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Review of Department of the Navy, Judge Advocate General's Surface Ship Fire Investigation Reports for the Period 1980 Through 1986

J.T. LEONARD, J.H. SHANLEY,* JR., J.L. SCHEFFEY,* AND J.B. FERGUSON**

Navy Technology Center for Safety and Survivability
Chemistry Division

**Hughes Associates, Inc.*
Wheaton, MD 20902

***Ferguson Engineering*
Clarksburg, MD 20871

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Leonard, J.T., Shanley,* J.H., Jr., Scheffey,* J.L. and Ferguson,** J.B.

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Ship fire loss data for the period 1980 to 1986 were developed by analyzing Department of the Navy, Judge Advocate General (JAG) investigation reports. The data were summarized using the Navy Fire Loss History Reporting Form which was used in a previous effort to summarize fire data from the period 1960 to 1979. This report outlines the summary technique, and presents recurring or common lessons learned. A total of 224 incidents were summarized including 190 surface ship fires, 6 submarine fires, 3 aircraft crashes on ships and 21 incidents of accidental fire extinguishing agent discharge. Summary reports for each incident will be presented in a subsequent report.

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REVIEW OF DEPARTMENT OF THE NAVY, JUDGE ADVOCATE GENERAL'S SURFACE SHIP FIRE INVESTIGATION REPORTS FOR THE PERIOD 1980 THROUGH 1986

BACKGROUND

The Navy Technology Center for Safety and Survivability, which is part of the Chemistry Division at the Naval Research Laboratory (NRL), was tasked by the NAVAL SEA SYSTEMS COMMAND, SEA 56Y5, to update the ship fire loss data base obtained by summarizing investigations and reports prepared by the Department of the Navy, Judge Advocate General (JAG). A data base exists for the period 1960 to 1979 [1]. A JAG investigation is conducted for situations where any U.S. Navy personnel, equipment, ship or facility is involved in an incident which results in death, injury, substantial loss or loss under suspicious circumstances, or where legal culpability is to be decided.

OBJECTIVE

The objective of this task was to update the ship fire loss data base from 1980 to 1986. It was not intended for this effort to be a detailed statistical analysis of loss data, but rather it is a general summary of the available JAG Investigation Reports. After each applicable JAG report was summarized using the same basic reporting format, this report was prepared to outline the project, highlight recurring or common lessons learned and to generate a matrix summary of the reports.

This report presents common or recurring lessons learned by the investigating officers. It is important to note that in the majority of incidents, no (or relatively minor) deficiencies were noted and the lessons learned contained positive comments on the actions of the crew, fire fighting equipment, etc. After each topic area in the "Common/Recurring Lessons Learned" section, all JAG Reports are listed which identify the particular issue as pertinent to the fire. This listing indicates the relative frequency of the particular problem and provides a source of additional detail.

Manuscript approved September 26, 1989.

PROJECT CHRONOLOGY

The JAG office has two methods for cataloging their reports. All reports prior to 1985 are cataloged in a card file which had to be searched for all fire incidents involving ships. To identify cases where an aircraft crash resulted in a fire on a ship, the aircraft (listed as "Plane") category had to be searched. After 1984 a computer data base system was used to catalog the reports and made searching through the categories for fire incidents much easier. In either case, all reports involving a fire, explosion or fire fighting agent discharge (listed under "Ship Damage") on a ship were listed. A total of 302 reports were identified.

Reports prior to 1985 are stored at the Federal Records Center in Suitland, Maryland. These reports were ordered and arrived within six weeks. Reports completed after 1984 were stored in the JAG office in Alexandria, Virginia.

Of the 302 JAG reports identified, 224 were summarized with the same reporting form used in the previous effort. Appendix A lists all of the applicable JAG reports which were reviewed. The remaining 78 JAG reports were not obtainable or summarized because they were lost (37), checked out (9), or obviously not applicable (32). A list of the JAG reports which were not summarized is provided in Appendix B.

Of the 224 summarized reports, 4 are classified and will be forwarded under a separate cover. Of the remaining 220 reports, 190 are surface ship fires or boiler explosions, 3 are aircraft crash induced ship fires, 6 are submarine fires and 21 are cases of accidental fire extinguishing agent discharge. In the case of boiler explosions, 1 resulted in a fire spreading beyond the boiler and 11 in no fire. When a fire ensued from a boiler explosion the incident was treated and summarized the same as a ship fire. When the boiler explosion did not cause a fire, the reporting form was partially completed to include only the incident date, ship name and number and a brief description of the incident as a boiler explosion which did not result in a fire.

Of the 190 surface ship fires there were 37 reported cases where arson was determined or suspected to be the cause. There were 6 incidents involving submarines. Five of the submarine reports are in a separate section, Appendix C. The sixth is classified and with the other classified reports.

In addition to the JAG Reports, investigation reports compiled by the Naval Sea Systems Command, Naval Material Command or Naval Facilities Command were utilized to provide

additional details and lessons learned for a number of major incidents. These reports were found attached to the JAG Report or were provided by SEA 56Y52. Where used to support the JAG investigative report, separate investigation reports are referenced in the summary report.

REPORT SUMMARY TECHNIQUE

The Navy Fire Loss History Reporting Form developed by Rolf Jensen and Associates for their review of JAG Reports [1] was utilized. A copy is shown in Appendix D.

Appendix D also contains an explanation of the terms used in the reporting form and a blank copy of the form. After the JAG Reports were summarized, the summaries were reviewed for technical accuracy, clarity and cohesiveness.

A check-off for "Early Warning" under the Equipment/Material/Personnel/Design section was added. A "yes" was indicated for the question "Would Early Warning Have Mitigated The Loss?" when the reviewer felt that a fire detection system (smoke and/or heat) would have reduced the delay in discovering the fire and thereby reduced the damage caused by the fire. This item was also checked "yes" if a detection system was in place and footnotes were used to give additional details. If the loss was insignificant, "yes" was checked and explanatory footnotes were provided which indicated that although the loss was minor, early warning would have reduced the time from ignition to discovery of the fire. This item was checked "no" when the fire was discovered immediately after ignition as would happen if the space was occupied at the time of ignition. If the JAG Report contained insufficient information to make this determination, then this was indicated. The objective was to evaluate the potential benefit of a fire detection system on the particular fire loss.

COMMON/RECURRING LESSONS LEARNED

This section presents those lessons learned which appeared in the JAG reports more than once during the course of this summary project and which indicate a need for further action. These lessons learned were identified by the JAG investigating officer, endorsing officers or the fire protection engineer who summarized the JAG reports. The lessons learned are summarized in Figs. 1 and 2. General recommendations for each of these recurring lessons learned are given in Appendix E.

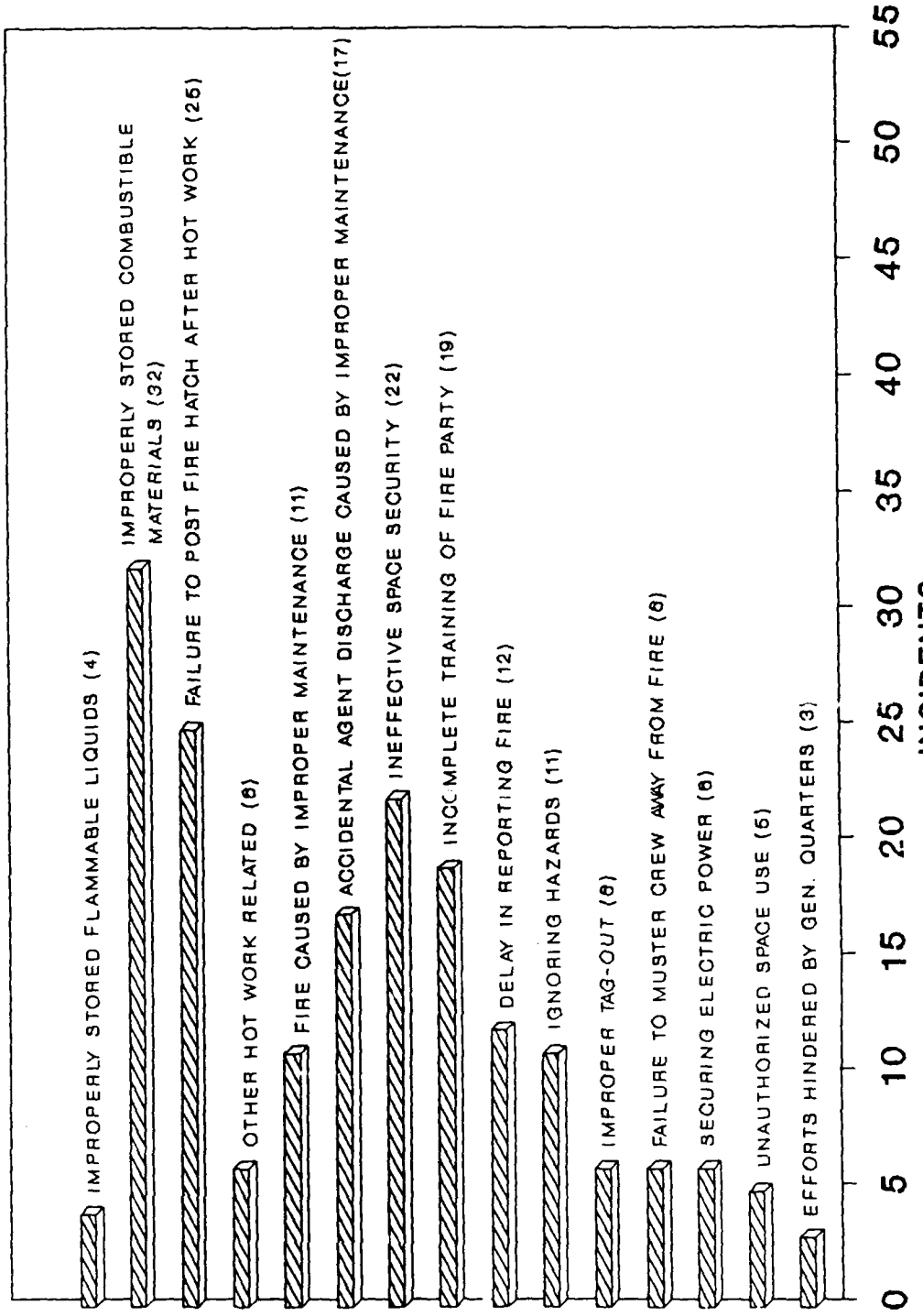

Fig. 1. Procedural/personnel related incidents

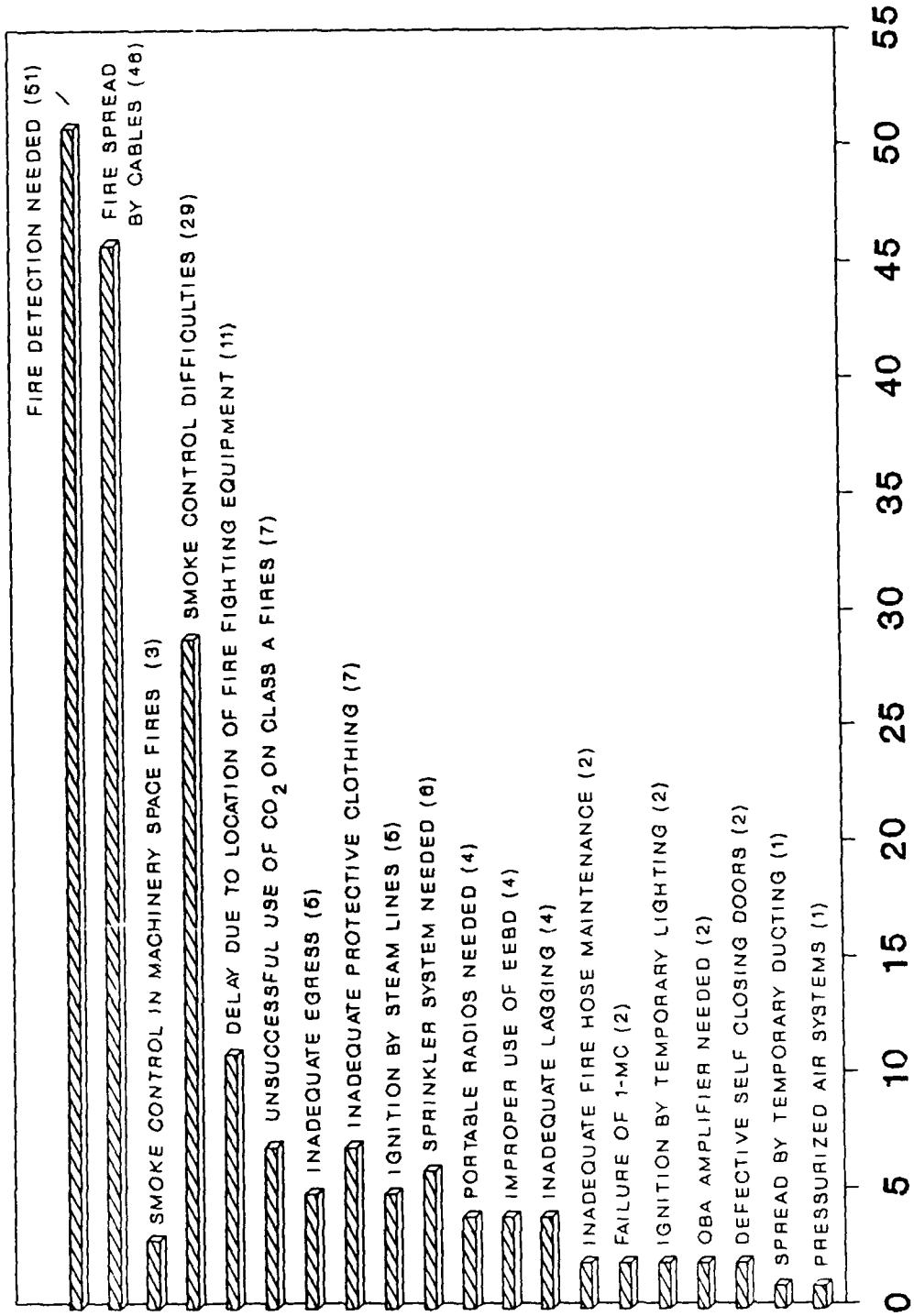

Fig. 2. Equipment/design related incidents

Procedural/Personnel Related

1. Storage: There were 36 incidents where flammable liquids (4 cases) and/or combustible materials (32 cases) were improperly stored. This included unauthorized storage (storage of material in a non-storage area), storage of a hazardous material in a storage area which was not designed for such a hazard, e.g., storing flammable liquid in a non-sprinklered storeroom, and excessive amounts of material in a storage area. Applicable Reports: JAGs 6460-79, 920-80, 3295-80, 4294-80, 5381-80, 1025-81, 5131-81, 5712-81, 6868-81, 923-82, 946-82, 1298-82, 1385-82, 3610-82, 4046-82, 5358-82, 2247-83, 2977-83, 3363-83, 3403-83, 3404-83, 4073-83, 0806-84, 2003-84, 3324-84, 4287-84, 4603-84, 3354-85, 3674-85, 4372-85, 4391-85, 4620-85, 1858-86, 2194-86, 2196-86, 4597-86.

2. Hot Work: Hot work was a recurring cause of fires on ships. There were 31 incidents where this was the case. The primary reason cited 25 times, was the failure to post a fire watch or the failure of assigned fire watch personnel to follow proper procedures. In some cases, personnel assigned to the fire watch had not received proper training in hot work watch procedures. Failure to maintain a fire watch 30 minutes after completion of hot work was also a contributing cause. Applicable Reports: JAGs 2319-80, 4389-80, 2595-81, 6868-81, 0623-82, 923-82, 1464-82, 4381-82, 4427-82, 5717-82, 2316-83, 3909-83, 4062-83, 0220-84, 0226-84, 1258-84, 1395-84, 4287-84, 1211-85, 4325-85, 0218-86, 0256-86, 1815-86, 1858-86, 1630-87.

Inexperienced or untrained welders were responsible for starting 6 fires during hot work. Applicable Reports: JAGs 2319-80, 2595-81, 1258-84, 4325-85, 0256-86, 1630-87.

3. Maintenance: Improper maintenance was cited in 28 incidents as the cause of fires or the accidental activation of fire suppression systems. In the 17 incidents where a fire resulted, the maintenance personnel failed to follow and/or complete the proper maintenance procedure. This resulted in an equipment failure or flammable liquid leak. Applicable Reports: JAGs 5437-80, 4940-81, 1385-82, 0071-83, 0585-84, 1421-84, 2434-84, 2528-84, 2630-84, 3467-84, 3197-85, 3960-85, 1516-86, 3136-86, 4135-86, 4364-86, 4655-86.

In most of the 11 incidents where a fixed fire suppression system (sprinkler, CO_2 or Halon 1301) was accidentally activated, maintenance was either being performed or had been recently completed. Applicable Reports: JAGs 2825-79, 3595-82, 4064-82, 5738-82, 0104-83, 0868-83, 4133-83, 2199-84, 3789-84, 0127-85, 0701-86.

4. Space Security: Spaces which should have been secured (locked) because of hazardous contents (e.g., flammable liquids, ordnance)but were not for various reasons presented an opportunity for 22 accidental or arson fires. Security watches should ensure that these spaces are secured. Damage control personnel should regularly survey the ship to locate unsecured, unprotected spaces which are a fire hazard. Applicable Reports: JAGs 626-80, 1831-80, 3295-80, 5375-81, 1385-82, 2345-82, 3610-82, 4046-82, 4067-82, 5586-82, 1510-83, 2247-83, 3403-83, 4632-83, 3319-84, 4603-84, 3674-85, 3781-85, 4296-85, 4391-85, 4396-85, 0602-86.

5. Training: Deficiencies in the actions of fire party personnel while fighting a ship fire were attributed to a lack of, or incomplete training in 19 incidents. Many of these incidents show that, despite their regularity, damage control team drills are not necessarily realistic or complete. Applicable Reports: JAGs 438-80, 4382-80, 3809-82, 2247-83, 2316-83, 3228-83, 3363-83, 3827-83, 4073-83, 1344-84, 1828-84, 2434-84, 0012-85, 2237-85, 3156-85, 4372-85, 4396-85, 4648-86, 4655-86.

6. Communication of Alarm: The immediate notification of the bridge or quarterdeck by the person discovering the fire and the immediate notification of ship's force and civilian or base fire departments is important. In 12 incidents, delays occurred in one or both of these communication links which probably contributed to the level of damage. Applicable Reports: JAGs 0374-82, 1385-82, 2464-82, 4046-82, 2247-83, 3257-83, 3615-83, 4632-83, 2003-84, 2264-84, 3337-84, 4187-84.

