DNB-1907-eat
07C19555
14 Jul 1955

~~CONFIDENTIAL~~

EIGHTH ENDORSEMENT on subject Court of Inquiry

From: Commandant of the Marine Corps
To: Chief of Naval Operations

Subj: Court of Inquiry - Deaths and injuries to Naval and Marine Corps personnel and to one civilian in explosion and fire aboard USS BENNINGTON (CVA20) on 26 May 1954 near Newport, Rhode Island; ordered by the Commander Air Force, U. S. Atlantic Fleet on 26 May 1954

1. Forwarded, contents noted.

B6

By direction

329.54

~~CONFIDENTIAL~~

C-CVA20(522)
Ser 522-036

ENDORSEMENT on subject Court of Inquiry

From: Chief, Bureau of Ships
To: Chief of Naval Operations (2)
Via: Commandant of the Marine Corps (1)

8 - JUL 1955

Subj: Court of Inquiry - Deaths and injuries to Naval and Marine Corps personnel and to one civilian in explosiom and fire aboard USS BENNINGTON (CVA20) on 26 May 1954 near Newport, Rhode Island; ordered by the Commander Air Force, U. S. Atlantic Fleet on 26 May 1954

1. Forwarded.

2. The Chief of the Bureau of Ships concurs in the proceedings, findings of facts, opinions, and recommendations of the Court of Inquiry, as modified by the convening authority, subject to the following comments:

a. Recommendations 1, 2, 3, 4, 6, 11, 12 and 13 relating to non flammable hydraulic fluids, the use of nitrogen, modification of pressure relieving methods, and research programs.

(1) The high pressure hydropneumatic systems installed in surface ships and submarines consist of two general types. The type involved in this casualty is the direct contact type wherein the pressurizing medium is in direct contact with the hydraulic fluid. The other type is that in which the pressurizing medium is separated from the hydraulic fluid by a piston or diaphragm. All submarine hydropneumatic systems are of the latter type. Such a system is inherently safer than the direct contact type, although the bag or diaphragm is subject to failure, resulting in direct contact conditions. Nitrogen charging of bag or diaphragm systems was attempted in submarines of the SSK1-3 class. However, excessive leakage, necessitating recharging with air due to the lack of space for installation of replacement nitrogen storage or nitrogen generating capability, nullified the effectiveness of the initial charge in a short time. Consequently, nitrogen charging of bag or diaphragm type hydropneumatic systems has been held in abeyance pending further investigation of system leakage. This action is subject to compliance with current safety precautions regarding slow opening of air charging valves and root valves to Bourdon pressure gages. (Recommendations 3 and 4).

(2) Regarding direct contact high pressure hydropneumatic systems charged with nitrogen, the relatively small percentage of oxygen remaining in the system after initial charging with nitrogen, a small amount included as an impurity in nitrogen used for recharging, oxygen introduced by recharging with

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(6)

In the event nitrogen is not available on board when recharging is necessary or that oxygen which becomes mixed with the hydraulic fluid in gravity tanks open to the atmosphere may prevent complete safety at high pressure. The exact percentage of oxygen present in the system which will compromise the safety of the system is not known. Experiments to establish this percentage are very time-consuming and final results are not expected for about three years. However, all naval engineering and research facilities concur that inerting of a high pressure direct contact hydropneumatic system containing combustible oil is essential and provides additional safety. Accordingly, action has been initiated to incorporate nitrogen as the pressurizing medium in all high pressure direct contact hydropneumatic shipboard systems under the cognizance of the Bureau of Ships. (Recommendations 3 and 4).

(3) Means for detection of nitrogen leaks by scenting the gas are under investigation and development, although to date no scenting agent or method of introduction has been found. In the interim, flame safety lamps are being used to indicate oxygen deficiency in compartments containing nitrogen pressurized systems. Detailed requirements have been established and explicit instructions published regarding operation of ventilation systems during system blowdown. Installation of warning plates incorporating these instructions is required as a part of the modification to the system which provides for the use of nitrogen. (Recommendation 3).

(4) Concurrent with the introduction of nitrogen as a pressurizing medium in these hydropneumatic systems, development of a non-combustible hydraulic fluid which will be suitable for use in these systems is being pursued. At the present time, no satisfactory fluid has been developed. Houghto-Safe 271, currently in use in Bureau of Aeronautics hydraulic catapults, does not appear suitable for use in hydraulic elevator machinery. The service life of catapult hydraulic pumps using Houghto-Safe is comparable to the service life of these pumps when a petroleum hydraulic fluid is used. However, the service life of airplane elevator pumps is less than one-half the required time when Houghto-Safe 271 is used in an elevator system. One fluid shows promise for use in these elevators, and a pilot installation will be made in the near future. (Recommendations 1 and 2).

(5) Provisions for instantaneous emergency venting must be provided, if possible, on all pressure vessels containing combustible fluids. The replacement of relief valves on direct contact hydropneumatic accumulators containing combustible fluids has progressed to the point where a trial installation of safety heads, or blow-out discs, has been made in the catapult systems in USS HENNINGTON (CVA20). This trial installation has been made to establish whether or not such an installation is compatible with the operating characteristics of a varying pressure direct contact hydropneumatic system. A design investigation has been initiated to explore the feasibility of providing safety heads in air-

plane elevator direct contact hydropneumatic systems. If such an installation proves feasible and a satisfactory hydraulic fluid is not available, safety heads will be installed. (Recommendation 6).

(6) Pressure snubbers for installation in pneumatic gage lines to prevent compression-ignition upon quick opening of valves or system pressure surges have been developed and satisfactorily tested. Instructions for procurement and installation are being prepared for use on pneumatic systems afloat. Flame screen coolers to prevent flame propagation in piping systems are undergoing development and testing. To date, no satisfactory flame screen cooler has been manufactured.

(7) Research is continuing at the Engineering Experiment Station, the Naval Research Laboratory, and at the Bureau of Standards in the development of kinetics of ignition and combustion. (Recommendations 11, 12, 13, 14 and 15).

b. Recommendations 5, 8 and 23, relating to: the restricted use of hydropneumatic equipment pending the introduction of suitable hydrolube and insofar as practical an adequate percentage of nitrogen; the consideration that all compartments containing high pressure hydropneumatic systems charged with a hydrocarbon oil and air are hazardous; the isolation required to prevent widespread distribution of explosive gases, flame and blast effects from any source within combatant ships.

(1) The second endorsement states that the Commander in Chief, U. S. Atlantic Fleet considers the complete isolation of catapult compartments is an absolute necessity until such time as the cognizant technical bureaus in the Navy Department state unequivocally that the hydrolube selected has been tested and found to be non-inflammable in all pressure and temperature ranges known or thought to exist in the launching accumulator. The intent of this comment, and that of recommendation 5 was implemented by the Chief of Naval Operations by message in June, 1954, and subsequently cancelled upon introduction of Houghto-Safe 271 in hydraulic catapults. In view of the fact that the degree of safety achieved by the introduction of nitrogen as the pressurizing medium in a direct contact hydropneumatic system is uncertain, and since to date no satisfactory non-inflammable hydraulic fluid has been developed for use in elevators, additional instructions are being issued by the Bureau of Ships relative to isolation of elevator machinery compartments. (Recommendations 8 and 23).

(2) It is acknowledged that air and oil in direct contact in a high pressure hydropneumatic system constitutes a hazard. It is considered that the hazard is somewhat less in an elevator hydropneumatic system than in catapult systems due to the lower operating pressures, which are in the order of 1000 psi

~~CONFIDENTIAL~~

(4)

and slower moving parts. The introduction of nitrogen on an interim basis further reduces this hazard, and places it in the calculated risk category accepted in aircraft carriers with regard to the stowage and handling of ammunition, bombs, rockets, missiles and aviation gasoline. Consequently, no reduction in operation of elevators is recommended. The incorporation and use of nitrogen as a pressurizing medium in these systems will be continued pending the development of a satisfactory hydraulic fluid. It is the ultimate goal that all shipboard hydraulic systems of all types employ such a fluid. (Recommendation 5).

c. Recommendation 16 - Discharge of catapult system gravity tank vents overboard.

(1) This recommendation has been implemented insofar as is practicable in consideration of the location of the catapult machinery in the ship, and permissible back pressure on the gravity tanks involved. With the introduction of Houghto-Safe 271, this requirement has been considered met if the gravity tanks vent into an airplane elevator pit open to the hangar area. It has been standard practice for many years to provide special ventilation in elevator pits to remove gasoline vapors which are sometimes present in the hangar space, and which could otherwise collect in such locations. This ventilation also serves to remove catapult fluid vapor.

d. Recommendation 24 relating to location and accessibility of boiler fuel oil emergency trip devices:

(1) Emergency trip devices are located at the front of each boiler, accessible from the upper and lower levels of the fireroom, and also outside the firerooms at the top of the escape hatches. The accessibility, ease of operation, and location of these devices are being investigated to determine if they are adequate and if any modification or relocation is necessary.

e. Recommendation 25 relating to location of OBA equipment in certain isolated key control centers, such as the Damage Control Central:

(1) OBA equipment is provided in sufficient quantity to equip 30% of the ship's crew. This equipment is dispersed throughout the ship in accordance with a location plan developed upon recommendations of the forces afloat. Further, it is considered the Commanding Officer's prerogative to effect minor redistribution of this equipment if such is considered necessary. Major relocation of equipment and increase of allowance is contingent upon receipt of specific recommendations of forces afloat.

