both the black powder and the propellant were stable. Tests showed that any possible static electric spark within the gun turret was too insignificant to ignite either the black powder or propellant. Moreover, after thorough investigation, no mechanical failure in the gun room was found that could have been or served as a source of ignition.

Analysis of the reconstructed rammer places the rammer head about 21 inches past its normal point inside the breech at the time of the explosion. At this position the rammer would have pushed the five powder bags up to the base of the projectile while constricting the opening and defining a confined space. Controlled tests of similar powder explosions indicated detonation occurred in the area of the first and second bags from the projectile in the breech and was a high order explosion generating about a 4,000 psi pressure wave.

The investigation into and the analysis of all potential causes of this tragic explosion have been complicated by the issues of improperly loaded munitions in the center gun (NALC D881 projectile with five full charge bags from NALC D846 vice six), lack of an effective and properly supervised assignment and qualification process, and poor adherence to explosive safety regulations and ordnance safety. While none of these factors have been determined to be the cause of the explosion, or provide an ignition source, they cast the proper operation of gunnery systems in USS IOWA (BB 61) in a very poor light and generate doubt.

Despite extensive testing, no anomalies which could have served as an accidental source of ignition have been found in either hardware or ammunition components. There is strong evidence however, to support an opinion that a wrongful intentional act caused this incident.

PRELIMINARY STATEMENT

1. By 19 April 1989 oral appointing order, VADM _____, U.S. Navv. Commander, Naval Surface Force, U.S. Atlantic Fleet, appointed RADM _____, U.S. Navy, to conduct a one officer investigation into circumstances related to the explosion in Turret II on board USS IOWA (BB 61) in the vicinity of the Puerto Rican operating area (PROA) on 19 April 1989. The original oral appointing order was subsequently confirmed, in writing, on 27 April 1989 by enclosure (1).

2. This investigation commenced in USS IOWA (BB 61) on 20 April 1989 and continued on board USS IOWA (BB 61), at Naval Legal Service Office, Norfolk, Virginia, and at Headquarters, Naval Surface Force, U.S. Atlantic Fleet until completion. Assigned counsel for the Investigating Officer was Commander _____, JAGC, USN. The following officers assisted the Investigating Officer as required:

- Captain _____, USN
- Lieutenant Commander _____, USN
- Lieutenant _____, JAGC, USN
- Lieutenant _____, USN
- Lieutenant _____, USN
- Lieutenant _____, JAGC, USNR
- Lieutenant (junior grade) J _____, USN

Additional Navy and Army technical expertise and assistance was provided by activities listed in enclosure (2) pp. 2, 3, Appendix M and Addendum 3 pp. 2, 3 to enclosure (2) under the direction of Captain _____, U.S. Navy, Naval Sea Systems Command (SEA-06X).

3. On 8 May 1989, after receiving information that suggested motive for a criminal act that could have caused the 19 April 1989 explosion in Turret II, USS IOWA (BB 61), I made a formal oral recommendation to the Convening Authority that he immediately initiate a criminal investigation into circumstances surrounding the incident. Commander, Naval Surface Force, U.S. Atlantic Fleet, on 8 May 1989, directed the Naval Investigative Service (NIS) to commence such an investigation. Although that investigation remains open and is ongoing, I have reviewed the 21 June and 10 July, 1989, NIS interim reports. Certain Findings of Fact and expressed Opinions contained in this report have been formulated after full consideration of the contents of those reports. Section 0212 of reference (a) proscribes inclusion of Naval Investigative Service Reports of Investigation in JAG Manual Investigations. Accordingly, a transcript of testimony taken from Mr. _____ the NIS case supervisor for the criminal investigation of this incident, has been included in this report to serve as an abbreviated foundation for Facts and Opinions formulated after consideration of the NIS investigation.

AUB6

4. The Federal Bureau of Investigation (FBI) is conducting forensic tests to validate preliminary findings by Navy metallurgists that material foreign to the propelling charge was present within the breech in center gun, Turret II on 19 April, 1989. Those initial Navy test results are included herein as support for certain Findings of Fact and Opinions. When completed, results of the FBI tests will be submitted to NIS for inclusion in a further criminal investigative report and provided to cognizant naval authorities for action, as appropriate. Based on NIS reporting results, review authorities for this JAGMAN investigation may change, modify, or enhance applicable Findings of Facts, Opinions, and/or Recommendations contained herein.

5. This investigation has been conducted and this report is being prepared in contemplation of litigation and for the express purpose of assisting attorneys representing the interests of the United States in this matter. All Memoranda for the Record included in this report which are not over my signature are produced as a result of my specific request or direction. In every instance, I was shown or was personally familiar with all documents or records used in establishing their content, and personally attest to their accuracy. All documents and material, as well as personal notes and references used during the course of the investigation that are not included in this report have been provided to Commander, Naval Surface Force, U.S. Atlantic Fleet.

6. No social security numbers or other information requiring Privacy Act statements contained in this report of investigation were solicited during the course of the investigation. Accordingly, no Privacy Act statements were executed or are enclosed. Social Security numbers for deceased servicemen were obtained from official sources.

7. All enclosures attached hereto are either original documents or are certified to be true and accurate copies of the original documents. Careful review of all enclosures, including video recordings, is warranted prior to release of this investigation to ensure sensitive material (i.e. bodies of deceased servicemen, etc.) is not unintentionally disclosed.

8. The Naval Sea Systems Command has provided invaluable technical and scientific expertise to this investigation and will continue to pursue certain issues requiring further evaluation, analysis, and review. To expedite submission of this investigation, this report is submitted after full review, consideration, and inclusion of Naval Sea Systems Command Technical Investigation Officer's interim technical report and addenda thereto concerning the incident. When completed, the final technical report will be submitted to appropriate review authorities for inclusion in this investigation. Based on future test results, review authorities may change, modify, or enhance applicable Findings of Fact, Opinions, and/or Recommendations contained herein.

As of 22 June 1989, manhours required for testing in support of this investigation at the various ordnance activities, laboratories and the Norfolk Naval Shipyard have totalled in excess of 45,669 hours, at a cost in excess of \$2,409,000.00. Additional testing is ongoing.

9. Difficulties encountered in this investigation include:

a. Watch station assignment information provided by the ship did not accurately reflect positions manned by personnel of Turret II. Further, the explosion made visual identification of deceased servicemen difficult. Accordingly, careful and close evaluation of all evidence was required to ensure the most accurate casualty identification and to match personnel with gunnery station assignments.

b. After successfully completing all fire fighting efforts in Turret II, the Commanding Officer took action to remove bodies and unexploded ordnance from the turret. Subsequently, organized working parties went through the turret to collect human body parts. The turret continued to present an immediate safety hazard to USS IOWA (BB 61) because of internal hydraulic oil spillage and unburned propellant. Accordingly, safety mandates compelled cleanup and disposal efforts to proceed prior to full and complete examination of all material located in Turret II. This was an impediment to this investigation's completeness because immediately after the explosion, no one systematically recorded the location of the bodies or the condition of the turret's interior. This precluded full examination of physical evidence at the scene to address possible issues of wrongful intentional acts.

c. Except for Commander Second Fleet Battle Watch, no time checks were conducted on board IOWA on the day of the accident. This resulted in discrepancies in recorded times for events.

10. Administrative and logistics support provided by Navy Legal Service Office, Norfolk, Virginia, was outstanding and noteworthy. Investigation results were expedited by this support.

11. All times contained in or discussed by this report are "Q" time unless otherwise indicated.

12. During the investigation, location, internal configuration, and manning for IOWA's 16"/50 caliber gun turrets were relevant to full circumstance development. The following descriptive overview of the turrets is provided to assist in review:

a. There are three 16"/50 caliber three-gun turrets on USS IOWA (BB 61), which comprise the ship's "Main Gun Battery." Turrets I, II, and III are almost identical, differing only in minor details which adapt each turret to its ship location. Located on ship centerline, two turrets are forward of the superstructure and one turret is aft (Enclosure (3)). Each turret is comprised of a gun house and a rotating structure, a fixed structure, magazines and ordnance installations. The gun house is mounted above and attached to the rotating structure. Cylindrical and conical in construction with a maximum diameter of thirty-five (35) feet, the rotating structure is supported by a roller path and consists of six deck levels. Turret II has a seventh deck level, a mezzanine in the powder handling flat, which is part of the fixed structure and provides

additional projectile stowage. Turrets II and III are equipped with rangefinders, while Turret I is not. Enclosure (4) shows the turret general arrangement.

The seven deck levels of Turret II are contained within five structures as follows:

The gun house, the uppermost section, with two levels, the shelf plate and the pan floor
Electric deck
Upper Projectile Flat
Lower Projectile Flat
Powder Handling Flat (lower most level with a mezzanine level for additional projectile stowage).

b. The gun house for Turrets I and III are located on IOWA's main deck. The gun house for Turret II is located on the O1 level.

c. The gun house is divided into six sections: a Turret Officer's booth, three gun rooms (left, center and right), and sight setter stations (left and right). The gun rooms and booth are separated from each other by bulkheads. Flame tight doors in the bulkhead between the gun rooms and the booth permit access (Enclosure (5)).

13. The 16" Gun MK 7 MOD 0 is a 50 caliber bag ammunition gun designed for use in IOWA's three gun turrets. During loading, a projectile is hoisted from the projectile deck into the cradle in the gun room using a projectile hoist. The breech plug then swings down, opening the gun's breech, and the cradle is extended into the breech. A primer is placed into the firing lock of the breech plug while a hydraulic ram slides the projectile across the cradle and into the breech.

A two-tier powder car carries powder charges through a powder trunk from the powder handling flat to the gun room. The cradleman and the gun captain guide the powder bags as they are dumped from the hoist car onto the cradle. Lead foil that serves as a decoppering agent is placed between the first and second powder bags to enter the breech. The ram then slides the powder into the breech behind the projectile. The cradle is retracted and the breech plug containing the primer is swung into place closing the breech. For a more detailed description of the loading sequence, see enclosure (6).

A complete round consists of a projectile and a propelling charge. A large quantity of propellant is required to shoot the projectile to its target. To facilitate loading, the propellant is divided into several fabric bags, each light enough to be handled by one person. An integral part of each bag is a red-dye quilted silk pad at one end which contains coarse black powder that ignites the propellant train.

The straps used for handling, the lacing used to cinch the bag and the bag itself are all made of silk because it burns without leaving a smoldering ash.

A full charge load consists of six bags of powder each weighing between about 94 lbs and about 110 lbs (depending on type) and a primer used to ignite the powder train. A reduced charge consists of six powder bags each weighing about 55 lbs and a primer used to ignite the powder train.

Throughout this record of investigation, some witnesses have characterized a reduced charge load as consisting of less than six full charge bags (ie. five or four full charge bags). Such characterization is inconsistent with standard Navy terminology and definitions.

14. Positions and assigned locations for turret operations follow:

<u>Location in turret</u>	<u>Position Description</u>
<u>GUN HOUSE</u>	
TURRET BOOTH	TURRET OFFICER TURRET CAPTAIN TURRET REPAIRMAN VELOCIMETER OPERATOR COMPUTER OPERATOR RANGEFINDER OPERATOR* RANGEFINDER POINTER* RANGEFINDER TRAINER*
LEFT GUN ROOM	LEFT GUN CAPTAIN LEFT CRADLEMAN LEFT RAMMERMAN LEFT PRIMERMAN LEFT POWDER CAR OPERATOR
CENTER GUN ROOM	CENTER GUN CAPTAIN CENTER CRADLEMAN CENTER RAMMERMAN CENTER PRIMERMAN CENTER POWDER CAR OPERATOR
RIGHT GUN ROOM	RIGHT GUN CAPTAIN RIGHT CRADLEMAN RIGHT RAMMERMAN RIGHT PRIMERMAN RIGHT POWDER CAR OPERATOR
SIGHT SETTER	LEFT SIGHT SETTER LEFT SIGHT POINTER LEFT SIGHT TRAINER RIGHT SIGHT SETTER RIGHT SIGHT POINTER RIGHT SIGHT TRAINER

ELECTRIC DECK

LEFT GUN LAYER
CENTER GUN LAYER
RIGHT GUN LAYER
TRAIN OPERATOR

PROJECTILE DECKS

PETTY OFFICER IN CHARGE

LEFT HOIST OPERATOR
CENTER HOIST OPERATOR
RIGHT HOIST OPERATOR
PHONE TALKER
PROJECTILE RING OPERATOR
PARBUCKLERS (3)
SHELLMAN (6)
TURRET ELECTRICIAN

POWDER FLAT

PETTY OFFICER IN CHARGE
RIGHT POWDER DOOR OPERATOR
CENTER POWDER DOOR OPERATOR
LEFT POWDER DOOR OPERATOR
PHONE TALKER

POWDERMAN (9)

ANNULAR SPACE

PETTY OFFICER IN CHARGE
PHONE TALKER
SCUTTLE LOADER (3)
SCUTTLEMAN (3)

MAGAZINES

PETTY OFFICER IN CHARGE
MAGAZINE SUPERVISOR (3)
PHONE TALKER (3)
POWDERMAN (12)

* Turrets II and III only.

15. The USS IOWA (BB 61) is the lead ship of the Iowa class battleships. Following the laying of the keel on 27 June 1940, the ship was launched in 1942 and commissioned the following year with a complement of 2,800 officers and enlisted men.

During World War II, IOWA served in the Pacific theater supporting carrier air strikes on Japanese held islands. On 24 March 1949, she was decommissioned and placed in the Reserve Mothball Fleet in San Francisco Bay.

On 1 April 1951, with the outbreak of hostilities in Korea, USS IOWA (BB 61) was recommissioned. As Flagship of the 7th Fleet, she fired 4,500 rounds of 16-inch ammunition, more than double the amount fired by IOWA in all of World War II. IOWA was decommissioned again on 24 February 1958 and retired to the Mothball Fleet in Philadelphia.

IOWA was commissioned for the third time on 28 April 1984. In all, Iowa has eighteen (18) years of active service in the forty-six (46) years since her original commissioning.

16. A glossary of acronyms and abbreviations used throughout this report (as well as evidence/testimony received) is attached as enclosure (7). The term "explosion" in its generic sense is used to describe the incident that happened in IOWA's Turret II on 19 April 1989. Although all powder burned within milliseconds and the pressure reached approximately 4,000 psi, technically the incident was a very rapid burning, a deflagration. For purposes of this report, the term "explosion" is synonymous with deflagration and/or conflagration.