7. Hazard familiarization: Eleven incidents were cited where the crew/shipyard workers ignored hazards inherent to a particular operation or equipment. Safety procedures were commonly ignored or only partially followed. Adherence to safety procedures would have prevented or lessened the damage or injury. Applicable Reports: JAGs 424-80, 2649-81, 3575-81, 5131-81, 6868-81, 946-82, 1298-82, 1464-82, 1258-84, 1828-84, 4187-84.

8. Tag-Out: There were 6 incidents where proper tag-out procedures were not followed. In some cases a fire was caused by a piece of equipment which should have been tagged-out to prevent its use. In other instances personnel wasted time trying to use inoperative fire fighting equipment which should have been tagged-out. Applicable Reports: JAGs 1139-81, 1464-82, 3923-83, 5066-83, 2742-85, 5302-86.

9. Crew Mustering: Crew members and shipyard workers who were not involved with fire fighting efforts should muster away from the fire area. In 6 incidents, the failure

of personnel to muster away from the fire area hampered fire/fighting efforts. A lesson learned is that all non-fire party personnel should be directed to assemble in a convenient area (e.g., hangar deck, fantail, or on the pier). Applicable Reports: JAGs 5360-80, 064-82, 5717-82, 1232-83, 2247-83, 1634-86.

10. Electric Power: Securing electric power to the fire area can be an important action in damage control. Fire parties experienced difficulties in accomplishing this in 6 incidents. Problems were frequently attributed to lack of accurate diagrams, unfamiliarity with the circuits, or multiple power sources. There were also cases where the improper securing of power, resulting in loss of lighting or ventilation, hampered fire fighting efforts. Applicable Reports: JAGs 1783-83, 3923-83, 1421-84, 1317-85, 1626-86, 3362-86.

11. Space Use: The unauthorized use of a space was cited as a contributory cause in 5 incidents. Most often this involved smoking in a smoking prohibited space. Applicable Reports: JAGs 438-80, 6868-81, 1569-82, 4296-85, 1466-86.

12. General Quarters: The use of General Quarters and setting of condition ZEBRA was cited in 3 incidents as a hindrance to fire fighting efforts. Problems involved manpower staging, securing of ventilation, and movement of equipment and supplies to the scene. Applicable Reports: JAGs 2319-80, 883-81, 4482-85.

Equipment/Design Related

1. Fire Detection: Operation of a properly designed, installed and maintained fire detection system may have reduced discovery time and may have reduced the fire loss in 51 incidents. Applicable Reports: JAGs 6460-79, 438-80, 920-80, 1831-80, 2165-80, 3295-80, 4294-80, 5360-80,5381-80, 1139-81, 2649-81, 2858-81, 3575-81, 4745-81, 5712-81, 0142-82, 0623-82, 756-82, 923-82, 946-82, 1569-82, 2564-82, 3595-82, 3610-82, 3809-82, 4046-82,4067-82, 4427-82, 1510-83, 2247-83, 3135-83, 3228-83, 3257-83, 3403-83, 4632-83, 0585-84, 0806-84, 1258-84, 1344-84, 2003-84, 2733-84, 3319-84, 3324-84, 3337-84, 3460-84, 4287-84, 4603-84, 0133-85, 1211-85, 1317-85, 3194-85, 4620-85, 0218-86, 0602-86, 1626-86, 1858-86, 2196-86, 3362-86, 1630-87.

There were six cases where a detection system was installed and operated properly. Applicable Reports: JAGS 3674-85, 4296-85, 4372-85, 4391-85, 1534-86, 4597-86.

2. Cables: Overhead cabling in compartments contributed significantly to the fuel load in the compartments and provided a means for fire spread in 46 incidents. Applicable Reports: JAGs 0920-80, 0933-80, 1542-80, 3483-80, 4382-80, 4389-80, 5437-80, 1139-81, 2649-81, 5131-81, 6868-81, 0064-82, 0142-82, 0946-82, 1476-82, 2345-82, 5717-82, 2247-83, 2316-83, 2744-83, 3257-83, 3339-83, 3363-83, 3403-83, 3404-83, 3615-83, 3827-83, 3923-83, 5066-83, 0220-84, 0585-84, 1258-84, 1344-84, 1828-84, 1909-84, 4287-84, 0378-85, 0414-85, 1317-85, 3197-85, 4296-85, 4391-85, 4396-85, 4410-86, 5036-86, 5504-86.

3. Space Ventilation: The proper setting of machinery space ventilation systems was unknown at the time of the fire in 3 incidents and probably contributed to the spread of fire and/or smoke. Applicable Reports: JAGs 0414-85, 3354-85, 5504-86.

Locating and fighting a fire was often hampered by smoke. Ventilation was usually accomplished by using Red Devil Blowers but these were not sufficient or utilized properly in 29 incidents. Despite these problems the JAG investigator could rarely give specific recommendations for dealing with the smoke problem. Applicable Reports: JAGs 3840-79, 2165-80, 4382-80, 5360-80, 5437-80, 2595-81, 5712-81, 646-82, 1476-82, 2464-82, 5708-82, 2744-83, 3135-83, 3909-83, 5066-83, 0806-84, 1395-84, 1828-84, 2733-84, 4287-84, 0378-85, 0414-85, 1317-85, 2940-85, 3354-85, 4391-85, 2196-86, 4364-86, 4893-86.

4. Location of Fire Fighting Equipment: In 11 incidents there was a significant delay in extinguishing the fire because either the equipment or the activating mechanism for a fixed sprinkler or gaseous system was improperly located. In some cases the equipment was too close to the fire and could not be reached or it was too far away and valuable time was lost in moving it to the fire area. Applicable Reports: JAGs 3840-79, 993-80, 5437-80, 1139-81, 756-82, 1476-82, 1909-84, 2434-84, 0133-85, 3136-86, 4410-86.

5. CO_2 Extinguishers: Carbon dioxide portable extinguishers were unsuccessfully used on Class A or B fires in 7 incidents. Applicable Reports: JAGs 883-81, 1139-81, 6868-81, 0374-82, 3404-83, 3615-83, 1395-84.

6. Egress: It is desirable to have a minimum of two remote, separate means of egress from every space. This is particularly important during in-port periods. This is especially important (and most difficult) in remote, inaccessible areas where hot work is being done. Lack of adequate egress routes was cited in 5 incidents as a

contributory cause of injury or loss of life. Applicable Reports: JAGs 424-80, 4910-80, 2649-81, 1828-84, 4410-86.

7. Protective Clothing: During 7 fire incidents, fire fighting efforts were hampered by the lack of, or inadequate, protective clothing. Fire party members were not able to advance on some fires and were injured because they did not have proper protective clothing. Applicable Reports: JAGs 3840-79, 4910-80, 4382-80, 2858-81, 3909-83, 1395-84, 1828-84.

8. Steam Lines: High pressure, high temperature steam lines may pass through storage or fuel handling areas. In 5 incidents, degraded steam pipe lagging protection resulted in a hot surface ignition source. Inspection of the lagging and proper storage techniques would probably have prevented these fires. Applicable Reports: JAGs 5381-80, 0142-82, 1909-84, 3324-84, 3460-84.

9. Sprinkler System: Sprinkler protection of a space was cited in 6 cases as a potential means for lessening the fire severity and the amount of damage caused by a fire. Applicable Reports: JAGs 3840-79, 4382-80, 3575-81, 4745-81, 2247-83, 1828-84.

10. Portable Radio: Improvements to internal communication within a ship include the use of wireless portable radios. These radios had not been provided to all ships and was cited as a means for improving communication in 4 incidents. Applicable Reports: JAGs 5712-81, 5708-82, 3827-83, 5504-86.

11. Breathing Apparatus: Emergency Escape Breathing Devices (EEBD) or their predecessor Survival Support Devices (SSD) were used by personnel in the same manner as an Oxygen Breathing Apparatus (OBA), during 4 fire fighting operations. Although no major problems were experienced in these cases, the EEBD and SSD are not provided for this purpose. Applicable Reports: JAGs 946-82, 1828-84, 2528-84, 1626-86.

12. Lagging: Inadequate lagging of overhead decks, bulkheads and pipes contributed to the start and/or spread of 4 ship fires. Applicable Reports: JAGs 4382-80, 1909-84, 3460-84, 3960-85.

13. Fire Hose Maintenance: Fire hoses which failed (burst) during 2 ship fires were found to have delinquent hydrostatic testing. Applicable Reports: JAGs 2165-80, 1828-84.

14. 1MC: Internal communications problems and confusion occurred because the 1MC failed or was out of

service during 2 fire incidents. Applicable Reports: JAGs 3483-80, 4287-84.

15. Temporary Lighting: The use of proper, shatter-proof temporary lighting during ship repair procedures would have eliminated an ignition source and probably have prevented 2 ship fires. Applicable Reports: JAGs 4910-80, 0558-84.

16. OBA Amplifier: Communications difficulties were experienced in 2 incidents when personnel had donned OBAs. An OBA voice amplifier has been developed but is not available on all ships. Applicable Reports: JAGs 5712-81, 5708-82.

17. Self-Closing Doors: Smoke spread beyond the compartment of origin was attributed to defective self-closing doors (Ellison Doors) in 2 cases. Applicable Reports: JAGs 4410-86, 5504-86.

18. Temporary Ducting: In one major incident, fire was able to rapidly spread along temporary, combustible ventilation ducting (neoprene) which was being used during a repair period. Applicable Report: JAG 2649-81.

19. Pressurized Air: Ruptured pressurized air systems and tubing in a space can contribute to the intensity of the fire. This problem occurred more than once but it was only cited once as a lesson learned. Applicable Report: JAG 5504-86.

MATRIX SUMMARY

A detailed summary list of all unclassified JAG Summary Reports is contained in matrix form in Appendix F. This matrix was compiled to assist in locating and referencing particular JAG Reports. An explanation of the terminology and rational used in compiling the list is also contained in Appendix F.

GENERAL TRENDS AND SUMMARY

This review was designed to gather and collate data on major Navy shipboard fires. A detailed statistical analysis is beyond the scope of the study, but it is useful to look at and summarize the data in general terms to identify relative trends. For this analysis, two categories of data are reviewed: situations which historically result in the most problems; and, recurring problems in fires with significant life or dollar loss. By looking at the data in these terms, the Navy may develop action items to reduce the overall

number of fires, and to improve fire protection/fire fighting to reduce the impact of fires.

Recurring Lessons Learned

Procedural/Personnel Related

The five most frequently cited issues are: improper storage of combustible and flammable materials; hot work; maintenance of equipment; space security; and training. The lessons learned from these recurring personnel-related issues show the importance of the human element and the wide gap between knowledge of the hazard and execution of the proper procedures. With a few particular exceptions, there is sufficient technical knowledge to address the problems. Although no direct comparison has been made with the previous study [1], there does not appear to have been any improvement in these areas, i.e., the same "people" related problems are repeated.

Improvements may only be effective if fundamental system changes are made. Several examples are pertinent:

1. Hot work, particularly during yard work, continues to be a major problem. Proper procedures are well known and documented. Closer supervision by trained personnel, especially during yard periods, is appropriate. This requires a commitment to watch procedures and, possibly, an increase in manpower to assure that adequate watches are maintained.

2. The training of personnel in fire fighting procedures and the use and maintenance of fire fighting equipment appears to need a general overhaul, as evidenced by:

   - Continued problems with OBAs and other equipment;
   - Problems with fire protection equipment during or just after maintenance; and
   - Communication problems between on-scene and back-up personnel.

Team training (i.e., a dedicated crew from a specific ship) versus the practice of fire fighting proficiency evaluation, has potential for improving fire fighting proficiency. Alternatively, an instructor could be sent to individual ships to train crews, using realistic training techniques. These efforts, which could be applied to all areas related to fire protection and damage control, would require a revamped training system including restructured instructor training.

There should be an effort initiated to better understand the human element in the overall fire protection of ships. The output of this effort should be specific recommendations/action items to improve the transfer of technical knowledge to actual shipboard training, security, monitoring and maintenance practices. For example, a finding may be that all routine items related to fire protection, including maintenance of systems and fire prevention, be assigned to a small team of sailors whose sole responsibility is fire safety. More intensive and realistic training could be given to these sailors, who then would be responsible for on-board fire party training on a routine basis.

There is at least one area where a better technical understanding of the problem is required. From a design standpoint, it may be prudent to install fixed fire protection systems in storage areas other than those used for hazardous materials and flammable liquids.

Equipment/Design Related

The five most frequently cited issues related to equipment and design are: fire detection, cables, space ventilation, location of fire fighting equipment, and unsuccessful use of CO_2 extinguishers.

It became obvious during the review process that the parameters of the "Early Warning Detection" check-off were too broad and subject to considerable individual interpretation. In particular, it was difficult to assign a value to early warning detection when the loss was small. And, the loss alone cannot be used as the sole determining parameter; a loss may be high in expensive equipment where the fire is discovered immediately, but a detection system would have had no impact from a strict loss standpoint since the fire was discovered immediately. It may, however, be prudent to install early warning based on other factors, such as manning levels, impact on mission, total loss potential, replacement capability, etc. The net result of the Early Warning Detection check-off in this analysis was to err on the conservative side so that "yes" is frequently checked. A more rigorous risk assessment with less subjective criteria is required to better determine the need for early warning fire detection. Development of a risk assessment method similar to that being developed for storage space protection is recommended. In addition, an acceptable detector design must be developed which will not have the reliability and maintenance problems of other systems either tried or in use now.

Electrical cables continue to be a primary means of fire spread and development. New "low smoke" cabling

(MIL-C-24643) should reduce the contribution of electrical cables to fire spread and smoke production but it is not a panacea. On existing ships the problem remains. In fact, the cabling is only part (albeit a large part) of the overall issue of vertical and horizontal fire spread. Investigation into methods and strategies for limiting horizontal and vertical fire spread is needed, e.g., what is the priority for space protection/insulation, how long should a barrier remain and under what exposure, and can active fire protection systems supplement or replace passive systems. Improved cable protection may result from investigating: new generation cables, i.e., those that are on order of magnitude better than the new MIL SPEC cable; and, fire stopping methods for cable penetrations (work is in progress plus there is substantial data in the literature).

Space ventilation and the associated issue of smoke control is an area of considerable interest with few hard facts to substantiate any given strategy. Smoke control strategies for new ships should be developed. They should emphasize simplicity and capability in design, compatibility with other ship systems, successful integration with other ship fire safety systems, and flexibility to compensate for variations in anticipated ship and environmental effects. The first criterion is to establish a realistic expectation of system performance. Elaborate and complex designs usually create as many problems as they are intended to solve.

Developing smoke control concepts and hardware for new ships is not straightforward; application of smoke control techniques for existing ships will be even more difficult. It is probable that only the most basic and easily understood methods will be appropriate for existing ships. For example, NRL investigated venting of machinery spaces [2] and found optimum alignments with existing equipment. The strategies involve simple fan alignments for machinery space ventilation. Ventilation systems serving more geometrically complex spaces/compartments are much more difficult to align effectively. Perhaps existing ships should rely on other passive and active systems to limit fire growth. Portable equipment, such as smoke curtains and an improved portable blower, could supplement smoke control on existing ships.

The use and location of portable fire extinguishers should be evaluated in a systematic way. A research task is in progress to assess fire extinguisher effectiveness, placement and spacing requirements.

Trends in Large Loss Fires

A review of all ship fires resulting in loss of life or damage in excess of $1 million was conducted to reveal any

common trends. There were eight fires involving loss of life and sixteen where the loss was greater than $1 million. After looking at such items as fire class, compartment of fire origin, ignition source, arson and fire fighting equipment used, it became evident that there were no outstanding trends where attention could be focused. Generally, the large loss fires involved spaces which contained a significant amount of fuel, such as fuel oil in a machinery space or materials in a storage space. There were many different ignition sources and all of the fire fighting equipment and agents were used to some degree. To learn anything from these fires, a comprehensive, in-depth study is needed. Items to consider may not be within the context of a JAG investigation and will need to be determined from other sources. Such items include the level of fire party training, fire prevention procedures, overall ship fire protection design and others.

In addition, large loss fire data from pre-1980 fires should be examined to look for common trends and areas where the fire record has improved or worsened. Data from other Navies, such as the United Kingdom, France and Italy may also provide insight.

DEFINITIONS AND ABBREVIATIONS

Additional definitions and abbreviations used in the JAG Reports are contained in Appendix G. This section is provided to clarify the numerous acronyms and jargon found in the reports. A description of the space designation lettering system is also provided.

REFERENCES

1. J.B. Ferguson, "Review of Judge Advocate General Fire Investigation Reports for Naval Surface Ships for 1960 to 1979," W2142.2, Rolf Jensen and Associates, Inc., April 1981.

2. J.T. Leonard and P.J. DiNenno, "Full Scale Tests of Machinery Space Class B Fires and Ventilation System Configuration," NRL Memorandum Report (in preparation), Nov 1986.