3. It is strongly recommended that a consolidated report on the results of

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the investigation conducted by the Court of Inquiry into this matter be issued on an unclassified basis for wide distribution to operating forces to emphasize the necessity for compliance with pertinent safety precautions, operating instructions and material directives.

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Copy to:
COMFLTAIR Quonset (1)
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JAGNAV (1)
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BUAER (1)

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~~C O N F I D E N T I A L~~

Aer-SI-34/4
04156
2 March 1955

SIXTH ENDORSEMENT on subject record

From: Chief, Bureau of Aeronautics
To: Chief of Naval Operations
Via: (1) Chief, Bureau of Ships
(2) Commandant of the Marine Corps

Subj: Court of Inquiry - Deaths and injuries to Naval and Marine Corps personnel and to one civilian in explosion and fire aboard USS BENNINGTON (CVA-20) on 26 May 1954 near Newport, R. I.; Ordered by the Commander Air Force, Atlantic Fleet on 26 May 1954

Encl: (1) One (1) copy, "Summary of Action by BUAER Relative to the Recommendations of the Court of Inquiry, Convened to Inquire into the Fire and Explosion aboard the USS BENNINGTON (CVA-20) on 26 May 1954 as associated with material and components under BUAER Cognizance."
(2) One (1) copy of BUAER ltr Aer-SI-341 ser 145362 of 6 Nov 1953
(3) One (1) copy of BUAER ltr Aer-SI-34 ser 160053 of 12 Dec 1953
(4) One (1) copy of BUAER msg 022104Z Jun 1954
(5) One (1) copy of BUAER Conf ltr ser 011566 of 14 Jun 1954
(6) One (1) copy of BUAER Conf ltr ser 013191 of 7 Jul 1954
(7) One (1) copy of BUAER ltr Aer-SI-34/50 of 19 Jul 1954
(8) One (1) copy of H8 Catapult Change No. 34 - Hydraulic Oil, Replacement of; and Oilgear Type Power Plant Pumps, modification of
(9) One (1) copy of H2-1, H4B, H4C, H4-1 Catapult Changes 42, 50, 57, and 52 - Hydraulic Oil Replacement of Oilgear Type Power Plant Pumps, modification of
(10) One (1) copy of H2-1, H4B, H4C, H4-1 Catapult Changes 43, 62, 61, and 56 - Hydraulic Oil Replacement of, and Oilgear Type Power Plant Pumps; modification of
(11) One (1) copy of BUAER ltr Aer-SI-34/16 of 8 Mar 1954
(12) One (1) copy of H2-1, H4B, H4C, H4-1, H8, C7, C11, C11-1, C11-2 Catapult Change No. 99, 145, 110, 121, 91, 12, 12, 12, 12, Safety Precautions Regarding the Use of Nitrogen; Instructions concerning
(13) One (1) copy of BUAER msg 021347Z Jul 1954
(14) One (1) copy of CNO msg 021927Z Jul 1954
(15) One (1) copy of BUAER msg 302233Z May 1954
(16) One (1) copy of CNO msg 311637Z May 1954
(17) One (1) copy of CNO msg 311639Z May 1954
(18) One (1) copy of BUAER ltr Aer-SI-34/6 of 9 Feb 1954
(19) One (1) copy of BUAER ltr Aer-SI-341/54 of 23 Jun 1954
(20) One (1) copy of BUAER ltr Aer-SI-34/70 of 16 Jul 1954
(21) One (1) copy of BUAER ltr Aer-SI-34/81 of 21 Aug 1954
(22) One (1) copy of BUAER ltr Aer-SI-34/80 of 19 Aug 1954
(23) One (1) copy of NAMATCEN ltr PE-21-RFB:mdb S83/H8 of 25 Jun 1954
(24) One (1) copy of NAMATCEN ltr PE-21-RFB:mdb S83/H8 S83/H2 of 15 Jul 1954

~~C O N F I D E N T I A L~~

ENCLOSURES RECEIVED IN 24

~~C-O-N-F-I-D-E-N-T-I-A-L~~

Aer-SI-34/4
04156

Subj: Court of Inquiry - Deaths and injuries to Naval and Marine Corps personnel and to one civilian in explosion and fire aboard USS BENNINGTON (CVA-20) on 26 May 1954 near Newport, R. I.; Ordered by the Commander Air Force, Atlantic Fleet on 26 May 1954

Encl: (25) One (1) copy of BUAER ltr Aer-SI-34/71 of 27 Jul 1954
(26) One (1) copy of BUAER TWX 202002 Sep 1954
(27) One (1) copy of BUAER ltr Aer-SI-34/113 of 11 Oct 1954
(28) One (1) copy of BUAER ltr Aer-SI-34/72 of 27 Jul 1954
(29) One (1) copy of Interdept Order NAer 01629 dated 25 Oct 1954
(30) One (1) copy of BUAER ltr Aer-SI-34/69 of 21 Jul 1954
(31) One (1) copy of H2-1, H4D, H4C, H4-1, H8 Catapult Bulletin No. 103, 151, 115, 127, 96 - Periodic Check of Relief Valve Lifting Pressures on Launching and Retracting Accumulators; Instructions concerning
(32) One (1) copy of H2-1, H4B, H4C, H4-1, H8 Catapult Bulletin No. 105, 153, 117, 129, 98 - Cleanliness of Hydraulic Catapult Systems; Instructions for maintaining

1. Forwarded.

2. Enclosures (1) to (32) inclusive, indicate the action taken by the Chief of the Bureau of Aeronautics and other Naval Activities relative to the recommendations of the subject Court of Inquiry as related to material and components under the cognizance of this bureau.

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Assistant Chief for Research & Development

Copy to: WITH ENCL. (1) THRU (32) OF SIXTH END.
COMFLTAIR Quonset
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BUPERS
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~~C-O-N-F-I-D-E-N-T-I-A-L~~

31100?4-55

BUMED:333:K:als (D)
ADAMS, Charles Edward
B6
Serial No. 06145
29 November 1954

~~CONFIDENTIAL~~

FIFTH ENDORSEMENT on subject record

From: Chief, Bureau of Medicine and Surgery
To: Chief of Naval Operations
Via: (1) Chief, Bureau of Aeronautics
(2) Chief, Bureau of Ships
(3) Commandant of the Marine Corps

Subj: Ct. of Inq. - Deaths and injuries to Naval and Marine Corps personnel and to one civilian in explosion and fire aboard USS BENNINGTON (CVA-20) on 26 May 1954 near Newport, R.I.; ord. by ComAirForLantFlt on 26 May 1954

1. Forwarded.

2. This Bureau concurs particularly in Recommendations 25 and 26 which are essentially the same as have been separately emphasized by Commander B6 MC, USN, the Senior Medical Officer of the BENNINGTON at the time of the explosion.

B6

By direction

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This endorsement is automatically declassified when removed from the basic record

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Pers B12d-fl

Ser N- 01218

20 OCT 1954

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FOURTH ENDORSEMENT on subject Court of Inquiry

From: Chief of Naval Personnel
To : Chief of Naval Operations
Via : (1) Chief, Bureau of Medicine & Surgery
(2) Chief, Bureau of Aeronautics
(3) Chief, Bureau of Ships
(4) Commandant of the Marine Corps

Subj: Ct. of Inq. - Deaths and injuries to Naval and Marine Corps personnel and to one civilian in explosion and fire aboard USS BENNINGTON (CVA-20) on 26 May 1954 near Newport, R.I.; ord. by ComAirForLantFlt on 26 May 1954

1. Forwarded, contents noted.

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By direction

End.

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JAG:III:8:MAJ:vn
Bnd. #3294-54

16 September 1954

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THIRD ENDORSEMENT on subject record

From: Judge Advocate General
To: Chief of Naval Operations
Via: (1) Chief of Naval Personnel
(2) Chief, Bureau of Medicine and Surgery
(3) Chief, Bureau of Aeronautics
(4) Chief, Bureau of Ships
(5) Commandant of the Marine Corps

Subj: Ct. of Inq. - Deaths and injuries to Naval and Marine Corps personnel and to one civilian in explosion and fire aboard USS BENNINGTON (CVA-20) on 26 May 1954 near Newport, R. I.