FINDINGS OF FACT

1. At 0955 on 19 April 1989, while being loaded into the open breech of the center gun of Turret II in USS IOWA (BB-61), five 94-pound bags of smokeless powder from NALC D846 ignited. (Enclosures (2) pp.9-12; (2) Addendum 1 encl (1) of encl (4) of encl (8); (2) Addendum 3 p.11; (8); (9) pp.6,24,28; (10) pp.2,14,16; (11); (12) p.5; (13) p.8)
2. The force of the explosion drove a 2700 lb. BL&P projectile about three-feet one-inch into the rifling with the blast blowing back through the gun house into the Turret Officer's booth, into the left and right gun rooms, and down through the powder trunks and vents to the lower levels of the turret. (Enclosures (2) p.9; (2) Addendum 3 p.11; (14); (15); (16); (17); (18))
3. Fire and blast of extreme velocity, pressure and temperature spread throughout Turret II instantaneously. (Enclosures (2) pp.9-12; (2) Addendum 3 pp.11,12; (18); (19); (20))
4. Extensive fire and blast damage occurred in the gun house and the powder handling flat. (Enclosures (2) pp.9-12; (2) Addendum 3 pp.11,12; (18); (21); (22); (23); (24); (25); (26))
5. Within seconds, a second explosion (low order) occurred when an unknown number of powder bags ignited and burned in the powder handling flat. (Enclosures (2) pp.10-12; (2) Appendix D; (12) pp.28,29; (27); (28))
6. Subsequently, a third ignition (low order), probably caused by carbon monoxide gas, occurred around nine minutes after the initial explosion. (Enclosures (2) Appendix D; (27); (29) pp.3,4)
7. Fire continued in the powder handling flat as powder bags on the left and right powder cars, the left and center powder trays, the scuttles and at other locations around the flat ignited. However, despite the intense heat and pressure, no projectiles detonated. (Enclosures (2) pp.9-12; (2) Appendix D; (9) p.29; (25); (26))
8. All forty-seven (47) servicemen in Turret II proper at the time of the explosion died instantaneously or nearly instantaneously of either blast, blunt force and/or thermal injuries. All were positively identified by dental records and/or fingerprints. Post-incident medical evaluation disclosed no evidence of drug or alcohol use by deceased servicemen. (Enclosures (2) p.1; (2) Appendix D; (27); (30); (31))
9. No personnel outside the turret sustained injuries as a result of the explosions. Twelve personnel in Turret II's annular space and magazine at the time of the explosion survived without injury. (Enclosures (9) pp.1-3; (10) p.1; (32) p.5; (33) p.2; (34) p.1; (35) pp.1, 10; (36) p.2; (37) p.1; (38) p.1; (39) p.1; (40) p.1; (41) p.1; (42) p.1))

Pre-Incident Scenario

10. Between 13 April and 19 April 1989, USS IOWA (BB-61) was participating in Fleet Exercise (FLEETEX) 3-89, a regularly scheduled exercise designed to train Battle Group Commander(s), staff(s), Warfare Commanders/Coordinators and units in conduct of offensive and defensive battle group operations. (Enclosure (43))

11. USS IOWA (BB 61) served as the flagship for Commander Second Fleet, the Officer Conducting the Exercise, (OCE). Commander Carrier Group Two was the Battle Group Commander. On 13 April 1989, the relevant command structure for the USS IOWA (BB 61) was:

a. Captain USN, Commanding Officer since May 1988.

b. Commander USN, Executive Officer since January 1989.

c. Commander , USN, Operations Officer since December 1986.

d. Commander I , USN, Weapons Officer since August 1988.

e. Lieutenant Commander , USN, Gunnery Officer since September 1988.

f. Lieutenant Junior Grade Phillip E. Buch, USN, G-2 Division Officer/Turret II Officer since March 1988. (Enclosures (43); (44); (45))

12. Specific operations scheduled within the exercise were intended to train Battle Group Warfare Commanders and ships in coordinated operations in a multi-threat environment with emphasis on responsiveness to intelligence and warning, rules of engagement, campaign planning and execution, and simulated tactical operations, including amphibious task force support. (Enclosure (43))

13. During the morning of 19 April 1989, IOWA was participating in a FLEETEX 3-89 (ADVANCED) Open Ocean Naval Gun Fire Support (NGFS) exercise. Originally, IOWA was to be point OSCAR and simulate stationary shore fire control party (SFCP) positions for gunnery exercises by USS AINSWORTH (FF-1090), USS AYLWIN (FF-1081), and USS IOWA (BB 61). (Enclosures (46); (47) pp.5,6)

14. The firing plan's stated objectives were to:

a. Train Combat Information Center (CIC), Fire Control, and gunnery personnel in delivering fire against a point target.

b. Verify operability of the main battery.

c. Provide IOWA Marine detachment personnel experience in calling and spotting fire missions. (Enclosure (48))

15. As originally written, the firing plan provided a commencement time of 1000 for the NGFS with IOWA shooting twenty-two (22) rounds of 16" Blind Loaded and Plugged (BL&P) projectiles from Turrets I and II. The firing sequence was to have been single gun salvos fired in succession to port from Turrets I and II, one gun at a time, until all allotted rounds (22) were expended. Forward Main Battery Plot was to have controlled Turret I and Aft Main Battery Plot was to have controlled Turret II. The firing plan called for reduced charge, forty-four (44) cans. (Enclosures (12) pp.62,64; (13) pp.8,106,107; (47) pp.5,6; (48))

16. Type Commander policy requires that prefire briefs precede gunnery exercises. (Enclosure (49))

17. The Firing Plan was briefed to IOWA personnel on 18 April 1989. To reduce the number of people at any one brief, unwritten IOWA policy permitted the use of two separate briefs, a "pre-prefire" brief and a "prefire" brief. (Enclosures (13) p.4; (50) p.5)

18. "Pre-prefire" briefs were to cover: exercise procedures, ammunition types to be employed, misfire/hangfire procedures, hot-gun procedures, and general safety precautions dealing with magazine safety. (Enclosures (13) p.4; (50) p.5)

19. Weapons Department policy required all gunnery, fire control, ammunition handling teams, and control personnel to attend pre-prefire briefs. (Enclosures (12) pp.45,46; (13) p.4; (47) p.4; (50) p.5)

20. If all personnel assigned to the above positions had attended the 18 April 1989 pre-prefire brief, the actual number of service members in attendance would have been in excess of 100 people. Gunner's Mates from G-1, G-2, and G-3 divisions are assigned to Turrets I, II, and III respectively. (Enclosures (13) pp.6,12; (47) pp.5,11; (50) p.5)

21. IOWA procedures did not ensure safety briefs were systematically conducted for all main gun battery personnel before gunnery exercises. (Enclosures (10) p.12; (13) pp.7,12; (47) pp.2-12; (51) pp.8,9; (52) p.6; (53) p.2)

22. LT _____, USN, the Main Gun Battery Fire Control Officer, discussed the 19 April firing plan at a pre-prefire brief on the port side of Turret III around 1000 on 18 April 1989 in IOWA. The only safety procedure addressed by LT _____ was the distance at which to keep the AYLWIN and AINSWORTH during the exercise. (Enclosures (46); (47) pp.2-12; (54))

23. Contrary to firing plan specifics, the pre-prefire brief included discussions about the possibility of Turret III firing 2700 lb BL&P projectiles using four bags of full powder charge from NALC D846. (Enclosures (47) p.8; (55) pp.35-37)

24. At the pre-prefire brief, personnel were not mustered, but approximately forty (40) servicemen attended. (Enclosure (47) pp.3,4,11)

25. In addition to IOWA's pre-prefire brief, CDR _____ conducted a prefire brief in IOWA on 18 April 1989. Although the Commanding Officer, Executive Officer, Turret Officers, Turret Captains, and Fire Control personnel normally attend prefire briefs, the Commanding Officer did not attend the one on 18 April 1989 due to scheduling conflicts. No muster was taken for this brief. (Enclosures (13) pp.6,7; (50) p.5)

26. The prefire brief included a discussion concerning safety procedures and the firing plan. Additionally, CDR _____ specifically briefed ammunition configuration, which included the use of 1900 lb BL&P projectiles (NALC D873) with reduced charge powder (NALC D845) in Turret I and 2700 lb BL&P projectiles (NALC D881) with five bags full charge powder from NALC D846 in Turret II. Firing for Turret III was not briefed. (Enclosure (13) pp.7-10)

27. The Commanding Officer was subsequently briefed on the firing plan, while on the bridge, by CDR Kissinger immediately before commencing the exercise. (Enclosure (13) pp.101-103)

28. At 0831 on 19 April 1989, gunnery stations were manned. During the evening hours of 18 April 1989, it was determined that USS AYLWIN (FF-1081) and USS AINSWORTH (FF-1090) would not participate in the gunnery exercise. Accordingly, the firing plan was orally modified (subsequent to manning) to fire the main battery guns to starboard. (Enclosures (13) p.8; (27); (47) p.8)

29. The decision to fire to starboard was motivated, in part, by the desire to fire Turret III guns. While Turret III guns are capable of firing to port, the on deck stowage of ship's boats port side aft made firing to port impracticable. (Enclosures (12) p.62; (13) p.8; (47) pp.8,9)

30. The Weapons Officer intended to request authorization from the Commanding Officer to fire the right and center guns of Turret III (left gun of Turret III was inoperable due to a broken powder hoist). No request was ever made or received. However, Turret III personnel prepared to fire 2700 lb projectiles (NALC D881) using four bags of full charge powder from NALC D846 by moving ordnance within the turret. (Enclosures (13) pp.8,26,27; (55) pp.34-37; (56); (57) p.2)

31. On and before 19 April 1989, the Commanding Officer's policy was that no ordnance could be moved in IOWA without his direct authorization. (Enclosures (13) p.103; (50) encl [8] p.6; (58) pp.36-37)

32. Movement of ordnance in Turret III on 19 April 1989 was not authorized by the Commanding Officer. (Enclosures (12) p.72; (58) pp.19, 36,37)

33. The Commanding Officer was not advised of the plan to fire right and center guns of Turret III or the load configuration intended to be fired from these guns. (Enclosures (12) pp.71,72; (58) pp.18,19,36,37)

34. IOWA commenced the initial main gun battery firing run at 0933 and commenced fire to starboard from Turret I at 0938. No secondary battery guns fired on 19 April 1989. (Enclosures (13) pp.112,113; (27); (59) pp.21,22)

Turret I

35. The firing sequence for Main Gun Battery on 19 April 1989 was to commence with Turret I firing left, center, and right guns. The load order stated: "Left, center, right guns one round. Load." All guns were loaded with 1900 lb BL&P (NALC D873) using NALC D845 power, lot number IU4C68. The firing sequence commenced with a misfire in the left gun. (Enclosures (60) pp.1-3; (61); (62) p.8)

36. Misfire procedures were immediately initiated in left gun Turret I. The center gun, then the right gun, both fired a single round salvo. After center gun and right gun were fired, personnel in Turret I reprimed, super-elevated, and then returned the left gun to target elevation. (Enclosure (62) p.8)

37. After reloading center and right guns, personnel in Turret I again attempted to fire left gun. A second misfire occurred. Center and right guns then fired one round sequentially. Left gun was reprimed, super-elevated, and returned to target elevation for the second time and misfired for a third time. The firing sequence proceeded to Turret II. Exact times for Turret I firing sequence were not recorded. (Enclosures (27); (62) pp.8-10; (63) p.40)

38. Although the term "super-elevated" is used frequently in testimony to describe elevating guns to the extreme elevation to seat charge bags back on the mushroom face, 16"/50 caliber turret guns are mechanically precluded from being super-elevated. The term as used by main gun battery personnel actually means elevated to the maximum point capable, given design constraints. (Enclosure (64))

39. Cognizant bridge personnel were aware of the danger posed by the left gun of Turret I and were conscious of the requirement to keep the gun pointed in a safe direction. (Enclosures (63) p.41; (65) p.8)

40. The Commanding Officer was unaware that ENS _____ was the only officer assigned in Turret I on 19 April 1989. ENS _____ had been on board IOWA for sixteen (16) days. (Enclosures (58) p.25; (66) p.1)

The Explosion in Turret II

41. On 19 April 1989, at morning quarters, both the Turret Officer and Turret Captain advised G-2 division personnel they would be firing 2700 lb projectiles (NALC D881) with five full charge powder bags from NALC D846 that morning. A total of ten rounds were to be fired, two from left and four from both center and right guns, respectively. (Enclosures (9) pp.6,28; (10) pp.2,12)

42. NALC D846 is defined in NAVSEA OP2165 as "Charge, propelling 16"/50 caliber full, bagged, non-flashless w/wear-reducing jackets, f/use w/1900 lb projectiles 3 sects per tank MK 4 MODS or MK 3-2, 1 RD consisting of 6 sects in 2 tanks." (Enclosure (67))

43. Naval policy requires every type of Naval gun to fire only ammunition assemblies authorized for that particular type of gun. (Enclosure (68) pp.12-24)

44. NALC D846 powder cans and the ammunition data cards contained therein state: "WARNING DO NOT USE WITH 2700 LB (AP, BL&P) PROJECTILE." (Enclosures (69); (70); (71))

45. Although the Commanding Officer knew Turrets I and II would fire reduced charges on 19 April 1989, he did not know the reduced charge anticipated for firing in Turret II was to be an abnormally configured charge of five full charge bags instead of six reduced charge bags. (Enclosures (13) pp.101-105; (58) p.18)

46. CDR [redacted], LCDR [redacted], FCCM(SW) [redacted], USNR, and GMCM(SW) [redacted], USN, all knew and approved of this load plan. FCCM(SW) [redacted] advocated and coordinated the use of experimental load configurations and shared data received with Naval Surface Warfare Center, Dahlgren, Virginia. (Enclosures (12) pp.5,6,11; (13) pp.7-9; (50) pp.7,8; (60) p.2; (63) pp.42-45; (65) pp.19-21; (72) pp.21-26,48,52,54,57,58; (73) pp.3,4; (74))

47. Prior to 19 April 1989, the only known instances of IOWA firing projectiles using five full charge bags was on 4 and 7 November 1987. (Enclosures (72) p.58; (73) pp.3,4; (74))

48. On 4 November 1987, IOWA fired six 1900 lb BL&P projectiles NALC D882, using five bags of full charge powder from NALC D846. On 7 November 1987, IOWA fired six 2700 lb BL&P projectiles, NALC D881, using five bags of full charge powder from NALC D846. (Enclosures (74); (75) pp.4,5)

49. Between 4 and 7 November 1987, the Weapons Officer, CDR [redacted] was on leave and this load configuration was fired without his expressed concurrence. Captain [redacted] USN, was in command of IOWA on 4 and 7 November 1987. (Enclosures (72) pp.53,54; (73) pp.3,4; (74))

50. IOWA had no authority to fire 1900 lb projectiles with less than six bags of powder on 4 November 1987, nor did IOWA have any authority to shoot 2700 lb projectiles NALC D881 with any amount of full powder charge from NALC D846 on 7 November 1987 or on 19 April 1989. (Enclosures (12) pp.6,9; (68); (72) pp.21-28; (73) p.4; (76))

