DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, DC 20350-2000

IN REPLY REFER TO
Ser 00/9C500284
31 August 1989

--Unclassified upon removal of enclosures (~~21~~), (30), (43), (46), (56), (76) (100), (~~102~~), (103), (173) (174), (272), and (291) (107)

THIRD ENDORSEMENT on RADM USN, ltr of 15 Jul 1989

From: Chief of Naval Operations
To: Judge Advocate General

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

Encl: (295) Exhibits 268-306, NIS Report of Investigation

1. I have reviewed this investigation in detail and agree with the findings and recommendations of the investigating officer and prior endorsers as modified by this endorsement. This case illustrates once again the harsh reality that tragedy and adversity are all-too-frequent visitors to the U.S. Navy. Our gallant sailors continually face difficult and overwhelming odds. Inexplicable losses are often the most painful to bear; loss of lives in peacetime during routine training may be the hardest to accept. Incidents such as this are grim reminders of the tremendous sacrifices made by Navy personnel and their families. To those who suffered personal loss, I extend my condolences; to the survivors of this ordeal who bravely saved their ship, I extend my admiration and heartfelt appreciation.

2. On 19 April 1989 a rapid series of three explosions within turret II aboard USS IOWA (BB 61) resulted in the instantaneous deaths of 47 American sailors. A Judge Advocate General's Manual investigation was convened immediately. Every conceivable source of ignition and every aspect of USS IOWA's condition and shipboard routine that might have bearing on the incident were evaluated: procedures, training, safety, manning, and personal conduct. Since the primary explosion was determined to have occurred within the center gun room, the focus of the investigation was properly directed to that location. The tragic loss of personnel within turret II and adjacent ammunition handling spaces precluded a precise causal determination since the personnel most knowledgeable of actions and intentions were those who lost their lives.

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3. The initial explosion was caused by premature ignition of five bags of smokeless powder contained within the center gun with the breech open. The point of ignition was most probably between the first and second bags. Exhaustive technical tests have ruled out the following possibilities which constitute the most logical inadvertent causes: burning ember, premature primer firing, mechanical failure, friction, electromagnetic spark, propellant instability, and personnel procedural error. Although deficiencies in training documentation, weapons handling procedures, and adherence to safety procedures were found within the weapons department, the exhaustive tests and duplication of the type of blast that occurred have conclusively demonstrated that these shortcomings did not cause the explosion. Accountability for the identified shortcomings will be addressed in the cases of those officers and petty officers responsible for the associated duties.

4. At the time of the incident, the center gun room of turret II was fully manned with four individuals. Confronted with evidence that brought into question a possible wrongful act, the Naval Investigative Service (NIS) conducted an exhaustive investigation into the backgrounds and recent behavior of not only center gun room personnel but of all relevant USS IOWA crewmembers. Results of those interviews and other circumstantial evidence are contained within the enclosures to this report. For purposes of completeness, additional exhibits submitted by NIS since 28 July 1989 are included in enclosure (295).

5. The thought of an intentional, wrongful act is repugnant to all professional seagoing men and women; however, this consideration had to be pursued when information surfaced that introduced its possibility. Extensive laboratory tests using optical and electron microscopy revealed the existence of foreign elements not normally present in the 16" guncharge. An attempt by separate FBI analysis to correlate these elements with material associated with an improvised explosive device proved inconclusive (exhibit 306 of enclosure 295). Additional hard factual evidence such as the position of the projectile/powder rammer and the subsequent delay in retracting the rammer to allow closing of the breech provides credibility to the theory that an intentional human act caused the ignition of the powder charge. The critical controlling station within turret II to allow the aforementioned factors to occur was that of the center gun captain. These factors, when combined with circumstantial evidence associated with the individual manning that

gun captain position at the time of the explosion, strongly suggest that an intentional human act most probably caused the premature ignition.