1. Forwarded for information and return.

2. The Judge Advocate General holds that the deaths and injuries of naval and Marine Corps personnel listed below were suffered in the line of duty and were not the result of their own misconduct. The Judge Advocate General further holds that the deaths and injuries sustained by personnel of the reserve components of the Navy and Marine Corps listed below were incurred while the said Reservists were employed on extended active duty as defined by Public Law 108, 81st Congress (34 USC 855c-1):

Died on 26 May 1954

ADAMS, Charles Edward, AN, USN
ALEXANDER, Cornelius Melroy, SD3, , USN
ARBOGUST, George Albert, LT , USN
ARRIGONI, Joseph Fred, LT, USN
BACON, Francis Sylvester, TN, USN
BASKIN, William Nash, AA, , USN
BEMISS, Guy Morton, CHPHOTO, , USN
BOYD, Rossel (n), AN, , USN
BRYAN, Terry Willard, LTJG, USN
BYERS, George Washington, TN, , USN
COLEMAN, Lloyd (n), TA, , USN
CROMARTIE, James (n), SD2, USN
DAVIS, Prince Arthur, TN, , USN
DEAN, Albert Penton, CHGUN, , USN
DREW, Henry Jackson, LT, USN
EOVINO, Dominic Joseph, CHSCLK, , USN
EPPS, Robert Daniel, Jr., AB3,
FAVRE, Joseph Louis, TN, , USN
FIX, Leo Francis, CHBOSN, , USN
FORE, Fred Walter, FP2, , USN
FOURNIER, Paul Eugene, LCDR, USN
GOLASZEWSKI, Edward John, AB1 14, USN
GONZALES, Leon (n), SD3, , USN
GOODRUM, Douglas (n), TN, USN
GREEN, Jesse Nelson, AO3, , USN
HART, George Joseph, Jr., AB3, , USN
HILLYER, Donald Paul, DT2, , USN
HOLLOWAY, Delois Vergil, LT, , USN
HOOKER, Alfred Funnel, SD3, USN
HUBETSEL, Alexander (n), AO1. USN
HURD, James Walter, CHCARP, USN
HUSTOFT, Harold Roger, ME3, , USN
JACKSON, Billy Glen, LT, USN
JACKSON, Charles (n), SD3, , USN
JEFFERSON, Paul "B", SN, USN

Contents Noted
Casualty Branch Pers G-2
By: Date: 9-20-54

CLASSIFICATION CHANGED TO UNCLASSIFIED
BY AUTHORITY OF: ~~OPNAVINST 5500.10~~ OPNAVINST 5511.41B
DATE: 24 JUN 1959
BY: , LT, USN
Office of JAG, Navy Dept.

This endorsement is automatically declassified when removed from the basic record

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Bnd. #3294-54

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KEIR, Richard Henry, AB3, , USN
KING, Max (n), CHGUN, , USN
LAKATOS, Albert "J", MM3, USN
LAMBDIN, Dewey Whitley, LT, , USN
LENZ, George William, SK2, , USN
LEWIS, Elliot Stanley, AO3, USN
MARTIN, Ernest Simms, AM1, , USN
MATTHIAS, Albert Joseph, EM3, , USN
MC GHEE, Charles Hunter, AN, , USN
MC NATT, Lloyd (n), MACH, USN
MILLER, Gordon R., LTJG, , USN
MILLS, Arthur Gean, SN, USN
MOODY, Thaddaeus Eugene, AN, , USN
MORTON, "J" Clyde, LT, USN
O'NEAL, Walter Issiah, SN, , USN
PHELPS, Donald Lee, LTJG, , USN
PRAMEK, Francis Joseph, SN, USN
PUGH, William Howard, PACT, , USN
REED, Marvin (n), LCDR, , USN
REYES, Juan (n), SD3, , USN
RICH, Wallace (n), LT, , USN
RILEY, Claude Patrick, SK1, , USN
RIVERS, Jesse Elmore, SD2, , USN
SICO, Benigno (n), SD2, , USN
SMITH, Ralph C., AMC, USN
SMITH, Robert Kent, SD3, , USN
SOMMARS, Cantrell Wallace, IC3, , USN
THOMAS, Eric Alfredo, SD1, USN
THORNHILL, David R., LTJG, USN
THORNTON, Earl (n), Jr., CHSCLK, USN
TINNEY, Earl Crawford, AO3, USN
TRIPLETT, Howard, SD2, , USN
VAN DER HOONING, John (n), AOC, , USN
WAGES, Kell Bruce, Jr., AB3, , USN
WILLIAMS, Marion (n), TN, , USN
WITVOET, Gerald James, LTJG, USN
WONSETLER, Paul Dallas, FT3, USN
WOODUM, Lonnie Gene, TA, , USN
WRIGHT, Henry Harold, Jr., SD3, , USN

74

Died on 28 May 1954

CAPISTRAND, Stanley L., CHPCLK, , USN
DEMERS, Raymond Conrad, RELE, USN
HACKBARTH, Thomas C., AO3, , USN
RAMEY, H., EM2, , USN
WILLIS, Herbert Lee, SD1, , USN
WILLIAMS, Willie, TN, , USN

Died on 30 May 1954

WRIGHT, Robert Reid, LT, , USN

Died on 4 June 1954

ROBINSON, Alto Lee, TN, , USN

Died on 26 May 1954

MARCHISELLI, Frederick Davis, PFC, USMC
MAYES, Bobby Lee, PFC, USMC

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Died on 28 May 1954

STANFORD, James T., PFC, , USMC

Died on 1 June 1954

BAIRD, Delbert, PFC, , USMC

Died on 26 May 1954

BARBER, Cyron Melvin, LT, , USNR
BARNES, Roger Earl, LTJG, USNR
DOLL, Charles Joseph, AN, USNR
DUFFY, Robert James, LTJG, USNR
GOINS, Floyd Wilson, AOU3, USNR
HOPPER, Charl· Edward, LTJG, , USNR
INGE, Robert Paul, LTJG, USNR
KANE, Orlo Hamlin, LTJG, USNR
KRASSY, Charles Edward, ADE3, , USNR
O'DONNELL, Roger Raymond, LT, , USNR
PENDELL, Emory Dean, ENS, USNR
SCHMUCKER, Charles Edwin, Jr., LTJG (SC), USNR
SMITH, Daniel Joseph, LT, USNR
THOMAS, Clyde Dana, Jr., LT(MC), USNR

Died on 28 May 1954

TONDO, Paul S., LTJG, , USNR

Injured on 26 May 1954

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, AA, USN
., SN, 7 , USN
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AKAN, USN
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ADAN, , USN
FT3, USN
, FN, USN
(n), BT3, USN
., SD1, , USN
(n), SA, , USN
., TN, USN
(n), AD3, USN
, AKAN, , USN
, FT3, , USN
, IC3, USN
, LTJG, USN
(n), SN, USN
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BM1, USN
, BT1, USN

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Bnd. #3294-54

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, SN, USNR
., EMP3, , USNR
LT, SNR
, LTJG, USNR

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3. The Judge Advocate General further holds that the death of Harold I. Loucks, civilian, occurred on 26 May 1954 as a result of the explosion and fire on board the USS BENNINGTON (CVA-20), and that his death was incurred within the scope of his employment by Westinghouse Electric Company while he was on authorized temporary duty aboard the USS BENNINGTON.

4. Subject to the remarks of the ordering and reviewing authorities, the proceedings in the attached case are legal.

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BUREAU OF NAVAL PERSONNEL
NAVY DEPARTMENT
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This endorsement is automatically declassified when removed from the basic record

FF1-2/A17-4
01747/14
25 AUG 1954

~~CONFIDENTIAL~~

SECOND ENDORSEMENT on Proceedings of Court of Inquiry, RADM USN, President

From: Commander in Chief U. S. Atlantic Fleet
To: Judge Advocate General

Subj: Court of inquiry to inquire into an explosion and fire aboard USS BENNINGTON which occurred 26 May 1954

1. Forwarded.

2. The Commander in Chief considers that the complete isolation of catapult compartments is an absolute necessity until such time as the cognizant technical bureaus in the Navy Department state unequivocally that the hydrolube selected has been tested and found to be noninflammable in all pressure and temperature ranges known or thought to exist in the launching accumulator.

3. The Commander in Chief further considers that the contradiction presented in setting the accumulator relief valve at a higher lift pressure than the prescribed hydrostatic test pressure for the accumulator, i.e., 4,000 p.s.i. vs 3,850 p.s.i., warrants immediate review and correction.

4. Subject to the foregoing, the proceedings, findings of fact, opinions and recommendations of the court of inquiry in this case, as modified by the convening authority, are approved.

Copy to:
COMAIRLANT

Ben # 3244-54

~~CONFIDENTIAL~~

COURT RECOMMENDATIONS REFERRED TO IN FIRST ENDORSEMENT BY COMAIRLANT

Recommendation 3 - Use of Nitrogen in high pressure hydro-pneumatic systems.

Recommendation 4 - If 100% Nitrogen not feasible then minimum amount required.

Recommendation 5 - Recommend following interim measures until non inflammable hydro-lube can be found:

a. Restrict use of cats to absolute minimum consistent with urgent military requirements.

b. If urgent military necessity requires continued use of cats then:

(1) Use maximum cycle times.
(2) Maintain maximum liquid level in accumulator.
(3) Use lowest possible launch pressures.
(4) Keep gasoline system inerted during cat launches.
(5) Secure magazines and bomb elevators during cat launches.

Recommendation 7 - Installation of a "dead man" type of control for cat pumps so that oil flow to accumulators would cease if man at control board were incapacitated.

Recommendation 8 - Recommends venting cat compartment directly to atmosphere and isolating entire compartment from remainder of ship.

Recommendation 9 - That future hydro-pneumatic system designs avoid direct liquid-gas contact.

Recommendation 15 - That a study of electrostatic charges in air-oil systems to determine whether a hazzard exists at or near bulk oil surfaces be undertaken.

Recommendation 19 - That a hydrostatic overload test of 50% over maximum working pressure be applied to the cat hydro-pneumatic system after initial installation and during each ship overhaul.