51. Prior to the explosion, on 19 April 1989, Turret II personnel reported they were manned and ready, which means Material Condition "Zebra" was set, prefire checks had been held, transmission checks had been conducted, people were on station, safety precautions had been briefed, and the turret was ready to fire. Battle dress was not uniformly enforced in Turret II. (Enclosures (10) p.12; (13) pp.7,11-18; (35) pp.7,8; (36) pp.3,4; (37) p.5; (40) p.4; (42) pp.3,4; (47) p.12)

52. After the manned and ready report, and shortly before the explosion, Turret II personnel interrupted passing powder to permit YN3, USNR, to exit the turret. (Enclosure (77) pp.6,7)

53. Subsequent to completion of Turret I's firing, the phone talker in main battery plot, FC2(SW) USN, was directed by the plotting officer to have Turret II load all guns, one round. FC2(SW) passed this directive to LTJG Buch, Turret II Turret Officer. (Enclosure (78) p.2)

54. LTJG Buch ordered all guns one round, load in response to FC2(SW) communication. Left gun was loaded in forty-four (44) seconds, right gun was loaded in sixty-one (61) seconds, and center gun did not complete loading. (As timed by Investigating Officer from video tape recording submitted with this report as Enclosure (79)). (Enclosures (78) p.2; (80) p.2)

55. LTJG Buch reported, "Left gun loaded" and then "Right gun loaded." Ten seconds later, there was a premature detonation in Turret II, and communications with Turret II ceased. Approximately eighty-six (86) seconds elapsed between placing the gun to load elevation and the explosion. (As timed by Investigating Officer from video tape recording submitted with this report as Enclosure (79)). (Enclosure (78) pp.2,3)

56. Sound powered phone circuits in use within Turret II and with communication outside Turret II on 19 April 1989 were the intra-turret "XJ" circuit, the "JD" circuit between turret officers, plot, gun control and director and the "JB" circuit between turret velocimeter operators and Main Battery plot. (Enclosure (78) p.2; (81); (82) p.1; (83) p.1)

57. Immediately before the explosion GMCS(SW) Reginald O. Ziegler, USN, was Turret II Turret Captain and had internal communication on the "XJ" circuit with several personnel including BM2 USN, in Turret II annular space and GMG3, USN, in magazine A-515-M. Of those personnel with whom GMCS(SW) Ziegler had communication prior to the explosion, only BM2 and GMG3 survived. (Enclosures (9) p.4; (35) pp.1,2)

58. Shortly before the explosion, BM2 heard GMCS(SW) Ziegler state over the "XJ" circuit "Left gun is loaded. Good job! Center gun is having a little trouble. We'll straighten that out." (Enclosure (35) p.4)

59. GMG3 recalls hearing GMG2(SW) Richard E. Lawrence, USN, state over the "XJ" circuit, "I have a problem here, I'm not ready yet." (Enclosure (9) p.24)

60. Additionally, GMG3 recalls that shortly before the explosion, he heard over the "XJ" circuit GMCS(SW) Ziegler shout to LTJG Buch: Tell plot we are not ready yet, there is a problem in center gun, or words to that effect. GMG3 also recalls hearing GMG2(SW) Lawrence excitedly restate "I'm not ready yet. I'm not ready yet." (Enclosure (9) pp.24,25)

61. GMG2(SW) Lawrence was a member of Turret II center gun crew and was talking on the "XJ" phone circuit (an internal Turret II net). (Enclosure (9) p.24)

62. BM2 I recalls a period of silence on the "XJ" phone line before he heard an explosion. (Enclosure (35) p.4)

63. No indication of any problem in Turret II was heard over sound powered "JB" circuit. (Enclosures (82) pp.1,2; (83) pp.1,2)

64. No identification of any problem in Turret II was conveyed over sound powered "JD" circuit. (Enclosure (78) pp.1,2)

65. According to IOWA's Deck Log, the time of the explosion was 0953. (Enclosure (27))

66. FC2(SW) states the ship's clock in forward main battery plot read 0955 at the time of the explosion. The Commander Second Fleet Battle Watch Log similarly records the time of explosion as 0955. (Enclosures (8); (78) pp.2,3; (84) pp.2,3)

67. IOWA's reported position at 0956 was 2202N 06439W. (Enclosure (11))

68. At 0955, the ship was on course 179 degrees true at speed 25 knots. True wind was from 130 degrees at 13 knots and relative wind was from 16 degrees off the port bow at 35 knots. (Enclosures (27); (85); (86); (87) pp.2,3)

69. Controlled post-incident test measurements of detonations demonstrate an explosion of the intensity experienced in center gun Turret II can only be reproduced when ignition occurs in the approximate location of the first and second bags from the projectile within the breech with the rammerhead in the breech. (Enclosures (2) p.9; (2) Appendix D; (2) Addendum 3 pp.11,40; (88))

70. Operating directives indicate lead foils, used as a decoppering agent, are to be removed from the rough silk envelopes in which they are packaged and inserted between the first and second powder bags prior to each gun firing. The general practice on board IOWA, however, was to leave the lead foil in their silk envelopes. Moreover, IOWA Main Battery gun captains did not uniformly place the lead in its proper position or use lead foil patches for each firing. Nevertheless, lead foil had been inserted in center gun Turret II prior to detonation on 19 April 1989. (Enclosures (2) Addendum 1 encl.[3] p.2; (6); (75) pp.7-9; (89); (90) pp.2-4; (91) pp.29-32))

71. The rammer is controlled by the rammerman who responds to hand signals of the gun captain. Projectiles are rammed at high speed (13.9 ft/sec), yet the ramming of powder is cautioned to be at slow speed (1-2 ft/sec). When the powder reaches the proper position in the breech the gun captain signals for retraction of the rammer. (Enclosure (89) fig. 4-26)

72. At time of detonation the cradle was spanned and the rammer was inside the breech in a forward ramming cycle about 21 inches past the end position of a normal powder ram. This position would place the powder at the base of the projectile. The rammer control mechanism was positioned to produce movement of approximately one foot per second in the ramming direction. Prior to detonation, the projectile had been rammed to the correct position in the breech. After detonation, the force of the explosion shattered the rammer chain, hurling the rammer head against the after bulkhead and blew the door and door frame off center gun room. (Enclosure (2) pp.9,20,21; (2) Appendix E; (2) Addendum 1 encl.[3]; (2) Addendum 3 pp.11-14,22,23; Appendix Q; (2) Addendum 4 pp.1-2; (2) Addendum 5 pp.1-2)

73. For the most part, the explosive force of each blast was contained within Turret II. Known exceptions:

- a. The Turret II tail hatch was blown overboard.
- b. All Turret II gun bucklers (bloomers) were destroyed.
- c. A fireball was observed in passageway A-330-1L
- d. Blast damage and scorching of ventilation in passageway A-330-1L. (Enclosures (2) Appendix D; (32) pp.2,3; (59) p.4; (92) p.1; (93); (94); (95); (96); (97))

74. Before the explosion, forty-five (45) bags of powder had been removed from fifteen (15) cans in magazine A-515-M. Four remained on the magazine trays, one was in the annular space tray and forty (40) had been passed into the powder handling flat. Of the forty (40) to reach the powder handling flat, five were in the left gun (breech closed), five were in the right gun (breech closed), and five were in the center gun breech (breech block down). (Enclosures (9) pp.23,24; (10) p.13; (15); (16); (17); (98) pp.11,12)

75. Of the twenty-five (25) bags remaining at the powder handling flat, three were on the top level and two on the bottom level of the left gun powder car (doors closed), three were on the top level and two on the bottom level of the right gun powder car (doors open), and three were on the top tray and two the bottom tray of the center gun powder hoist (doors closed and car up). Of the remaining ten bags at least three were placed on passing scuttles, and at least three were on the left powder hoist trays. The exact location of the remaining four bags of powder cannot be determined. (Enclosures (2) Appendix D; (15); (16); (17); (25); (26); (77) pp.7,8)

76. The NALC D846 powder used in Turret II was taken from magazine A-515-M as briefed. All NALC D846 powder in that magazine was from lot number CRA87B001-001. (Enclosures (10) p.2; (12); (69); (70); (71); (99))

77. IOWA 16"/50 caliber full service charge powder NALC D846 Lot NR CRA87B001-001 and other powder and projectiles had been temporarily stored at Naval Weapons Station, Yorktown, Virginia, in barges from various dates in April until various dates in August and September, 1988. A post-incident study disclosed barge stowage reduced the remaining service life of NALC D846 powder from twelve (12) to ten (10) years. (Enclosures (2) p.25; (2) Addendum 1 encl.5; (2) Addendum 3 pp.6,28; (100); (101); (102))

78. No temperature or humidity records were kept for the period of temporary storage at NWS, Yorktown. (Enclosure (102))

79. Four scorched, but unignited, powder bags were recovered from the powder flat after the explosion. (Enclosures (15); (16); (17))

80. Fire and ordnance experts state their "best estimate of the number of charges burned in the powder handling flat is 18 minimum." (Enclosure (2) Appendix D)

Turret II Manning

81. The IOWA experienced manning shortages for Gunnery in both the Gunner's Mate rating as well as non-rated support from other departments. Specifically, manning on 19 April 1989 was as follows:

Gunnery Manning
Gunner's Mates

	SMD	NMP	COB
GMCM	2	2	1
GMCS	1	1	1
GMC	8	9	4
GMG1	15	12	5
GMG2	25	29	17
GMG3	28	26	50
GMGSN	<u>25</u>	<u>21</u>	<u>7</u>
	104	100	85

Other Departmental Support

SR/SA/SN	297	226*	219*
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*Fair share of total NMP and COB
(Enclosures (103); (104); (105))

82. The Ship Manning Document identifies ninety (90) positions to be filled in Turret II during General Quarters. Enclosure (106) provides Turret II General Quarters station assignments for 19 April 1989 were to have been:

TURRET OFFICER	LTJG Phillip E. Buch, USN
TURRET CAPTAIN	GMCS(SW) Reginald O. Ziegler, USN
TURRET REPAIR	GMG1(SW) Ernest E. Maryecz, USN
LEFT GUN CAPTAIN	GMG3 Jack E. Thompson, Jr., USN
LEFT CRADLE	GMG3(SW) James D. White, USN
LEFT RAMMERMAN	BM3 Todd C. McMullen, USN
LEFT PRIMERMAN	BMSN Robert J. Gedeon, III, USN
LEFT POWDER CAR	SN Brian R. Jones, USNR
CENTER GUN CAPT	GMG2(SW) Richard E. Lawrence, USN
CENTER CRADLE	BM2 Gary J. Fisk, USN
CENTER RAMMERMAN	GMG3 Robert W. Backherms, USN
CENTER PRIMERMAN	SR Reginald L. Johnson, Jr., USN
CENTER POWDER CAR	SN USN
RIGHT GUN CAPT	GMG3 Matthew R. Price, USNR
RIGHT CRADLE	GMG3 Milton F. DeVaul, USNR
RIGHT RAMMERMAN	GMG3 Geoffrey S. Schelin, USN

All B6

RIGHT PRIMERMAN	SA Brian W. Gendron, USNR
RIGHT POWDER CAR	SN Tyrone D. Foley, USN
SIGHT SETTER	BM2 Michael R. Williams, USN
SIGHT POINTER	not assigned
SIGHT TRAINER	" "
LEFT GUN LAYER	GMGSN John R. Young, USN
CENTER GUN LAYER	GMG3 Peter E. Bopp, USN
RIGHT GUN LAYER	GMG3 Heath E. Stillwagon, USN
TRAIN OP	GMG3 Walter S. Blakey, USNR
PROJECTILE DK POIC	GMG2 John P. Cramer, Jr., USN
LEFT HOIST OP	SA Leslie A. Everhart, Jr., USN
CENTER HOIST OP	SR Todd E. Miller, USN
RIGHT HOIST OP	SR John L. Goins, USN
PHONE TALKER	BM2, USN
PARBUCKLERS	SR Ramon J. Bradshaw, USN
	SA Scott A. Holt, USN
	SA Nathaniel C. Jones, USNR
	SN, USN
TURRET ELECTRICIAN	EM3 David L. Hanson, USN
POWDER FLAT	GMG2 Stephen J. Weldon, USN
	GMG3 Darin A. Ogden, USN
	YN3, USN
RIGHT POWDER CAR	SA Eric E. Casey, USN
CENTER POWDER CAR	SN Michael S. Justice, USNR
LEFT POWDER CAR	SN Ricky R. Peterson, USN
PHONE TALKER	SH3, USN
POWDERMAN	SR Rodney M. White, USN
	SN Edward J. Kimble, USN
	SN Otis L. Moses, USN
	SA Jose L. Martinez, Jr., USNR
	SR Todd T. Tatham, USNR
ANNULAR SPACE	BM2, USN, (POIC)
PHONE TALKER	SN, USN
POWDERMAN	SN, USN
	SR Harold E. Romine, Jr., USNR
POWDER MAG	GMG3, USN
	GMG3, USN
PHONE TALKER	SN, USN

POWDERMAN	SN	, USN
	SN	, USN
	SN	, USN
	SN	, USN
	SN	, USN

83. Although undated, enclosure (106) was distributed prior to the explosion. Such documents are not formally promulgated Weapons Department watch bills. Rather, they are documents initiated and distributed by Turret Officers to notify turret personnel of assigned stations. No other written Turret II station assignments were presented to or found by the Investigating Officer. There was no formal Watch, Quarter and Station Bill. (Enclosures (12) p.23; (13) p.68; (107) p.2)

84. Station assignments as listed in enclosure (106) were changed before gun stations were manned on 19 April 1989. Specifically, SN 1 BM2 SN and SH3 were not on board IOWA on that date. (Enclosures (36) p.4; (108); (109); (110))

85. Excluding the four above named personnel, all other listed service members performed duties in Turret II on 19 April 1989. Additionally, the following also served in Turret II on that date to bring the total stations filled to fifty-six (56) plus four under instruction:

FC3 Tung T. Adams
 EMFA Dwayne C. Battle
 SN
 GMG2 Clayton M. Hartwig
 LN1(SW) Michael W. Helton
 FCSA Richard J. Lewis
 LN1(SW) Robert K. Morrison

General Quarters stations not filled in Turret II on 19 April were nine local control stations (firing from local control was not planned), eight of fifteen (15) projectile decks stations, two of fourteen (14) powder handling flat stations, six of nine annular space stations and nine of eighteen (18) magazine stations. (Enclosures (9) p.22; (27); (31); (111))

86. BM2 , SN and SN performed assigned duties in Turret II's annular space on 19 April 1989 and survived the explosion. (Enclosures (35) p.1; (36) p.2; (37) p.1)

87. GMG3 , GMG3 SN , SN , SN performed assigned duties in magazine A-515-M and survived the explosion. (Enclosures (9) p.1; (10) p.1; (33) p.1; (34) p.1; (38) p.1; (39) p.1; (40) p.1; (41) p.1; (42) p.1)