6. The evidence amassed includes: (1) irrefutable facts on conditions in the center gun room at the instant of the explosion, such as the position of the rammer, (2) the fact GMG2 Clayton M. Hartwig was in the gun captain position, and (3) significant circumstantial evidence documenting the lifestyle and thought patterns of GMG2 Hartwig over a lengthy period of time. The combination of these factors leads me reluctantly to the conclusion that the most likely cause of the explosion was a detonation device, deliberately introduced between powder bags that were being rammed into the breech of the center gun. This caused premature detonation and the subsequent disastrous explosions aboard USS IOWA on 19 April 1989, resulting in the deaths of 47 sailors, including Hartwig. I further concur with the investigating officer and the subsequent endorsers that the preponderance of evidence supports the theory that the most likely person to have introduced the detonation device was GMG2 Hartwig.

7. As with any catastrophe, the immediate impulse is to take every possible step to prevent a recurrence. However, the fact of the matter is, Navy life, with its associated mission of maintaining combat readiness at sea, is replete with danger, and mutual trust among shipmates to do their job properly is at the core of our most sophisticated screening, training, and reliability testing. Should a person choose to violate that trust, it is virtually impossible to have established procedures to absolutely preclude disastrous results of such an individual choice.

8. Recommendations 1 through 21, as modified below, are approved. By copy of this endorsement designated commanders are directed to take indicated recommendations for action:

a. Recommendation 1: Commander, Naval Sea Systems Command (COMNAVSEASYSCOM), shall conduct recommended investigations and report findings, recommendations and any corrective actions to the Chief of Naval Operations (CNO) (OP-09).

b. Recommendation 3: Navy Inspector General shall conduct a complete investigation of reported variations and experimentation associated with 16"/50 projectile and propellant handling and

report findings and make recommendations for corrective actions to the CNO (OP-09).

c. Recommendations 4, 5, 7, 18, and 19: COMNAVSEASYSCOM shall conduct appropriate examinations, studies or reviews and report to the CNO (OP-09) on the feasibility of recommended actions.

d. Recommendation 6: Commander in Chief, U.S. Atlantic Fleet (CINCLANTFLT), and Commander in Chief, U.S. Pacific Fleet (CINCPACFLT), shall ensure appropriate interim implementation prior to amendment and distribution of procedural documents by COMNAVSEASYSCOM.

e. Recommendations 9 and 11: Chief of Naval Personnel shall coordinate with CINCLANTFLT and CINCPACFLT to determine feasibility of implementing these recommendations and report results to the CNO (OP-09).

f. Recommendation 10: CINCLANTFLT and CINCPACFLT shall ensure implementation.

g. Recommendation 12: Chief of Naval Education and Training (CNET), shall coordinate with Commander, Naval Surface Force, U.S. Atlantic Fleet (COMNAVSURFLANT), and Commander Naval Surface Force, U.S. Pacific Fleet (COMNAVSURFPAC), and Chief of Naval Personnel.

h. Recommendation 13: CINCLANTFLT and CINCPACFLT shall ensure that appropriate repair parties are manned during firing of main battery guns on BB 61 class ships.

i. Recommendation 15: CINCLANTFLT and CINCPACFLT shall ensure implementation.

j. Recommendation 16: CINCLANTFLT and CINCPACFLT shall implement as deemed appropriate.

k. Recommendation 17: CINCLANTFLT and CINCPACFLT shall implement as deemed appropriate.

l. Recommendation 20: CINCLANTFLT and CINCPACFLT shall implement as deemed appropriate.

report findings and make recommendations for corrective actions to the CNO (OP-09).

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k. Recommendation 17: CINCLANTFLT and CINCPACFLT shall implement as deemed appropriate.

l. Recommendation 20: CINCLANTFLT and CINCPACFLT shall implement as deemed appropriate.

Designated commanders shall make monthly progress reports to the CNO (OP-09) on relevant recommendations.