Recommendation 20 - That pending development of a suitable over-pressure relief system, a periodic check of the relief valve lifting pressure on top of launching and retracting accumulators be prescribed.

Recommendation 23 - That actions be taken to obtain isolation in order to prevent widespread distribution of explosive gases, flame, and blast effects from any source within combatant ships.

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15. Subject to the foregoing remarks, the proceedings, findings of fact, opinions and recommendations of the court of inquiry in this case are approved.

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6. Recommendation 5 is approved with the substitution of the word "or" for "and" in the first sentence so that the first sentence reads as follows: "That, in the interim, until a suitable hydrolube, or insofar as practicable, an adequate percentage of nitrogen, are in use in catapults, such action as the following be taken:"

7. Recommendation 6 is approved with the substitution of the words "design test pressures" for the words "design working limits."

8. Recommendation 7 is not approved since the forthcoming installation of a fire-resistant or non-inflammable hydraulic fluid renders the need for such a device extremely small and the device therefore becomes a refinement, the added complexity and maintenance requirements of which can not be justified.

9. Recommendation 8 is approved. It should be pointed out, however, that this recommendation becomes no longer applicable as soon as the approved hydrolube has been installed.

10. Recommendation 9 is approved for oils and other flammable fluids, but is considered an unnecessary complication when the approved hydrolube has been installed.

11. Recommendation 15 is approved, except that the emphasis for this investigation should be shifted to the circumstances and ambient conditions existing in fuel oil and heavy end aviation fuel tanks.

12. Recommendation 19 is approved in principle. It is recommended that the practice established for steam pressure vessels such as boilers be applied to this equipment.

13. Recommendation 20 is approved in principle. However, a complete redesign of the relief valve system is indicated before a satisfactory periodic pressure test can be accomplished by other than factory or shipyard shop facilities.

14. Recommendation 23 is approved in principle, but not to the extent that the entire structural arrangement of the ship is dictated by this consideration to the disadvantage of other important factors. Further, it should be pointed out that this redesign appears to be of relatively minor importance after the installation of the approved hydrolube has been completed.

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Serial: 06/01127

26 JUL 1954

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FIRST ENDORSEMENT on Proceedings of Court of Inquiry, RADM [redacted], USN, President

From: Commander Air Force, U. S. Atlantic Fleet
To: Judge Advocate General of the Navy
Via: Commander in Chief, U. S. Atlantic Fleet

Subj: Court of Inquiry to inquire into an explosion and fire aboard the U.S.S. BENNINGTON which occurred 26 May 1954

1. Forwarded.

2. It is considered that the subject investigation as a whole was unusually thorough, exhaustive, and complete in all pertinent details. The president and all of the members of the court, as well as the technical assistants to the court, are deserving of high praise for the outstanding loyalty and devotion to duty demonstrated by the exceptional record presented herewith which required aggressive, persistent and arduous work extending over a long period of time.

3. The opinions are considered to be well supported by the findings of fact and the result of unusually keen analysis of complex and frequently confusing circumstances. The findings and opinions are concurred in and, together with such recommendations as are finally approved, should receive wide dissemination in order that this information for which such a high price has been paid may be most effectively utilized by all units of the United States Naval forces in which hydro-pneumatic or hydraulic machinery is employed.

4. Recommendation 3 is approved as an interim measure in those ships wherein the introduction of the approved fire-resistant hydraulic fluid can not be installed at a very early date for various reasons such as the location of the ships on deployed duty or the unavailability of sufficient quantities of the fire-resistant fluid to meet the first upkeep availabilities in the continental United States.

5. Recommendation 4 is approved subject to the comments on recommendation number 3 above.

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- FINDING OF FACTS -

1. That on the early morning of 26 May 1954, the U.S.S. BENNINGTON was about 80 miles S.S.E. of Brenton Reef Lightship enroute from Norfolk to Narragansett Bay operating area and was engaged in normal flight training operations.

2. That the ship was under the operational and administrative control of Commander Air Force, U.S. Atlantic Fleet.

3. That Captain USN, , was the Commanding Officer and was on the bridge.

4. That Lieutenant (junior grade) , USNR, was the Officer of the Deck and had the conn.

5. That, at about 0600, jet aircraft launchings commenced.

6. That the first plane on the starboard catapult was a dud, and no launches were made on this catapult.

7. That 13 jet aircraft were launched in about as many minutes on the port catapult.

8. That at 0615 the ship's position was Latitude 80° 10.5' N., Longitude 70° 39.3'W., course 330° (T) and speed 28 knots.

9. That, shortly after the 13th launch on the port catapult, white "smoke" was observed from the bridge emanating from under both sides of the flight deck forward and the general alarm was sounded, followed shortly thereafter by the fire alarm.

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10. That, after the "smoke" was sighted and at about 0615, a series of devastating explosions occurred in the forward portion of the ship. At least three explosions occurred.

11. That there was a considerable amount of "smoke" observed in many compartments in the forward part of the ship, including Hangar Bay No. 1, prior to the first explosion.

12. That there was no evidence that the gasoline, HEAF, fuel oil, and other fuel systems did either initiate, or add energy to the explosions, or in any way contribute to the extension of damage, nor that the aircraft lubricating oil system did initiate or contribute to the explosion.

13. That the ammunition, pyrotechnics, magazines and ordnance equipment did not initiate the explosions nor add power thereto, and were not involved in the casualty, except for secondary effects such as: isolated flooding of certain magazines, blast down a bomb elevator trunk knocking two 250 lb. bombs out of their bins in A-527-M and exposure of fifty-six 2.25 inch STAR rockets on the third deck to the explosion effects.

14. That the source of the explosive gases and vapors was the flammable hydraulic fluid from the port catapult hydro-pneumatic launching system.

15. That, except for damage to the hangar deck and in A-309-L, structural damage was not extensive.

16. That shock damage was minor.

17. That no conflagration occurred, only small, isolated, incipient fires which were extinguished by the fire fighting efforts of the crew and by leaks from small damaged pipe lines.

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8. That fire fighting facilities were generally adequate after the explosions n spite of the broken firemain riser on the starboard side of the second deck.

9. That partial flooding of the gasoline and salt water pump room, and of he gasoline pump motor room, put the forward gasoline system out of commission.

0. That the majority of damage sustained by the ship was to the light metal oiner bulkheads and to the non-tight ventilation ducts on the 2nd and 3rd lecks forward, between frames 23 and 100, and to the 100 #STS hangar deck plating in Hangar Bay No. 1.

1. That the performance of steel watertight vent ducts, in resisting overpressure from either within or from without, was far superior to that of non-watertight vent ducts.

2. That flooding of the ship was minor, It was due to the rupture of one firemain riser and fracture of small pipe lines such as fresh water, drainage, etc., and to the fire fighting. Two magazines and the forward gasoline pump and pump motor rooms were flooded. Flooding had no serious effect on the ship's stability.

23. That, at the time of the casualty, the U.S.S. BENNINGTON was going from Condition Yoke to Condtion Xray.

24. That most of the 3rd and 2nd deck passageway doors and hatches were open.

25. That the ship was in a weak material condition for warding off the effects of an internal explosion.

26. That, prior to 0626, Nos. 1 and 2 firerooms were secured as a result of entrance of dense smoke.

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27. That, after securing Nos. 1 and 2 firerooms, and with heavy smoke in the engineroom, shafts 1 and 4 were secured.

28. That No. 1 Boiler was found to have suffered a low water casualty due to leaving one burner in operation after the feed water had been secured.

29. That the emergency fuel oil trip valve for securing all fuel to No. 1 Boiler was not closed in securing the boiler. It was found difficult to operate.

30. That boilers 5, 6, 7 and 8 were found salted to approximately 25 E.P.M.

31. That the normal watch in Damage Control Central handled damage control action with limited personnel until smoke asphyxiated the personnel in the space. Subsequently, control of damage was assumed by Main Engine Control and later by Repair IV.

32. That at 0747 communications on 1MC, 2MC, 21MC and 24MC were lost on the bridge and were regained at 0826.

33. That power was lost forward when No. 1 switchboard was secured.

34. That the only damage to aircraft was to plane 112, which suffered damage to a wing when a hatch, frame 51, in the starboard side of the hangar deck was blown open by the force of an explosion which occurred below.

35. That the BENNINGTON suffered terrific loss of life and very widespread damage emanating from a local internal source.

36. That a check was made of the brig shortly after the accident and it was determined that the one prisoner had been released.