88. YN3 was called out of Turret II just prior to the explosion and survived. (Enclosures (35) p.8; (77) pp.3,6)

89. LTJG Philip E. Buch, , USN, USS IOWA (BB-61) died from multiple blunt force injuries while performing duties as the Turret Officer in the turret booth. (Enclosures (9) p.4; (112); (113); (114); (115) p.32)

90. GMCS(SW) Reginald O. Ziegler, , USN, USS IOWA (BB-61) died from inhalation of products of combustion while performing duties as Turret II Captain in the turret booth. (Enclosures (9) p.4; (29) p.20; (55) p.29; (57) p.10; (106); (112); (113); (115) p.32; (116); (117))

91. GMG1(SW) Ernest E. Hanyecz, , USN, USS IOWA (BB-61) died from blunt force injuries to the head while performing duties as turret repairman in the turret booth. (Enclosures (55) p.29; (106); (112); (115) p.32; (117); (118))

92. GMG3 Jack E. Thompson, Jr., , USN, USS IOWA (BB-61) died from inhalation of products of combustion and thermal injuries while performing duties as left gun captain in the left gun room. (Enclosures (55) p.29; (106); (112); (117); (119))

93. GMG3(SW) James D. White, , USN, USS IOWA (BB-61) died from thermal injuries while performing duties as left gun cradleman in the left gun room. (Enclosures (106); (112); (120))

94. BM3 Todd C. McMullen, , USN, USS IOWA (BB-61) died from inhalation of products of combustion while performing duties as right gun cradleman in the right gun room. (Enclosures (112); (121); (122) p.4)

95. BMSN Robert J. Gedeon, III, , USN, USS IOWA (BB-61) died from inhalation of combustion products while performing duties as left gun primerman in the left gun room. (Enclosures (106); (112); (122) p.3; (123))

96. SN Brian R. Jones, , USNR, USS IOWA (BB-61) died from inhalation of products of combustion while performing duties as the left gun powder hoist operator in the gun house. (Enclosures (36) p.4; (112); (124))

97. GMG2(SW) Richard E. Lawrence, , USN, USS IOWA (BB-61) died from blast injuries while performing duties as the center gun cradleman in the center gun room. He attended the prefire brief on 18 April and signed the prefire check sheet as the center gun captain. (Enclosures (9) p.4; (55) p.29; (106); (112); (117); (125); (126))

98. GMG2 Clayton M. Hartwig, , USN, USS IOWA (BB-61) died from multiple blunt force injuries (blast) while performing duties as center gun captain in the center gun room. His current tour expiration date was to have been November 1989. (Enclosures (112); (113); (127); (128); (129))

99. GMG3 Robert W. Backherms, , USN, USS IOWA (BB-61) died from multiple blunt force injuries while performing duties as center gun rammerman in the center gun room. (Enclosures (106); (112); (130))

100. SN Reginald L. Johnson, Jr., USN, USS IOWA (BB-61) died from blunt force injuries to the chest and neck while performing duties as center gun primerman in the center gun room. (Enclosures (106); (112); (131))

101. BM2 Gary J. Fisk, , USN, USS IOWA (BB-61) died from inhalation of products of combustion while performing duties as center gun powder hoist operator in the gun house. (Enclosures (36) pp.4,5; (112); (132); (133) p.4)

102. GMG3 Matthew R. Price, USNR, USS IOWA (BB-61) died from blunt force injuries to the head while performing duties as right gun captain in the right gun room. (Enclosures (55) p.29; (106); (112); (117); (134))

103. GMG3 Milton F. Devaul, USNR, USS IOWA (BB-61) died from blunt force injuries to the head and inhalation of products of combustion while performing duties as left gun rammerman in the left gun room. (Enclosures (55) p.29; (112); (117); (135))

104. GMG3 Geoffrey S. Schelin, USN, USS IOWA (BB-61) died from inhalation of hot gases and thermal injuries while performing duties as right gun rammerman in the right gun room. (Enclosures (106); (112); (117); (136))

105. SA Brian W. Gendron, USNR, USS IOWA (BB-61) died from inhalation of products of combustion while performing duties as right gun primerman in the right gun room. (Enclosures (106); (112); (117); (137))

106. BM2 Michael R. Williams, USN, USS IOWA (BB-61) died from thermal injuries while performing duties as right sight setter in the gun house. (Enclosures (55) p.29; (106); (112); (113); (117); (138); (139))

107. GMGSN John R. Young, , USN, USS IOWA (BB-61) died from thermal injuries and inhalation of products of combustion while performing duties as left gun layer on the electric deck. (Enclosures (55) p.29; (106); (112); (117); (139); (140))

108. GMG3 Peter E. Bopp, USN, USS IOWA (BB-61) died from inhalation of products of combustion while performing duties as center gun layer on the electric deck. (Enclosures (55) p.29; (106); (112); (117); (141))

109. GMG3 Heath E. Stillwagon, USN, USS IOWA (BB-61) died from closed head blunt force injuries and inhalation of products of

combustion while performing duties as right gun layer on the electric deck. (Enclosures (106); (112); (142))

110. GMG3 Walter S. Blakey, , USN, USS IOWA (BB-61) died from blunt force injuries of head and trunk, inhalation of products of combustion, and thermal burns while performing duties as train operator on the electric deck. (Enclosures (106); (112); (139); (143))

111. GMG2 John P. Cramer, Jr., USN, USS IOWA (BB-61) died from thermal injuries and inhalation of products of combustion while performing duties as the POIC of the upper projectile deck. (Enclosures (55) p.29; (106); (112); (117); (139); (144))

112. SA Leslie A. Everhart, Jr., USN, USS IOWA (BB-61) died from inhalation of products of combustion while performing duties on the projectile deck. (Enclosures (55) p.29; (106); (112); (117); (145))

113. SR Todd E. Miller, , USN, USS IOWA (BB-61) died from thermal injuries and inhalation of products of combustion while performing duties as the center projectile hoist operator on the upper projectile deck. (Enclosures (55) p.29; (106); (112); (117); (146))

114. SR John L. Goins, USN, USS IOWA (BB-61) died from thermal injuries and inhalation of products of combustion while performing duties as the right projectile hoist operator, on the upper projectile deck. (Enclosures (55) p.29; (106); (112); (115) p.33; (117); (147); (148) p.5)

115. SR Ramon J. Bradshaw, , USN, USS IOWA (BB-61) died from craniocervical blunt force injuries while performing duties on the upper projectile deck. (Enclosures (55) p.29; (106); (112); (117); (149))

116. SA Scott A. Holt, , USN, USS IOWA (BB-61) died from thermal injuries while performing duties on the upper projectile deck. (Enclosures (55) p.29; (106); (112); (117); (150))

117. SA Nathaniel C. Jones, Jr., USNR, USS IOWA (BB-61) died from inhalation of products of combustion while performing duties on the upper projectile deck. (Enclosures (55) p.29; (106); (112); (117); (151))

118. EM3 David L. Hanson, , USN, USS IOWA (BB-61) died from inhalation of products of combustion while performing duties as Turret Electrician on the upper projectile deck. (Enclosures (55) p.29; (112); (117); (152))

119. GMG2 Stephen J. Weldon, , USN, USS IOWA (BB-61) died from craniothoracic blunt force injuries while performing duties on the powder flats. (Enclosures (55) p.29, (77) p.2; (106); (112); (117); (153); (154))

120. GMG3 Darin A. Ogden, 2, USN, USS IOWA (BB-61) died from inhalation of products of combustion and thermal burns while performing duties on the powder flats. (Enclosures (55) p.29; (77) p.2; (106); (112); (117); (154); (155))

121. SA Eric E. Casey,, USN, USS IOWA (BB-61) died from thermal injuries and blunt force injuries to the head while performing powderman duties on the powder flats. (Enclosures (55) p.29; (77) p.4; (106); (112); (117); (148) p.5; (154); (156); (157) p.3)

122. SN Michael S. Justice,, USNR, USS IOWA (BB-61) died from thermal injuries and inhalation of products of combustion while performing duties as center powder car lower door operator on the powder flats. (Enclosures (56) p.29; (75) p.4; (99); (104); (110); (154); (158))

123. SN Ricky R. Peterson, 2, USN, USS IOWA (BB-61) died from inhalation of products of combustion and thermal burns while performing duties as the left powder car lower door operator on the powder flats. (Enclosures (55) p.29; (77) p.4; (106); (112); (117); (154); (159))

124. SN Edward J. Kimble,, USN, USS IOWA (BB-61) died from inhalation of products of combustion and thermal burns while performing the duties of the sound powered phone talker on the powder flats. (Enclosures (55) p.29; (77) p.4; (106); (112); (117); (154a); (160))

125. SR Rodney M. White, 4, USN, USS IOWA (BB-61) died from thermal injuries while performing powderman duties on the powder flats. (Enclosures (55) p.29; (77) p.4; (106); (112); (117); (154); (161))

126. SN Otis L. Moses, 06, USN, USS IOWA (BB-61) died from thermal injuries and inhalation of products of combustion while performing duties as right powder car lower door operator on the powder flats. (Enclosures (55) p.29; (77) p.3; (106); (112); (117); (154); (162))

127. SA Jose L. Martinez, Jr.,, USNR, USS IOWA (BB-61) died from inhalation of combustion products while performing powderman duties on the powder flats. (Enclosures (55) p.29; (77) p.4; (106); (112); (117); (154); (163))

128. SR Todd T. Tatham,, USNR, USS IOWA (BB-61) died from inhalation of products of combustion while performing powderman duties on the powder flats. (Enclosures (55) p.29; (106); (112); (117); (164))

129. SR Harold E. Romine, Jr.,, USNR, USS IOWA (BB-61) died from inhalation of products of combustion and thermal injuries while performing duties on the powder flats. (Enclosures (77) p.5; (154); (165))

130. FCSA Richard J. Lewis, , USNR, USS IOWA (BB-61) died from blast injuries while performing duties as the velocimeter operator (under instruction) in the turret booth. (Enclosures (82) pp.1,2; (112); (113); (166))

131. FC3 Tung T. Adams, , USN, USS IOWA (BB-61) died from blunt force injuries head and chest while performing the duties as velocimeter operator, supervising FCSA Lewis in the turret booth. (Enclosures (82) p.2; (112); (113); (167))

132. EMFA Dwayne C. Battle, , USN, USS IOWA (BB-61) died from acute carbon monoxide inhalation while performing duties as electrician (under instruction) on the electric deck. (Enclosures (55) p.29; (112); (117); (168))

133. LN1(SW) Michael W. Helton, , USN, USS IOWA (BB-61) died from inhalation of products of combustion while performing under instruction duties in the right gun room. (Enclosures (111); (112); (113); (169))

134. LN1(SW) Robert K. Morrison, , USN, USS IOWA (BB-61) died from craniocerebral blunt force injuries while performing under instruction duties in the right gun room. (Enclosures (111); (112); (113); (170))

135. SN Tyrone D. Foley, , USN, USS IOWA (BB-61) died from extensive thermal injury and inhalation of hot gases while performing duties as the right powder hoist operator in the gun house. (Enclosures (106); (112); (171))

Material Condition and Damage Control

136. U.S. Navy ships and units are required to file casualty reports (CASREPS) with higher authority if any defect in equipment effecting a unit's primary or secondary mission can not be repaired within 48 hours. There were no Turret II CASREPs on 19 April 1989. (Enclosures (58) p.29; (172); (173))

137. Post-incident tests and analysis disclosed that the center gun, Turret II, rammer system was operating properly up to the time of the explosion. (Enclosure (2) Addendum 3, Appendix E, p.2)

138. The Board of Inspection and Survey (INSURV), Atlantic, conducted an "Underway Material Inspection" of USS IOWA (BB 61) during the period 20-24 March 1989 and found:

- a. No significant deficiencies or discrepancies in Turret II,

b. No significant Main Gun Battery Planned Maintenance System (PMS) deficiencies, and

c. IOWA fit for further service.
(Enclosures (174); (175))

139. On 19 April 1989, remote operation of Turret II hydraulic sprinkler system was not possible from Turret I annular space. Similarly, the center gun Turret II powder hoist had to be stopped manually vice automatically as designed and as possible in both right and left gun powder hoists. Although these discrepancies existed for an indeterminate but lengthy period prior to 19 April 1989, no CASREPs were submitted. (Enclosures (9) pp.8,9; (36) p.4; (62) p.48; (63) pp.31,34; (173))

140. Turret II work center (WGO2) PMS accomplished the week of 3 April 1989 covering operation of the hydraulic sprinkler system from all stations reports satisfactory completion with no discrepancies. (Enclosures (176); (177))

141. Current Ships Maintenance Project (CSMP) report for work center WGO2 (Turret II) dated 25 April 1989 indicates no deficiencies that would inhibit the safe operation of Turret II. (Enclosure (178))

142. Material Condition Zebra, normally set for General Quarters, provides the highest degree of protection for fire and flooding. Material Condition Zebra was reported set in Turret II. (Enclosures (13) p.16; (35) pp.7,8; (77) pp.6,20,21; (179))

143. Post-incident inspection of Turret II indicates Material Condition Zebra was not uniformly set throughout the turret. (Enclosure 180)

144. The Damage Control Assistant (DCA) was unable to position Emergency Escape Breathing devices (EEBDs) at turret battle stations due to inadequate allowance. (Enclosure (59) pp.17,18)

145. During gun fire operations, fire fighting protection is provided by the intraturret sprinkler system. The Turret Officer is required to assign personnel to ensure the sprinkling system is charged and operational. (Enclosure (181))

146. The Turret II intraturret sprinkler system was not, as a matter of practice, charged by Turret II personnel during gun operations. (Enclosures (59) p.17; (77) pp.21,22; (115) pp.22,26-29)

147. Turret II's hose connecting the intraturret sprinkler system with the ship's firemain system was connected, but not charged. The intraturret sprinkler system had not been activated at the time of the explosion. (Enclosures (2) Addendum 3 p.24; (59) p.17; (77) p.22)

148. At 0955, immediately after the explosion, IOWA went to General Quarters. (Enclosures (27); (50) p.3; (84) pp.2,3; (182) p.2)

149. Crew members responded rapidly to General Quarters and were soon spraying water on Turret II's gun barrels and into the turret around the gun barrels. This was the first action taken by personnel on the scene. (Enclosures (183); (184); (185) p.2; (186) p.4; (187) p.1; (188) p.1)

150. Numerous crew members, in the initial response effort, were not in full battle dress. (Enclosures (183); (184); (185) p.2; (186) p.4; (189))