9. This report is provided to CINCPACFLT for information and action as deemed appropriate in addition to action otherwise directed.

10. As noted above, the investigating officer found deficiencies in training documentation and safety of ordnance handling on board USS IOWA. Although determined not to have been a contributing factor in this incident, these deficiencies nevertheless reflect adversely upon command priorities and main battery readiness. Uncompromising compliance with published training, qualification, safety, and ordnance handling requirements is fundamental to fleet readiness. The breakdown in those procedures in USS IOWA requires that accountability of individuals listed in recommendation 22 be determined in accordance with the Uniform Code of Military Justice (UCMJ) and that appropriate action be taken subject to the following modifications:

a. Enclosures (280) through (284) are forwarded to CINCLANTFLT for appropriate disposition by him or his designee in accordance with Article 15, UCMJ.

b. Recommendations concerning detachment for cause as modified in the endorsements are approved.

c. Recommendations 22b, 22h, and 22i as modified by the first endorser are approved.

d. Recommendation 22k is disapproved.

11. I have further directed by separate correspondence that specific lessons learned be reviewed. All battleship weapons departments are to be inspected and deficiencies corrected prior to authorizing full unrestricted use of 16" gun systems.

12. All individuals associated with this investigation, particularly the investigating officer and his team, agents of the NIS and the FBI, and the endorsers, are recognized for their considerable efforts in conducting and evaluating the investigation. The cooperation of many shipmates and family members of the deceased is also greatly appreciated. The tragic loss of life, magnitude of

destruction, sheer volume of evidence to be gathered and evaluated, and complexity of issues have made this a very demanding process.

13. Subject to the foregoing, the findings of fact, opinions, and recommendations of the investigating officer as endorsed are approved.

Admiral, U.S. Navy

Copy to:
CINCLANTFLT
CINCPACFLT (complete report w/o encls)
CHNAVPERS (complete report w/o encls)
CNET
COMNAVSEASYSCOM (complete report w/o encls)
COMNAVSURFLANT
COMNAVSURFPAC (complete report w/o encls)
NAVY IG
RADM USN

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DEPARTMENT OF THE NAVY

UNITED STATES ATLANTIC FLEET

HEADQUARTERS OF THE COMMANDER IN CHIEF

NORFOLK, VIRGINIA 23511-6001

5830
Ser N02L/C004933

11 Aug 1989

--Unclassified upon removal of enclosures (11), (30), (43), (46), (56), (76) (100), (102), (103), (107), (173), (174), (272) and (291)

SECOND ENDORSEMENT on RADM [redacted] USN, ltr of 15 Jul 89

From: Commander in Chief, U.S. Atlantic Fleet
To: Chief of Naval Operations

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

Encl: (292) NAVSEA Report dtd 11 Aug 89
(293) FBI Academy ltr dtd 3 Aug 89
(294) Interview of Nathan Allen Estey dtd 28 Jul 89

1. Forwarded.

2. In reviewing this investigation, each reader should bear in mind that the standard of proof requirements of a JAG Manual Investigation as compared to the standard of proof required for a finding of guilty in a judicial proceeding differ substantially. The facts developed by a criminal investigator for use in a judicial proceeding must provide a prosecutor with admissible evidence from which a case can be proven beyond a reasonable doubt. A JAG Manual Investigation is an administrative fact-finding body, as such, it is the responsibility of the investigating officer to provide convening and reviewing authorities with facts developed through consideration of relevant materials that are sufficient to fashion basic decisions concerning the matters involved. The rules governing the conduct of JAG Manual Investigations are modeled on the Administrative Procedures Act (See 5 U.S.C. 556). Evidence must be relevant, material, and not overly redundant. Facts are established by reliable, probative, and substantial evidence. There may be more factual information available upon which to base opinions, and ultimately decisions, than in a judicial proceeding. Evidence properly considered by a JAG Manual Investigation might be excluded from a judicial proceeding for a variety of reasons.