APPENDIX A

LIST OF REVIEWED JAG REPORTS 1980-1987

LIST OF REVIEWED JAG REPORTS 1980-1987

1979 (Missing from previous review)

	JAG #	Ship Name	Hull #	Incident	Incident Date
1.	2825-79	Saratoga	CV60	Sprinkler Activation	5 Jan 79
2.	3840-79	JF Kennedy	CV67	Four Arson Fires	9 Apr 79
3.	6460-79	DD Eisenhower	CV69	Fire in Shaft Alley	14 Jan 79

1980

	JAG #	Ship Name	Hull #	Incident	Incident Date
1.	424-80	Coronado	LPD11	Class C Fire in Switchboard	16 Mar 79
2.	438-80	Shenandoah	AD26	Fire in Paint Room	19 May 79
3.	626-80	Conyngham	DDG 17	Four Arson Fires	12-14 Jul 78
4.	920-80	Paul Revere	LPA248	Arson Fire in Passageway	1 May 79
5.	993-80	Manley	DD940	Fuel Oil Fire	8 Apr 79
6.	1542-80	Independence	CV62	Fire in Pump Room	9 Jun 79
7.	1831-80	Savannah	AOR4	Fire in Passageway	27 Nov 79
8.	2165-80	Bradley	FF1041	Fire in Storeroom	8 Nov 79
9.	2319-80	Turner Joy	DD951	Fire in Engineering	8 Nov 79
10.	3295-80	Anchorage	LSD36	Fire in Berthing	4 Dec 79
11.	3438-80	White Plains	AF54	Electrical Fire	19 Nov 79
12.	4162-80	Whipple	FF1062	Explosion and Fire	21 Jan 80
13.	4244-80	Barry	DD933	Fire in CIC	25 Apr 80
14.	4382-80	Iwo Jima	LPH2	Arson Fire in Berthing	3 Jul 79
15.	4389-80 & 5029-84	Truckee	TAO147	Fire in Pumproom	7 Aug 80
16.	4910-80	McCloy	FF1038	Fire in Chain Locker	16 Oct 79
17.	5360-80	Iwo Jima	LPH2	Fire in Trash Can	31 Mar 80
18.	5364-80	WH Standley	CG32	Boiler Explosion - No Fire	3 Mar 80
19.	5381-80	Independence	CV62	Fire in Storage Room	19-20 Jun 80
20.	5437-80	Davidson	FF1045	Spray Fire	17 Jun 80

1981

	JAG #	Ship Name	Hull #	Incident	Incident Date
1.	883-81	California	CGN36	Fire in Berthing	4 Dec 79
2.	1025-81	Saratoga	CV60	Fire in Berthing	21 Oct 79
3.	1139-81	Horne	CG30	Fire in Galley	10 Sept 80
4.	2595-81	King	DDG41	Fire in Storeroom	20 Apr 80

	JAG #	Ship Name	Hull #	Incident	Incident Date
5.	2649-81	Spruance	DD963	Fire near Sonar Dome	4 Oct 80
6.	2858-81	(None)	YBN1177	Fire on Barge	14 Feb 81
7.	3563-81	Haleakala	AE25	Boiler Explosion - No Fire	5 Dec 80
8.	3575-81	Okinawa	LPH3	Fire in Storeroom	30 Sept 80
9.	4009-81	Dyess		No Fire	23 Sept 80
10.	4042-81	Somers	DDG34	Boiler Explosion - No Fire	14 Aug 80
11.	4609-81	RL Page	FFG7	Flooding - No Fire	30 May 81
12.	4745-81	Okinawa	LPH3	Fire in AV Storeroom	21 Feb 81
13.	4940-81	LY Speer	AS36	Fire in Foundry	21 Apr 81
14.	5131-81	Nimitz	CVN68	Fire at Fueling Station	23 Dec 80
15.	5322-81	MacDonough	DDG39	Oil Overflow - No Fire	8 Sept 81
16.	5366-81	Downes	FF1070	Boiler Flareback - No Fire	8 Feb 81
17.	5375-81	Puget Sound	AD38	Fire on Flight Deck	2 Nov 80
18.	5712-81	Enterprise	CVN65	Fire in Void	1 Jun 81
19.	6174-81	Guam	LPH9	Helo Crash and Fire	19 Jul 81
20.	6704-81	O'Brien	DD975	Steam Leak - No Fire	26 Aug 81
21.	6728-81	Kansas City	AOR3	Boiler Explosion - No Fire	14 Aug 81
22.	6816-81	Turner Joy	DD951	No Fire	18 Feb 81
23.	6868-81	Aylwin	FF1081	Fire in CIC	4 Apr 81

1982

	JAG #	Ship Name	Hull #	Incident	Incident Date
1.	0064-82	Guam	LPH9	Fire in Berthing	27 Jan 82
2.	0142-82	Independence	CV62	Fire in Cat Pipe Space	18 Jul 81
3.	0366-82	Brooke	FFG1	Flooding - No Fire	31 Jul 81
4.	0374-82	O'Callahan	FF1051	Overheated Transformers	25 Jan 81
5.	0623-82	Boulder	LST1190	Fire in Storeroom	11 Oct 81
6.	0756-82	Fanning	FF1076	Fire in Stateroom	15 Feb 81
7.	0923-82	Ouellet	FF1077	Fire in Storeroom	24 Sept 81
8.	0946-82	America	CV66	Fire in Cat Piping Trunk	23 Sept 81
9.	1298-82	Savannah	AOR4	Fire in Dry Dock	15 May 81
10.	1385-82	Independence	CV62	Fire in AirOps	15 Aug 81
11.	1464-82	Savannah	AOR4	Fire in Fireroom	25 Jun 81
12.	1476-82	Nitro	AE23	Spray Fire	1 Jun 81
13.	1569-82	Halekala	AE25	Fire in Storeroom	5 Sept 81
14.	1907-82	Milwaukee	AOR2	No Fire	29 May 81
15.	2280-82	Independence	CV62	Fire in Shop	20 Jan 82
16.	2345-82	McInerney	FFG8	Fire in Storeroom	22 Mar 82
17.	2464-82	Mt Whitney	LCC20	Fire in Storeroom	18 Feb 82
18.	2564-82	Clark	FFG11	Fire in SSDG	29 Oct 81

	JAG #	Ship Name	Hull #	Incident	Incident Date
19.	2584-82	Inchon	LPH12	Boiler Explosion - No Fire	7 Oct 81
20.	2657-82	(None)	YTB766	No Fire	16 Dec 81
21.	3194-82	Nimitz	CVN68	Crash on Flight Deck	26-27 May 81
22.	3234-82	E. McDonnell	FF1043	No Fire	10 Feb 82
23.	3595-82	Pensacola	LSD38	Fire in Switchboard	6 Nov 81
24.	3610-82	Nimitz	CVN68	Fire in Fan Room	1 Oct 81
25.	3809-82	Guam	LPH9	Fire in Storeroom	17 Feb 82
26.	3962-82	Biddle	CG34	No Fire	2 Mar 82
27.	4046-82	McInerney	FFG8	Fire in 400Hz Room	10 Apr 82
28.	4064-82	Jos. Daniels	CG27	Activation of Sprinkler	9 Jul 81
29.	4067-82	Guam	LPH9	Fire in Storeroom	4 Apr 82
30.	4381-82	Juneau	LPD10	Explosion in Tank	12 Mar 82
31.	4427-82	Coral Sea	CV43	Fire in CIC	24 Jun 82
32.	4991-82	San Diego	AF56	Activation of Sprinklers	16 Apr 82
33.	5358-82	JP Jones	DDG32	Fire in Void	21 Oct 80
34.	5586-82	Blakely	FF1072	Fire in Windlass Room	22 Jan 82
35.	5662-82	England	CG22	Boiler Explosion - No Fire	30 Jun 82
36.	5708-82	Ranger	CV61	Two Fires	5-6 Aug 81
37.	5709-82	Patterson	FF1061	Flooding by Sprinklers	14 Jun 81
38.	5717-82	Sylvania	AF52	Fire in Office	9 Aug 82
39.	5738-82	Vulcan	AR5	Accidental CO_2 Discharge	29 Apr 82

1983

	JAG #	Ship Name	Hull #	Incident	Incident Date
1.	0071-83	Hunley	AS31	Explosion and Fire in Engine	12 Jan 82
2.	0097-83	Mount Hood	AE29	No Fire	29 Oct 81
3.	0104-83	Virginia	CGN38	Activation of Sprinklers	6 Jul 82
4.	0501-83	Somers	DDG34	Boiler Explosion - No Fire	12 Sept 82
5.	0868-83	Vulcan	AR5	Accidental CO_2 Discharge	27 May 82
6.	1088-83	Bradley	FF1041	Flooding by Sprinklers	21 Mar 82
7.	1232-83	Tarawa	LHA1	Oven Fire	14 May 82
8.	1302-83	JA Moore	FFG19	No Fire	17 May 82
9.	1510-83	CV Ricketts	DDG5	Fire in Elect. Equip.	19 Aug 82
10.	1783-83	Harlan County	LST1169	Fire in Switchboard	5 Dec 82
11.	1784-83	J Rodgers	DD983	Fire in Aux. Mach. Space	20 Jun 82
12.	1792-83	Norton Sound	AVM1	Flooding - No Fire	26 Oct 82
13.	2110-83	RL Page	FFG5	No Fire - Tank Rupture	22 Sept 82
14.	2247-83	JF Kennedy	CV67	Fire in Storage Space	18-19 Jan 83

	JAG #	Ship Name	Hull #	Incident	Incident Date
15.	2316-83	Newport	LST1179	Bilge Fire in Engineroom	18 Mar 82
16.	2744-83	Taluga	TAO62	Spray Fire	3 Apr 81
17.	2977-83 & 1967-83	Shreveport	LPD12	Fire in Trash Burner Room	30 Jan 83
18.	3135-83	America	CV66	Arson Fire	1 Aug 82
19.	3228-83	Oldendorf	DD972	Spray Fire	10 Aug 82
20.	3257-83	Sydney	FFG35	Arson Fire	24 Jan 82
21.	3339-83	Dubuque	LPD8	Fire in Machinery Room	23 Oct 82
22.	3363-83	Seattle	AOE3	Explosion and Fire in Storage	13 Jul 82
23.	3403-83	Ponce	LPD15	Fire in Vehicle Storage	25 Feb 83
24.	3404-83	Jos. Daniels	CG27	Fire in IC Storage	14 Feb 83
25.	3615-83	Constellation	CV64	Fire in Tool Room	5 Jun 83
26.	3734-83	Camden	AOE2	Boiler Explosion - No Fire	4 Oct 82
27.	3827-83	Independence	CVN62	Arson in Wardroom	29 May 82
28.	3909-83	Iwo Jima	LPH2	Fire in Locker	30 Jan 82
29.	3923-83	Gridley	CG21	Fire in SES	22 Apr 83
30.	4062-83	Sunbird	ASR15	Fire in Stateroom	17 May 83
31.	4073-83	San Diego	AFS6	Fire in Incinerator Room	4 Jan 83
32.	4133-83	David R. Ray	DD971	Sprinkler Flooding	22 Mar 83
33.	4142-83	Glover	FF1098	Boiler Casualty	15 Nov 82
34.	4556-83	Bradley	FF1041	Flooding - No Fire	9 Jun 82
35.	4632-83	Blue Ridge	LCC19	Fire in Storeroom	27 May 83
36.	4651-83	Butte	AE27	No Fire	2 Feb 83
37.	4893-83	Virginia	CGN38	Sprinkler Activation	27 Mar 83
38.	5066-83	JF Kennedy	CV67	Fire in Cat Piping Spaces	12 Aug 83

1984

	JAG #	Ship Name	Hull #	Incident	Incident Date
1.	0220-84	Hull	DD945	Fire in Uptake Trunk	1 Mar 83
2.	0226-84	Hermitage	LSD34	Fire in Storeroom	10 Sept 84
3.	0511-84	Ramsey	FFG2	Sprinkler Activation	31 Jan 83
4.	0558-84	Dubuque	LPD8	Fire in Fuel Tank	15 Apr 83
5.	0585-84	Saugus	YTB780	Fire in Engine Room	17 Jun 83
6.	0806-84	Belleau Wood	LHA3	Fire in Storeroom	7 Dec 82
7.	1258-84	Farragut	DDG37	Fire in Office	16 Sept 83
8.	1344-84	Hermitage	LSD34	Fire in Shop	7 Oct 83
9.	1395-84	Coral Sea	CV43	Fire in Fireroom	17 Dec 83
10.	1421-84	Reeves	CG24	Fire in Switchboard	13 Sept 83
11.	1819-84	Bowditch	TAGS21	No Fire	12 Jan 84
12.	1828-84	Ranger	CV61	Spray Fire	1 Nov 83

	JAG #	Ship Name	Hull #	Incident	Incident Date
13.	1832-84	Oak Ridge	ARDM1	Boiler Explosion - No Fire	23 23 Jan 83
14.	1909-84	Independence	CV62	Fire in Cat. Void	8 Sept 83
15.	2003-84	Davidson	FF1045	Fire in Office	10 Aug 83
16.	2199-84	Nashville	LPD13	Sprinkler Flooding	3 Jan 84
17.	2264-84	G Philip	FFG12	Fire in #4 SSDG	27 May 83
18.	2434-84	Fidelity	MSO443	Fire in Generator	17 Oct 83
19.	2528-84	Tattnall	DDG19	Cable Fire in Fireroom	18 Jan 84
20.	2630-84	Suribachi	AE21	Fire in SSTG	26 Jan 84
21.	2733-84	Peleliu	LHA5	Three Fires	27-28 Aug 83
22.	3319-84	Hunley	AS31	Fire in Storeroom	2 Oct 83
23.	3324-84	Kitty Hawk	CV63	Fire in Storeroom	6 Apr 84
24.	3337-84	Midway	CV41	Fire in Berthing	19 Dec 83
25.	3460-84	Constellation	CV64	Fire in Storeroom	11 Mar 84
26.	3467-84	Kiska	AE35	Fire in Generator	12 Jun 84
27.	3789-84	Stump	DD978	Sprinkler Activation	20 May 84
28.	4187-84	Papago	ATF160	Fire in Switchboard	14 May 84
29.	4287-84	Ranger	CV61	Fire in GSK Storeroom	10 Mar 84
30.	4481-84	(None)	YTB821	No Fire	20 Mar 84
31.	4603-84	Tripoli	LPH10	Fire in GSK Storeroom	30 Apr 84
32.	4716-84	Merrimack	AO179	Helo Crash and Fire	30 Dec 83

1985

	JAG #	Ship Name	Hull #	Incident	Incident Date
1.	0012-85	Iwo Jima	LPH2	Sprinkler Activation	1 Aug 84
2.	0127-85	Monongahela	AO178	Halon 1301 Discharge	11 Sept 84
3.	0133-85	Koelsch	FF1049	Fire in Berthing	15 Jun 84
4.	0378-85	Enterprise	CVN65	Fire in Office Area	31 May 84
5.	0414-85	Ticonderoga	CG47	Fire in Uptake Trunk	8 Sept 84
6.	0663-85	Fortify	MSO446	Fire in Switchboard	24 Aug 84
7.	0664-85	Iowa	BB61	Fire in Switchboard	4 Nov 84
8.	1211-85	CF Adams	DDG2	Fire in Storeroom	15 Aug 84
9.	1317-85	Barbour County	LST1195	Fire in Locker	1 Jun 84
10.	2178-85	(None)	YTM252	Engine Explosion - No Fire	30 Jan 85
11.	2237-85	Keokuk	YTB771	Fire in Stack	5 Sept 84
12.	2447-85	Turtle	DSV3	Fire on a DSV	16 Aug 84
13.	2742-85	Knox	FF1052	Fire in Switchboard	13 Jul 84
14.	2940-85	Saipan	LHA2	Fire in Storage Area	3 Aug 84
15.	3156-85	Kalamazoo	AOR6	Sprinkler Activation	13 Mar 85
16.	3194-85	Merrimack	AO179	Fire in Berthing	12 Mar 85
17.	3197-85	Moinester	FF1097	Fire in Overhead	16 Jan 85
18.	3212-85	Concord	AFS5	Fire on Main Deck	16 Jan 85
19.	3296-85	(None)	IX506	Fire in Switchboard	25 Apr 85
20.	3354-85	WS Simms	FF1059	Fire in Machine Room	14 Dec 84
21.	3623-85	S. Gompers	AD37	Fire in Circuit Breaker	15 Apr 85
22.	3674-85	Concord	AFS5	Fire in Storeroom	12 Jan 85

	JAG #	Ship Name	Hull #	Incident	Incident Date
23.	3781-85	Merrimack	AO179	Fire in Control Room	31 Mar 85
24.	3960-85	Illusive	MSO448	Fire in Engine Room	16 Feb 85
25.	4296-85	Biddle	CG34	Fire in Flam. Liq. Storeroom	20 Jan 85
26.	4325-85	Ponce	LPD15	Fire in Stateroom	18 Apr 85
27.	4372-85	E Montgomery	FF1082	Fire in Helo Hangar	20 Dec 84
28.	4391-85	Ingersoll	DD990	Fire in JP5 Pumproom	17 Jan 85
29.	4396-85	Merrimack	AO179	Arson Fire in Control Room	31 May 85
30.	4482-85	Inflict	MSO456	Small Fire in Jacking Gear	10 Jun 85
31.	4529-85	Leader	MSO490	Fire in Generator	21 Dec 84
32.	4620-85	Blue Ridge	LCC19	Fire in Trash Burner Room	10 Jun 85

1986

	JAG #	Ship Name	Hull #	Incident	Incident Date
1.	0218-86	Luce	DDG38	Fire in Storeroom	2 Jun 85
2.	0256-86	Mont Hood	AE29	Fire in Storeroom	15 Oct 85
3.	0428-86	Monongahela	AO178	AFFF Discharge	5 Oct 85
4.	0533-86	Fahrion	FFG22	Fire in SFC	26 Aug 85
5.	0602-86	Portland	LSD37	Three Arson Fires	9 Aug 85
6.	0699-86	Saipan	LHA2	Fire/Explosion in Shop Oven	27 Aug 85
7.	0701-86	Iowa	BB61	PKP Discharge	18 Nov 85
8.	1466-86	LY Spear	AS36	Fire in Gig-Whaleboat	21 Oct 85
9.	1516-86	Harlan County	LST1196	Cable Fire in Engine Room	17 Sept 85
10.	1534-86	Fahrion	FFG22	Fire in Converter Room	21 Oct 85
11.	1626-86	Portland	LSD37	Fire in Berthing	6 Oct 85
12.	1634-86	Monongahela	AO178	Fire in Deck Locker	16 Dec 85
13.	1815-86	HE Yarnell	CG17	Fire in Storeroom	4 Dec 85
14.	1858-86	DD Eisenhower	CVN69	Fire in Storage Space	21 Feb 86
15.	2119-86	Patterson	FF1061	Fire Behind the Stack	18 Dec 85
16.	2194-86	Iowa	BB61	Fire in Storeroom	11 Feb 86
17.	2196-86	Platte	AO186	Fire in Flam. Liq. Issue Room	2 May 86
18.	2884-86	Zeus	T-ARC7	Boiler Explosion - No Fire	21 May 85
19.	3136-86	America	CV66	Fire in Electrical Load Center	3 Mar 85
20.	3362-86	Fahrion	FFG22	Electrical Equipment Fire	20 Dec 85
21.	4135-86	Pigeon	ASR21	Diesel Generator Failure	6 May 86
22.	4364-86	Camden	AOE2	Fire in Switchboard	31 Oct 85
23.	4410-86	Spica	T-AFS9	Fire in Engine Room	26 Sept 85

	JAG #	Ship Name	Hull #	Incident	Incident Date
24.	4591-86	Concord	AFS5	Fire in Berthing Head	20 Oct 85
25.	4593-86	Shenandoah	AD44	No Fire	14 Jun 85
26.	4597-86	Stump	DD978	Fire in Flam. Liquid Storeroom	12 May 85
27.	4599-86	Ponce	LPD15	Fire in Forklift	9 Oct 85
28.	4648-86	Jos. Daniels	CG27	Fire in #2 Main Engine	21 Apr 86
29.	4655-86	Proteus	AS19	Fire in Captain's Gig	16 Apr 86
30.	4893-86	DD Eisenhower	CVN69	Fire in Storeroom	20 Mar 86
31.	5036-86	Dale	CG19	Fire in MG Room	3 Nov 85
32.	5302-86	Inflict	MSO456	PKP Discharge	27 Jun 86
33.	5326-86	Proteus	AS19	Crankcase Explosion	22 Oct 85
34.	5504-86	Schenectady	LST1185	Spray Fire	6 May 86