151. Capt _____, USMC, and 1st SGT _____, USMC, were the first personnel to reach the O1 level outside Turret II. With some difficulty, yet within eight minutes of the explosion, they opened Turret II's emergency escape hatch to rescue any possible survivors. (Enclosures (29) pp.4-6; (115) p.20; (182) pp.4,5; (190) pp.4,5; (191) p.2)

152. Repair party members were unfamiliar with the physical layout and operations of the turrets, and had not been trained to conduct damage control within the turrets. (Enclosures (29) p.5; (57) pp.8,9; (192) p.5; (193) pp.6,7; (194) p.5)

153. Prior to the opening of the escape hatch, a number of crew members led by BM2 _____, right gun captain of Mount 54, had charged hoses and were spraying water into Turret II from port side main deck. (Enclosures (29) p.3; (187) pp.1-4; (188) pp.1-2; (190) pp.3,4; (195) p.3)

154. Simultaneously, a group led by BM1 _____ hooked up a hose on the O1 level and also began spraying Turret II. (Enclosures (29) p.3; (187) pp.3,4; (188) p.2; (190) pp.3,4)

155. As soon as the escape hatch was opened, FN _____, a repair V member, in a recently delivered one-piece fire fighting ensemble and OBA, entered the turret through the opened escape hatch to fight the fire. (Enclosures (29) pp.2-4; (182) p.5)

156. Fire fighting ensembles protected the service members wearing them from extreme heat. (Enclosures (29) pp.5-8; (196) p.4; (197) pp.2, 3; (198) pp.2,3)

157. While alone in the turret, a secondary explosion pushed FN _____ against an interior bulkhead. This explosion occurred between General Quarters plus eight and nine minutes as announced on the 1MC. (Enclosure (29) pp.4, 5)

158. Immediately thereafter, ENFN _____, FR _____, and MR3 _____ all from repair V, joined FN _____ within the turret fighting the fire. All wore the new one-piece fire fighting ensembles. (Enclosures (29) pp.9,12,25; (196) p.2; (197) pp.2,3; (198) pp.3,4)

159. The Turret II Turret booth was quickly cooled by fire fighting efforts of repair V personnel within the turret, and electricity to Turret II was secured by EM3 _____, USN. (Enclosure (29) pp.4-6)

160. GMGC , GMG1 , and HT1 (all wearing flash gear and OBA's) then entered the turret and took charge of fire fighting efforts until all fires were extinguished. (Enclosures (29) pp.8,9; (57) pp.9,10; (91) pp.3,4; (192) pp.3,4)

161. As repair parties initiated fire fighting efforts on deck, the men stationed in the annular space of Turret II and the men in magazine A-515-M escaped and attacked the fire by other means. Specifics:

a. Upon hearing the explosion, GMG3 , a petty officer in the magazine, departed the magazine, and entered the annular space. He opened the water tight door into the powder handling flat and took two steps in. Upon seeing active fire, feeling extreme heat, and receiving no response to his call for survivors, he retreated.

b. The personnel from the magazine and annular space evacuated, redogging all hatches behind them as they departed their spaces.

c. GMG3 went to DC central and activated the groups three and four powder magazine sprinkler system and the electrically activated sprinkler system covering the annular space and the outer (non-rotating) portion of the projectile magazines. Then GMG3 assisted the Damage Control Assistant (DCA) in setting fire boundaries from DC Central. (Enclosures (9) pp.2-4; (10) pp.16-20; (59) p.9; (199) pp.1,2)

162. Simultaneously, repair II was manned, and their fire fighting and damage control efforts commenced. The repair VI ordnance repair party was not manned on 19 April 1989 and as a matter of routine, is never manned during gunnery evolutions, General Quarters or not, in IOWA. (Enclosures (13) pp.112,113; (59) pp.2,3,21,22; (199) pp.1,2)

163. The Commanding Officer ordered Turret II magazine flooded at General Quarters plus eight and reiterated this order at General Quarters plus fourteen. (Enclosures (27); (28); (58) pp.28,29)

164. Subsequent to extinguishing the initial fire, there were several reflashes in the Turret II gun house. The last recorded reflash was logged as being out at 1124. (Enclosures (27); (28))

165. After all fires were out, the presence of unburned ordnance and hydraulic oil continued to present a significant safety hazard. Ordnance disposal and clean up efforts were quickly initiated and subsequently continued for several days. (Enclosures (27); (91) p.4,5)

166. Considering the 19 April 1989 incident a mass conflagration, the Commanding Officer controlled, directed, and coordinated the damage control/fire fighting response over the 1MC from the bridge. (Enclosures (50) pp.3-5; (58) pp.27; (59) pp.3-5)

167. Refresher training ("Limited Type Training" (LTT)) received by IOWA at Guantanamo Bay, Cuba, realistically prepared IOWA personnel to

effectively deal with a major shipboard disaster (Mass Conflagration scenario). (Enclosures (58) pp.28-29; (199) p.5)

168. USS AYLWIN (FF 1081), the first ship within proximity of USS IOWA (BB 61) after the explosion, arrived at 1047 and took station two to four thousand (2,000 to 4,000) yards off IOWA's port quarter. No assistance was required. (Enclosures (27); (28); (65) p.8)

169. CDR _____, MC, USN, IOWA's senior medical officer, coordinated the medical response with IOWA personnel augmented by medical personnel from USS CORAL SEA (CV 43), who arrived by helicopter at 1145. (Enclosures (32) p.2; (200); (201); (202); (203); (204))

170. In addition to caring for the bodies of the forty-seven (47) deceased men, medical personnel assisted nine other servicemen who experienced minor injuries as a result of damage control and fire fighting efforts. All were successfully treated and returned to full duties. (Enclosures (32) p.4; (200); (201))

171. Even though internal structural damage resulted from blast, fire and water, the NAVSEA Damage Assessment Team concludes there is no mechanical or structural reason Turret II cannot be fully reactivated. (Enclosure (2) pp.4-5, Addendum 3 p.6)

172. Current total estimated cost to repair and reactivate Turret II is \$14,741,000.00. (Enclosure (2) Addendum 3 pp.6-10)

173. The cost to rework ammunition subjected to the elements of the explosion and damage control effort is estimated to be \$343,000.00. (Enclosure (205))

Pre-Incident Training

174. The Navy's 16"/50 caliber training school has no turret or gun mock up and largely consists of classroom and technical manual training with little hands-on training. (Enclosure (57) p.5)

175. Applicable Personnel Qualification Standard (PQS) directives require the Commanding Officer, Executive Officer, Training Officer, PQS Coordinator, Department Head, Division Officer and the Department PQS Coordinator to establish, maintain, and supervise a formal PQS program for qualifying personnel on various main gun battery watch stations. (Enclosures (206) pp.5-8; (207) pp.3-6; (208); (209); (210))

176. Since August 1988, and on 19 April 1989, CDR Finney was assigned collateral duties as IOWA's Training Officer and PQS Coordinator. (Enclosures (209) pp.10,12; (211) pp.7,8; (212))

177. ENS A , USNR, was the Weapons Department PQS coordinator on 19 April 1989. (Enclosures (210) pp.1-6; (213) p.2)

178. Turret watch stations requiring completion of formal PQS include:

- (1) Lower Powder Door Operator
- (2) Powderman & Scuttle Operator
- (3) Powder Hoist Operator
- (4) Parbuckler
- (5) Projectile Hoist Operator
- (6) Projectile Ring Operator
- (7) Primerman
- (8) Cradle Operator
- (9) Rammerman
- (10) Sight Setter, Trainer, Pointer
- (11) Gun Trainer
- (12) Gun Layer Operator
- (13) Strikedown Equipment Operator
- (14) Projectile/Powder POIC
- (15) Gun Captain
- (16) Turret Captain

(Enclosure (207) encl.[1] pp.5,6)

179. In IOWA, watch stations which require formal PQS certification must be manned by personnel qualified through the PQS program. Prior to 19 April 1989, IOWA's Commanding Officer established a policy which stated no person was to be assigned a watch station unless PQS qualified to stand that watch. No one was allowed to stand an under instruction watch unless he was observed by a qualified person. (Enclosures (13) p.59; (50) p.7; (207) p.1; (211) p.12)

180. The predominant 16"/50 caliber gun PQS book in use on board IOWA on 19 April 1989 was NAVEDTRA 43415, which is in the process of being superseded by NAVEDTRA 43415A. Significant differences exist between NAVEDTRA 43415 and NAVEDTRA 43415A. Specifically, the latter requires three times the signatures per line item, the sequence of progression is different, and each final qualification requires the signature of the Commanding Officer or his designated representative. (Enclosures (115) p.17; (214); (215)).

181. Prior to 19 April 1989, the PQS program for 16" turrets had been in a state of transition to newly revised requirements. Preliminary updated books had been on board approximately six months. (Enclosures (55) pp.14-20; (115) p.17)

182. Turret I received about twenty (20) final versions of the new books (NAVEDTRA 43415A) in April 1989. Turrets II and III had not received the final editions. (Enclosure (55) pp.14,15)

183. Turret I unilaterally implemented use of the new PQS book (NAVEDTRA 43415A) on some date prior to 19 April 1989 without the concurrence of the Weapons Officer, Executive Officer or Commanding Officer. (Enclosures (55) pp.13-20; (115) p.17)

184. The Weapons Officer approved watch station qualifications and recommended final qualification to the Executive Officer and the Commanding Officer. (Enclosure (207) p.5)

185. On 19 April 1989 and dates preceding, final qualification authority for IOWA was held by the Commanding Officer. (Enclosure (207) p.3)

186. Once a final PQS qualification had been achieved, Division Officers were responsible for ensuring that appropriate entries in members service records (page four) were made to reflect final qualification. (Enclosure (206) p.8)

187. In August 1988, IOWA ship's force conducted a ship wide inspection of the PQS program. Results were distributed to all Department Heads. (Enclosures (50) p.6; (212) p.4)

188. A Training Readiness Evaluation was conducted on 1-2 September 1988, in accordance with COMTRALANT OPOD 2000. A spot check of seventy-five (75) personnel from all departments on board revealed sixty-nine (69) to be at their indicated level of PQS qualification. (Enclosure (216))

189. On 8 November 1988, a PQS standdown was conducted as directed by COMNAVSURFLANT msg 210400Z OCT 88. Results were provided to COMCRUDESGRU EIGHT via IOWA Navgram SER 03/016 dated 22 November 1988. The inspection results focused on Enlisted Surface Warfare Specialist (ESWS) and Damage Control (DC) PQS as documented in enclosure (217). (Enclosures (217); (218); (219))

190. The COMNAVSURFLANT Combat Systems Mobile Training Team (CSMTT) conducted a Combat Systems Assessment (CSA) in IOWA during March 1989 in conjunction with Tomahawk/Harpoon Cruise Missile Tactical Qualification. A CSA is a one day "snapshot" of Combat Systems Readiness and includes a PQS review covering PQS administration and a spot check of watch station qualification progress. The PQS review conducted as a part of the CSA in IOWA was evaluated as satisfactory, but did not include the 16" turrets as part of a spot check of watch station qualifications. (Enclosures (50) p.6; (107) p.2; (212) p.2; (220) pp.3,4; (221) pp.1,2; (222) pp.1,3; (223))

191. There were three methods of watch station "qualification" being employed in IOWA's main gun battery turrets prior to 19 April 1989:

a. The under instruction watch stander was allowed to perform the duties of the new watch station under the direct supervision of a qualified watch stander in the space for the sole purpose of observing the under instruction watch stander.

b. The under instruction watch stander was allowed to perform the duties of the new watch station under the supervision of a qualified watch stander. However, the qualified watch stander was not in the space solely to observe the under instruction watch stander. The qualified watch stander would also perform duties at another watch station in close proximity to the under instruction watch stander. Example, an under instruction gun captain would be observed by a qualified gun captain, while the qualified gun captain would also act as the cradle operator.

c. A de facto qualification procedure was conducted in each turret whereby a training and qualification process was implemented independent from strict PQS standards and compliance. An individual was characterized as "qualified" (ie. capable of performing the assigned task) if he could demonstrate sufficient operational skill to perform the duties of the watch station to the satisfaction of a qualified watch stander. (Enclosures (13) pp.62,63; (58) pp.40-42; (62) pp.3-5; (91) p.17; (133) pp.5,6; (224) p.3)

192. Only four (4) of fifty-five (55) watch stations actually manned in Turret I requiring formal PQS qualification were filled by PQS qualified personnel during the 19 April 1989 gunshoot. (Enclosure (225))

193. Only thirteen (13) of fifty-one (51) watch stations actually manned in Turret II requiring formal PQS qualification were filled with PQS qualified personnel at the time of the 19 April 1989 explosion in Turret II. There were some personnel assigned to watch stations in Turret II whose PQS books could not be obtained. These books were either destroyed by fire, never existed, or have not been located. Accordingly, if no PQS book was found for a deceased service member, findings are based exclusively on service record page four entries. Available Turret II personnel PQS books are enclosures (226-242). The following is a list of personnel by watch station and their PQS qualification status as of 19 April 1989:

Turret II

Position	Person Manning	PQS Qualified	Parent Division Assigned
Turret Officer	LTJG Buch	N/A	G-2
Turret Captain	GMCS(SW) Ziegler	Yes	G-2
Turret Repair	GMG1(SW) Hanyecz	N/A	G-2
L Gun Captain	GMG3 Thompson	Yes	G-2
L Cradle Op	GMG3 J. White	Yes	G-2
L Rammerman	GMG3 Devaul	Yes	G-2
L Primerman	SA Gedeon	No	2nd

L Powder Hoist Op	SN B. Jones	No	2nd
C Gun Captain	GMG2 Hartwig	Yes	G-2
C Cradle Op	GMG2(SW) Lawrence	Yes	G-2
C Rammerman	GMG3 Backherms	No	G-2
C Primerman	SN Johnson	No	2nd
C Powder Hoist Op	BM2 Fisk	No	2nd
R Gun Captain	GMG3 Price	Yes	G-2
R Cradle Op	BM3 McMullen	No	2nd
R Rammerman	GMG3 Schelin	Yes	G-2
R Primerman	SA Gendron	No	2nd
R Powder Hoist Op	SN Foley	No	2nd
R Gun room	LN1(SW) Morrison	U/I	LC01
	LN1(SW) Helton	U/I	LC01
Sight Setter	BM2 Williams	No	2nd
L Gun Layer	GMG3 Young	Yes	G-2
C Gun Layer	GMG3 Bopp	Yes	G-2
R Gun Layer	GMG3 Stillwagon	No	G-2
Gun Trainer	GMG3 Blakey	No	G-2
Projectile Dk POIC	GMG2 Cramer	No	G-2
L Proj Hoist Op	SN Everhart	No	G-2
C Proj Hoist Op	SN Miller	No	G-2
R Proj Hoist Op	SN Goins	No	2nd
Phone Talker (XJ)	(Unknown)*	---	---
Parbucklers	SN Bradshaw	No	2nd
	SN Holt	No	2nd
	SN N. Jones	No	2nd
Turret Electrician	EM3 Hanson	N/A	E-Div
	EMFN Battle	U/I	E-Div
Powder Flats POIC	GMG2 Weldon	No	G-2
L Lwr Pwdr Door Op	SN Peterson	No	2nd
C Lwr Pwdr Door Op	SR Justice	No	2nd
R Lwr Pwdr Door Op	SN Moses	No	2nd
Phone Talker (XJ)	SN E. Kimble	Yes	2nd
Powderman	GMG3 Ogden	Yes	G-2
	YN3 **	No	G-2
	SR R. White	No	2nd
	SA Romine	No	2nd
	SN Martinez	No	2nd
	SN Casey	Yes	2nd
	SR Tatham	No	2nd
Annular Space	BM2	No***	2nd
POIC/(XJ)			
Pwdrman/Scuttle Op	SN	No	2nd
	SN	No	2nd
Powder Mag POIC	GMG3	N/A	G-2
Phone Talker (XJ)	GMG3 Mu y	No	G-2