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37. That the following named U. S. Navy and Marine Corps personnel attached to the U.S.S. BENNINGTON, all of whom were then in a duty status, were killed on the dates set forth hereafter as a result of said explosions occurring in said ship and of the causes set opposite their respective names:

NAVAL PERSONNEL

Died on 26 May 1954

NAME	SERVICE NUMBER	CAUSE OF DEATH
ADAMS, Charles Edward, AN		
ALEXANDER, Cornelius Melroy, SD3		
ARBOGUST, George Albert, LT		
ARRIGONI, Joseph Fred, LT		
BACON, Francis Sylvester, TN		
BASKIN, William Nash, AA		
BEMISS, Guy Morton, CHPHOTO		
BOYD, Rossel (n), AN		
BRYAN, Terry Willard, LTJG		
BYERS, George Washington, TN		
COLEMAN, Lloyd (n), TA		
CROMARTIE, James (n), SD2		
DAVIS, Prince Arthur, TN		
DEAN, Albert Penton, CHGUN		
DREW, Henry Jackson, LT		
EOVINO, Dominic Joseph, CHSCLK		
EPPS, Robert Daniel, Jr., AB3		

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NAME	SERVICE NUMBER	CAUSE OF DEATH
FAVRE, Joseph Louis, TN		
FIX, Leo Francis, CHBOSN		
FORE, Fred Walter, FP2		
FOURNIER, Paul Eugene, LCDR		
GOLASZEWSKI, Edward John, AB1		
GONZALES, Leon (n), SD3		
GOODRUM, Douglas (n), TN		
GREEN, Jesse Nelson, AO3		
HART, George Joseph Jr., AB3		
HILLYER, Donald Paul, DT2		
HOLLOWAY, Delois Vergil, LT		
HOOKER, Alfred Punnel, SD3		
HUBETSEL, Alexander (n), AO1		
HURD, James Walter, CHCARP		
HUSTOFT, Harold Roger, ME3		
JACKSON, Billy Glen, LT		
JACKSON, Charles (n), SD3		
JEFFERSON, Paul "B", SN		
KEIR, Richard Henry, AB3		
KING, Max (n), CHGUN		
LAKATOS, Albert "J", MM3		
LAMBDIN, Dewey Whitley, LT		

ALL B6

[redacted]

NAME	SERVICE NUMBER	CAUSE OF DEATH
LENZ, George William, SK2		
LEWIS, Elliot Stanley, AO3		
MARTIN, Ernest Simms, AM1		
MATTHIAS, Albert Joseph, EM3		
MC GHEE, Charles Hunter, AN		
MC NATT, Lloyd (n), MACH		
MILLER, Gordon R., LTJG		
MILLS, Arthur Gean, SN		
MOODY, Thaddaeus Eugene, AN		
MORTON, "J" Clyde, LT		
O'NEAL, Walter Issiah, SN		
PHELPS, Donald Lee, LTJG		
PRAMEK, Francis Joseph, SN		
PUGH, William Howard, PACT		
REED, Marvin (n), LCDR		
REYES, Juan (n), SD3		
RICH, Wallace (n), LT		
RILEY, Claude Patrick, SK1		
RIVERS, Jesse Elmore, SD2		
SICO, Benigno (n), SD2		
SMITH, Ralph C., AMC		
SMITH, Robert Kent, SD3		

[redacted]

[redacted]

NAME	SERVICE NUMBER	CAUSE OF DEATH
SOMMARS, Cantrell Wallace , IC3		
THOMAS, Eric Alfredo, SD1		
THORNHILL, David R., LTJG		
THORNTON, Earl (n) Jr., CHSCLK		
TINNEY, Earl Crawford, AO3		
TRIPLETT, Howard, SD2		
VAN DER HOONING, John (n), AOC		
WAGES, Kelly Bruce, Jr., AB3		
WILLIAMS, Marion (n), TN		
WITVOET, Gerald James, LTJG		
WONSETLER, Paul Dallas, FT3		
WOODUM, Lonnie Gene, TA		
WRIGHT, Henry Harold Jr. SD3		
	Died on 28 May 1954	
CAPISTRAND, Stanley L., CHPCL		
DEMERS, Raymond Conrad, RELE		
HACKBARTH, Thomas C., AO3		
RAMEY, H., EM2		
WILLIS, Herbert Lee, SD1		
WILLIAMS, Willie, TN		

[redacted]

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ALL BG

[redacted]

NAME	SERVICE NUMBER	CAUSE OF DEATH
	Died on 30 May 1954	
WRIGHT, Robert Reid, LT		
	Died on 4 June 1954	
ROBINSON, Alto Lee, TN		

MARINE CORPS PERSONNEL

NAME	SERVICE NUMBER	CAUSE OF DEATH
	Died 26 May 1954	
MARCHISELLI, Frederick Davis, PFC.		
MAYES, Bobby Lee, PFC		
	Died 28 May 1954	
STANFORD, James T., PFC		
	Died 1 June 1954	
BAIRD, Delbert, PFC		

38. That the following named U.S. Naval Reserve personnel attached to U.S.S. BENNINGTON, all of whom were then on extended active duty and in a duty status, were killed on the dates set forth below as a result of said explosion occuring in said ship and of the causes set opposite their names:

NAME	SERVICE NUMBER	CAUSE OF DEATH
	Died 26 May 1954	
BARBER, Cyron Melvin, LT		
BARNES, Roger Earl, LTJG		

(36)

[redacted]

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[redacted]

NAME	SERVICE NUMBER	CAUSE OF DEATH
DOLL, Charles Joseph, AN		
DUFFY, Robert James, LTJG		
GOINS, Floyd Wilson, AOU3		
HOPPER, Charles Edward, LTJG		
INGE, Robert Paul, LTJG		
KANE, Orlo Hamlin, LTJG		
KRASSY, Charles Edward, ADE3		
O'DONNELL, Roger Raymond, LT		
PENDELL, Emory Dean, ENS		
SCHMUCKER, Charles Edwin, Jr. LTJG (SC)		
SMITH, Daniel Joseph, LT		
THOMAS, Clyde Dana, Jr., LT(MC)		Died 28 May 1954
TONDO, Paul S., LTJG		

39. That the following named civilian employee of the Westinghouse Electric Company, who was then authorized by the Chief of Naval Operations to take passage in naval vessels, and by Commander Air Force, U.S. Atlantic Fleet to report to the Commanding Officer, U.S.S. BENNINGTON for temporary duty in connection with rendering technical assistance, and who was then at work aboard the U.S.S. BENNINGTON, was killed as a result of said explosions occurring in said ship and of the causes set opposite his name.

[redacted]

ALL B6

[redacted]

Died 26 May 1954

NAME	RESIDENCE	CAUSE OF DEATH
LOUCKS, Harold I.		

40. That the following named U.S. Navy and U.S. Marine Corps personnel attached to U.S.S. BENNINGTON, all of whom were then in a duty status, suffered injuries requiring hospitalization, for various determinate and indeterminate periods, all of whom are or were hospitalized at Newport Naval Hospital, Rhode Island, or NAS Infirmary, Quonset Point, Rhode Island, as a result of said explosions occurring in said ship, the nature and extent of their injuries being set opposite their respective names:

NAVAL PERSONNEL

NAME	SERVICE NO.	NATURE & EXTENT OF INJURIES
, TN		
AA		, ,
	SN	, ,
	SN	
	IC2	
	SN	
, QM2		
, SD3		
., SD3		

[redacted]

(381)

ALL B6

[redacted]

NAME	SERVICE NO.	NATURE & EXTENT OF INJURIES

[redacted]

ALL B6

[redacted]

NAME	SERVICE NO.	NATURE & EXTENT OF INJURIES

[redacted]

ALLB6

[redacted]

NAME	SERVICE NO.	NATURE & EXTENT OF INJURY

[redacted]

ALL B6

[redacted]

NAME	SERVICE NO.	NATURE AND EXTENT OF INJURIES

[redacted]

ALL B6

[redacted]

NAME	SERVICE NO.	NATURE & EXTENT OF INJURY

MARINE CORPS PERSONNEL

[redacted]

(43)

ACL B6

[redacted]

41. That the following named members of the U.S. Navy Reserve, attached to U.S BENNINGTON, all of whom were then on extended active duty and were then in a duty status, suffered injuries requiring hospitalization, for various determinate and indeterminate periods, all of whom are or were hospitalized at Newport Naval Hospital, Rhode Island, or NAS Infirmary, Quonset Point, Rhode Island as a result of said explosions occurring in said ship, the nature and extent of their injuries being set opposite their respective names:

NAME	SERVICE NO.	NATURE AND EXTENT OF INJURIES

42. That the following named U. S. Navy personnel attached to U.S.S. BENNINGTON, all of whom were then in a duty status, suffered injuries requiring treatment, all of whom were treated at U.S.S. BENNINGTON Sick Bay, as a result of said explosion occurring in said ship, and were returned to duty on 26 May 1954, the nature and extent of their injuries being set opposite their respective names:

NAME	SERVICE NO.	NATURE AND EXTENT OF INJURIES

[redacted]

ALLBG

[redacted]

NAME	SERVICE NO.	NATURE & EXTENT OF INJURY

[redacted]

ALC B6

[redacted]

NAME SERVICE NO. NATURE & EXTENT OF INJURY

43. That the following named U.S. Naval Reserve personnel attached to U.S.S. BENNINGTON, all of whom were then on extended active duty and were then in a duty status, suffered injuries requiring treatment, all of whom were treated at U.S.S. BENNINGTON Sick Bay, as a result of said explosions and fire occurring in said ship, and were returned to duty on 26 May 1954, the nature and extent of their injuries being set opposite their respective names:

NAME SERVICE NO. NATURE & EXTENT OF INJURY

44. That no person other than those mentioned in the foregoing paragraphs were killed or injured as a result of said explosion.