3. There were essentially two parallel investigations conducted regarding this tragic incident. The JAG Manual Investigation was convened within hours of the incident by Commander, Naval Surface

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Force, U.S. Atlantic Fleet (COMNAVSURFLANT). Subsequent to the commencement of the JAG Manual Investigation, information was developed which raised the possibility of a deliberate human act as the cause of the explosion. When this information appeared, COMNAVSURFLANT immediately requested that the Naval Investigative Service (NIS) initiate a criminal investigation. While RADM ___ report is finished, the NIS Investigation remains open and additional materials continue to be gathered. The FBI is conducting a forensic examination of materials submitted by the Naval Investigative Service, which will further assess the presence of an introduced foreign object or device. The results of these tests will be forwarded upon receipt for inclusion in the report of investigation. However, there is little expectation of major new disclosures that are apt to significantly alter the findings of fact and opinions contained in the Investigating Officer's report and the endorsements to date. COMNAVSURFLANT, VADM ___ III, USN, as the officer convening both the JAG Manual Investigation and the NIS Investigation, summarized and related the contents of the two investigations in the First Endorsement.

4. The JAG Manual Investigation incorporated assistance from Commander, Naval Sea Systems Command (NAVSEA). NAVSEA Technical reports are progressive and developmental in nature, the first reports deal with original expectations and were subject to change as new evidence was developed and test results were obtained. The most recent test results are incorporated by this endorsement as enclosure (292) and are supportive of the conclusions of the investigation.

5. During the course of the investigation, the Investigating Officer found a number of major administrative and supervisory discrepancies on board USS IOWA (BB 61), as well as substantial and serious failures by senior USS IOWA personnel to properly discharge their responsibilities, and made recommendations for administrative and disciplinary action. Exhaustive testing and evaluation has virtually ruled out any of these discrepancies as directly causing the deaths of the 47 crewmembers in Turret II. Nevertheless, the number and egregiousness of the discrepancies create an impression of laxity and disregard that will cloud the investigation in the minds of non-expert critics for the foreseeable future. In addressing accountability for these discrepancies, the convening authority recognized that it is not possible for the Commanding Officer or Executive Officer of a ship the size of USS IOWA to be constantly aware, in depth, of everything that is transpiring on board during busy operational and pre-deployment periods such as

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USS IOWA was undergoing in the months prior to the tragedy. These two officers must rely on the loyal and competent professional support of their department heads, division officers, and others in the chain of command. For this reason, COMNAVSURFLANT recommended against judicial action or detachment for cause with respect to the Commanding Officer and Executive Officer. This recommendation is concurred in; however, the Commanding Officer's and Executive Officer's overreliance on outside inspections and non-substantive reports from their subordinates as adequate assurance that the ship's main battery was being safely and properly administered needs to be made a matter of record. While delegation is expected and encouraged, proper execution of doctrine and directives is the responsibility of the Commanding Officer. Accountability is the core value in the measurement of performance. Operating procedures are established to ensure safe, successful evolutions. Personnel training programs are established to ensure safety, unit readiness, and career development. These systems are not supposed to become empty rituals. Under the Commanding Officer's and Executive Officer's supervision, their principal officers and petty officers, identified in the Investigating Officer's report, failed to properly lead and manage the main battery of the ship--the 16-inch guns. Consequently, Commander, Naval Surface Force, U.S. Atlantic Fleet is directed to ensure that these deficiencies in performance are fully documented by special reports of fitness on the Commanding Officer and Executive Officer.