1987

	JAG #	Ship Name	Hull #	Incident	Incident Date
1.	0245-87	Iowa	BB61	No Fire	6 Aug 86
2.	1630-87	Mississippi	CGN30	Fire in Storeroom	14 Oct 86

APPENDIX B

LIST OF JAG REPORTS NOT AVAILABLE FOR REVIEW

LIST OF JAG REPORTS NOT AVAILABLE FOR REVIEW

	JAG NO.	SHIP NAME	INCIDENT DATE
1.	3863-80	USS Lexington	1/17/80
2.	540-80	USS Kitty Hawk	6/25/79
3.	1670-80	USS Midway	8/9/79
4.	2913-80	USS Saratoga	1/23/80
5.	3492-80	USS Guam	3/25/79
6.	4203-80	USS Enterprise	6/20/79
7.	2344-80	USS Shasta	5/1/80
8.	3009-81	USS Biddle	8/21/79
9.	1260-82	USS Bowen	8/30/81
10.	3288-82	USS California	12/17/81
11.	4564-81	(No Name)	4/15/81
12.	5666-82	USS England	6/30/82
13.	6090-81	USS Jouell	4/6/81
14.	3384-82	USS Kennedy	11/26/81
15.	742-82	USS Mississippi	5/19/81
16.	3642-81	USS Schofield	6/4/80
17.	2004-82	USS F. Sherman	11/17/81
18.	441-81	USS Somers	8/14/80
19.	1570-82	USS South Carolina	4/1/82
20.	4022-81	USS Tattnall	9/1/80
21.	4096-83	USS Arkansas	2/7/83
22.	(Unknown)	USS Doyle	3/27/85
23.	3155-83	USS Garcia	4/19/82
24.	(Unknown)	USS J.P. Jones	10/21/80
25.	(Unknown)	USNB Jupiter	1/19/83
26.	0614-83	USS Morton	3/5/81
27.	(Unknown)	USS Ponce	4/15/85
28.	1653-85	USS Thach	7/22/84
29.	2590-84	USS Waddell	12/5/83
30.	2529-86	USS Roosevelt	11/16/85
31.	4396-85	USS Merrimack	4/31/85
32.	3896-86	USS Canisteo	9/9/85
33.	171-86	USS Sunbird	7/25/85
34.	9244-86 (INO)*	USS Simon Lake	7/6/85
35.	1429-86	USS Halsey	12/17/85
36.	5514-86 (INO)*	USS W.H. Standley	5/5/86
37.	10557-86 (INO)*	USS King	8/26/87
38.	0061-86	USS Doyle	3/27/85
39.	4599-86	USS Ponce	10/9/85
40.	4637-86	USS Dubuque	4/15/83
41.	10690-86 (INO)*	USNS HassayampAn	7/18/86
42.	10354-86 (INO)*	(No Name)	9/5/86

* JAG Investigation Number (INO) - report in progress, no JAG No. assigned.

	JAG NO.	SHIP NAME	INCIDENT DATE
43.	1451-86	SS Letitia Lykes	5/8/85
44.	2744-83	USNS Taluga	4/3/81
45.	2199-84	USS Nashville	1/3/84
46.	4087-85	USS Guadalcanal	6/3/85
47.	2741-85	USS Constellation	8/7/84
48.	0126-85	USS Monogahelia	9/15/84
49.	1688-86	USS Biddle	12/23/85
50.	4776-85	USS Koelsch	1/15/85
51.	4789-85	USS America	7/13/85
52.	2588-84	USS Thorne	
53.	2476-83	N/A	
54.	1188-84	N/A	
55.	0221-81	N/A	
56.	1599-83	[illegible]tz	8/4/82
57.	4086-83	USS Kincaid	12/11/82
58.	4815-84	USS Vogue	8/17/84
59.	4693-85	USS Barbey	6/27/85
60.	2627-86	USS Fife	9/1/85
61.	1480-86	USS Kitty Hawk	10/30/85
62.	5523-86	USS Midway	7/10/85
63.	2681-86	USS Enterprise	3/8/86
64.	4823-85	USS Midway	7/13/85
65.	2782-87	USS Carl Vinson	12/29/86
66.	5702-86	USS Carl Vinson	7/18/86
67.	3138-86	USS Guadalcanal	3/9/86
68.	0879-86	USS Iwo Jima	8/12/85
69.	0174-86	USS Midway	8/17/85
70.	5432-86	USS Constellation	3/12/86
71.	0615-86	USS Coral Sea	10/20/85
72.	5653-86	USS Underwood	6/9/86
73.	1434-86	USS Halyburton	9/11/85
74.	6165-80	USS Saratoga	
75.	2657-81	YTB 766	12/16/81
76.	0065-82	USS Dahlgren	6/29/81
77.	4591-85	USS Concord	10/20/85
78.	5072-79	USS Piedmont	

APPENDIX C

SUBMARINE FIRE INCIDENTS

SUBMARINE FIRE INCIDENTS

A total of six submarine fire incident JAG Reports were identified and summarized. An additional seventh, classified, incident is included with the other classified reports. A cross reference matrix is provided with the submarine reports.

All of the fires included here resulted in minor damage and were easily handled by the ship's force. Fires aboard submarines are infrequent and there were no common or recurring lessons learned from these 6 incidents.

NAVY FIRE LOSS HISTORY REPORTING FORM

JAG # 2534-81 DATE 25 May 80

SHIP NAME USS George Bancroft SHIP# SSBN 643

LOCATION 1. AT SEA _____
2. MOORED X

Portsmouth Naval Shipyard, VA

I. THE FIRE/CAUSE

Fire in missile compartment of submarine

A. CLASS OF FIRE A. X B. _____ C. _____ D. _____

B. ALARM TRANSMITTED 1735 DECLARED OUT 1752 DURATION 17 min

C. COMPARTMENT/FRAME/DECK LOCATION OF IGNITION # _____

DESCRIPTION Missile Compartment

D. SOURCE OF HEAT OF IGNITION

1.	ELECTRICAL	_____	7.	OPEN FLAME/WELDING	_____
2.	EXPLOSION	_____	8.	MECHANICAL FAILURE/ FRICTION	_____
3.	COOKING	_____	9.	SPONTAN. COMBUSTION	_____
4.	ENEMY ACTION	_____	10.	HEATING APPLIANCES	_____
5.	HOT SURFACES	_____	11.	OTHER (SPECIFY)	_____
6.	MATCHES/SMOKING	X - Arson			

E. FIRST MATERIAL IGNITED (CHECK 1)(SPECIFY)

1.	GAS	_____	3.	EXPLOS./INCEND.	_____
2.	FL./LIQ.	_____	4.	ORDINARY COMB.	Paper wrappings

5. ARSON/SUSPICIOUS? Yes

F. ALARM SEQUENCE - METHOD OF ALERTING

1. Smoke coming from boat was discovered topside by personnel who went below and found more smoke billowing from doorway leading to missile room.
2. Word of fire passed on 4MC
3. Shortly after 1735 "Fire in missile compartment" passed over 1MC.
4. General alarm sounded at 1740.
5. Shipyard Fire Department called at 1742.

JAG # 2534-81

II. FACTORS CONTRIBUTING TO SPREAD OR LOSS

A. MEANS FOR SPREAD

1. HOLE IN DECK/BULKHEAD		5. FLAMMABLE LIQUID FLOW	
2. CONDUCTION THROUGH DECK/BULKHEAD		6. WIND	
3. EXPLOSION		7. ELECTRICAL CABLES	
4. VENT DUCTS		8. OTHER (SPECIFY)	

B. MATERIALS INVOLVED IN SPREAD

1. GAS		3. EXPLOS./INCEND.	
2. FL./LIQ.		4. ORDINARY COMB.	X - Electronic parts

C. EQUIPMENT/MATERIAL/PERSONNEL/DESIGN

CONTRIBUTION TO CAUSE OF FIRE

1. Arson
2. Accumulation of combustible materials

SPREAD OF FIRE/FIREFIGHTING EFFECTIVENESS

1. Fire fighting efforts hampered by problems with EABs. Personnel were unfamiliar with their use and a number of EAB were defective.
2. Fire fighting efforts were disorganized due to a delay in establishing command.
3. Communication between Damage Control and missile compartment was sporadic and unreliable.

WOULD EARLY WARNING HAVE MITIGATED THE LOSS?

X* YES _____ NO _____ INSUFFICIENT INFORMATION

* Delay in detecting fire

JAG # 2534-81

III. ACTIONS/ASSISTANCE

A. EXTINGUISHING AGENTS USED

1.	WATER/FOG	X	5.	PROTEIN FOAM	
2.	PKP	X	6.	HALON	
3.	AFFF		7.	OTHER (SPECIFY)	Dry powder
4.	CO_2	X Hoseline			

B. SHIPS FIXED EXTINGUISHING SYSTEMS / PORTABLE EQUIPMENT

1.	SPRINKLERS		1.	EXTINGUISHERS	CO_2, PKP & DC
2.	GASEOUS SYSTEMS		2.	PUMPS	
3.	WATER HOSELINES	X	3.	FOAM	
4.	PKP/AFFF		4.	OBA'S and EAB'S	X

C. ACTIONS TO VENT?

1.	MECH. VENT DUCTS	X	1.	NATURAL VENTILATION	
2.	PORTABLE BLOWERS		2.	OTHER (SPECIFY)	

D. FIRE FIGHTING ORGANIZATIONS

1. SHIP'S FORCE X
2. SHORE BASED - NAVY
   MUNICIPAL X Portsmouth Naval Shipyard FD
3. OTHER SHIPS

IV. THE DAMAGE

A. AREA OF FIRE/SMOKE INVOLVEMENT/# OF SPACES/LEVELS INVOLVED

Missile compartment

B. DIRECT COST OF FIRE $65-$100,000

C. OPERATING DAYS LOST

D. REPAIR MAN-HOURS

E. LOSS OF LIFE

F. PERSONAL INJURY 8-Smoke inhal.

G. DAMAGED
Missile tube electrical and mechanical support systems, spare parts

JAG # 2534-81

V. SUMMARY

A. NARRATIVE OF EVENTS UNTIL DECLARED OUT:

1. Smoke discovered coming from missile compartment at 1733.
2. Fire alarm passed over 4MC and 1MC.
3. Shipyard Fire Department called at 1742 by the barge.
4. Word was passed over 1MC that "fire is out" when in fact it was not.
5. Some personnel donned EABs, some did not.
6. Fire Department arrived with a 1000 GPM pumper, a CO_2 truck, and fire and flooding equipped van.
7. Fire hoses rigged from barge to ship.
8. CO_2 extinguisher discharged into the compartment. Too much smoke prevented location of the fire.
9. Fire fighters with CO_2 hand line and air pacs entered ship. More CO_2 extinguishers passed down to the missile compartment.
10. Numerous personnel had problems with EABs.
11. Fire found and extinguished with CO_2 extinguisher. Water hose line was used once briefly.
12. Desmoking was begun at 1752.

B. LESSONS LEARNED

1. JAGMAN: "Training on use of OBA and EAB should be conducted more frequently. Emphasis on the necessity of respiratory protection at all times in a toxic atmosphere."
2. JAGMAN: "Improve damage control gear maintenance organization."
3. JAGMAN: "Reliable uninterrupted communication between Damage Control and fire area must be maintained at all times."
4. HAI: Early warning/detection would minimize the delay in detectin and locating this fire.

NAVY FIRE LOSS HISTORY REPORTING FORM

JAG # 5354-83 DATE 6 Jul 83

SHIP NAME USS George Washington Carver SHIP# SSBN-656

LOCATION 1. AT SEA _____
2. MOORED X Drydock #4

Newport News, VA

I. THE FIRE/CAUSE

Fire in Engine Room Escape Trunk

A. CLASS OF FIRE A._____ B._____ C._X_ D._____

B. ALARM TRANSMITTED 1815 DECLARED OUT 1820 DURATION 5 min

C. COMPARTMENT/FRAME/DECK LOCATION OF IGNITION # _____

DESCRIPTION Engine Room

D. SOURCE OF HEAT OF IGNITION

1.	ELECTRICAL	Arc	7.	OPEN FLAME/WELDING	_____
2.	EXPLOSION	_____	8.	MECHANICAL FAILURE/ FRICTION	_____
3.	COOKING	_____	9.	SPONTAN. COMBUSTION	_____
4.	ENEMY ACTION	_____	10.	HEATING APPLIANCES	_____
5.	HOT SURFACES	_____	11.	OTHER (SPECIFY)	_____
6.	MATCHES/SMOKING	_____			

E. FIRST MATERIAL IGNITED (CHECK 1)(SPECIFY) *

1.	GAS	_____	3.	EXPLOS./INCEND.	_____
2.	FL./LIQ.	_____	4.	ORDINARY COMB.	_____

5. ARSON/SUSPICIOUS? No

* No sustained burning resulted from the electric arc.

F. ALARM SEQUENCE - METHOD OF ALERTING

1. At 1814 motor generator testing was commenced and when port TG bus was energized a loud explosion (electric arc) was heard from engine room escape trunk.
2. Fire was announced over 4MC at 1815.

JAG # 5354-83

II. FACTORS CONTRIBUTING TO SPREAD OR LOSS

A. MEANS FOR SPREAD

1. HOLE IN DECK/BULKHEAD	_____	5. FLAMMABLE LIQUID FLOW	_____
2. CONDUCTION THROUGH DECK/BULKHEAD	_____	6. WIND	_____
3. EXPLOSION	_____	7. ELECTRICAL CABLES	_____
4. VENT DUCTS	_____	8. OTHER (SPECIFY)	_____

B. MATERIALS INVOLVED IN SPREAD

1. GAS	_____	3. EXPLOS./INCEND.	_____
2. FL./LIQ.	_____	4. ORDINARY COMB.	_____

C. EQUIPMENT/MATERIAL/PERSONNEL/DESIGN

CONTRIBUTION TO CAUSE OF FIRE

1. Poor judgment and improper procedures used during testing.
2. Failure to properly tag an open tie breaker resulted in a closed circuit which was thought to be open.

SPREAD OF FIRE/FIREFIGHTING EFFECTIVENESS

WOULD EARLY WARNING HAVE MITIGATED THE LOSS?

_____ YES __X__ NO _____ INSUFFICIENT INFORMATION

JAG # 5354-83

III. ACTIONS/ASSISTANCE

A. EXTINGUISHING AGENTS USED

1.	WATER/FOG		5.	PROTEIN FOAM	
2.	PKP		6.	HALON	
3.	AFFF		7.	OTHER (SPECIFY)	
4.	CO_2	X			

B. SHIPS FIXED EXTINGUISHING SYSTEMS / PORTABLE EQUIPMENT

1.	SPRINKLERS		1.	EXTINGUISHERS	CO_2
2.	GASEOUS SYSTEMS		2.	PUMPS	
3.	WATER HOSELINES		3.	FOAM	
4.	PKP/AFFF		4.	OBA'S	

C. ACTIONS TO VENT?

1.	MECH. VENT DUCTS		1.	NATURAL VENTILATION	
2.	PORTABLE BLOWERS		2.	OTHER (SPECIFY)	

D. FIRE FIGHTING ORGANIZATIONS

1. SHIP'S FORCE X
2. SHORE BASED - NAVY
   MUNICIPAL
3. OTHER SHIPS

IV. THE DAMAGE

A. AREA OF FIRE/SMOKE INVOLVEMENT/# OF SPACES/LEVELS INVOLVED

Engine room escape trunk

B.	DIRECT COST OF FIRE	Minimal	C.	OPERATING DAYS LOST	
D.	REPAIR MAN-HOURS		E.	LOSS OF LIFE	
F.	PERSONAL INJURY	0	G.	DAMAGED	*

* Minor to escape trunk

JAG # 5354-83

V. SUMMARY

A. NARRATIVE OF EVENTS UNTIL DECLARED OUT:

1. During the testing of port motor generator an electrical explosio resulted at 1815 after the port TG bus was energized from super shore power.
2. Power was immediately secured and the small resulting fire was extinguished with CO_2 from above and below the escape trunk.
3. No further fire or damage resulted.

B. LESSONS LEARNED

1. JAGMAN: "When tagging open circuit breakers and switches, the local manual trip feature should be activated to ensure the breaker/switch is open."
2. JAGMAN: "All reasonably available electrical isolation devices should be used to de-energize equipment to be electrically isolated."

NAVY FIRE LOSS HISTORY REPORTING FORM

JAG # 5432-83 DATE 14 Aug 83

SHIP NAME USS Richard B Russell SHIP# SSN-627

LOCATION 1. AT SEA _____
2. MOORED X

Mare Island Naval Shipyard, CA

I. THE FIRE/CAUSE

Fire in the Diesel Room

A. CLASS OF FIRE A._____ B._X___ C._____ D._____

B. ALARM TRANSMITTED 1340 DECLARED OUT 1350 DURATION 10 min

C. COMPARTMENT/FRAME/DECK LOCATION OF IGNITION # E

DESCRIPTION Diesel Generator Room

D. SOURCE OF HEAT OF IGNITION

1. ELECTRICAL	_____	7. OPEN FLAME/WELDING	_____
2. EXPLOSION	_____	8. MECHANICAL FAILURE/ FRICTION	_____
3. COOKING	_____	9. SPONTAN. COMBUSTION	_____
4. ENEMY ACTION	_____	10. HEATING APPLIANCES	_____
5. HOT SURFACES	_____	11. OTHER (SPECIFY)	X Unknown
6. MATCHES/SMOKING	_____		

E. FIRST MATERIAL IGNITED (CHECK 1)(SPECIFY)

1. GAS	_____	3. EXPLOS./INCEND.	_____
2. FL./LIQ.	X-Grease	4. ORDINARY COMB.	_____

5. ARSON/SUSPICIOUS? Possible

F. ALARM SEQUENCE - METHOD OF ALERTING

1. Person discovered smoke in a bow compartment at approximatel 1340. When he looked into the diesel generator room fire wa seen. Fire was reported via ship's telephone at 1340.
2. Fire announced over 4MC emergency annunciating circuit.

JAG # 5432-83

II. FACTORS CONTRIBUTING TO SPREAD OR LOSS

A. MEANS FOR SPREAD

1. HOLE IN DECK/BULKHEAD		5. FLAMMABLE LIQUID FLOW	
2. CONDUCTION THROUGH DECK/BULKHEAD		6. WIND	
3. EXPLOSION		7. ELECTRICAL CABLES	
4. VENT DUCTS		8. OTHER (SPECIFY)	

B. MATERIALS INVOLVED IN SPREAD

1. GAS		3. EXPLOS./INCEND.	
2. FL./LIQ.	X-Grease	4. ORDINARY COMB.	

C. EQUIPMENT/MATERIAL/PERSONNEL/DESIGN

CONTRIBUTION TO CAUSE OF FIRE

1. Open can of grease was not secured properly.

SPREAD OF FIRE/FIREFIGHTING EFFECTIVENESS

WOULD EARLY WARNING HAVE MITIGATED THE LOSS?