[redacted]

(16)

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[redacted]

45. That there remained after the accident only one ship's company doctor and one air group doctor aboard.

46. That helicopters were used extensively in transfer of casualties ashore.

47. That passageways were blocked by damaged metal joiner bulkheads, ventilation and furniture on the second deck.

48. That, Lieutenant B6 stated he heard a yell from the vicinity of the port catapult room prior to the first explosion, as follows: "This thing is going to blow. Let's get out of here."

49. That witnesses reported variously hearing a clank or bang "like a hammer thrown against a bulkhead...." followed by a hissing noise "like the sound of high pressure air escaping...." in the vicinity of the port catapult compartment.

50. That, on or about the early evening of the day of the casualty, a Marine guard was placed near the only access to the port catapult machinery and pump rooms to prevent unauthorized entry into these spaces.

51. That a fire occurred in the forward starboard part of the port catapult room as evidenced by shallow paint blisters, burned paper, charred rags, etc., over which was a heavy deposit of soot.

52. That the port catapult engine was an H8 Catapult, No. 365, manufactured by the McKiernan-Terry Co. of Harrison, N.J.

53. That, since installation, the port catapult was fired about 2,446 shots.

54. That the hydraulic oil in the catapults was replaced by new oil in March 1954 and anti-foaming agent had been added.

(47)

[redacted]

ALL B6

[redacted]

55. That all personnel in the port catapult machinery and pump rooms were killed, leaving no surviving eye witnesses who can testify to the sequence of events that occurred in the port catapult spaces just prior to the explosion.

56. That three unidentified bodies were found in the after end of the port catapult room.

57. That an unidentified body was found in the access trunk at the fourth deck level near the door leading into the pump room.

58. That there was no direct explosive damage to the port catapult compartment, nor was there evidence of sufficient sustained heat to warp any structure therein.

59. That, subsequent to the explosions, the port catapult compartment was found coated with a heavy deposit of soot which was saturated with oil in the immediate area of the launching accumulator. This deposit was heaviest in the forward portion of the catapult compartment and extended into the outer passageway and aft, diminishing in quantity away from the catapult compartment.

60. That the deck of the port catapult machinery room was found covered with a layer of hydraulic oil under which was a layer of soft carbonaceous material.

61. That the deck of the port catapult pump room was found covered with a layer of hydraulic oil.

62. That the launching indicator card was removed from the port catapult after the accident and, upon removal of carbon deposits, approximately 75 percent of the power stroke tracings was legible.

63. That this indicator card contained tracings of multiple launchings, all of which were normal throughout the legible portions, and showed an approximate 2700 p.s.i. launching pressure.

[redacted]

[redacted]

64. That all valves and controls on the port catapult launching and retraction panels were found in the proper position for normal catapult operations.

65. That the port catapult engine was found in the battery position with the piston valve securing stem full out (normal) and the firing operating valve in "standby" which is the normal operating position.

66. That the launching sump and gravity tanks were found empty.

67. That the launching pumps were found clean and undamaged and had normal relief valve settings.

68. That one or more of the launching hydraulic pumps continued to discharge into the accumulator after the casualty.

69. That the strainer of launching pump No. 14 was found covered by a heavy deposit of lint.

70. That the port hydraulic pump vent piping was found to discharge to the suction side of the pump in lieu of the gravity tank as prescribed by the manufacturer's plans.

71. That there was fire in the accumulator, as evidenced by:

(a) Internal carbonaceous deposits,

(b) Intergranular penetration by molten brass of the stainless steel pilot of the relief valve,

(c) Severe erosion of the relief valve pilot and other interior portions of the relief valve,

(d) Destruction of 40 percent of the upper part of the brass Tee-fitting, reducing it to a cusped form.

(e) Complete disintegration of the brass poppet in the relief valve,

[redacted]

[redacted]

(f) Annealing of the lower helix of the relief valve spring, indicating temperatures above 1350° F,

(g) Enlargement of the threaded hole of the accumulator top flange by about ½ inch in diameter,

(h) Hardening of the periphery of the hole of the accumulator top flange to Rockwell C 50,

(i) Carbon deposits in the relief valve,

(j) Burning of the paint on the overhead of the compartment in a roughly circular area with the center directly above the accumulator, and,

(k) Blistered paint on the forward side of 25 #STS bulkhead 39, but only at the top just forward of the accumulator.

72. That the overboard discharge line from the port launching accumulator relief valve was found ruptured at a 90° bend near the relief valve.

73. That the relief valve was found on the deck alongside the piston valve, approximately 8 feet from the accumulator.

74. That the port launching accumulator relief valve had been replaced by ship's force in March, 1954, with one drawn from stock, and that the stock description indicated that it was pre-set at 4,000 p.s.i.

75. That the brass Tee-fitting was found separated from the accumulator flange due to the fracture of a steel nipple.

76. That the brass elbow, connecting the liquid level gage line to the 4 inch air line of No. 1 air flask, was ruptured outward by internal pressure below its hot-short temperature.

[redacted]

77. That the paint on the overhead above the burst elbow, connecting the liquid level line to the 4 inch air line between the accumulator and No. 1 air flask, was found unburned and clean.

78. That, subsequent to rupture, the elbow in the liquid level gage line was not heated above its recrystallization temperature.

79. That the interior of the liquid level gage line, from the ruptured elbow to a point in the middle liquid level gage corresponding to the 52 inch level in the accumulator, was found coated with carbon.

80. That the entire interior of the 4 inch line connecting No. 1 air flask to the accumulator was found coated with carbon.

81. That the interior surfaces of the 4 inch lines, connecting the No. 3 and No. 4 air flasks to the accumulator, were found coated with carbon a distance of about 18 inches from the accumulator; and that the interior of the 4 inch line of No. 2 air flask was found coated nearly to the air flask.

82. That the port launching accumulator was found to contain oil to within 25 inches of the top flange.

83. That the interior of the accumulator was found covered with relatively heavy patches of carbon down to within 36 inches of the bottom flange.

84. That the oil level at the end of a launching, when using a 2700 p.s.i. launching pressure would normally be 36 inches, measured from the lower accumulator flange.

85. That the interior of No. 1 air flask was found clean except for numerous rivulets of black carbonaceous sludge extending from the upper mouth of the flask down to the liquid level.

[redacted]

95. That the port catapult launching pressure gages were found undamaged and indicated zero.

96. That, when one of the launching pressure gages was subjected to increasing test pressures after the casualty, permanent damage resulted at 6500 p.s.i. test pressure.

97. That the right hand port launching regulator unit was found in the full right position, corresponding to a pump cut-off pressure of 3750 p.s.i.

98. That the launching pump regulator selector switch was found in the full right hand position, in which position the right hand regulator unit is controlling the pumps.

99. That it was general practice to control the launching pressure by manual control of the pressure regulators.

100. That about two hours after the explosion the port catapult retracting system was at 425 p.s.i. with the pressure regulator selector in neutral. At this time the launching pressure was zero.

101. That the interior of the air charging line and fixtures at the end of this line (pressure gages, air blow down valve, main air charging valve, pressure gage manifold, pressure regulator valve and regulator proper) were found clear of any carbon deposits, and the interior of this line was found coated with a thin film of oil for at least 15 feet from the accumulator, while adjacent to the regulator valve it contained a trace of water and corrosion products, but no oil.

102. That the section of pipe between the middle and lower liquid level gages was found to be standard weight low pressure steel pipe and no distortion had occurred.

[redacted]

[redacted]

103. That in April 1954, while in Jacksonville, Florida, the starboard gravity tank had overflowed about fifty to one hundred gallons of oil foam into the elevator pit following operations and that overflow was a common occurrence.

104. That a small amount of oil foam was emitted from the screened vent on top of the port launching gravity tank during the plane launchings on 26 May 1954.

105. That the port catapult retracting sump tank vent has, on various occasions, discharged mist into the second deck port passageway abreast the wardroom.

106. That launching accumulator relief valves of H8 catapults in various ships have opened during catapult operations for unknown reasons.

107. That Diesel action in the liquid phase in catapults has been a familiar phenomenon for many years and has not led to any serious consequences heretofore.

108. That previous instances have been reported of air reaching the piston valve from the accumulator due to vortex action in the accumulator of H8 catapults.

109. That an anti-vortexing baffle was installed in the bottom of the catapult launching accumulators of the HORNET in an attempt to eliminate such air carryover.

110. That existing test specifications on the H8 catapult prescribe an hydrostatic test of 3850 p.s.i. prior to certification of the catapult for service.

111. That three authorized catapult changes and a part of one catapult bulletin were not accomplished on the port catapult, as follows:

[redacted]

[redacted]

Change No. 19

Change No. 25

Change No. 27

Bulletin No. 72 (painting certain valve handles white)

112. That ALNAV 60, which prescribes certain safety precautions arising out of the LEYTE explosion, was received on board the U.S.S. BENNINGTON on 6 December 1953, but had not been sighted by the present Air Officer, the V2 Division Officer and the Catapult Officer.

113. That the Air Department of the U.S.S. BENNINGTON was not organized in strict accordance with ComAirLant Standard Air Department Instructions which were issued for guidance.

114. That the catapult logs were not found to be in strict accordance with current ComAirLant Standard Air Department Instructions which were issued for guidance.