Powdermen	SN	No	2nd
	SN 1	No	2nd
	SN	No	2nd
	SF	No	2nd
	SR	No	2nd
	SF	No	2nd
	SR	No	2nd
Velocimeter Op	FC3 Adams	N/A	FM
	FCSA Lewis	U/I	FM

- * May have been filled by SN Everhart
- ** Left turret prior to explosion
- *** Qual Phone Talker/not Qual as Powderman
(Enclosures (243); (244))

194. Only nine (9) of sixty-two (62) watch stations actually manned in Turret III requiring formal PQS qualification were filled with PQS qualified personnel on 19 April 1989. (Enclosures (245); (246))

NOTE: To verify PQS qualification status of Main Gun Battery watch standers, an examination of all page four entries and available PQS books and charts for the personnel known to be manning the various watch stations in all three turrets was conducted. (Enclosures (225); (243); (244); (245); (246); (247))

195. Interim qualifications authorized by NAVEDTRA 43100.1C were not employed in IOWA's Weapons Department. (Enclosures (13) pp.59,61; (50) p.7; (58) pp.40-42; (211) p.12)

196. Applicable Navy directives indicate a Chief Gunner's Mate (Guns) is the appropriate rate to fill the Main Gun Battery turret captain station. On 19 April 1989, GMG2 _____ was Turret I's turret captain with GMG3 _____ serving under instruction. (Enclosures (62) p.11; (105))

197. Officer Distribution Control Report for IOWA designates Lieutenants as the grade for Weapons Division Officer billets. (Enclosure 248)

198. In IOWA, Ensigns and Lieutenants (junior grade) served as Weapons Department Division Officers. In fact, ENS _____ who had been on board IOWA for only sixteen (16) days, was the only officer in Turret I on 19 April 1989. The G-1 Division Officer, ENS _____ r, USN, who normally acts as the Turret Officer for Turret I, was standing the Junior Officer of the Deck watch on the bridge. ENS _____ was not familiar with turret operations, safety, misfire or hangfire procedures. (Enclosures (66) pp.1,2,10-14; (115) pp.1,2; (212) p.7)

199. Deck Department personnel assigned to turret General Quarters or Condition III watch stations were not PQS qualified for those watches either by Deck Department or Weapons Department. No PQS watch station

assignments were recommended to the Deck Department Officer by Weapons Department personnel. Furthermore, the PQS boards for turret personnel did not include Deck Department members. There had been some on station training conducted outside the PQS program, but this training is not documented. (Enclosures (36) p.5; (55) p.15; (212) p.7; (225); (244); (245))

200. Training for the Deck Department personnel assigned to turret crews was conducted almost exclusively during General Quarters and when gunnery stations were manned. No other training sessions were scheduled by the Planning Board for Training (PBFT). (Enclosures (12) p.33; (13) p.78)

201. BM2 Fisk was assigned to Turret II and walked through his duties as upper powder hoist operator for center gun Turret II a "few" days before the accident. BM2 Fisk was not PQS qualified for this position. (Enclosure (133) pp.4-6)

202. On 19 April 1989, the Weapons Department's undated listing of personnel authorized to sign off turret PQS included one First Class Gunner's Mate Guns per turret. GMCS(SW) Ziegler, GMGC and the ship's gunner, GCMC(SW) ----- Both of the personnel listed as authorized to sign PQS line items in Turret III departed the ship prior to 19 April 1989. GMG1 Martinez was transferred in November 1988 and GMGC ----- retired in March 1989. GMGC had been relieved of duties in Turret III as of August 1988. (Enclosures (55) p.7; (249))

203. The Commanding Officer, Executive Officer, the Weapons Officer and the Gunnery Officer were not aware of the current qualification status of personnel assigned to the 16"/50 caliber turrets. None were aware of the large number of watch stations being manned by personnel not qualified under the PQS program. (Enclosures (12) pp.24,38; (13) pp.80,82; (58) pp.11-14,42; (65) pp.19; (250))

204. CDR ----- did not retain the monthly PQS reports which had been submitted to him by the departments, as required. He did not submit monthly PQS progress reports to the Commanding Officer. He did not directly monitor the ship's PQS material stock. (Enclosures (65) p.19; (211) pp.12-14; (212))

205. CDR ----- did not deliver the required PQS indoctrination briefs to all "I" division personnel as required by NAVEDTRA 43100-1C. (Enclosure (212))

206. The Weapons Officer accepts responsibility for the training and documentation of PQS qualifications for the Deck Department personnel assigned to General Quarters and Condition III watch stations in the main battery turrets. PQS Qualification records for these personnel were not maintained or administered by their parent division/department. (Enclosures (13) pp.64,71; (186) pp.8,9; (251) pp.2,3)

207. The Weapons Officer never reviewed PQS qualifications of deck personnel assigned to Main Gun Battery for gunnery evolutions. He only reviewed PQS qualifications for servicemen permanently assigned to one of the gunnery divisions. (Enclosure (13) pp.64,71)

208. The Weapons Officer did not authorize the 16"/50 caliber turret Division Officers to suspend the Weapons Department PQS program during the transition from 16"/50 caliber PQS book (NAVEDTRA 43415) to the revised edition (NAVEDTRA 43415A). (Enclosure (13) p.65)

209. The Gunnery Officer never reviewed PQS qualifications of deck personnel assigned to Main Gun Battery for gunnery evolutions. He only reviewed PQS qualifications for servicemen permanently assigned to one of the gunnery divisions. (Enclosure (12) pp.32,33)

210. PQS Boards in all three turret divisions were not updated weekly as required by NAVEDTRA 43100-1C and had not been since mid 1988. (Enclosures (206) p.25; (225); (243); (244); (245); (246); (247))

211. ENS , the Weapons Department PQS Coordinator, never reviewed PQS Status Boards nor coordinated availability of PQS documentation material. (Enclosures (210) pp.1-5; (213) p.2)

212. ENS the G-3 Division/Turret III Officer, without permission, suspended the PQS program in Turret III from November 1988 until 19 April 1989, while awaiting arrival of the new 16"/50 caliber PQS books. Specific examples of PQS accomplishments not forwarded include GMG3 GMG2 GMG3 , GMG3 , GMG3 . (Enclosures (12) pp.36,37; (13) p.68; (55) pp.19,20; (260) p.15; (245))

213. The 19 April 1989 Turret III turret captain, GMGC Miller, did not require watch standers to be PQS qualified when they were assigned to a station. (Enclosures (57) p.5; (245))

214. COMNAVSURFLANTINST 8023.4D and IOWAINST 8023.1A require all operators of power-operated handling equipment and personnel whose duties include tasks involving explosive devices be qualified, and recertified yearly, in Non-Nuclear Ordnance Handling. (Enclosures (252); (253))

215. Of the thirty-seven (37) positions manned in Turret II on 19 April 1989 involving power-operated handling equipment or personnel involved with explosive devices, only nine had current non-nuclear ordnance certification in accordance with IOWAINST 8023.1A. The non-nuclear ordnance certification program on board IOWA covered only Weapons Department personnel. (Enclosures (252); (253); (254))

Causation

216. The following are the most plausible non-intentional causes, in no specific order, for the explosion in center gun Turret II on 19 April 1989:

- a. Burning ember
- b. Premature primer firing
- c. Mechanical failure
- d. Hazards of Electromagnetic Radiation to Ordnance

(HERO/EMI)

- e. Electrostatic discharge (ESD)
- f. Propellant instability
- g. Friction
- h. Personnel error

(Enclosure (2) p.19)

217. The burning ember theory of ignition in center gun Turret II, has been ruled out because:

a. Turret I fired two single round salvos from each of the center and right guns prior to the explosion in center gun Turret II. During the firing of Turret I, the true wind was from approximately 130 degrees, 13 knots. The ship was on course 179 degrees true, speed 25 knots. The relative wind was 16 degrees to port at 35 knots. The last Turret I firing was at least three minutes 48 seconds prior to opening the breech to load center gun Turret II. (Enclosures (2) Addendum 3 p.40; (27); (79); (85))

b. The wind carried the smoke and fireball from Turret I firings clear of Turret II. (Enclosures (2) Addendum 3 p.40; (79); (85))

c. On 19 April 1989, Turret II had not fired prior to the explosion in center gun. Gas ejection air was operable. A 2700 lb. BL&P projectile (NALC D881) had been loaded in the barrel of center gun prior to the explosion, precluding an ember from entering the barrel from that point on. (Enclosures (2) Addendum 3 pp.11,40; (9) p.2; (12) p.5; (13) pp.11-18,21; (14); (47) p.12; (125); (255))

d. Event reconstruction by laboratory tests of eight actual 16"/50 caliber firings at Yuma Proving Grounds, Arizona, on 22 April 1989 resulted in little or no residue that could constitute a burning ember. (Enclosures (2) pp.25,29; (2) Addendum 3 p.40; (256))

218. Premature Primer Ignition. The primer in the firing lock of the center gun breech had not been fired. It was removed intact and unfired, on 20 April 1989 by GMG2 and passed to BM1 USN. It was eventually thrown over the side.

Further, the center gun breech was open and, by design, the primer cannot be fired electrically until the breech is completely closed.

Early in the investigative phase, testing of the possibility of igniting the powder with the breech open by firing the primer with cradle spanned and not spanned was attempted. The design of the breech is such that the primer blast will not touch the powder. (Enclosures (2) pp.21,22,29; (2) Appendices F,G; (2) Addendum 3 pp.23,24; (98) p.9; (257) p.2; (258) pp.1,2; (259); (260))

219. Mechanical Casualty. Post incident analysis disclosed no mechanical discrepancies within Turret II that would have caused detonation. The center gun powder hoist discrepancy could not have caused the detonation. (Enclosure (2) pp.20-22,29; Appendices E,F; Addendum 1 encl.[2]; Addendum 3 pp.ii, 22,23,35,40,41; (2) Addendum 4 pp. 2-3; (2) Addendum 5 pp. 2-3)

220. Hazards of Electromagnetic Radiation to Ordnance (HERO/EMI) concern transmissions from the ship's communications, radar, etc. as possible ignition sources. The HERO survey analysis did not find any hazardous potentials at the gun breech. (Enclosure (2) pp.23,24,29; Appendix I; Addendum 2 p.3; Addendum 3 pp.25,26,35,40,41)

221. Electrostatic Discharge (ESD) is spark generated by static electricity. Previous incidents aboard battleships near the end of World War II involved the ignition of air-ether mixtures during the handling of unopened powder tanks containing reduced charges. The cause of these incidents was found to be an internal electrostatic discharge capable of igniting the air-ether mixture trapped in the tank. The fact that the incident in IOWA involved service charge bags and that detonation originated in the gun compartment vice the magazine area discount a similar scenario in this case. Based on tests and analysis, it is considered unlikely that an ESD event was a contributing factor in the incident aboard the IOWA on 19 April 1989. (Enclosure (2) p.23; Appendix H; Addendum 2 p.2, encl.[4]; Addendum 3 pp.25,35,40,41; Addendum 5 p.6)

222. NALC D846 is composed of propellant SPD 9419 and an ignition pad containing black powder. When 16" pyro (single-base) propellant was manufactured, the stabilizer requirement was 0.45 to 0.55% diphenylamine (DPA). SPD 9419 propellant had 0.46% DPA when manufactured in 1945. Tests in support of this investigation report the following remaining effective stabilizer for NALC D846:

a. 135 powder samples taken from 28 tanks from IOWA which were barge stowed in 1988 averaged 0.27% DPA (0.15% low and 0.39% high).

b. Six samples (2 tanks) taken from Naval Weapons Station Seal Beach magazines averaged 0.30% (0.26% low and 0.32% high).

c. Six samples (2 tanks) taken from Weapons Center Dahlgren magazines averaged 0.32% (0.30% low and 0.34% high). (Enclosures (2) Addendum 3 p.28; (2) Addendum 5 p.2; (69))

223. The U.S. Army uses a lower limit of 0.20% average remaining effective stabilizer as the minimum value for safe stowage. Below this value the propellant is disposed of. The Navy test for stability is the fume test where lot samples are kept at a temperature of 65.5 degrees centigrade (150 degrees fahrenheit). Samples that fume in less than thirty (30) days are considered unstable and the lot is disposed of. NALC D846 Lot Number CRA87AB001-001 propellants from IOWA, Seal Beach and Dahlgren have been subjected to the fume test and have not fumed at the thirty (30) day point. (Enclosure (2) Addendum 1 encl.[5]; Addendum 3 p.28)

224. Black powder from NALC D846 Lot CRA87B001-001 ignition pads from all three of IOWA's turrets, NAVSWC Dahlgren and WPNSTA Seal Beach was analyzed and tested with no finding that would result in or cause an abnormal source of ignition. (Enclosure (2) p.25; Appendix J,K; Addendum 1 encls.[1]; Addendum 3 pp.29-32,38)

225. NALC D846 wear reducing jackets reduce the rate of venting of ether through the side walls of the propelling charge as compared to the silk bag material alone, but laboratory tests show the jacket material to be permeable to ether. Levels of volatiles, which include ether as a part, were higher in the wear reducing jackets and silk bag material from the powder bags removed from IOWA than from those stowed in magazines ashore. Laboratory tests show the actual ether level in the volatiles to be small, and sensitivity tests using jacket and bag materials with high ether levels showed no effect on propellant or black powder sensitivity to friction. Ether measurements within the powder stowage tanks taken from IOWA were lower than those taken from tanks stowed ashore. (Enclosure (2) Addendum 1 encl.[1]; Addendum 2 p.2, encls.[2],[3]; Addendum 3 pp.30-32,38; Addendum 4 p.3; Addendum 5 p.2)