X* YES ____ NO ____ INSUFFICIENT INFORMATION

* Delay in detecting fire.

JAG # 5432-83

III. ACTIONS/ASSISTANCE

A. EXTINGUISHING AGENTS USED

1.	WATER/FOG		5.	PROTEIN FOAM	
2.	PKP		6.	HALON	
3.	AFFF		7.	OTHER (SPECIFY)	
4.	CO_2	X			

B. SHIPS FIXED EXTINGUISHING SYSTEMS / PORTABLE EQUIPMENT

1.	SPRINKLERS		1.	EXTINGUISHERS	CO_2
2.	GASEOUS SYSTEMS		2.	PUMPS	
3.	WATER HOSELINES		3.	FOAM	
4.	PKP/AFFF		4.	OBA'S	

C. ACTIONS TO VENT?

1.	MECH. VENT DUCTS		1.	NATURAL VENTILATION	
2.	PORTABLE BLOWERS		2.	OTHER (SPECIFY)	

D. FIRE FIGHTING ORGANIZATIONS

1. SHIP'S FORCE X
2. SHORE BASED - NAVY
   MUNICIPAL
3. OTHER SHIPS

IV. THE DAMAGE

A. AREA OF FIRE/SMOKE INVOLVEMENT/# OF SPACES/LEVELS INVOLVED

Diesel Generator Room

B. DIRECT COST OF FIRE: Less than $1000

C. OPERATING DAYS LOST:

D. REPAIR MAN-HOURS:

E. LOSS OF LIFE: 0

F. PERSONAL INJURY: 0

G. DAMAGED: *

* Minor damage to console

JAG # 5432-83

V. SUMMARY

A. NARRATIVE OF EVENTS UNTIL DECLARED OUT:

1. At 1340 fire in an open grease can sitting on a workbench in diesel generator room was discovered by person passing by.
2. Alarm announced over 4MC.
3. CO_2 extinguisher used by personnel to extinguish fire. Fire did not spread beyond the grease can.
4. Cause of fire was not determined.

B. LESSONS LEARNED

1. JAGMAN: "There should be continued effort in training for fires and fire prevention."
2. JAGMAN: "Better security is needed to control access to the boat.

NAVY FIRE LOSS HISTORY REPORTING FORM

JAG # 0848-85 DATE 13 Sept 84

SHIP NAME USS Barbel SHIP# SS 580

LOCATION 1. AT SEA X
2. MOORED

Pacific Ocean

I. THE FIRE/CAUSE

Class C Fire in Propulsion Cubicle

A. CLASS OF FIRE A.____ B.____ C. X D.____

B. ALARM TRANSMITTED 2354 DECLARED OUT 2356 DURATION 2 min

C. COMPARTMENT/FRAME/DECK LOCATION OF IGNITION # E

DESCRIPTION Main Propulsion Cubicle

D. SOURCE OF HEAT OF IGNITION

1.	ELECTRICAL	X	7.	OPEN FLAME/WELDING	
2.	EXPLOSION		8.	MECHANICAL FAILURE/ FRICTION	
3.	COOKING				
4.	ENEMY ACTION		9.	SPONTAN. COMBUSTION	
5.	HOT SURFACES		10.	HEATING APPLIANCES	
6.	MATCHES/SMOKING		11.	OTHER (SPECIFY)	

E. FIRST MATERIAL IGNITED (CHECK 1)(SPECIFY)

1.	GAS		3.	EXPLOS./INCEND.	
2.	FL./LIQ.		4.	ORDINARY COMB.	

5. ARSON/SUSPICIOUS? No

F. ALARM SEQUENCE - METHOD OF ALERTING

1. At 2353 smoke was seen coming out of the aft part of the Mai Propulsion Cubicle.
2. The EWS ordered the cubicle isolated and passed the word "Fire in the Cubicle" via 7MC.

JAG # 0848-85

II. FACTORS CONTRIBUTING TO SPREAD OR LOSS

A. MEANS FOR SPREAD

1. HOLE IN DECK/BULKHEAD	_____	5. FLAMMABLE LIQUID FLOW	_____
2. CONDUCTION THROUGH DECK/BULKHEAD	_____	6. WIND	_____
3. EXPLOSION	_____	7. ELECTRICAL CABLES	_____
4. VENT DUCTS	_____	8. OTHER (SPECIFY)	_____

B. MATERIALS INVOLVED IN SPREAD

1. GAS	_____	3. EXPLOS./INCEND.	_____
2. FL./LIQ.	_____	4. ORDINARY COMB.	_____

C. EQUIPMENT/MATERIAL/PERSONNEL/DESIGN

CONTRIBUTION TO CAUSE OF FIRE

1. JAGMAN: "An area of high resistance between the incoming power line and the contactor button caused overheating and Class C fire. The nuts that secure the contactor lug to the melamine board had become loose due to vibration."
2. There are no lock washers holding the nuts to the lugs or to the melamine board which is relatively soft.

SPREAD OF FIRE/FIREFIGHTING EFFECTIVENESS

WOULD EARLY WARNING HAVE MITIGATED THE LOSS?

_____ YES __X__ NO _____ INSUFFICIENT INFORMATION

JAG # 0848-85

III. ACTIONS/ASSISTANCE

A. EXTINGUISHING AGENTS USED

1.	WATER/FOG		5.	PROTEIN FOAM	
2.	PKP		6.	HALON	
3.	AFFF		7.	OTHER (SPECIFY)	
4.	CO_2	X			

B. SHIPS FIXED EXTINGUISHING SYSTEMS

1.	SPRINKLERS	
2.	GASEOUS SYSTEMS	
3.	WATER HOSELINES	*
4.	PKP/AFFF	

PORTABLE EQUIPMENT

1.	EXTINGUISHERS	1-CO_2
2.	PUMPS	
3.	FOAM	
4.	OBA'S	

* Hose was rigged but not used.

C. ACTIONS TO VENT?

1.	MECH. VENT DUCTS		1.	NATURAL VENTILATION	
2.	PORTABLE BLOWERS		2.	OTHER (SPECIFY)	

D. FIRE FIGHTING ORGANIZATIONS

1. SHIP'S FORCE Damage Control Party
2. SHORE BASED - NAVY
   MUNICIPAL
3. OTHER SHIPS

IV. THE DAMAGE

A. AREA OF FIRE/SMOKE INVOLVEMENT/# OF SPACES/LEVELS INVOLVED

Confined to main motor field rheostat assembly.

B.	DIRECT COST OF FIRE	$2452	C.	OPERATING DAYS LOST	
D.	REPAIR MAN-HOURS		E.	LOSS OF LIFE	0
F.	PERSONAL INJURY	0	G.	DAMAGED	*

* Melamine board, wiring, buttons

JAG # 0848-85

V. SUMMARY

A. NARRATIVE OF EVENTS UNTIL DECLARED OUT:

1. At 2353 smoke was seen coming out of the aft part of the Main Propulsion Cubicle.
2. The EWS ordered the cubicle isolated and passed the word "Fire in the Cubicle" via 7MC.
3. A CO_2 portable extinguisher was discharged onto the rheostat assembly and the fire was declared out at 2356. A fire hose was rigged but was not used.
4. DC Party personnel responded within 2 minutes.

B. LESSONS LEARNED

1. JAGMAN: "Research the proper torque values that should be used on the wiring connectors. In view of the age and suspect condition of the equipment in question, submit PMS feedbacks necessary to cause increased attention to the propulsion cubicle."

NAVY FIRE LOSS HISTORY REPORTING FORM

JAG # 1028-85 DATE 14 Aug 84

SHIP NAME USS Barbel SHIP# SS 580

LOCATION 1. AT SEA X
2. MOORED

Near Ford Island, HI

I. THE FIRE/CAUSE

Class C Fire in Main Propulsion Cubicle

A. CLASS OF FIRE A.____ B.____ C. X D.____

B. ALARM TRANSMITTED 0707 DECLARED OUT 0715 DURATION 8 min

C. COMPARTMENT/FRAME/DECK LOCATION OF IGNITION # E

DESCRIPTION Main Propulsion Cubicle

D. SOURCE OF HEAT OF IGNITION

1.	ELECTRICAL	X	7.	OPEN FLAME/WELDING	
2.	EXPLOSION		8.	MECHANICAL FAILURE/ FRICTION	
3.	COOKING		9.	SPONTAN. COMBUSTION	
4.	ENEMY ACTION		10.	HEATING APPLIANCES	
5.	HOT SURFACES		11.	OTHER (SPECIFY)	
6.	MATCHES/SMOKING				

E. FIRST MATERIAL IGNITED (CHECK 1)(SPECIFY)

1.	GAS		3.	EXPLOS./INCEND.	
2.	FL./LIQ.		4.	ORDINARY COMB.	

5. ARSON/SUSPICIOUS? No

F. ALARM SEQUENCE - METHOD OF ALERTING

1. At 0705 person sighted smoke coming from the Stern Room.
2. At approximately 0707 "Fire in the Cubicle" was passed to Control via 7MC.
3. Fire party not called out.

JAG # 1028-85

II. FACTORS CONTRIBUTING TO SPREAD OR LOSS

A. MEANS FOR SPREAD

1. HOLE IN DECK/BULKHEAD	_____	5. FLAMMABLE LIQUID FLOW	_____
2. CONDUCTION THROUGH DECK/BULKHEAD	_____	6. WIND	_____
3. EXPLOSION	_____	7. ELECTRICAL CABLES	_____
4. VENT DUCTS	_____	8. OTHER (SPECIFY)	_____

B. MATERIALS INVOLVED IN SPREAD

1. GAS	_____	3. EXPLOS./INCEND.	_____
2. FL./LIQ.	_____	4. ORDINARY COMB.	_____

C. EQUIPMENT/MATERIAL/PERSONNEL/DESIGN

CONTRIBUTION TO CAUSE OF FIRE

1. The cause of the electrical failure was felt to be due to a slight misalignment in the contactors on the Load Bearing Rheostat.

SPREAD OF FIRE/FIREFIGHTING EFFECTIVENESS

1. Fire self-extinguished when the cubicle was electrically isolated.

WOULD EARLY WARNING HAVE MITIGATED THE LOSS?

_____ YES __X__ NO _____ INSUFFICIENT INFORMATION

JAG # 1028-85

III. ACTIONS/ASSISTANCE

A. EXTINGUISHING AGENTS USED None

1. WATER/FOG		5. PROTEIN FOAM	
2. PKP		6. HALON	
3. AFFF		7. OTHER (SPECIFY)	
4. CO_2			

B. SHIPS FIXED EXTINGUISHING SYSTEMS / PORTABLE EQUIPMENT

1. SPRINKLERS		1. EXTINGUISHERS	
2. GASEOUS SYSTEMS		2. PUMPS	
3. WATER HOSELINES		3. FOAM	
4. PKP/AFFF		4. OBA'S	

C. ACTIONS TO VENT?

1. MECH. VENT DUCTS		1. NATURAL VENTILATION	
2. PORTABLE BLOWERS		2. OTHER (SPECIFY)	

D. FIRE FIGHTING ORGANIZATIONS

1. SHIP'S FORCE
2. SHORE BASED - NAVY
   MUNICIPAL
3. OTHER SHIPS

IV. THE DAMAGE

A. AREA OF FIRE/SMOKE INVOLVEMENT/# OF SPACES/LEVELS INVOLVED

Damage confined to a Load Balancing Rheostat.

B. DIRECT COST OF FIRE	$305.98	C. OPERATING DAYS LOST	
D. REPAIR MAN-HOURS		E. LOSS OF LIFE	0
F. PERSONAL INJURY	0	G. DAMAGED	*

* Electrical contactors within Rheostat

JAG # 1028-85

V. SUMMARY

A. NARRATIVE OF EVENTS UNTIL DECLARED OUT:

1. At 0705 person sighted smoke coming from the Stern Room. As person went to investigate the EWS reported loss of Main Motor Fields and immediately rang up all stop and tripped the main motors off the line.
2. At 0707 the Stern Room phone talker saw a blue flash from the bac of the cubicle. Control was notified of the fire via 7MC.
3. The cubicle was completely isolated and it was determined that there was no fire in progress. No further fire fighting action was required.
4. Secured from fire at 0715 and reflash watch posted.

B. *LESSONS LEARNED*

1. JAGMAN: "A PMS feedback report for MIP C9 4HLU N MRC EL-17/R-1 should be submitted adding two additional parts to step 1g. to read:
   (4) Check tightness of rheostat buttons to board
   (5) Check that all rheostat buttons heights are equal."
2. Commander Submarine Squadron ONE: "CO USS BARBEL is directed to review the MRC for adequacy and clarity and to submit a PMS feedback report."

NAVY FIRE LOSS HISTORY REPORTING FORM

JAG # 3360-87 DATE 24 Apr 86

SHIP NAME USS San Juan SHIP# SSN 751

LOCATION 1. AT SEA _____
2. MOORED X

Under construction at Electric Boat, Groton CT (36% complete)

I. THE FIRE/CAUSE

Fire in Battery Well

A. CLASS OF FIRE A. X B. _____ C. X D. _____

B. ALARM TRANSMITTED 0435 DECLARED OUT Unknown DURATION Unknown

C. COMPARTMENT/FRAME/DECK LOCATION OF IGNITION # _____

DESCRIPTION Battery Well below FWD Torpedo Room

D. SOURCE OF HEAT OF IGNITION

1.	ELECTRICAL	*	7.	OPENFLAME/WELDING	*
2.	EXPLOSION		8.	MECHANICAL FAILURE/ FRICTION	
3.	COOKING		9.	SPONTAN. COMBUSTION	
4.	ENEMY ACTION		10.	HEATING APPLIANCES	
5.	HOT SURFACES		11.	OTHER (SPECIFY)	Unknown
6.	MATCHES/SMOKING				

* Possible

E. FIRST MATERIAL IGNITED (CHECK 1)(SPECIFY)

1.	GAS		3.	EXPLOS./INCEND.	
2.	FL./LIQ.		4.	ORDINARY COMB.	Pitch

5. ARSON/SUSPICIOUS? No

F. ALARM SEQUENCE - METHOD OF ALERTING

1. At approximately 0435 the Electric Boat Division Fire Department responded to an alarm in the forward section of SSN 751.

JAG # 3360-87

II. FACTORS CONTRIBUTING TO SPREAD OR LOSS

A. MEANS FOR SPREAD

1.	HOLE IN DECK/BULKHEAD	5.	FLAMMABLE LIQUID FLOW
2.	CONDUCTION THROUGH DECK/BULKHEAD	6.	WIND
3.	EXPLOSION	7.	ELECTRICAL CABLES
4.	VENT DUCTS	8.	OTHER (SPECIFY)

B. MATERIALS INVOLVED IN SPREAD

1.	GAS	3.	EXPLOS./INCEND.
2.	FL./LIQ.	4.	ORDINARY COMB. X

C. EQUIPMENT/MATERIAL/PERSONNEL/DESIGN

CONTRIBUTION TO CAUSE OF FIRE

1. Two most probable causes were, a short in a vacuum cleaner electrical cord or hot welding slag from carbon arc back gouging operations.
2. Fire watches (civilian) were not attentive during welding/gouging operations.

SPREAD OF FIRE/FIREFIGHTING EFFECTIVENESS

1. No details given.

WOULD EARLY WARNING HAVE MITIGATED THE LOSS?

_____ YES _____ NO __X__ INSUFFICIENT INFORMATION

JAG # 3360-87

III. ACTIONS/ASSISTANCE

A. EXTINGUISHING AGENTS USED

1. WATER/FOG	_____	5. PROTEIN FOAM	_____
2. PKP	_____	6. HALON	_____
3. AFFF	_____	7. OTHER (SPECIFY)	
4. CO_2	_____	Jet X - High Expansion Foam	

B. SHIPS FIXED EXTINGUISHING SYSTEMS / PORTABLE EQUIPMENT

1. SPRINKLERS	_____	1. EXTINGUISHERS	_____
2. GASEOUS SYSTEMS	_____	2. PUMPS	_____
3. WATER HOSELINES	X	3. FOAM	_____
4. PKP/AFFF	_____	4. OBA'S	_____

C. ACTIONS TO VENT?

1. MECH. VENT DUCTS	_____	1. NATURAL VENTILATION	_____
2. PORTABLE BLOWERS	_____	2. OTHER (SPECIFY)	_____

D. FIRE FIGHTING ORGANIZATIONS

1. SHIP'S FORCE No (Boat not commissioned)
2. SHORE BASED - NAVY _____
   MUNICIPAL Electric Boat Fire Department
3. OTHER SHIPS _____

IV. THE DAMAGE

A. AREA OF FIRE/SMOKE INVOLVEMENT/# OF SPACES/LEVELS INVOLVED

Confined to Battery Well below Forward Torpedo Room

B. DIRECT COST OF FIRE	Unknown	C. OPERATING DAYS LOST	_____
D. REPAIR MAN-HOURS	_____	E. LOSS OF LIFE	_____
F. PERSONAL INJURY	0	G. DAMAGED	*

* 5 battery cells were partially charred or burned, overhead lighting and cabling

JAG # 3360-87

V. SUMMARY

A. NARRATIVE OF EVENTS UNTIL DECLARED OUT:

1. At approximately 0435 the Electric Boat Division Fire Department responded to an alarm in the forward section of SSN 751.
2. Fire Department extinguished the fire by filling the Battery Well with high expansion foam.

B. LESSONS LEARNED

1. JAGMAN: "The Shipyard Safety Department should inspect battery compartments on ships with battery cells installed."
2. JAGMAN: "The shipyard/contractor should be audited for compliance with safety practices."