115. That, immediately after the LEYTE explosion, a top priority study of applying less flammable fluids was undertaken. Houghto-Safe 271 was tested at N.A.M.C. in catapult pumps and immediately thereafter in each model of service catapults. After 3,000 test launchings in the H4 Catapult, arrangements were made to service test Houghto-Safe in the port catapult of the U.S.S. LEYTE, during the period of which test, the BENNINGTON casualty occurred.

116. That Hydrolubes are not flammable in air at atmospheric pressure with any degree of spray dispersion.

117. That, immediately after the LEYTE explosion, a survey was made to determine the nitrogen requirements of all shipboard hydraulic systems and that all requirements have been met except for hydro-pneumatic catapults for which a sufficient source of supply of nitrogen has not yet been found.

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118. That action was initiated on all the recommendations of the LEYTE Court of Inquiry.

119. That the development of an overboard discharge from the catapult accumulators involving use of rupture discs was being prosecuted at the time of the casualty.

120. That in high pressure hydro-pneumatic systems using oil, insurance underwriters require the use of nitrogen, in lieu of air.

121. That the estimated cost of all repairs resulting from the casualty is $2,071,954 and the time required is 3 months, on a single shift, no overtime basis, the controlling jobs being repair of the hangar deck and repair of the port catapult.

122. That there has been found no evidence of sabotage.

123. That the Commanding Officer had repeatedly and continuously stressed safety in the operations of the ship.

124. That the exact initiator of the fire in the port catapult launching hydro-pneumatic system has not been positively determined.

[redacted]

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- OPINIONS -

1. That the heavy and loosely adhering carbon deposits on the piston valve and the closely adhering deposit on the interior of the accumulator end of the piston valve housing were evidently deposited thereon by combustion of oil within the housing.

2. That rapid closing of the piston valve can result in Diesel ignition which might be evidenced by carbon deposits on the piston valve and within the piston valve housing.

3. That the most probable cause of the fire within the port launching high pressure hydro-pneumatic system is Diesel ignition in the piston valve and piston valve housing.

4. That the most probable sequence of events in the catapult casualty is:

(a) The catapult was fired normally;

(b) The level of oil in the accumulator dropped rapidly and normally;

(c) A vortex was formed at the bottom of the accumulator in which an air column extended into the manifold and possibly to the piston valve;

(d) As the cross-head approached the end of the launching stroke, the piston valve cut-off was energized in the normal manner;

(e) The control valve actuating line, containing abnormal quantities of air, closed the piston valve abruptly in an abnormal manner;

(f) Diesel ignition occurred as a result of the piston valve closing violently on its seat;

(g) Sufficient air from the vortex remained between the piston valve and the accumulator, through the manifold, to permit propagation of the flame to the accumulator and oil discharge from the hydraulic pumps would tend to assist passage of the flame back to the accumulator;

(h) Oil vapor and foam in the accumulator ignited;

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(i) A rapid increase in pressure occurred within the accumulator, connecting piping and air flasks;

(j) The relief valve opened;

(k) The overboard discharge line burst at the bend adjacent to the relief valve, causing gas and flame to be discharged into the catapult room;

(l) Hot gas and flame, passing through the relief valve, eroded the interior and then blew it off the accumulator;

(m) The upper 40 percent of the brass Tee-fitting was melted and washed away by hot gas and flame;

(n) The steel nipple failed allowing the brass "cusped" Tee-fitting to blow off;

(o) The flame and hot gas continued to pour out of the accumulator flange hole until the diameter was enlarged $\frac{1}{2}$ inch;

(p) The brass elbow in the liquid level gage line connected to the 4 inch line leading to No. 1 air flask burst at some indeterminate time after the initiation of the fire in the accumulator;

(q) The hole in the brass elbow permitted the simultaneous discharge of high pressure air from the 4 inch line and hydraulic oil from the liquid level gage line forming an air-oil mixture or oil fog which spread through the forward part of the ship;

(r) The flame at the top of the accumulator slowly changed in composition as the air supply was diminished due to combustion and ultimately the process became typical of a gas generator in which partial combustion cracks some of the oil, whereupon the inflammable by-products also spread through the forward part of the ship;

(s) The oil rich flame generated large quantities of carbon which were deposited on surfaces in the form of soot.

[redacted]

5. That the inflammable oil fog and explosive hydrocarbon products of the fire in the forward end of the port catapult machinery room passed out of this room through its open forward doorway 3-48-1 into the 3rd Deck passageways, from where it quickly expanded aft through the open 3rd Deck doors and passages and forward and up through open Watertight Hatchway 2-43 from whence it spread through the 2nd Deck officers' country and down into the wing 3rd Deck living spaces, again primarily through open doors and hatches and passageways.

6. That the explosive products which spread throughout the ship exploded when mixed with sufficient air and an ignition source was provided.

7. That although the most probable cause of fire within the hydro-pneumatic system is Diesel ignition at the piston valve, it will not suffice to eliminate only this source of ignition. Corrective action must include all possible sources of ignition.

8. That the other possible sources of ignition, but of lesser probability than the piston valve, are:

(a) Diesel action in the main hydraulic pumps.

(b) Oxidation in the vapor phase, liquid phase or the oil films of the accumulator or the liquid level gages, involving the presence of peroxides, catalysts, degenerated products of oil oxidation, increased oil temperature due to firing, etc.

(c) Generation of electrostatic charges due to friction or rupture of fluid surfaces and subsequent discharge to the steel wall of the accumulator.

(d) External heating, due to an outside fire, of some thin spot of the high pressure hydro-pneumatic system containing explosive vapor, such as the liquid level line or in the section of the air charging

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line adjacent to the accumulator.

(c) Diesel action due to chattering of the relief valve.

9. That the air charging line from the pressure regulator to the tee-fitting does not indicate evidence of Diesel action.

10. That the carbon deposits in the middle and upper liquid level gages and the upper liquid level line leading to the 4 inch line of No. 1 air flask indicate that fire occurred therein.

11. That the liquid level line does not have the mechanism necessary to produce compression ignition.

12. That no fire occurred in the 4 launching air flasks.

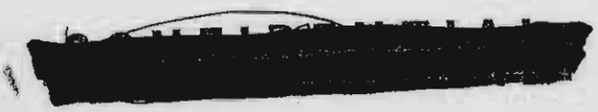
13. That the fire in the accumulator was initiated at approximately the time of piston valve closure for the 13th shot as evidenced by the following observations:

(a) The pressure indicator card showed a normal cylinder pressure pattern until a time approximately 1/3 second before the piston valve closed, the remainder of the record being illegible.

(b) The carbon deposits in the accumulator extended to approximately the low level reached by the oil in the accumulator for a shot at 2700 p.s.i.

(c) The low oil level in the accumulator exists for a very short time since the level starts to rise immediately after the piston valve closes.

14. That the continued action of the pumps, after the rupture of the brass elbow and the blowing-off of the relief valve, may have extended the amount of damage, due to continued supply of oil.



15. That the very dirty strainers on two of the pumps could account for their unusually noisy operation.

16. That the position of the launching pump regulator selector switch and the regulator settings indicate that the pumps were being manually controlled.

17. That the 13th shot was recorded on the indicator card and that the launching pressure pattern for this shot was normal for the 75 percent of the power stroke which was legible.

18. That the retraction panel operator had not yet started to recover retraction accumulator pressure when the casualty occurred.

19. That the hot-short temperature of the ruptured brass elbow, connecting the liquid level gage line to the 4 inch air line of No. 1 flask, is approximately 600° F.

20. That the recrystallization temperature of the severely cold-worked portion of the ruptured brass elbow was about 400° F.

21. That the section of low pressure piping between the middle and lower liquid level gages did not contribute to the casualty and indicated that sustained pressures in excess of 6,400 p.s.i. did not exist.

22. That there was no break in the hydraulic system that could have permitted the entry of fire into the accumulator and caused its initiation.

23. That the ruptured elbow in the liquid level line was defective in that the walls were abnormally thin or were weakened by inclusions.

24. That the relief valve and associated fittings did not fail as a result of fatigue or vibration.

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25. That a minimum percentage of nitrogen content to prevent combustion of inflammable hydraulic oil as well as for safety fluids at high pressure has not been determined.

26. That copper and copper alloys are the most likely metallic catalytic agents for promoting oxidation of hydrocarbons.

27. That the non-accomplishment of the three (3) authorized H8 catapult Changes Nos. 19, 25 and 27 and one part of the H8 Catapult Bulletin No. 72 in no way contributed to the casualty.

28. That, although ALNAV 60 had not been seen by the Air Officer, the V2 Division Officer and the Catapult Officer, the provisions of this ALNAV were being essentially carried out by the ship through execution of other pertinent directives and that this non-sighting of ALNAV 60 did not contribute in any way to the casualty.

29. That the fact that the catapult logs were not maintained in strict accordance with current ComAirLant Standard Air Department Instructions did not contribute to the cause of the casualty.

30. That the port catapult crew were apparently forewarned of the catapult casualty as evidenced by Lieutenant B6 testimony.

31. That the three bodies found in the port catapult machinery room were members of the port catapult crew.

32. That the existing service instructions do not specifically prescribe the frequency and scope of tests to determine suitability of used catapult hydraulic fluid, but that the absence of such specific instructions did not contribute to the initiation of this casualty.