6. The Commanding Officer and other officers expressed the belief that there were no serious problems in the Weapons Department because both the group commander and type commander inspectors had given the ship satisfactory marks in areas inspected during the pre-deployment workup. Ignorance of on-board conditions is not exculpated and command cannot be abrogated by deference to outside inspectors. Inspection results, however, are supposed to assist commanding officers and not contribute to unwarranted complacency. The action initiated by Commander, Naval Surface Force, U.S. Atlantic Fleet to tighten up inspections as stated in paragraph 21 of the First Endorsement on the Investigating Officer's report is appropriate. Limited assets and time do not permit inspecting every facet of a command, nor would such a program be desirable. Nevertheless, inspections and assist visits are important tools when properly utilized and evaluated by a commanding officer. In implementing his revised assessment procedures, COMNAVSURFLANT should ensure inspection assets are concentrated in areas of highest expected benefit and that inspectors are precise in describing to the Commanding Officer and department heads exactly what areas they have inspected and the level to which inspected.

Generalizations such as "Your PQS looks good", should be avoided when only a small sampling of specific divisions PQS has actually been examined. This type of error is particularly prone to occur when normally separate inspections or assist visits are overlapped to take advantage of available resources or opportunities.

7. The investigating officer also identified unacceptable failures at Naval Weapons Station, Yorktown, Virginia to follow procedures for the proper storage and monitoring of powder taken from the USS IOWA during her yard period. It has been administratively determined that Commander, Naval Sea Systems Command is investigating these failures and those persons bearing responsibility will be held accountable. One of the primary purposes of a JAG Manual Investigation is to identify such deficiencies for correction. The recommendations relative to these discrepancies on board USS IOWA (BB 61) and at Naval Weapons Station, Yorktown are being evaluated and have been or will be implemented as appropriate. Thorough testing of numerous samples of powder taken from USS IOWA, has established a very high degree of improbability that any of these discrepancies or failures of responsibility caused the explosion.

8. It should be noted that the "Equivocal Death Evaluation" provided by the Federal Bureau of Investigation cannot be released without the approval of the FBI. Per enclosure (293), requests for release of the evaluation should be referred to the Freedom of Information Act Section, Records Management Division or the National Center for the Analysis of Violent Crime. The equivocal death examination was conducted utilizing all information generated by the NIS Investigation and the Naval Investigative Service continues to provide all information to the FBI to ensure that no evidence exists that could alter the opinions expressed in the evaluation. The most recent statement pertinent to the Equivocal Death Evaluation, enclosure (294), has been provided to the FBI.

9. In the conduct of this investigation, every conceivable cause of the explosion was explored and all leads with theoretical possibility of contribution have been exhaustively pursued using every investigative and technical tool at our disposal. A concerted effort has been made to protect the individual rights and reputations of those concerned.

10. The conclusion that a sailor deliberately, and with careful preparation, caused his own death and those of forty six of his shipmates is initially repugnant almost to the point of disbelief. This reviewing officer has had great difficulty in accepting such an opinion and has therefore carefully reviewed the complete investigation to date in great detail. The technical and administrative investigators have been excruciatingly thorough. Large sums of money and thousands of man hours have been expended. The result is impressive but discomforting. No living human being will ever know with unassailable certainty what happened in Turret II to initiate the tragedy, but the sheer weight of evidence leads in only one direction. Exhaustive testing has reduced the probability of causation to a single source, i.e., direct and deliberate human intervention during the loading process. Strong forensic evidence exists that an ignition device was deliberately introduced among the powder bags being rammed into the breech of the center gun. Based on the evidence, one must consider who had the access, knowledge, and motivation to accomplish such an act. The weight of information contained in the investigation, including the Naval Investigative Service reports, leads this reviewing officer to agree with the opinion of the Investigating Officer and the First Endorser--the person on board USS IOWA at the time of the explosion who most credibly meets this test was GMG2 Clayton M. HARTWIG.

11. Subject to the foregoing, the findings of fact, opinions, and recommendations of the Investigating Officer, as endorsed, are approved.