SUBMARINES

APPENDIX

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER	2534-81	5354-83	5432-83	0848-85	1028-85	3360-87
YEAR						
HULL NUMBER	SSBN 641	SSBN 656	SSN 627	SS580	SS580	SSN 751
YEAR OF INCIDENT	80	83	83	84	84	86
LOCATION — AT SEA		X		X	X	
LOCATION — IN PORT	N	N	N			*
CLASSES OF FIRE — A	X					X
CLASSES OF FIRE — B			X			
CLASSES OF FIRE — C		X		X	X	X
CLASSES OF FIRE — D						
EXPLOSIONS — BOILER						
EXPLOSIONS — ORDNANCE						
DELAY IN — ALARM	X		X			
DELAY IN — RESPONSE						
SPRRAD BEYOND COMPARTMENT OF ORIGIN — FIRE						
SPRRAD BEYOND COMPARTMENT OF ORIGIN — SMOKE						
SUSPICIOUS/ARSON	X		X			
MEANS FOR SPREAD						
FIRE FIGHTING DEFICIENCIES	X					
OBA PROBLEMS	X					
EXTINGUISHING AGENTS — H_2O	X					X
EXTINGUISHING AGENTS — PKP	X					
EXTINGUISHING AGENTS — AFFF						
EXTINGUISHING AGENTS — CO_2	X	X	X	X		
EXTINGUISHING AGENTS — P. FOAM						
FIXED SUPPRESSION USED	3					3
VENTING USED	X					
VENTING NEEDED						
FIRE FIGHTING ORGANIZATIONS — SHIPS FORCE	X	X	X	X	X	
FIRE FIGHTING ORGANIZATIONS — SHORE NAVY	X					
FIRE FIGHTING ORGANIZATIONS — MUNICIPAL						X
FIRE FIGHTING ORGANIZATIONS — OTHER SHIPS						
LOSS, $500,000						
LIFE LOSS	0	0	0	0	0	0
NO. INJURIES	8	0	0	0	0	0
HEAT OF IGNITION	6	1	11	1	1	1

* Under construction, 36% complete

APPENDIX D

STANDARD REPORT FORM

REPORT FORM TERMINOLOGY

A blank Summary Report form is shown on pages D-8 through D-11. The following list explains the terms used in the JAG Summary Report in the order they appear on the form. Appendix G contains definitions of many of the technical terms used here and elsewhere.

I. THE FIRE/CAUSE: A brief description of the incident is given.

A. CLASS OF FIRE. With few exceptions at least one class of fire was noted. Frequently, there were multiple classes of fires. Where this was the case, footnotes were used to indicate the initial fire class.

B. ALARM TRANSMITTED, DECLARED OUT, DURATION. In most cases, the time of alarm transmission was the time that the fire alarm was sounded from the bridge or the quarterdeck. Where there was a reflash, the time of reflash was noted.

C. COMPARTMENT/ETC. Where provided, the compartment of fire origin was given, by both compartment number, deck and frame location (where available) and by compartment description. Where it was not given or known, the compartment type was designated by the appropriate letter as given in Appendix G.

D. SOURCE OF HEAT OF IGNITION. The source of the heat of ignition was indicated as determined from the JAG report.

E. FIRST MATERIAL IGNITED.
E1 through E4 - Appropriate item was checked and a description was given.
E5 - Where either the JAG "Findings-of-Fact" or "Opinions" determined "arson" to be likely, or where the JAG Report recorded arson as possible this category was checked.

F. ALARM SEQUENCE. This was provided in narrative form because the description of the alarm sequence was not always reported on in the "Findings-of-Fact" or "Opinions". Frequently, the "alarm sequence" was found in testimony in enclosures, or pieced together from deck or engineering logs. This narrative usually began with a description of how the fire was first discovered, and continued with the alerting of ship's forces and other,

outside assistance. Detection by human observation or by automatic systems was noted.

II. FACTORS CONTRIBUTING TO SPREAD OR LOSS

A. MEANS FOR SPREAD. One or more of these categories was normally checked when the fire or smoke was not confined to the compartment of origin. A differentiation was made where possible between fire spread and smoke spread. This category was also checked when there was fire spread between major pieces of machinery or equipment within the same space.

B. MATERIALS INVOLVED IN SPREAD. Used to indicate the means by which fire spread within or beyond the compartment of origin.

C. EQUIPMENT/MATERIAL/PERSONNEL/DESIGN

CONTRIBUTION TO CAUSE OF FIRE. The various factors which contributed to the incident were outlined. Sequence in listing was not meant to indicate order of importance.

SPREAD OF FIRE/FIRE FIGHTING EFFECTIVENESS. The various factors contributing to spread of fire, or inadequacies in fire fighting were noted in outline fashion. Order of appearance in the list is not indicative of order of importance. Included in this category were factors that led to damage or loss. For example, if a door was locked which inhibited fire party entry or prevented a person's safe escape, it was noted.

WOULD EARLY WARNING HAVE MITIGATED THE LOSS? When the loss was significant and there was a delay in discovering the fire "Yes" was checked. If the loss was insignificant "yes" was checked but a footnote was used to indicate the stipulation. If a detection system was in place "Yes" was checked and footnotes were used to clarify and describe. In all other cases "No" or "Insufficient Information" was indicated. If the space was occupied at the time of ignition, "No" was indicated.

III. ACTIONS/ASSISTANCE

A. EXTINGUISHING AGENTS USED. One or more categories were checked off to indicate what agents were utilized.

B. SHIPS FIXED EXTINGUISHING SYSTEMS. One or more categories were checked off. "Fixed" extinguishing equipment could be either manually or automatically actuated.

C. ACTIONS TO VENT. This category identified any means of active fire ventilation as well as any inadvertent actions that led to diffusion or dilution of combustion products, or otherwise led to exhausting smoke from affected areas, either during or after the fire.

D. FIRE FIGHTING ORGANIZATIONS. Indicates forces used to fight the fire. Private shipyard fire departments were entered as shore based municipal force.

IV. THE DAMAGE

A. THE AREA OF FIRE/SMOKE INVOLVEMENT/NUMBER OF SPACES/LEVEL INVOLVED. Indicates areas of the ship where damage occurred.

B. DIRECT COST OF FIRE. Generally the dollar loss value entered here was an estimate of repair costs taken directly from the JAG "Findings-of-Fact." These figures were sometimes later revised upwards or downwards in endorsements. The most recent figures were used. There was little consistency in how the dollar loss was reported. Some investigators included the cost of damage control and fire fighting equipment used, some included cost of shipyard and Ship's Force labor; some included only structural contents, or equipment damage. Actual repair or replacement costs were rarely given.

C. OPERATING DAYS LOST. This category was rarely filled out because it was generally not known or reported. Frequently, the investigation was completed before operating days lost were known.

D. REPAIR MAN-HOURS (DAYS). When the information was provided this category was filled out.

E. LOSS OF LIFE. The loss of life figures were taken directly from the JAG "Findings-of-Fact."

F. PERSONNEL INJURY. Frequently, the number injured identified were only those injuries requiring hospitalization for more than 24 hours. There was no consistency in the basis for injuries reported.

G. DAMAGE. Specific comments on "items" damaged were added here to supplement the discussion in item "A" above.

V. SUMMARY

A. NARRATIVE OF EVENTS UNTIL DECLARED OUT. A narrative description of the incident which was provided by the JAG "Findings-of-Fact" and enclosures. The level of detail varies greatly depending on the quality of the investigation.

B. LESSONS LEARNED. Recommendations and lessons learned as put forth by the investigating and endorsing officers are provided. All sources of information were indicated. HAI sources indicate the engineering judgement of Hughes Associates, Inc.

NAVY FIRE LOSS HISTORY REPORTING FORM

JAG # _____ DATE _____

SHIP NAME USS _____ SHIP# _____

LOCATION 1. AT SEA _____
2. MOORED _____

I. THE FIRE/CAUSE

A. CLASS OF FIRE A._____ B._____ C._____ D._____

B. ALARM TRANSMITTED _____ DECLARED OUT _____ DURATION _____

C. COMPARTMENT/FRAME/DECK LOCATION OF IGNITION # _____

DESCRIPTION _____

D. SOURCE OF HEAT OF IGNITION

1. ELECTRICAL	_____	7. OPEN FLAME/WELDING	_____
2. EXPLOSION	_____	8. MECHANICAL FAILURE/ FRICTION	_____
3. COOKING	_____	9. SPONTAN. COMBUSTION	_____
4. ENEMY ACTION	_____	10. HEATING APPLIANCES	_____
5. HOT SURFACES	_____	11. OTHER (SPECIFY)	_____
6. MATCHES/SMOKING	_____		

E. FIRST MATERIAL IGNITED (CHECK 1)(SPECIFY)

1. GAS	_____	3. EXPLOS./INCEND.	_____
2. FL./LIQ.	_____	4. ORDINARY COMB.	_____

5. ARSON/SUSPICIOUS? _____

F. ALARM SEQUENCE - METHOD OF ALERTING

JAG # _____

II. FACTORS CONTRIBUTING TO SPREAD OR LOSS

A. MEANS FOR SPREAD

1.	HOLE IN DECK/BULKHEAD _____	5.	FLAMMABLE LIQUID FLOW _____
2.	CONDUCTION THROUGH DECK/BULKHEAD _____	6.	WIND _____
3.	EXPLOSION _____	7.	ELECTRICAL CABLES _____
4.	VENT DUCTS _____	8.	OTHER (SPECIFY) _____

B. MATERIALS INVOLVED IN SPREAD

1.	GAS _____	3.	EXPLOS./INCEND. _____
2.	FL./LIQ. _____	4.	ORDINARY COMB. _____

C. EQUIPMENT/MATERIAL/PERSONNEL/DESIGN

CONTRIBUTION TO CAUSE OF FIRE

SPREAD OF FIRE/FIREFIGHTING EFFECTIVENESS

WOULD EARLY WARNING HAVE MITIGATED THE LOSS?

_____ YES _____ NO _____ INSUFFICIENT INFORMATION

JAG # _____

III. ACTIONS/ASSISTANCE

A. EXTINGUISHING AGENTS USED

1.	WATER/FOG	_____	5.	PROTEIN FOAM	_____
2.	PKP	_____	6.	HALON	_____
3.	AFFF	_____	7.	OTHER (SPECIFY)	
4.	CO_2	_____		_____	

B. SHIPS FIXED EXTINGUISHING SYSTEMS

			PORTABLE EQUIPMENT		
1.	SPRINKLERS	_____	1.	EXTINGUISHERS	_____
2.	GASEOUS SYSTEMS	_____	2.	PUMPS	_____
3.	WATER HOSELINES	_____	3.	FOAM	_____
4.	PKP/AFFF	_____	4.	OBA'S	_____

C. ACTIONS TO VENT?

1.	MECH. VENT DUCTS	_____	1.	NATURAL VENTILATION	_____
2.	PORTABLE BLOWERS	_____	2.	OTHER (SPECIFY)	_____

D. FIRE FIGHTING ORGANIZATIONS

1. SHIP'S FORCE _____
2. SHORE BASED - NAVY _____
   MUNICIPAL _____
3. OTHER SHIPS _____

IV. THE DAMAGE

A. AREA OF FIRE/SMOKE INVOLVEMENT/# OF SPACES/LEVELS INVOLVED

B.	DIRECT COST OF FIRE	_____	C.	OPERATING DAYS LOST	_____
D.	REPAIR MAN-HOURS	_____	E.	LOSS OF LIFE	_____
F.	PERSONAL INJURY	_____	G.	DAMAGED	_____

JAG # _____

V. SUMMARY

A. NARRATIVE OF EVENTS UNTIL DECLARED OUT:

B. LESSONS LEARNED

APPENDIX E

CROSS-REFERENCE MATRIX OF JAG REPORTS

CROSS-REFERENCE MATRIX OF JAG REPORTS

In order to quickly identify JAG incident report forms that are of interest with respect to a particular category or subject, a cross-reference matrix was developed and is included. An explanation of the terms and rationale used to compile the matrix is given below.

1. Indexing System - The JAG reports were listed in order of increasing JAG numbers, which were listed first by the year in which the JAG investigation was completed, and secondly by the four or five digit number assigned to the JAG report for a particular calendar year. The JAG report number is important because it is the means by which JAG reports can be ordered.

2. Hull Number - The ship type and hull number were listed.

3. Year of the Incident - Generally, the JAG investigation was completed within the same calendar year as the fire incident, or in the next year. There were some cases where the investigation/endorsement process took longer.

4. Location - With few exceptions, the location of the ship at the time of the fire was noted. A "P" for inport means moored at a private shipyard, and an "N" means moored at a Navy facility. Where the specific inport location was not stated, an "X" was entered under "Inport". At-sea was applicable when the ship was steaming under its own power at the time of the incident.

5. Classes of Fire - One or more categories of fire were noted as taken from the JAG reporting form.

6. Explosions/Boiler/Ordinance - Where these incidents were reported on the JAG reporting form they were so noted.

7. Delay in Alarm/Response - Where there was any delay in fire discovery or reporting to the OOD or to the fire department, "DELAY IN ALARM" was checked. Where there was any delay in fire party response once the fire was discovered and the OOD was notified, such as the inability to pinpoint the location of fire, it was so noted.

8. Heat of Ignition - The numbers on the JAG Reporting Form appropriate to this category were entered

directly into the Matrix. For example, a "6" meant the fire was due to matches or smoking.

9. Spread Beyond Compartment of Origin/Fire/Smoke - Where fire or smoke were indicated to spread beyond the compartment of origin on the JAG Reporting Form, an "X" was entered in the appropriate column.

10. Suspicious/Arson - If arson was deduced as definite, probable or possible by the JAG report or by endorsements, this category was checked. If a fire was of undetermined origin, but where the foregoing was not indicated in the JAG report, this category was not checked.

11. Means for Spread - The number on the JAG Reporting Form appropriate to this category was entered directly onto the matrix. For example, a "2" means conduction through a deck or bulkhead.

12. Fire Fighting Deficiencies - When fire fighting personnel experienced problems with equipment, organization, command etc., it was indicated here. However, note that:

    (a) Problems with OBA's are not included under this column, and

    (b) Problems in delay in detection and alarm were not included under this column. They are addressed separately under other columns.

13. OBA Problems - Where OBA problems were noted either due to inadequate numbers of OBAs, equipment failure, or training, this box was checked with an "X".

14. Extinguishing Agents - One or more extinguishing agents were checked with an "X" as identified on the JAG Reporting Form.

15. Fixed Suppression Used - Included in this category are any fixed total flooding suppression system activations such as magazine sprinklers, or CO_2 total flooding, whether manually or automatically activated.

16. Venting Used - Where any active means of venting, exhausting or diluting fire gases/smoke was used, either during or after the fire, an "X" was entered here.

17. Venting Needed - Where there was indication in the "Lessons Learned" from either the JAG report or from the opinion of Hughes Associates that more rapid or additional ventilation was needed, an "X" was entered in this column.

18. Fire Fighting Organizations - An "X" was entered in the appropriate category.

19. Direct Cost of Fire - Where the dollar loss was indicated at over $500,000, an "X" was entered here.

20. Life Loss - The total number of persons reported killed was entered here.

21. No Injured - The total number of persons reported as injured was entered here.

In summary, an "X" entered in a column means either "used", or "yes". A question mark ("?") or no entry means either "not used", "no" or that information was not provided.

1979

APPENDIX C

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER	2825-79	3840-79	6460-79																	
YEAR																				
HULL NUMBER	CV60	CV67	CV69																	
YEAR OF INCIDENT	79	79	79																	
LOCATION	AT SEA	X	X	X																
	IN PORT		N																	
CLASSES OF FIRE	A	-	X	X																
	B	Sprinkler Arrivation - No Fire																		
	C																			
	D																			
EXPLOSIONS	BOILER																			
	ORDNANCE																			
DELAY IN	ALARM			X																
	RESPONSE																			
HEAT OF IGNITION			6	6																
SPREAD BEYOND COMPARTMENT OF ORIGIN	FIRE			X																
	SMOKE																			
SUSPICIOUS/ARSON			X																	
MEANS FOR SPREAD				1																
FIRE FIGHTING DEFICIENCIES																				
OBA PROBLEMS																				
EXTINGUISHING AGENTS	H_2O		X	X																
	PKP		X																	
	AFFF		X																	
	CO_2		X																	
	P. FOAM																			
FIXED SUPPRESSION USED	1	1,3	3																	
VENTING USED		X																		
VENTING NEEDED																				
FIRE FIGHTING ORGANIZATIONS	SHIPS FORCE		X	X																
	SHORE NAVY		X																	
	MUNICIPAL																			
	OTHER SHIPS																			
LOSS, $500,000		X	X	X																
LIFE LOSS		0	1	0																
NO. INJURIES		0	41	0																

1980-A

APPENDIX C

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER	424-80	438-80	626-80	920-80	993-80	1542-80	1831-80	2165-30	2319-80	3295-80	3483-80	4162-80	4294-80	4389-80 5028-80
YEAR														
HULL NUMBER	LPD11	AD26	DDG17	LPA248	DD940	CV62	AOR4	FF1041	DD951	LSD36	AFS4	FF1062	DD933	TAO147
YEAR OF INCIDENT	79	79	78	79	79	79	79	79	79	79	79	80	80	80
LOCATION — AT SEA				X					X					
LOCATION — IN PORT	N	P	N		N	X	X	P		N	N	N	P	P
CLASSES OF FIRE — A		X	X	X		X	X	X	X	X			X	
CLASSES OF FIRE — B					X							X		X
CLASSES OF FIRE — C	X					X					X			
CLASSES OF FIRE — D														
EXPLOSIONS — BOILER														
EXPLOSIONS — ORDNANCE														
DELAY IN — ALARM		X				X	X		X	X			X	
DELAY IN — RESPONSE							X	X						
HEAT OF IGNITION	1	6	6	6	11	1	6	11	7	6	1	2	11	7
SPRRAD BEYOND COMPARTMENT OF ORIGIN — FIRE					X				X		X	X		
SPRRAD BEYOND COMPARTMENT OF ORIGIN — SMOKE								X						
SUSPICIOUS/ARSON			X	X			X			X				
MEANS FOR SPREAD					2.5				1		2	3		
FIRE FIGHTING DEFICIENCIES		X		X	X	X		X	X			X		
OBA PROBLEMS		X			X									
VENTING USED		X	X		X	X							3	
VENTING NEEDED														
FIXED SUPPRESSION USED		2.3	3	3	3	3	3	3	3	3	3	4	3	3
EXTINGUISHING AGENTS — H_2O	X	X	X	X	X		X	X	X	X	X		X	X
EXTINGUISHING AGENTS — PKP	X											X		
EXTINGUISHING AGENTS — AFFF					X	X				X		X		
EXTINGUISHING AGENTS — CO_2	X					X			X	X	X			
EXTINGUISHING AGENTS — P. FOAM														
LIFE LOSS	0	0	0	0	1	0	0	0	0	0	0	0	0	0
NO. INJURIES	0	0	0	2	6	0	0	0	0	0	2	0	0	3
LOSS, $500,000					X							X		
FIRE FIGHTING ORGANIZATIONS — SHIPS FORCE	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FIRE FIGHTING ORGANIZATIONS — SHORE NAVY			X		X		X		X	X				
FIRE FIGHTING ORGANIZATIONS — MUNICIPAL	X							X						X
FIRE FIGHTING ORGANIZATIONS — OTHER SHIPS		X			X									