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33. That Nos. 5, 6, 7, and 8 boilers were salted to approximately 25 E.P.M. due to contamination of the L.P drain system, apparently caused by continued operation of the forward evaporators unattended.

34. That the ventilation system, though contributing to the extension of damage played only a secondary part in the spread of damage as compared to the part played by open doors and hatches and open passageways leading from the port catapult room and as compared to drafts through these passageways.

35. That the damage sustained by the armored hangar deck and to the compartment below does not condemn the design of this deck, for it was not intended to limit damage beneath when attacked from beneath.

36. That assistance furnished by outside Naval and Coast Guard Commands and civil activities in providing air-lift, doctors, corpsmen and other services was prompt, adequate, and commendable.

37. That helicopters minimized effects of personnel casualty by early and rapid transfer of doctors and corpsmen to the ship and of the injured to hospitals.

38. That, although handicapped by the death of one doctor and one Medical Corp specialist, first aid was ably rendered with the assistance of many volunteers trained in first aid.

39. That, although the ship was handicapped by loss of key personnel, dense smoke, and fire, damage control and rescue work were executed effectively.

40. That there were adequate medical stores aboard.

41. That, in general, damage control equipment was adequate to carry out damage control and rescue operations.

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[redacted]

42. That no sabotage occurred.

43. That safety precautions issued as a result of the LEYTE accident were being followed in the BENNINGTON.

44. That all the studies and investigations recommended by the LEYTE Court of Inquiry have been initiated and prosecuted and that, as rapidly as could be expected, the results of these studies and investigations have been, and are being, applied.

45. That the BENNINGTON casualty would not have occurred had nitrogen been in use in the catapults.

46. That the BENNINGTON casualty would not have occurred had a non-flammable hydraulic fluid been in use in the catapults.

47. That the discipline and general performance of duty of personnel in damage control and rescue operations was outstanding, and in keeping with the best traditions of the service.

48. That the catapult personnel, including officers and crew, were efficient and well-trained.

49. That no fault or blame should accrue to Captain Commander Lieutenant or Lieutenant .

50. That the explosions were not due to the intent, fault, negligence or inefficiency of any person in the naval service or connected therewith.

51. That the deaths of, and injuries to all Naval and Marine Corps personnel which were suffered or sustained as a result of the explosions here under inquiry were incurred in the line of duty and not as a result of the misconduct of any of them.

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52. That the deaths of, and injuries to, all Naval Reserve and Marine Corps Reserve personnel which were suffered or sustained as a result of the explosions here under inquiry were incurred while such reserve personnel were on extended active duty within the meaning of Public Law 108, 81st Congress (Ac of June 20, 1949; 34 U. S. Code 855c-1) and in line of duty and not as a result of misconduct of any of them.

53. That the death of the civilian involved, which was suffered as a result of the explosion here under inquiry, was incurred within the line and scope of his employment by Westinghouse Electric Company while he was on authorized temporary duty on board the U.S.S. BENNINGTON and not as the result of his own misconduct.

54. That the deaths of, and injuries to, all personnel which were suffered or sustained as a result of the explosion here under inquiry were not caused by the intent, fault, negligence or inefficiency of any person or persons in the naval service or connected therewith.

55. That it has been known for many years that localized Diesel ignition has occurred in the submerged areas of catapult engines. This ignition was not considered dangerous due to the limited air supply and quick smothering effect of the large surrounding oil volume. This is supported by many years of catapult operations involving hundreds of thousands of catapult launchings, wherein no casualties or mechanical problems resulted therefrom. The U.S.S. LEYTE casualty was attributed to Diesel ignition in the pneumatic system, which is obviously dangerous. Corrective action was initiated and safety precautions were issued to prevent recurrence of this casualty. As a result of the U.S.S. BENNINGTON casualty it now appears that there is a possibility (65) of Diesel ignition, in submerged areas of the catapult, which may reach the [redacted]

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pneumatic section in the accumulator due to unusual circumstances. This indicates that Diesel ignition in any section of the catapult is dangerous and must be completely eliminated. It is believed that compliance with the recommendations set forth herein will eliminate all possible future casualties of this type.

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RECOMMENDATIONS

1. That a fully non-flammable fluid be developed for use in high pressure hydro-pneumatic systems in Navy ships in lieu of presently used flammable hydraulic oils.

2. That, until such time as a fully non-flammable fluid suitable for use in high pressure hydro-pneumatic systems can be found, the least flammable suitable fluid be used.

3. That an inert gas such as nitrogen be used in high pressure hydro-pneumatic systems, except small piston type, giving due consideration to the hazards involved in its onboard manufacture, and that some means such as scenting be used for detection in event of leakage.

4. That, in the event it is impracticable to provide 100 percent nitrogen in the hydro-pneumatic system, a lesser amount be used; the minimum amount of nitrogen which will provide safety to be determined by test.

5. That, in the interim, until a suitable Hydrolube, and insofar as practicable, an adequate percentage of nitrogen, are in use in catapults, such action as the following be taken:

   a. Use of catapults and other similar systems operating on the high pressure hydro-pneumatic principle be limited to the absolute minimum consistent with urgent military requirements.

   b. If urgent military necessity demands the firing of catapults operating with flammable oil and air, every possible precaution be taken to prevent another casualty, by use of: Maximum cycle times, maximum liquid level in the accumulator, lowest possible launching pressures, strict compliance with instructions and safety precautions.

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c. The gasoline system be inerted during catapult launchings.

d. Magazines and bomb elevators be secured during catapult operations.

6. That the accumulator over-pressure relief system be redesigned to accommodate full discharge of the hydro-pneumatic system, including combustion products resulting from a fire within the accumulator, without subjecting any portion of the hydro-pneumatic system to pressures exceeding design working limits.

7./

8. That such compartments as catapult compartments containing high pressure hydro-pneumatic systems using flammable fluids be considered hazardous, that instructions be issued to vent such spaces to the atmosphere, and to isolate them from the remainder of the ship, and that sources of sparks, such as exposed lighting fixtures, be eliminated.

9. That future hydro-pneumatic system designs avoid arrangements having direct liquid-gas contact.

10. That Hydrolube for service use be thoroughly laboratory tested under conditions which may be encountered in service to prove its safety, including tests in partial nitrogen atmosphere.

11. That the present research and test program at the Engineering Experiment Station, in Diesel ignition and in the evaluation of hydraulic fluids and of pressure snubbers and flame screens, be continued with high priority.

12. That the present research and test program at the Naval Research Laboratory, in the studies at high pressure of the properties of air-oil vapor mixtures and the ignition in all sorts of dispersion of

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hydrocarbons in various oxygen-nitrogen mixtures, be continued and expedited all possible. The focus of this program should be the determination of these facts which will demonstrate the degree, and will set the limits, of safety of those hydraulic fluids of operational interest, particularly Houghto-Safe 271, in air and air-nitrogen mixtures up to 4,000 psi.

13. That the present research program at Pennsylvania State University in flame propagation in air lines be continued.

14. That the study of the firefighting problems, and of improvement of equipment and techniques for fighting fires arising from hydro-pneumatic systems, be continued.

15. That a study of electrostatic charges in air-oil systems to determine whether a hazard exists at or near bulk oil surfaces be undertaken.

16. That catapult gravity tank vents be discharged overboard.

17. That supplementary service instructions be issued which more specifically prescribe the frequency and scope of tests required to determine the suitability of used hydraulic fluids.

18. That emphasis be placed on meticulous cleaning of all hydraulic systems to remove all foreign matter such as lint, grit, etc.

19. That a hydrostatic overload test of 50 percent over maximum working pressure be applied to the catapult hydro-pneumatic system after initial installation and during each shipyard overhaul.

20. That, pending development of a suitable over-pressure relief system, a periodic check of the relief valve lifting pressure on top of the launching and retracting accumulators be prescribed.

21. That instructions for catapult log preparation be more specifically set forth.

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22. That, in the event a relief valve opens, the inside of the top of the accumulator be inspected for evidence of combustion and a report be made by message to the type commander.

23. That action be taken to obtain isolation in order to prevent widespread distribution of explosive gases, flame, and blast effects from any source within combatant ships.

24. That emergency trip valves for cutting off fuel oil supply to boiler burners be made more easily operable, the trip to be easily found in the dark and operable from both the upper and lower levels.

25. That a study be made to determine the advisability of limited supply of OBA equipment in certain isolated key control centers, such as the Damage Control Central.

26. That the following be emphasized:

(1) Frequent and realistic damage control drills, simulating loss of key personnel.

(2) Self-aid and first aid, especially for flash burns.

(3) The value of clothing in protecting the body against flash burns.

(4) Importance of dispersal of key personnel in the same specialty, and of medical supplies, throughout the ship.

(5) Drills in using emergency trip for cutting off fuel supply to boilers.

27. That no action of a legal nature or for disciplinary purposes be taken, and further, that no disciplinary action is indicated and none is recommended as to Captain , Commander , Lieutenant and Lieutenant.

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28. That the Commanding Officer, U.S.S. BENNINGTON submit a list of those persons most deserving of commendation and the degree thereof.

Rear Admiral, U.S. Navy, President,

Rear Admiral, U.S. Navy, Member,

Captain, U.S. Navy, Member,

Captain, U.S. Navy, Member.

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