Copy to:
COMNAVSURFLANT
RADM [redacted], USN
NAVCOMPT (OP-82)

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DEPARTMENT OF THE NAVY

COMMANDER NAVAL SURFACE FORCE
UNITED STATES ATLANTIC FLEET
NORFOLK, VIRGINIA 23511-6292

5830
Ser N003/C358
28 Jul 1989

- Unclassified upon removal of enclosures (1), (30), (43), (46), (56), (76), (100), (102), (103), (173), (174), (272) and (291) (107)

FIRST ENDORSEMENT on RADM U.S. Navy, /1110 ltr of 15 July 1989

From: Commander, Naval Surface Force, U.S. Atlantic Fleet
To: Chief of Naval Operations
Via: Commander in Chief, U.S. Atlantic Fleet

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

Encl: (285) NIS Report of Investigation Exhibits (1-267)
(286) CAPT USN, ltr of 20 Jul 89
(287) COMNAVSURFLANT 121130Z Jun 89
(288) COMNAVSURFLANT 211800Z Jul 89
(289) COMNAVSURFLANT ltr 1500 Ser N511A/06742 of 14 Jun 89
(290) NAVEDTRASUPPCENPAC ltr 1500 Ser N7/1885 of 23 Jun 89
(291) COMNAVSURFLANT 270556Z May 89 (C)

1. Readdressed and forwarded.

2. The investigative effort to determine the cause of this tragedy has been monumental. With no survivors able to explain what happened, and with much of the physical evidence disturbed during firefighting, the investigating team of experienced line officers and scientists relied largely on scientific tests, forensic data and circumstantial evidence in reaching their ultimate opinion. The opinion that the disaster of Turret Two aboard USS IOWA on 19 April 1989 was caused by a human act committed with the intent of bringing about the explosion leaves the reader incredulous, yet the opinion is supported by facts and analysis from which it flows logically and inevitably.

3. The opinion of the investigating officer is further supported by a Naval Investigative Service (NIS) inquiry of great depth and detail. When read together, the two investigations identify the probable source of ignition which caused the explosion, the probable manner in which the source of ignition was introduced into the gun barrel, and the identity of the person most likely to have perpetrated the act. In his preliminary statement, the investigating officer

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explains that certain findings of fact and expressed opinions, in particular finding of fact 230 and opinion 56, were formulated after full consideration of the NIS report. For purposes of clarification and completeness, all of the exhibits submitted by NIS in its Report of Investigation are now included in this report as enclosure (285). Accordingly, this report constitutes the investigation into the USS IOWA turret explosion, to date.

4. In attempting to determine what caused the explosion, a carefully conceived plan of investigation was followed. From the fact that the projectile was moved over three feet by the force of the explosion, it was clear that the explosion took place in the gun barrel and the measured force of the explosion allowed investigators to determine with accuracy the point at which ignition occurred in the powder bag train. Analysis of the turret and the character of the injuries to personnel located throughout the turret enabled scientific determination of the size and path of the fireball. Numerous tests established that the source of ignition had to be between the first and second powder bags closest to the projectile. Ignition at any other location would have resulted in an explosion with different characteristics.

5. The investigating team then considered all of the logical possibilities for an explosion. The burning ember theory was analyzed and eliminated since it was a cold gun. Video of the firing from Turret One confirmed that it is extremely improbable that embers could have entered any of the three gun barrels of Turret Two. Furthermore, tests showed that burning embers are not generated by the powder used in Turret One and therefore could not ignite 16"/50 powder bags.

6. Premature primer firing was considered but disproved as a probable ignition source. Testimony was received that the primer in gun two had never fired and had been thrown overboard after the explosion. Furthermore, with the breech open and the powder tray down, as was the situation when the explosion occurred, the primer, even if it had gone off, could not have ignited the powder. Multiple tests were conducted that demonstrated that the primer when fired with breech open cannot ignite the powder.

7. Possible mechanical failure was carefully analyzed. The rammer was reconstructed, as was the link chain and the hydraulic pump which drove it. Tests confirm that all had been in proper working order.