1980-B

APPENDIX C

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER / YEAR		4910-80	5360-80	5364-80	5381-80	5437-80	NAVFAC 4382-80									
HULL NUMBER		FF1038	LPH2	CG32	CV62	FF1045	LPH2									
YEAR OF INCIDENT		79	80	80	80	80	79									
LOCATION	AT SEA				X	X										
	IN PORT	N	N				N									
CLASSES OF FIRE	A	X	X		X		X									
	B					X										
	C															
	D															
EXPLOSIONS	BOILER			X												
	ORDNANCE															
DELAY IN	ALARM			-												
	RESPONSE			No Fire -												
HEAT OF IGNITION		5	6		5	5	6									
SPREAD BEYOND COMPARTMENT OF ORIGIN	FIRE	X					X									
	SMOKE		X				X									
SUSPICIOUS/ARSON							X									
MEANS FOR SPREAD		2	8				1,2,4,7									
FIRE FIGHTING DEFICIENCIES		X	X		X		X									
OBA PROBLEMS																
EXTINGUISHING AGENTS	H_2O	X	X		X	X	X									
	PKP															
	AFFF					X										
	CO_2															
	P. FOAM															
FIXED SUPPRESSION USED		3	3		3	3	3									
VENTING USED		X	X			X	X									
VENTING NEEDED																
FIRE FIGHTING ORGANIZATIONS	SHIPS FORCE	X	X		X	X	X									
	SHORE NAVY		X				X									
	MUNICIPAL	X														
	OTHER SHIPS						X									
LOSS, $500,000							X									
LIFE LOSS		1	0	0	0	0	0									
NO. INJURIES		0	0	0	0	0	0									

1981-A

APPENDIX C

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION	CLASSES OF FIRE				EXPLOSIONS		DELAY IN		HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN		SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS				FIXED SUPPRESSION USED	VENTING USED	VENTING-NEEDED	FIRE FIGHTING ORGANIZATIONS				LOSS, $500,000	LIFE LOSS	NO. INJURIES
			AT SEA	A	B	C	D	BOILER	ORDNANCE	ALARM	RESPONSE		SMOKE	FIRE					PKP	AFFF	CO_2	P. FOAM				SHIPS FORCE	SHORE NAVY	MUNICIPAL	OTHER SHIPS			
883-81	CGN36	79	X	X							X	6			X		X			X		3	X		X					0	0
1025-81	CV60	79		X	X							11					X					3			X					0	X
1139-81	CG30	80	X		X							3					X		X			3	X		X					0	X
2595-81	DDG41	80		X								7	X			1	X	X	X			3	X		X	X				0	0
NAVEAC 2649-81	DD963	80	N	X								7		X		1	X	X	X			3	X		X	X				1	5
2858-81	YFNB17	81	N	X								11			X				X			3	X		X					0	X
3563-81	AE25	80			X			X		-	No Fire -																				
3575-81	LPH3	80	N	X							X	6	X			2	X		X			1.3	X		X	X				0	0
4009-81		80	P							-	No Fire -																				
4042-81	DDG34	80							X	-	No Fire -																			0	0
4609-81	FFG7	81	N							-	No Fire -											1								0	0
4745-81	LPH3	81		X	X							11			X		X		X			1	X		X					0	0
4940-81	AS36	81			X							5									X				X					0	X
5131-81	CVN68	80	N	X								7							X			3			X					0	0

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CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

APPENDIX C

JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION	CLASSES OF FIRE				EXPLOSIONS		DELAY IN		HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN		SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS				FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS				LOSS, $500,000	LIFE LOSS	NO. INJURIES
			AT SEA	D	C	B	A	ORDNANCE	BOILER	RESPONSE	ALARM		SMOKE	FIRE					P. FOAM	CO_2	AFFF	PKP				OTHER SHIPS	MUNICIPAL	SHORE NAVY	SHIPS FORCE			
5322-81	DDG39	81	X							-		No Fire -								X			1					X			0 0
5366-81	FF1070	81						X		-		No Fire -				8												X		0	0 0
5375-81	AD38	80	X				X					11	X		X		X			X		X	3	X					X		0 0
NAVFAC 5712-81	CVN65	81	N				X				X	9					X				X	X	3					X		0	0
6704-81	DD975	81								-	-	No Fire -																			
6728-81	AOR3	81							X	-		No Fire -																			
6816-81	DD951	81	N							-		No Fire -																			
6868-81	FF1081	81	P				X					7	X			1				X			3	X				X		0	0
5375-81	AD38	80	X				X					11			X					X			3					X		0	0
6174-81	LPH9	31				X	X		X			11	X			5	X			X	X	X	1 3 4					X	X	4	12

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CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

APPENDIX C

JAG NUMBER / YEAR

HULL NUMBER	YEAR OF INCIDENT	LOCATION: IN PORT	LOCATION: AT SEA	CLASSES OF FIRE: A	CLASSES OF FIRE: B	CLASSES OF FIRE: C	CLASSES OF FIRE: D	BOILER	ORDNANCE	EXPLOSIONS	DELAY IN: ALARM	DELAY IN: RESPONSE	HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN: FIRE	SPREAD BEYOND COMPARTMENT OF ORIGIN: SMOKE	SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS: H_2O	EXTINGUISHING AGENTS: PKP	EXTINGUISHING AGENTS: AFFF	EXTINGUISHING AGENTS: CO_2	EXTINGUISHING AGENTS: P. FOAM	FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS: SHIPS FORCE	FIRE FIGHTING ORGANIZATIONS: SHORE NAVY	FIRE FIGHTING ORGANIZATIONS: MUNICIPAL	FIRE FIGHTING ORGANIZATIONS: OTHER SHIPS	LOSS, $500,000	LIFE LOSS	NO. INJURIES
064-82	LPH9	81	N		X											X		X		X					3	X		X	X				0	1
0142-82	CV62	81		X		X					X		5	X			2,5	X		X		X	X		3	X		X				X	0	4
366-82	FFG1	81									-	No	Fire	-																			0	0
0374-82	FF1051	81	N				X											X					X							X			0	2
0623-82	LST1190	81	N		X								7	X			2	X		X					3			X					0	0
756-82	FF1076	31	N		X						X		1										X					X		X	X		0	0
923-82	FF1077	31	N		X	X							7	X			2,4		X	X					3			X	X		X		0	0
946-82	CV66	81		X	X						X		5,9	X	X		2,4,7			X					3		X	X					0	0
1464-82	AOR4	81	P		X								7					X		X	X		X		2,3			X		X			0	4
1476-82	AE23	81		X	X	X							11	X	X		2,7	X		X		X	X		3,4	X		X				X	0	6
1569-82	AE25	81		X	X								6,11							X					3			X					0	0
1907-82	AOR2	81									-	No	Fire	-																			0	3
2345-82	FF68	82	N		X						X		11			X				X					3			X	X				0	0
2564-82	FFG11	82	N				X						1					X					X			X		X				X	0	0

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CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER YEAR		2584-82	2657-82	3234-82	3595-82	3610-82	3809-82	3962-82	4046-82	4067-82	4381-82	4427-82	4991-82	5368-82	5662-82
HULL NUMBER		LPH12	YTB766	FF1043	LSD38	CVN68	LPH9	C634	FFG82	LPH19	LPD10	CV43	AFS6	DDG32	CG22
YEAR OF INCIDENT		81		82	81	82	82		82	82	82	82	82	80	82
NO. INJURIES					0	0	0		0	0	3	0	0	0	
LIFE LOSS					0	0	0		0	0	0	0	0	0	
LOSS, $500,000															
FIRE FIGHTING ORGANIZATIONS	OTHER SHIPS									X					
	MUNICIPAL						X				X				
	SHORE NAVY								X	X					
	SHIPS FORCE				X	X	X		X	X	X	X		X	
VENTING NEEDED												X			
VENTING USED							X				X			X	
FIXED SUPPRESSION USED					2	3	3		3	3		3	1		
EXTINGUISHING AGENTS	P. FOAM														
	CO_2				X	X			X					X	
	AFFF														
	PKP														
	H_2O					X	X		X	X		X	X		
OBA PROBLEMS															
FIRE FIGHTING DEFICIENCIES					X					X					
MEANS FOR SPREAD						4				4		1,4			
SUSPICIOUS/ARSON										X					
SPREAD BEYOND COMPARTMENT OF ORIGIN	SMOKE					X					No Fire	X			
	FIRE												No Fire -		
HEAT OF IGNITION		- No Fire -	- No Fire -	- No Fire -	1	6	1,6	- No Fire -	6	11	7	7		7	- No Fire -
DELAY IN	RESPONSE				X								- Sprinkler Activation -		
	ALARM					X			X	X		X		X	
EXPLOSIONS	ORDNANCE														
	BOILER	X													X
CLASSES OF FIRE	D										- Explosion				
	C				X	X									
	B														
	A					X	X		X	X		X		X	
LOCATION	AT SEA		X			X							X		X
	IN PORT	X			N		X		N	N	N	N		N	

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APPENDIX C

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION: IN PORT	LOCATION: AT SEA	CLASSES OF FIRE: A	CLASSES OF FIRE: B	CLASSES OF FIRE: C	CLASSES OF FIRE: D	EXPLOSIONS: BOILER	EXPLOSIONS: ORDNANCE	DELAY IN: ALARM	DELAY IN: RESPONSE	HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN: FIRE	SPREAD BEYOND COMPARTMENT OF ORIGIN: SMOKE	SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS: H_2O	EXTINGUISHING AGENTS: PKP	EXTINGUISHING AGENTS: AFFF	EXTINGUISHING AGENTS: CO_2	EXTINGUISHING AGENTS: P. FOAM	FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS: SHIPS FORCE	FIRE FIGHTING ORGANIZATIONS: SHORE NAVY	FIRE FIGHTING ORGANIZATIONS: MUNICIPAL	FIRE FIGHTING ORGANIZATIONS: OTHER SHIPS	LOSS, $500,000	LIFE LOSS	NO. INJURIES
5708-82	CV61	81	N		X						X		6		X	X	4	X		X	X				3	X	X	X	X				0	11
5709-82	FF1061	82	X		- Sprinkler Activation - No Fire -															X													0	0
5717-82	AFS2	82		X	X								7		X			X		X			X		3			X					0	0
5738-82	AR5	82	P		- CO_2 Discharge - No Fire -													X					X		2			X					0	9
1385-82	CV62	81	N		X						X	X	11					X		X					3	X		X	X			X	0	0
1298-32	AOR4	31	P			X						X	11	X			1			X					3			X		X			0	2
4064-82	CG27	81		X	- Sprinkler Activation - No Fire -															X					1									
2280-32	CV62	82		X	X								7							X			X		3			X					0	6
5586-82	FF1072	82	X		X						X		6							X					3			X					0	0
2464-82	LCC20	82		X	X						X	S	6,7							X			X		2,3			X					0	1

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CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

APPENDIX C JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION		CLASSES OF FIRE					EXPLOSIONS	DELAY IN		HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN	SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS					FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	ORGANIZATIONS		FIRE FIGHTING		LOSS, $500,000	LIFE LOSS	NO. INJURIES
			IN PORT	AT SEA	A	B	C	D	BOILER	ORDNANCE	ALARM	RESPONSE	FIRE	SMOKE					H_2O	PKP	AFFF	CO_2	P. FOAM				SHIPS FORCE	SHORE NAVY	MUNICIPAL	OTHER SHIPS			
0071-83	AS31	82		X		X							2							X	X	X		2,4			X					0	2
0097-83	AE29	81	X								-	No	Fire -																			0	0
0104-83	CGN38	82	N								-	No	Fire -					X						1								0	0
0501-83	DDG34	82		X					X		-	No	Fire -																			0	0
0868-83	AR5	82	P		- CO^2 Discharge - No Fire -																X			2								0	1
1088-83	FF1041	82	N		- Sprinkler Activation - No Fire -													X						1								0	0
1232-83	LHA1	82	N			X							1,5				X				X				X		X	X				0	0
1302-83	FFG19	82	X								-	No	Fire -																			0	0
1510-83	DDG5	82	N		X								11		X																	0	0
1783-83	LST1196	82	N				X						1														X					0	0
1784-83	DD983	82	X			X							5			5				X	X			4			X					0	0
1792-83	AVM1	82	N								-	No	Fire -																			0	0
2110-83	FFG5	82		X							-	No	Fire -																			0	0
NAVFAC 2247-83	CV67	83	N		X						X		6		X		X	X	X					3	X		X		X			0	7

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CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION	CLASSES OF FIRE				EXPLOSIONS		DELAY IN		HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN		SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS					FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS			LOSS, $500,000	LIFE LOSS	NO. INJURIES
			AT SEA	A	B	C	D	ORDNANCE	BOILER	RESPONSE	ALARM		SMOKE	FIRE					H_2O	PKP	AFFF	CO_2	P. FOAM				SHIPS FORCE	SHORE NAVY	MUNICIPAL	OTHER SHIPS		
NAVSEA 2316-83	LST1179	82	X		X							7	X	X		5	X		X	X	X	X		3,4	X				X		0	18
2967-83 2977-83	LPD12	83	X	X								7,11							X			X		1							0	0
3135-83	CV66	82	N	X						X		6			X	4	X		X					3			X	X			0	0
3228-83	DD972	82			X					X		5					X		X		X	X		1,3	X						0	0
NAVSEA 3257-83	KAMOI FFG35	82	X	X						X		6	X		X	2,7			X					3	X			X			0	0
3339-83	LPD8	82	N		X							1,5					X		X					3			X	X			0	4
3363-83	AOE3	82	X	X	X							11	X	X		3	X		X					3			X				0	8
3403-83	LPD15	83	P	X						X		6	X	X		8			X					3			X				0	0
3404-83	OG27	83	N	X								7	X	X		8	X		X		X			3			X	X			0	13
3615-83	CV64	83	N	X								6							X	X	X			3			X		X		0	0
3734-83	AOE2	82	P					X		- No Fire -																						
3827-83	CVN62	82	N	X						X		6	X	X	X	2	X		X					1,3	X		X	X			0	0
3909-83	LPH2	82	N	X								7	X	X		2	X		X					3	X		X	X			0	0
3923-83	OG21	83	N			X				X	X	1					X		X					3			X	X			0	1

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

APPENDIX C JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION: IN PORT	LOCATION: AT SEA	CLASSES OF FIRE: A	CLASSES OF FIRE: B	CLASSES OF FIRE: C	CLASSES OF FIRE: D	BOILER	EXPLOSIONS: ORDNANCE	DELAY IN: ALARM	DELAY IN: RESPONSE	HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN: FIRE	SPREAD BEYOND COMPARTMENT OF ORIGIN: SMOKE	SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS: H_2O	EXTINGUISHING AGENTS: PKP	EXTINGUISHING AGENTS: AFFF	EXTINGUISHING AGENTS: CO_2	EXTINGUISHING AGENTS: P. FOAM	FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS: SHIPS FORCE	FIRE FIGHTING ORGANIZATIONS: SHORE NAVY	FIRE FIGHTING ORGANIZATIONS: MUNICIPAL	FIRE FIGHTING ORGANIZATIONS: OTHER SHIPS	LOSS, $500,000	LIFE LOSS	NO. INJURIES
4062-83	ASR15	83	P		X						X	X	7					X		X			X		3	X		X		X			0	0
4073-83	AFS6	83		X	X								11					X		X			X		3			X					0	0
4188-83	DD971	83		X	- Sprinkler Discharge - No Fire -																															
4142-83	FF1098	82		X		X							5								X	X			3			X					0	0
4556-83	FF1041	82		X							- No Fire -																								
4632-83	LCC19	83	P		X						X	X	6					X		X			X		3			X		X	X		0	0
4651-83	AE27	83	P								- No Fire -																								
4893-83	CGN38	83			- Sprinkler Activation - No Fire -															X					1								0	0
5066-83	CV67	83		X	X		X						1	X	X		2 4.7	X		X					3			X					0	8
2744-83	TAO62	81		X	X	X						X	5.7							X					3		X	X			X	1	1

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CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

APPENDIX C JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION		CLASSES OF FIRE				BOILER	EXPLOSIONS	DELAY IN		HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN		SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS					FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS				LOSS, $500,000	LIFE LOSS	NO. INJURIES
			IN PORT	AT SEA	A	B	C	D		ORDNANCE	ALARM	RESPONSE		FIRE	SMOKE					H_2O	PKP	AFFF	CO_2	P. FOAM				SHIPS FORCE	SHORE NAVY	MUNICIPAL	OTHER SHIPS			
0220-84	DD945	83	N			X	X						1	X			4			X		X	X		3	X		X	X	X			0	0
0226-84	LSD34	84	P		X								7							X			X			X		X		X			0	0
0511-84	FFG2	83		X	- Sprinkler Activation - No Fire -															X					1									
0558-84	LPD8	83	N		X								1													X							0	0
0585-84	YTB780	83	N			X							5					X		X	X		X		3			X			X		0	0
0806-84	LHA3	82		X	X						X		9		X		1,4			X					3		X	X					0	0
1258-84	DDG37	83	N		X						X		7	X	X		2,4	X		X			X		3			X	X		X		0	1
1344-84	LSD34	83	P		X						X		11					X		X			X		3			X		X			0	0
1395-84	CV43	83	N			X							11					X		X		X	X		3			X	X				0	1
1421-84	CG24	83	N				X						1					X								X		X	X				0	0
NAVSEA 1828-84	CV61	83		X		X							5	X	X		1,2	X		X	X	X	X		3,4	X		X				X	6	48
1832-84	ARDM1	84	N						X		- No Fire -																						
1909-84	CV62	83		X	X						X		5	X	X	X	2,4	X	X	X					3			X					0	20
2003-84	FF1045	83	N		X						X	X	11					X		X					3	X		X					0	2

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CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION		CLASSES OF FIRE				BOILER	EXPLOSIONS	DELAY IN		HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN		SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	AGENTS			EXTINGUISHING		FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS				LOSS, $500,000	LIFE LOSS	NO. INJURIES
			IN PORT	AT SEA	A	B	C	D		ORDNANCE	ALARM	RESPONSE		FIRE	SMOKE					H_2O	PKP	AFFF	CO_2	P. FOAM				SHIPS FORCE	SHORE NAVY	MUNICIPAL	OTHER SHIPS			
2264-84	FFG12	83	P			X					X		5									X	*		2,3			X					0	0
2434-84	MSO443	83		X			X						1					X	X	X			X*		2,3			X					0	1
2528-84	DDG19	84		X			X						1					X			X	X	X		4			X					0	0
2630-84	AE21	84	P				X						1										X		2			X					0	0
2733-84	LHA5	83	N		X						X		6			X			X	X			X		3	X	X	X			X		0	1
3319-84	AS31	83	N		X						X		11			X				X					3	X		X					0	0
3324-84	CV63	84	N		X						X		5	X	X		2,4			X					3		X	X					0	0
3337-84	CV41	83	N		X	X					X		1		X		1,4	X		X		X	X		3	X		X					0	3
3460-84	CV64	84	X		X						X		5							X					3			X					0	0
3467-84	AE35	84		X			X						1										X		2			X					0	0
3789-84	DD978	84	- Sprinkler Activation - No Fire -																	X					1								0	0
4187-84	ATF180	84		X			X				X		1										X					X					0	1
4287-84	CV61	84	N		X						X		7	X	X		2,4	X		X					3	X		X	X			X	0	6
4481-84	YTB821	84		X							- No Fire -																							