226. Friction.

a. Smokeless Powder: Numerous tests have been conducted attempting to ignite smokeless powder from a ruptured bag. In no test using pressure obtainable in the loading process has ignition been obtained. Stability indices are normal. Smokeless powder is safe to handle. (Enclosure (2) pp.25-27,29; Appendices J,K; Addendum 2 encls.[2],[4]; Addendum 3 pp.27-30,33-35; Addendum 4 p.3; Addendum 5 p.2)

b. Black powder in ignition pads: An additional set of tests was conducted for black powder. No ignitions have been obtained. No indication of increased sensitivity has been found. (Enclosure (2) pp.26,29; Appendices J,K; Addendum 2 p.2, encls.[2],[4]; Addendum 3 pp.27-30,33-35; Addendum 4 p.2; Addendum 5 p.2)

227. Personnel error was considered as a possible cause of the accident. The following apply:

a. While Turret II personnel loaded powder into the center gun breech behind the projectile, detonation occurred. (Enclosure (2) pp.9,10)

b. Seconds before detonation, sound powered phone communications from the turret by both GMCS(SW) Ziegler and GMG2(SW) Lawrence indicated there was a problem in center gun Turret II. (Enclosure (9) pp.4-6)

c. Spark producing devices, including six lighters, were found on the remains of the deceased. A charred soda can containing a cigarette butt was found on the projectile deck in post incident clean up. No smoking apparatus (lighters, etc.) were found in the center gun room after the explosion. (Enclosure (261))

d. The Turret Officer's Booth was regarded as "outside" the area of the magazine and pre-incident policy permitted smoking in the booth during those periods when gunnery evolutions were not ongoing. (Enclosures (52) pp.4,5; (75) pp.3,4; (224) p.14; (262) p.8; (263) pp.3,4; (264) pp.3,4; (265) p.3; (266) pp.2,3)

e. No personnel could be found who ever saw smoking in the magazine or inside the turret (excepting the Turret Booth). (Enclosures (51) p.1; (52) pp.4,5; (60) p.3; (224) pp.14,15; (264) pp.3,4; (265) p.3; (266) pp.2,3; (267) pp.1-3)

f. The Center Gun Captain and Center Gun Cradle Operator in Turret II were non-smokers. (Enclosure (51) p.1)

g. In the past, torn powder bags have been discovered during loading operations. Personal judgement controlled whether torn bags were loaded or placed in immersion tanks. (Enclosures (52) p.3; (60) p.9; (75) p.3; (98) p.4; (264) p.3; (268); (269) p.2; (270) pp.2,3; (271) p.1.4-10)

h. Five full charge bags are not a normal powder load. (Enclosures (6); (67))

i. There were inexperienced personnel manning assigned Turret II center gun watch stations, specifically the rammerman and the primerman. (Enclosures (10) pp.3,4; (243); (244))

j. Although the rammerman in center gun Turret II was not PQS qualified and had never served as rammerman for a live firing, he had observed five live fire exercises (14 rounds) and had practiced operating the rammer prior to filling the position on 19 April 1989. To be qualified under the Navy PQS program in effect on 19 April 1989 (NAVEDTRA 43415) an individual must have demonstrated an ability to ram/retract the rammer once and must have stood two (2) watches under qualified supervision. (Enclosure (214); (272); (273))

k. An improper ramming of the powder bags caused the rammer to be extended about 21 inches past the point of a normal ram pushing the powder bags to the base of the projectile. (Enclosure (2) Addendum 3 pp.22-23; Appendix Q; Addendum 4 pp.2-3; Addendum 5 pp.1-2)

228. No significant preexisting disease or condition which might have contributed to the mishap was detected. No crew member had a positive drug screen. Elevated alcohol levels in each case solely are attributed to decomposition based on tissue distribution studies. (Enclosures (30); (112))

229. No accidental cause for premature ignition of powder located in center gun, Turret II on 19 April 1989 has been identified. (Enclosure (2) w/addenda)

230. An intentional wrongful act as the source of ignition was considered. The following related facts, compiled after review of the interim NIS reports of investigation and enclosures(274) through (278), and as discussed in paragraph 3 of the Preliminary Statement, are germane:

a. GMG2 Clayton M. Hartwig, USN, Turret II center gun captain on 19 April 1989, was a capable Gunner's Mate equipped with a working knowledge of explosives and explosive devices. He graduated from the basic electricity and electronics (Class P) and Gunner's Mate (Class A) schools and possessed literature on how to build explosive devices.

b. GMG2 Clayton M. Hartwig, USN, Turret II center gun captain on 19 April 1989, experimented with, was capable of, and had made explosive and detonation devices prior to 19 April 1989.

c. GMG2 Clayton M. Hartwig, USN, center gun captain, Turret II, on 19 April 1989, was the serviceman closest to the location of premature ignition of powder in the gun. He had full access and opportunity to intentionally cause premature detonation by placement of an ignition source into center gun, Turret II.

d. The rotating band from the projectile in center gun, Turret II on 19 April 1989, was removed and analyzed. Similarly, analysis was conducted on two other rotating bands; A "control" band from a projectile used in a test firing employing a standard propelling charge and a rotating band from a projectile used in a test firing which employed a timer controlled explosive device.

e. Metallurgists at the Norfolk Naval Shipyard determined the rotating band from the projectile in IOWA's center gun, Turret II on 19 April 1989, contains traces of Aluminum, Silicon, Calcium, Barrium, and Iron Wire, all inorganic materials not found in an uncontaminated propelling charge.

f. All three rotating bands have been examined under a Scanning Electron Microscope (SEM). The overall SEM spectra shows a close comparison between the IOWA ring and the ring from the test firing employing a timer controlled explosive device and a marked difference in properties between these two rings and the "control" ring.

g. A post-incident "equivocal death analysis" was prepared by qualified psychologists from the National Center for the Analysis of Violent Crime (NCAVC), Federal Bureau of Investigation (FBI) Academy in response to an NIS request and as part of the criminal investigation into this incident. Opinions formulated in that report concern GMG2 Clayton M. Hartwig, USN. The analysis was based on information and material provided to the FBI by NIS and included technical information concerning the explosion; the physical layout of the turret; the physical location of each man in the gun room; letters written by GMG2 Hartwig and at least one other person; results of interviews with family and associates of the victim; and GMG2 Hartwig's personal history and activities leading up to his death. (These are all matters with which the JAGMAN Investigating Officer is familiar). After lengthy review, the analysis concludes: "Clayton Hartwig died as a result of his own actions, staging his death in such a fashion that he hoped it would appear to be an accident."

[Investigating Officer's note: As discussed in paragraph 3 of this report's Preliminary Statement, section 0212 of reference (a) provides criminal investigative jurisdiction over this incident is exclusively held by the Naval Investigative Service (NIS). Finding of Fact 230 is not an all inclusive summary of the NIS findings to date. Full evaluation of criminal issues relevant to the 19 April 1989 incident in USS IOWA (BB 61) requires review of the appropriate Naval Investigative Service Report of Investigation in accordance with section 0212(c) of reference (a).]

OPINIONS

1. There was not a viable Main Gun Battery PQS program in IOWA on 19 April 1989. (Findings of Fact 175-183, 191-196, 199-215)

2. IOWA's Commanding Officer did not:

- a. Establish an effective PQS organization;
- b. Effectively use the PBFT to monitor the PQS program;
- c. Maintain overall cognizance of the PQS program;
- d. Ensure that the PQS Coordinator submitted monthly reports or conducted periodic inspections.
- e. Adequately determine the extent and significance of the various PQS reviews conducted by the Iowa PQS Coordinator in support of the CNSL PQS Standdown, by the Training Command in support of TRE, and by the CNSL CSMTT during CSA. (Findings of Fact 175-196, 199-215)

3. IOWA's Executive Officer did not:

- a. Effectively act as overall training supervisor;
- b. Effectively monitor the PQS program through the PBFT;
- c. Ensure that the PQS Coordinator provided monthly reports on the PQS program to the Commanding Officer.
- d. Adequately determine the extent and significance of the various PQS reviews conducted by the IOWA PQS Coordinator in support of the CNSL PQS Standdown, by the Training Command in support of TRE, and by the CNSL CSMTT during CSA. (Findings of Fact 175-187, 191-194, 199-206, 210, 214, 215)

4. IOWA's Weapons Officer did not:

- a. Properly oversee achievement of PQS watch station qualifications or setting of PQS advancement goals;
- b. Monitor PQS within Weapons Department;
- c. Ensure only PQS qualified personnel are assigned to watch stations. (Findings of Fact 175, 177-196, 199-215)

5. IOWA's Training Officer/PQS Coordinator did not:

- a. Supervise implementation of the PQS program;

b. Ensure the PQS program was the basis for training objectives within the command training program;

c. Effectively advise the PBFT on training matters concerning PQS;

d. Properly prepare the monthly PQS progress report and forward it to the Commanding Officer;

e. Conduct the PQS indoctrination of newly reporting enlisted personnel.

f. Effectively supervise the various PQS reviews conducted in support of the CNSL PQS Standdown, the TRE, or the CSA. (Findings of Fact 175-182, 187-196, 199-205, 213-215)

6. IOWA's 14 August 1988 PQS instruction was not followed. Accordingly, it did not improve effectiveness of IOWA's PQS program. The monthly reports mandated by the instruction were not properly reviewed by the chain of command and the delineated feedback loop was ignored. (Findings of Fact 175, 191-194, 199, 200, 203, 204)

7. IOWA's failure to adhere to the formalized PQS qualification process negates structured Navy wide quality control policies designed to ensure uniform and effective training of 16"/50 caliber gun battery watch standers. (Findings of Fact 175, 178-183, 191-194, 199-203, 206-209)

8. IOWA's turret watch stations were informally assigned at the Division Officer level, and subject to last minute undocumented changes. Such last minute substitutions occurred in Turret II on 19 April 1989. This may have resulted in confusion on the part of some center gun Turret II personnel during loading operations. (Findings of Fact 83-85, 88, 191-194, 199, 201, 203, 213)

9. Battleship Main Gun Battery PQS and shipboard training programs need greater emphasis than the norm in view of identified limitations of the Navy's 16"/50 caliber formal training course. (Finding of Fact 174)

10. The lack of a formal qualification process for Turret Officers permits assignment of officer personnel to the position of Turret Officer without adequate training. Ensigns and/or first tour Division Officers do not have requisite experience or training to effectively serve as Turret Officers. (Findings of Fact 192-198, 210, 212)

11. IOWA's turret manning and training would be accomplished more efficiently through integration of the First Lieutenant and Deck Divisions and the Marine Corps Detachment into the Weapons Department. (Findings of Fact 14, 191-194, 199-201, 203, 206, 207, 209, 214, 215)

12. The shortage of Gunner's Mates and undesignated seaman in IOWA on 19 April 1989 contributed to some stations not being filled in Turret II. The inability to man some stations did not contribute to the explosion, but the shortage of Gunner's Mates did affect the level of training of those manning turret stations. (Findings of Fact 81, 82, 216-230)

13. Ineffective enforcement of safety policy and procedures was the norm within Turret II. Specifically:

a. Proper attention was not given to setting and maintaining material condition Zebra;

b. Proper attention was not given to preventing flame and spark producing items from being taken into the magazines;

c. Proper attention was not given to maintaining the integrity of the magazine sprinkler systems;

d. Proper attention was not given to the wearing of battle dress.

e. Standard safety briefs were not given. (Findings of Fact 17-22, 24, 51, 139, 142, 143, 145-147, 227)

14. The complexities of turret operations, when coupled with the relative inexperience of main gun battery turret officers, contributed to poor management and administration of maintenance, safety and training programs. (Findings of Fact 17-22, 24, 40, 51, 83, 84, 139, 142, 143, 145, 146, 175, 186, 191-194, 197-202, 210, 212, 213, 227)

15. As a result of the efforts of FCCM(SW) (working informally with employees of NAVSWC Dahlgren), IOWA utilized her Main Gun Battery to engage in unauthorized Research and Development. (Findings of Fact 41-50)

16. Barge stowage of IOWA's powder and projectiles is not authorized by OP-5. The load should have been magazine stowed where it could have been properly monitored in a controlled environment as required by higher authority. (Findings of Fact 76-78)

17. Although minor discrepancies existed in the hydraulic magazine sprinkler system on 19 April 1989, failing to ensure proper operation of the system did not contribute to the loss of life or damage in Turret II. (Findings of Fact 1-9, 69, 72, 73, 139-141, 161)

18. Failing to charge the jumper hose for the intraturret magazine sprinkler system on 19 April 1989 did not contribute to the loss of life, but may have hindered damage control in Turret II. Had this system been activated prior to the explosion only the 200 gallons of water in the turret reservoir would have been available. (Findings of Fact 1-9, 69, 73, 145-147)

19. Although a safety discrepancy, failing to properly set material condition Zebra did not contribute to loss of life in Turret II on 19 April 1989. (Findings of Fact 1-9, 69, 73, 142, 143)

20. The clothing material worn by Turret II personnel had no relationship to the cause of death given the extremely high temperature fire. No reasonable alternative to the cotton dungarees would have affected the survivability of the individuals. (Findings of Fact 1-8, 89-135)

21. Although unauthorized, use of a five bag vice six bag configuration in center gun Turret II did not cause premature detonation. (Findings of Fact 41-46, 216-230)

22. Center gun Turret II was in satisfactory material condition and was capable of conducting the Open Ocean Naval Gun Fire Exercise scheduled for the morning of 19 April 1989. (Findings of Fact 136-138, 141, 219)

23. IOWA's Commanding Officer did not effectively oversee the planning and preparation for the gunshoot on 19 April 1989. Specifically:

a. He did not know ENS _____ was the only officer scheduled to be in Turret I during the gunnery exercise. (Findings of Fact 40, 198)

b. He was not informed of the unauthorized load configuration used in Turret II (which had been coordinated by FCCM(SW) _____ and approved by the Gunnery Officer and the Weapons Officer). (Findings of Fact 41-46, 50)

c. He was not informed of the following with respect to Turret III:

(1) that Turret III personnel had been briefed that they would shoot if time permitted during the gunnery exercise. (Findings of Fact 23, 33)

(2) that Turret III personnel were moving powder and projectiles in preparation for the gunshoot. (Findings of Fact 30-33)

(3) an unauthorized load configuration was to be employed by Turret III (which had been coordinated by FCCM(SW) _____ and approved by the Gunnery Officer and the Weapons Officer). (Findings of Fact 33, 42-44, 50)

24. On 19 April 1989, lax command oversight and ill-defined Main Gun Battery ordnance handling procedures resulted in the unauthorized movement of powder and projectiles in Turret III. (Findings of Fact 30-33)

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25. IOWA's pre-prefire briefs did not accomplish stated objectives. Specifically:

- a. Misfire/hangfire procedures were not discussed;
- b. Hot gun procedures were not briefed;
- c. General magazine safety precautions were not reviewed.