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

8. Friction as an ignition source was considered in great detail. The investigation documents numerous simple and sophisticated tests which created varying degrees of friction, yet no ignition occurred. Tests were conducted where a rammer was pushed over broken powder bags; where the powder was rammed at high speed; where it was over-rammed and compressed against the projectile, but no ignition occurred. The rammer in USS IOWA was determined to have been moving at slow speed during the ram stroke prior to the explosion. Friction was eliminated as a source of ignition.

9. The investigators considered the possibility of a spark from electromagnetic sources. The electromagnetic environment on USS IOWA was duplicated and electrical potentials at the breech were measured. No spark could be produced and this was eliminated as an ignition source.

10. Propellant instability due to improper storage of the powder was carefully considered. Chemical analysis of powder deterioration, ether levels and residual stabilizing agents proved unequivocally that unstable powder did not cause the explosion.

11. Having ruled out the most obvious ignition sources, the investigating team next looked at personnel error as a cause. Considerable administrative and training deficiencies raised concern about the operation of gunnery systems in accordance with prescribed Navy directives. Lack of an effective personnel qualification program, poor adherence to explosive safety regulations and ordnance safety, and an improperly supervised watch assignment process were all found to exist. Nevertheless, for personnel error to be the cause, it had to relate to the source of ignition. Pressure tests on powder bags, together with the friction tests, ruled out improper operation of the rammer as a cause. Cigarette lighters had been found on some of the bodies, but personnel closest to the breech, the Gun Captain and Cradle Operator, were not smokers. Tests showed that a burning lighter held against a powder bag for a short period of time could not sustain ignition and cause the explosion. The flame would have had to be applied for a length of time in excess of that available prior to the explosion. There was no evidence of smoking in the turret during the firing exercise.

12. The Center Gun had been loaded with five powder bags rather than a normal six bag load. All of the tests discussed were conducted with loads of six and five bags. Number of bags did not influence gun powder stability and was not a factor in the explosion. Having examined all conceivable sources of an accidental explosion, the investigating team turned to the possibility of an intentional act.

13. The Gun Captain, GMG2 Hartwig's sister wrote to the Navy complaining that GMG3 a survivor of the explosion, was the beneficiary of Hartwig's $100,000 life insurance policy. She explained that Hartwig and had had a falling out and argued that Hartwig's parents should receive the money. This letter opened the question of possible deliberate initiation of the explosion, and NIS was directed to commence an investigation. The focus of this investigation centered on and Hartwig as well as other people who had been killed in the Center Gun Room. A search of the personal effects of the deceased sailors disclosed nothing noteworthy, but in Hartwig's effects was found a magazine which discussed munitions. Further investigation into Hartwig's background disclosed that he had experimented with explosive devices and detonators in the past; that he had frequently talked about different ways of dying; that he had a fascination with ship disasters (as evidenced by an album in his parent's house containing numerous newspaper clippings reporting ship disasters); that he had recently had a falling out with his extremely close friend, , and that on the evening before the explosion, his attempts at entering into a close relationship with another sailor had been rejected. Furthermore, Hartwig had attempted suicide while in high school and had discussed suicide in the weeks before the explosion, noting that his preferred way to go was by explosion. Hartwig said he wanted to die in the line of duty and be buried in Arlington Cemetery. Numerous additional factors regarding Hartwig's emotional state and the likelihood that he committed suicide are contained in the FBI Equivocal Death Analysis, exhibit (226) of enclosure (285).

14. NIS looked at the possibility that had murdered Hartwig by causing the explosion. For to have caused the explosion, he would have had to somehow plant a powder ignition source so that the explosion would occur when planned. The Gun Captain is supposed to place a flat silk packet containing a square of lead foil between the first and second powder bags as they are loaded into the barrel. The lead acts as a decoppering agent, essentially cleaning the barrel. Conceivably, a detonating device could have been planted in one of the lead foil packets stored in a canister near the Gun

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