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Category	Subcategory	LPH10	LPD13	AO179
NO. INJURIES		0	0	5
LIFE LOSS		0	0	0
LOSS, $500,000				
FIRE FIGHTING ORGANIZATIONS	OTHER SHIPS			
	MUNICIPAL			
	SHORE NAVY	X		
	SHIPS FORCE	X		X
VENTING NEEDED				
VENTING USED		X		
FIXED SUPPRESSION USED		3		3
EXTINGUISHING AGENTS	P FOAM			
	CO_2			
	AFFF			X
	PKP			
	H_2O	X		X
OBA PROBLEMS				
FIRE FIGHTING DEFICIENCIES				X
MEANS FOR SPREAD				
SUSPICIOUS/ARSON		X	- Sprinkler Activation - No Fire -	
SPREAD BEYOND COMPARTMENT OF ORIGIN	SMOKE			
	FIRE			
HEAT OF IGNITION		6		11
DELAY IN	RESPONSE			
	ALARM	X		
EXPLOSIONS	ORDNANCE			
	BOILER			
CLASSES OF FIRE	D			
	C			
	B			X
	A	X		
LOCATION	AT SEA			X
	IN PORT	N	N	
YEAR OF INCIDENT		84	84	
HULL NUMBER		LPH10	LPD13	AO179
APPENDIX C JAG NUMBER YEAR		4603-84	2199-84	4716-34

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

APPENDIX C JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION		CLASSES OF FIRE				BOILER	EXPLOSIONS	DELAY IN		HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN		SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS					FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS				LOSS, $500,000	LIFE LOSS	NO. INJURIES
			IN PORT	AT SEA	A	B	C	D		ORDNANCE	ALARM	RESPONSE		FIRE	SMOKE					H_2O	PKP	AFFF	CO_2	P. FOAM				SHIPS FORCE	SHORE NAVY	MUNICIPAL	OTHER SHIPS			
0012-85	LPH2	84		X	- Sprinkler Activation - No Fire -															X					1								0	0
0127-85	AO178	84	N		- Halon Discharge - No Fire -																		*		2								0	0
0133-85	FF1049	84	N		X						X		11		X	X	8	X		X			X		3			X				0	0
0663-85	MSO446	84	P				X						1							X		X										0	0
0664-85	BB61	84		X			X						1										X					X				0	1
1211-85	DDG2	84	X		X						X		7							X					3			X				0	0
1317-85	LST1195	84	N		X		X				X		6,7	X	X	X	2,7	X		X			X		3	X		X	X			0	0
2178-85	YTM252	85		X		X							2			-	No Fire -															0	1
2237-85	YTB771	84	N			X							5										X					X	X			0	0
2742-85	FF1052	84	N				X						1										X					X				0	0
3156-85	AOR6	85		X	- Sprinkler Activation - No Fire -															X					1								0	0
3194-85	AO179	85	N		X						X		11			X				X					3	X		X				0	0
3197-85	FF1097	85		X	X		X						1										X					X				0	0
3296-85	LX506	85	N				X						1										X					X				0	0

* Halon

1985-B

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

APPENDIX C JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION		CLASSES OF FIRE				BOILER	ORDNANCE	EXPLOSIONS	DELAY IN		HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN		SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS					FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS			LOSS, $500,000	LIFE LOSS	NO. INJURIES
			IN PORT	AT SEA	A	B	C	D				ALARM	RESPONSE		FIRE	SMOKE					H_2O	PKP	AFFF	CO_2	P. FOAM				SHIPS FORCE	SHORE NAVY	MUNICIPAL	OTHER SHIPS			
3354-85	FF1059	84	P		X	X								1		X			X		X					3	X		X		X	X	X	0	0
3623-85	AD37	85	X				X					X		1																				0	2
3674-85	AFS5	85	N		X							X		6			X				X					3	X		X	X				0	0
3781-85	AO179	85	N		X							X		11			X							X					X					0	0
3960-85	MSO448	85		X	X							X		5							X			X		3			X					0	0
4296-85	CG34	85	N		X	X								6			X				X			X		2,3			X	X				0	0
4325-85	LPD15	85		X	X									7		X		14			X					3	X		X					0	0
4372-85	FF1082	84	P		X									11					X		X			X		3	X		X					0	0
4391-85	DD990	85		X	X							X		6							X					3			X					0	0
4582-85	MSO456	85	N			X							X	5								X							X					0	0
4529-85	MSO490	84	N				X							1										X					X					0	0
4620-85	LCC19	85	N		X							X	X	6							X					3		X	X	X				0	0
4396-85	AO179	85	N		X							X		6	11		X				X			X		3			X					0	0
2447-85	DSV3	84		X		X	X							1							X			X		2,3			X					0	0

1985-C

APPENDIX C

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER / YEAR		0414-85	0373-85	1653-85	2940-35	3212-85										
HULL NUMBER		CG47	CVN65	FFG43	LHA2	AFS5										
YEAR OF INCIDENT		84	84	84	84	85										
LOCATION	AT SEA	X	X													
	IN PORT			X	N	N										
CLASSES OF FIRE	A	X	X		X	X										
	B															
	C	X	X	X	X											
	D															
EXPLOSIONS	BOILER															
	ORDNANCE															
DELAY IN	ALARM	X	X	X	X											
	RESPONSE															
HEAT OF IGNITION		6	7	1	11											
SPREAD BEYOND COMPARTMENT OF ORIGIN	FIRE	X	X													
	SMOKE			X												
SUSPICIOUS/ARSON					X	X										
MEANS FOR SPREAD		4	7	4												
FIRE FIGHTING DEFICIENCIES					X											
OBA PROBLEMS																
EXTINGUISHING AGENTS	H_2O	X	X		X	X										
	PKP															
	AFFF		X													
	CO_2	X	X	X												
	P. FOAM															
FIXED SUPPRESSION USED		3	3		3	3										
VENTING USED		X	X	X	X											
VENTING NEEDED																
FIRE FIGHTING ORGANIZATIONS	SHIPS FORCE	X	X	X	X	X										
	SHORE NAVY				X											
	MUNICIPAL			X												
	OTHER SHIPS															
LOSS, $500,000		X														
LIFE LOSS		0	0	0	0	0										
NO. INJURIES		13	23	0	0	0										

1936-A

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

APPENDIX C

JAG NUMBER / YEAR

JAG NUMBER / YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION: IN PORT	LOCATION: AT SEA	CLASSES OF FIRE: A	CLASSES OF FIRE: B	CLASSES OF FIRE: C	CLASSES OF FIRE: D	BOILER	ORDNANCE	EXPLOSIONS	DELAY IN: ALARM	DELAY IN: RESPONSE	HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN: FIRE	SPREAD BEYOND COMPARTMENT OF ORIGIN: SMOKE	SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS: H_2O	EXTINGUISHING AGENTS: PKP	EXTINGUISHING AGENTS: AFFF	EXTINGUISHING AGENTS: CO_2	EXTINGUISHING AGENTS: P. FOAM	FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS: SHIPS FORCE	FIRE FIGHTING ORGANIZATIONS: SHORE NAVY	FIRE FIGHTING ORGANIZATIONS: MUNICIPAL	FIRE FIGHTING ORGANIZATIONS: OTHER SHIPS	LOSS, $500,000	LIFE LOSS	NO. INJURIES
0218-86	DDG38	85	N		X							X		7							X					3	X		X			X		0	0
0256-86	AE29	85	P		X							X	X	7	X			2			X					3			X		X			0	2
0428-86	AO178	85		X	- AFFF Discharge - No Fire -																			X										0	0
0533-86	FFG22	85	N				X					X		1											X				X					0	0
0602-86	LSD37	85	N		X							X		1,6			X		X		X				X	3	X		X	X				0	2
0699-86	LHA2	85	N			X								11					X		X	X	X			3			X	X				0	0
0701-86	BB61	85		X	- PKP Discharge - No Fire -																	X												0	0
1466-86	AS36	85		X	X								X	11			X				X		X			3			X					0	2
1516-86	LST1196			X	X									5										X					X					0	0
1534-86	FFG22	85	N			X								6			X							X					X					0	0
1626-86	LSD37	85	N				X					X		11					X	X	X					3	X		X	X		X		0	10
1634-86	AO178	85	N		X									6					X		X					3	X		X					0	0
1915-86	CG17	85	X		X									7					X						X				X					0	0
1358-86	CVN69	86	P		X							X	X	6							X					3	X		X					0	0

1986-B

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

APPENDIX C JAG NUMBER YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION		CLASSES OF FIRE					EXPLOSIONS	DELAY IN		HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN	SMOKE	SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS					FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS				LOSS, $500,000	LIFE LOSS	NO. INJURIES
			IN PORT	AT SEA	A	B	C	D	BOILER	ORDNANCE	ALARM	RESPONSE		FIRE						H_2O	PKP	AFFF	CO_2	P. FOAM				SHIPS FORCE	SHORE NAVY	MUNICIPAL	OTHER SHIPS			
2119-86	FF1061	85	P		X						X		5							X					3			X					0	1
2194-86	BB61	86	N		X								7							X			X		3	X		X					0	3
2196-86	AO186	86	N		X						X		6		X		4	X					X					X					0	0
2834-86	TARC7	85	X						X		-	No	Fire -																				0	0
3136-86	CV66	86	X				X						1															X					0	0
3362-86	FFG22	85	N				X						1															X	X				0	0
4135-86	ASR21	86		X		X							5,8													X							0	0
4364-86	AOE2	85	N				X						1				3						X					X	X				0	1
4410-86	TAF59	85		X	X	X	X						1	X			1,7	X		X			X		2,3			X				X	0	0
4591-86	AFS5	85	N		X						X		6			X				X													0	0
4593-86	AD44	85	X								-	No	Fire -																				0	0
4597-86	DD978	85	N		X	X							6			X				X			X		2,3			X					0	0
4655-86	AS19	86	X		X	X							1				2	X	X	X	X		X		3	X		X					0	1
4893-86	CVN69	86	P		X						X		11	X			2			X					3			X					0	0

1986-C
1987

APPENDIX C

CROSS REFERENCE MATRIX OF JAG FIRE REPORT CATEGORIES

JAG NUMBER / YEAR	HULL NUMBER	YEAR OF INCIDENT	LOCATION: AT SEA	LOCATION: IN PORT	CLASSES OF FIRE: A	CLASSES OF FIRE: B	CLASSES OF FIRE: C	CLASSES OF FIRE: D	EXPLOSIONS: BOILER	EXPLOSIONS: ORDNANCE	DELAY IN: ALARM	DELAY IN: RESPONSE	HEAT OF IGNITION	SPREAD BEYOND COMPARTMENT OF ORIGIN: FIRE	SPREAD BEYOND COMPARTMENT OF ORIGIN: SMOKE	SUSPICIOUS/ARSON	MEANS FOR SPREAD	FIRE FIGHTING DEFICIENCIES	OBA PROBLEMS	EXTINGUISHING AGENTS: H_2O	EXTINGUISHING AGENTS: PKP	EXTINGUISHING AGENTS: AFFF	EXTINGUISHING AGENTS: CO_2	EXTINGUISHING AGENTS: P. FOAM	FIXED SUPPRESSION USED	VENTING USED	VENTING NEEDED	FIRE FIGHTING ORGANIZATIONS: SHIPS FORCE	FIRE FIGHTING ORGANIZATIONS: SHORE NAVY	FIRE FIGHTING ORGANIZATIONS: MUNICIPAL	FIRE FIGHTING ORGANIZATIONS: OTHER SHIPS	LOSS, $500,000	LIFE LOSS	NO. INJURIES
5036-86	CG19	85		N			X						1				7									X							0	0
5302-86	MSO456	86		P	-	FKP	Discharge		-	No			Fire																				0	0
5504-86	LST1B3	86	X		X	X	X						5	X			1	X	X	X		X			3	X							0	20
4599-86	LPD15	86	X				X						1								X		X			X			X				0	0
5326-86	AS19	35		N									2,8							X		X			3								0	0
4648-86	CC27	86	X		X	X	X						5	X			5	X		X	X	X	X		3,4		X	X					0	0
0245-87	BB61	86	X								-	No	Fire	-																			0	0
1639-87	CGN30	86		N	X						X		7	X			1			X					3.			X					0	0

APPENDIX F

ABBREVIATIONS AND DEFINITIONS
SPACE DESIGNATION

I. ABBREVIATIONS AND DEFINITIONS

ACC - Automatic Combustion Control

ACC&R - Air Conditioning and Refrigeration Watch

AER - After Engine Room

AFFF - Aqueous Film Forming Foam, a fluorocarbon surfactant, used to float upon and seal the surface of flammable liquid fires.

AirOps - Air Operations

AMR - Auxiliary Machine Room

APN - All-Purpose Nozzle (Navy)

AS - Automatic Sprinkler

ASSW - Anti-Ship Warfare

ASW - Anti-Submarine Warfare

AUX - Auxiliary

ASROC - Anti-Submarine Rocket

BMOW - Bosuns Mate of the Watch

CASREP - Casualty Report

CAT - Catapult

CDO - Command Duty Officer

Class A Fire - A fire involving ordinary combustible materials such as wood, cloth and paper

Class B Fire - A fire involving flammable or combustible liquids

Class C Fire - A fire involving energized electrical equipment

Class D Fire - A fire involving combustible metals

CIC - Combat Intelligence Center

CO - Commanding Officer, or Carbon Monoxide

CO_2 - Carbon Dioxide

Conflag (Conflagration Control) Station - On CV's, a compartment located well above the hanger deck which offers an unbostructed view of the deck and movement of aircraft.

CPO - Chief Petty Officer

CVIC - Carrier Information Center

DCA - Damage Control Assistant

DCC or DC Central - Damage Control Central

DFM - Diesel Fuel Marine

Donut - A "donut" is a sludge barge used by ships in port for disposal of bilge pump waste oil discharge.

DSV - Deep Submergence Vehicle

ECM - Electronic Counter - Measures

EEBD - Emergency Escape Breathing Device (used to replace the SSD).

EOS - Engineering Operating Station

EOSS - Engineering Operational Sequencing System

EOOW - Engineering Officer of the Watch

EWS - Engineering Watch Station

FER - Forward Engine Room

FM - Fire Marshall

FOSP - Fuel Oil Service Pump

FP - Fire Pump

GenSpec - General Specifications

GPM - Gallons Per Minute

GQ - General Quarters

GTG - Gas Turbine Generator

HAI - Hughes Associates, Inc.

Halon - Halogenated Extinguishing Agent

HCFF - High Capacity Fog Foam system on the flight deck or hanger deck of aircraft carriers (same as HICAP).

Helo - Helicopter

HICAP - (see HCFF)

HP - High Pressure

HT - Hull Technician

Huffers - Aircraft starting tractor on CV's

INSURV - Inspection and Survey

INT - Intelligence

JAG - Office of the Judge Advocate General, Department of the Navy

JAGMAN - The officer appointed by the captain of the ship to conduct the investigation in accordance with the Jag Manual (JAGINST 5800.7B)

JP-5 - A grade of jet fuel, similar to kerosene

LP - Low Pressure

MB5 - A crash fire truck backfitted on all aircraft carriers after the ENTERPRISE fire

1MC - Ship's interior communication (general announcing) system

MG - Motor Generator

Mickey Mouse - Term used in reference to flight deck sound attenuators or helmets.

MMR - Main Machinery Room

MRC - Maintenance Requirement Card

NAS - Naval Air Station

NAVFAC - Naval Facilities

NAVMAT - Naval Material

NAVSAFECEN - Naval Safety Center

NAVSEA - Naval Sea Systems Command

NAVSUP - Naval Supply

NDFO - Navy Distillate Fuel Oil

NIS - Navy Investigative Service

NSFO - Navy Special Fuel Oil

OBA - (self-contained) Oxygen Breathing Apparatus used by the Navy, with oxygen provided by a chemical reaction contained in a replaceable metal cannister

OOD - Officer of the Deck

OPAREA - Operations Area

OPNAV - Operations Naval

PKP - Purple "K" (potassium bicarbonate) dry chemical extinguishing agent

POOW - Petty Officer of the Watch

PMS - Planned Maintenance System

PQS - Personnel Qualifications Standard

PSI - Pressure in Pounds Per Square Inch

PVC - Polyvinyl chloride

R&A - Rescue and Assistance Detail

Red Devil - A shipboard electric driven portable blower used for desmoking

Reefer - Refrigerator

ROH - Repair and Overhaul

SAR - Search and Rescue

SCBA - Self Contained Breathing Apparatus

SOP - Standard Operating Procedure

SSD - Survival Support Device (same as EEBD)

SSDG - Ship's Service Diesel Generator

S&S - Sounding and Security Watch

SSTG - Ship's Service Turbine Generator

TAU - Twin Agent (PKP, AFFF) mobile fire fighting unit (same as TAFES)

TECHEVAL - Technical Evaluation

XO - Executive Officer

XRAY - Watertight condition of a ship. Usually set at night.

YOKE - Watertight condition of a ship (more than XRAY, less than ZEBRA).

ZEBRA - Most watertight condition of a ship. Usually set with General Quarters.

II. **SPACE DESIGNATION**

A - Stowage Areas

AA - Cargo Holds

C - Ship and fire control operating areas which are normally manned including CIC, communications, electronic spaces, pilot house, I.C. rooms, plotting rooms

E - Machinery/Engineering Spaces including pump rooms, evaporator rooms, emergency generator rooms

F - Diesel fuel, lube oil and fog oil tanks

FF - Cargo fuel tanks

G - Gasoline tanks

GG - Cargo gasoline tanks

J - JP-5 tanks

JJ - Cargo JP-5 tanks

K - Stowage of chemicals, semisafe and dangerous materials except gas and gasoline tanks.

L - Living quarters, medical areas, passageways

M - Ammunition Magazine

Q - Areas not otherwise covered including not normally manned engineering, electrical and electronic areas; galley, laundry, pantries, shops and wiring trunks

T - Vertical Access Trunks

V - Void Compartments

W - Compartments storing water including bilge and sump tanks.