(Findings of Fact 14-24)

26. IOWA's turret crews were not properly prepared for the Main Gun Battery gunshoot on 19 April 1989. (Findings of Fact 14-24)

27. Prior to commencement of loading center gun Turret II, loading operations in Turret II were proceeding normally. (Findings of Fact 51, 53-58, 63)

28. The Turret Officer, Turret Captain and Center Gun Cradleman were alerted to an abnormality in the loading sequence prior to detonation. (Findings of Fact 58-60)

29. Although confronted with something atypical during the loading process of center gun Turret II, center gun personnel continued the loading sequence. (Findings of Fact 58-60, 69, 71, 72)

30. An abnormal condition occurred during the ramming cycle with the rammer being extended about 21 inches past the normal ram position at the time of ignition. This condition was not the result of a mechanical failure of the rammer system. (Findings of Fact 69, 71, 72, 137, 227-230)

31. Detonation took place at 0955 on 19 April 1989. (Findings of Fact 65, 66)

32. The ignition in the center gun breech started in the approximate location of the first and second powder bags (as numbered from the base of the projectile) while the rammer head was well within the breech during a forward ram cycle. (Finding of Fact 69, 72)

33. Outside of center gun room, no Turret II personnel had time or opportunity to prevent the explosion. Further, none had time or opportunity to minimize the extent of damage or take life saving measures. (Findings of Fact 1-9, 58-64)

34. In the powder handling flat of Turret II, twenty-one (21) bags of powder burned or detonated resulting in secondary explosions of lower order seconds after the initial blast. (Findings of Fact 3-5, 7, 74, 75)

35. Construction and design of the turret prevented progressive fire and blast damage throughout the ship, demonstrating the survivability of battleships. (Findings of Facts 1-8, 166, 167, 170-172)

36. IOWA's Commanding Officer correctly decided to approach the explosion in Turret II as a mass conflagration incident. As a direct result of effective and realistic training, repair party personnel successfully (and courageously) responded. (Findings of Fact 148-170)

37. During major disasters treated as mass conflagration, personnel are trained to use initiative. However, the consequences of flooding magazines can be dramatic. Accordingly, if possible, coordination with the central decision making authority (usually the Commanding Officer) is mandated. (Findings of Fact 161, 163, 166)

38. Given the magnitude of the explosion and the fire in Turret II, the fire's close proximity to the turret's powder magazines, and the potential threat to the ship if the magazines caught fire, flooding of the Groups Three and Four magazines was operationally prudent. (Findings of Fact 1-9, 69, 74-76, 79, 80, 161, 163-165)

39. Although many fire fighting personnel were unfamiliar with the interior design of Turret II, IOWA's damage control parties responded quickly and efficiently, placing fire fighting water inside Turret II. (Findings of Fact 148, 149, 151-160)

40. One-piece fire fighting ensembles permitted repair party personnel to enter Turret II rapidly, thereby expediting the intended rescue. (Findings of Fact 155-159)

41. Additional Emergency Escape Breathing Devices (EEBD) could assist turret personnel in exiting the turret in case of a low order explosion or fire. (Finding of Fact 144)

42. Ignition did not result from mechanical failure. (Findings of Fact 136-141, 219, 229, 230)

43. An ESD event did not cause the premature ignition in the center gun of Turret II. (Finding of Fact 221, 229, 230)

44. Hazards of Electromagnetic Radiation to Ordnance (HERO) did not cause premature ignition in the center gun of Turret II. (Finding of Fact 220, 229, 230)

45. The propellant and black powder in NALC D846 Lot CRA87B001-001 on board IOWA on 19 April 1989 were stable. (Findings of Fact 222-226)

46. Neither successful firing from Turret I nor the misfire in left gun Turret I caused or contributed to the premature ignition in Turret II. (Findings of Fact 35-39, 65-68, 217, 229, 230)

47. Environmental conditions did not contribute to premature ignition. (Findings of Fact 35-39, 68, 216-230)

48. In light of test results demonstrating the concentration of ether required for ignition exceeds that present in samples tested, the presence of elevated volatile levels, which include ether, is not the source of ignition. (Findings of Fact 222-230)

49. While the possibility of a ripped bag being loaded and rammed into center gun cannot be ruled out, extensive testing of loose propellant and black powder has failed to develop compression or friction as a source of ignition. A friction event was not the source of ignition. (Findings of Fact 219, 222-230)

50. No musters were taken at either the pre-prefire brief or the prefire brief. Firings conducted were inconsistent with the written prefire plan. Accordingly, it cannot be determined that center gun Turret II personnel were adequately briefed and confusion may have resulted from an abnormal configuration of five vice six powder bags. (Findings of Fact 14-29, 41-46)

51. While smoking was allowed inside the Turret Officer's Booth when gun shoots were not in progress, smoking was not permitted anywhere inside the turrets during gunnery exercises. No smoking apparatus was found in center gun room, Turret II after the explosion on 19 April 1989. Smoking did not contribute to premature detonation in center gun Turret II. (Finding of Fact 227)

52. The investigation into and the analysis of all potential causes of this tragic explosion have been complicated by the issues of improperly loaded munitions in the center gun (NALC D881 projectile with five full charge bags vice six), lack of effective, properly supervised assignment and qualification processes, and poor adherence to explosive safety regulations and ordnance safety. While these and all other personnel error related issues were not the cause of the explosion and did not provide an ignition source, they cast the proper operation of gunnery systems in USS IOWA (BB-61) in a poor light and generate doubt. Further, such a substandard operations and readiness baseline results in systemic deficiencies that can serve as a foundation for disaster. (Findings of Fact 20-24, 41-46, 51, 142, 143, 145-147, 175-183, 191-230)

53. Personnel error could only have caused the rammer to extend about 21 inches past the normal position as the result of an improper signal on the part of the gun captain, miscommunication of signals between the gun captain and rammerman, or improper operation of the rammer by the rammerman. None of these causes are likely in light of the qualifications of the gun captain, the training of the rammerman, and the fact that the rammer was in the proper slow ahead position for a powder ram. The rammer was extended beyond the normal position by the rammerman in response to an overt and intentionally conveyed hand signal on the part of GMG2 Hartwig, Turret II's center gun captain. (Findings of Fact 71, 72, 227-230)

54. In the normal course of events, the 19 April 1989 ramming of five powder bags about 21 inches past the standard ram position could not have caused premature ignition. (Findings of Fact 72, 226-230)

55. The explosion in center gun, Turret II, USS IOWA (BB 61) on 19 April 1989 resulted from a wrongful intentional act. (Findings of Fact 58-60, 69-72, 98, 137, 138, 216-230)

56. Based on this investigative report and after full review of all Naval Investigative Service's reports to date, the wrongful intentional act that caused this incident was most probably committed by GMG2 Clayton M. Hartwig, USN. (Findings of Fact 58-60, 69-72, 98, 137, 138, 216-230 and review of NIS Reports)

57. Main battery guns in Iowa Class Battleships can be operated safely. Proper training and safety procedures reduce potential for accidents. (Findings of Fact 216-230)

RECOMMENDATIONS

1. Commander, Naval Sea Systems Command, conduct a thorough review of and investigation into ammunition storage procedures at Naval Weapons Station, Yorktown, and take action as necessary to ensure compliance with all applicable and controlling directives.

2. Commanding Officer, USS IOWA (BB-61) ensure that no 16"/50 caliber firing is conducted using other than authorized and service approved projectiles, propellants and propellant loads without specific prior authorization of Commander, Naval Sea Systems Command, in accordance with paragraph 1266 of OPNAVINST 5100.194.

3. Commander, Naval Sea Systems Command, conduct a complete investigation to determine if 16"/50 caliber projectile and propellant variant experimentation has been improperly conducted by personnel from NAVSWC DAHLGREN and other ordnance activities in conjunction with personnel assigned to USS IOWA. Further, that Commander, Naval Sea Systems Command conduct an internal review to ensure effective and appropriate oversight is provided to command personnel before such personnel authorize nonstandard weapons evolutions.

4. Commander, Naval Sea Systems Command investigate ether entrapment characteristics of powder bag wear reducing wrappers and determine the need for any change in design.

5. Commander, Naval Sea Systems Command originate an Ordnance Alteration providing a recording system at the IC switchboard location that will record the JD, JC and XJ circuits for Battleship Main Gun Battery operations.

6. Commander, Naval Sea Systems Command amend 16"/50 caliber procedural documents to include a caution which states: "In the event a powder bag or ignition pad becomes ripped, torn or otherwise damaged, CEASE all operations in the affected turret, dispose of the damaged bag in the nearest immersion tank, clean up and dispose of any spilled powder in the nearest immersion tank, and only then proceed with turret operations."

7. Commander, Naval Sea Systems Command review and rewrite, in a user friendly format that does away with foldouts and better supports maintenance and operator training, the "Maintenance Manual for 16-Inch Three Gun Turrets BB-61 Class", publications SW330-AA-MMA-010 through -040.

8. Commander, Naval Surface Force, U.S. Atlantic Fleet, review Combat Systems Assessment (CSA) reporting methods to ensure reports accurately denote the one day "snapshot" and "spot check" coverage.

9. Chief of Naval Personnel take immediate action to fill all Battleship Division Weapons Gunnery billets with second tour Division

Officers. Such assignments should require all reporting officers to report for assignment as Turret Officers only after successful completion of formal 16"/50 caliber training.

10. Type Commanders take immediate action to ensure lead foils and primers used in the 16"/50 caliber gun system are kept under secure and positive control and all expenditures are accounted for on an item basis.

11. BB-61 class ships be authorized a Chief Warrant Officer (W-3) ordnance technician to serve as explosive safety officer, special assistant for training, and assistant for technical matters to the Weapons Officer.

12. Implementation of a Navy Wide formal Turret Officer qualification process. Enclosure (279) is provided for review and implementation as appropriate.

13. Repair VI, ordnance repair party, on board Battleships be manned during all gunnery evolutions.

14. The suspension of 16"/50 caliber firings imposed by CNO Msg 192305Z APR 89 be rescinded on an individual Battleship basis upon:

a. Type Commander certification, through a Main Gun Battery Safety Standdown that:

(1) A complete PQS program is installed and operating.

(2) All required Turret Watch Stations requiring PQS qualification are filled with final or interim qualified personnel.

(3) Rigorous adherence to explosive ordnance safety is demonstrated, including full compliance with Non-Nuclear Ordnance Certification requirements.

(4) Appropriate Repair Party personnel be familiar with turret arrangement, explosive stowage, and sprinkler system operations and activation policy.

(5) A proper magazine safety procedure is in place which considers the turrets as magazines at all times and which prohibits smoking inside of the turrets, including the Turret Officer's booth.

b. Commander, Naval Sea Systems Command confirm 16"/50 caliber propellant currently in the four Battleships is serviceable and usable without qualification.

15. Type Commanders take steps necessary to ensure lead foils are being removed from silk bag envelopes prior to insertion into the powder train in accordance with paragraph 3-45.2.2 of SWO30-AA-MMO-010.

16. To maximize training and operational efficiencies, structure Battleships' manning organization to include the First Lieutenant, Deck Divisions and Marine Corps Detachment under the Weapons Officer in Weapons Department.

17. The Manned and Ready Report from each turret, when manning Gunnery Stations or setting General Quarters, be formally defined as follows:

- a. all required stations are manned;
- b. material Condition Zebra is set;
- c. all personnel are in appropriate Battle Dress;
- d. an on station safety brief has been conducted;

(1) For turret personnel by the Turret Captain over the announcing circuit;

(2) For magazine personnel by POIC;

e. the Petty Officer in Charge of the powder handling flat has reported the intraturret Sprinkler System jumper hose has been connected and charged.

18. Type Commanders review Battleship Emergency Escape Breathing Device allowances with a view toward sufficiencies to support Battleship Main Gun Batteries.

19. Commander, Naval Sea Systems Command investigate the feasibility and initiate, as appropriate, a ship alteration for the installation of an automatically activated HALON or similar fire and life protection system for 16"/50 caliber turrets.

20. Fleet training in support of mass conflagration highlight location of magazine and sprinkler system control devices and emphasize both the need for the highest possible level of command coordination and ramifications of flooding.

21. During the course of this investigation, it became clear that numerous IOWA service members, in an attempt to save their ship and the lives of their shipmates, distinguished themselves through extraordinary acts of heroism. It is recommended the following officers and crew members of USS IOWA (BB-61), be recognized by award of the Navy Marine Corps Medal:

LT	USN
CAPT	r, USMC
1st LT	C
1st SGT	, USMC
GMC	USN

GMG1		1, USN
BM1		, USN
BM2		1. USN
BM2		n, USN
HT1 T		h, USN
GMG3		7. USN
ENFA		, USN
FN E		, USN
FR		, USN
MR3		, USN
BM2		, USN

This list is not all inclusive. Many other personnel performed heroically on 19 April 1989. It is recommended that Commander, Naval Surface Force, U.S. Atlantic Fleet, in close coordination with Commanding Officer, USS IOWA (BB-61), ensure all such personnel be identified and appropriately recognized.

22. While the failure to execute an effective Personnel Qualification System for turret personnel and the general disregard for ordnance safety cannot be directly associated with the cause of the 19 April 1989 explosion and loss of 47 Navy men, such failures to meet established requirements warrant consideration of the following judicial, disciplinary and/or administrative action:

a. The charge contained in enclosure (280) concerning Captain _____, USN, be preferred and referred for appropriate disciplinary or judicial action. Further, that subsequent to such action, higher authority determine if detachment for cause, in accordance with MILPERSMAN 3410100.5 is warranted.

b. Appropriate administrative action be taken to caution Commander _____, USN, Executive Officer, USS IOWA (BB-61) with respect to his duties.

c. The charge contained in enclosure (281) concerning Commander _____, USN, be preferred and subsequently referred for appropriate disciplinary or judicial action.

d. Commander _____, USN, Weapons Officer, USS IOWA (BB-61), be detached for cause in accordance with MILPERSMAN 3410100.5.

e. The charge contained in enclosure (282) concerning Commander _____, USN, be preferred and subsequently referred for appropriate disciplinary or judicial action.

f. Lieutenant Commander _____, USN, Gunnery Officer, USS IOWA (BB-61), be detached for cause in accordance with MILPERSMAN 3410100.5.

g. The charge contained in enclosure (283) concerning Lieutenant Commander _____, USN, be preferred and subsequently referred for appropriate disciplinary or judicial action.

h. Appropriate administrative action be taken to caution Lieutenant junior grade _____, USN, G-1 Division Officer, USS IOWA (BB-61) with respect to his duties.

i. Appropriate administrative action be taken to caution Ensign _____, USN, G-3 Division Officer, USS IOWA (BB-61) with respect to his duties.

j. The charge contained in enclosure (284) concerning Master Chief Fire Controlman (SW) _____, USN, be preferred and subsequently referred for appropriate disciplinary or judicial action.

k.