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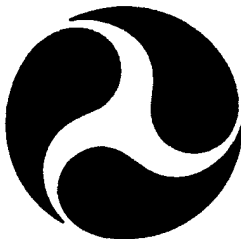
Small Cutter Fire Protection Project

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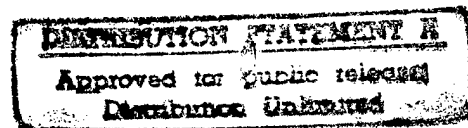
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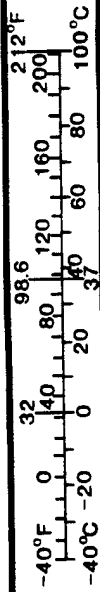
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15. Supplementary Notes The Coast Guard technical contact and COTR is Brian Dolph of the U.S. Coast Guard Research and Development Center. The Headquarters Project Officer is LCDR John Hautala of the Office of Engineering, Logistics and Development.					
16. Abstract The Small Cutter Fire Protection Project is a comprehensive effort to analyze the fire safety of nine classes of Coast Guard Patrol Boats, Tugboats, and Buoy Tenders between 65' and 110' in length. This is the final report in the project; it documents and summarizes the major results, conclusions and recommendations provided in the four interim reports submitted during the course of the project. The four interim reports are: "Analysis of Cutter Standard Repair Locker Inventory"; Preliminary Fire Safety Analysis of Three Small Coast Guard Cutters"; Fire Safety Analysis of Three Small Coast Guard Cutter Classes"; and "Fire Safety Analysis of Six Small Coast Guard Cutter Classes". In addition, the final report includes a detailed fire protection doctrine tailored for each class of cutter. Each doctrine provides: information pertinent to fire science in part A, firefighting policy and guidance provided by the Commandant, U.S. Coast Guard for small cutters in part B, and procedures for combating all classes of fires in all conceivable compartments in part C. The Ship Fire Safety Engineering Methodology (SFSEM) was utilized as an analytical tool to conduct a comprehensive analysis of the baseline fire safety and hypothetical improvements to achieve preestablished fire safety objectives. Results indicate that the majority of compartments in small cutters meet fire safety objectives with their existing passive and active fire protection features in effect. The Method was shown to be a valuable tool to evaluate heretofore incomparable entities such as a better barrier or a more effective firefighting system and quantify their effectiveness. This study clearly demonstrates that it is feasible to reduce reliance on manual firefighting in small cutters by enhancing selective passive and active fire protection features. This study identified several areas where the Ship Fire Safety Engineering Methodology could be enhanced to improve its effectiveness. Recommendations are also made to improve the fire safety of the cutters studied.					
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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures					Approximate Conversions from Metric Measures				
Symbol	When You Know	Multiply By	To Find	Symbol	Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH					LENGTH				
in	inches	* 2.5	centimeters	cm	mm	millimeters	0.04	inches	in
ft	feet	30	centimeters	cm	cm	centimeters	0.4	inches	in
yd	yards	0.9	meters	m	m	meters	3.3	feet	ft
mi	miles	1.6	kilometers	km	km	kilometers	1.1	yards	yd
							0.6	miles	mi
AREA					AREA				
in ²	square inches	6.5	square centimeters	cm ²	cm ²	square centimeters	0.16	square inches	in ²
ft ²	square feet	0.09	square meters	m ²	m ²	square meters	1.2	square yards	yd ²
yd ²	square yards	0.8	square meters	m ²	km ²	square kilometers	0.4	square miles	mi ²
mi ²	square miles	2.6	square kilometers	km ²	ha	hectares (10,000 m ²)	2.5	acres	ac
	acres	0.4	hectares	ha					
MASS (WEIGHT)					MASS (WEIGHT)				
oz	ounces	28	grams	g	g	grams	0.035	ounces	oz
lb	pounds	0.45	kilograms	kg	kg	kilograms	2.2	pounds	lb
	short tons (2000 lb)	0.9	tonnes	t	t	tonnes (1000 kg)	1.1	short tons	st
VOLUME					VOLUME				
tsp	teaspoons	5	milliliters	ml	ml	milliliters	0.03	fluid ounces	fl oz
tbsp	tablespoons	15	milliliters	ml	l	liters	0.125	cups	c
fl oz	fluid ounces	30	milliliters	ml	l	liters	2.1	pints	pt
c	cups	0.24	liters	l	l	liters	1.06	quarts	qt
pt	pints	0.47	liters	l	l	liters	0.26	gallons	gal
qt	quarts	0.95	liters	l	m ³	cubic meters	35	cubic feet	ft ³
gal	gallons	3.8	liters	l	m ³	cubic meters	1.3	cubic yards	yd ³
ft ³	cubic feet	0.03	cubic meters	m ³					
yd ³	cubic yards	0.76	cubic meters	m ³					
TEMPERATURE (EXACT)					TEMPERATURE (EXACT)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C	°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

* 1 in = 2.54 (exactly).



Small Cutter Fire Protection Project

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LIST OF ABBREVIATIONS AND TERMS

- Active Fire Protection** - Fire protection features designed to limit the flame movement by automatic detection, fixed fire extinguishing systems, and manual suppression. Examples of active fire protection features are: automatic sprinkler systems, fire extinguishers, and trained firefighting teams. See "Passive Fire Protection".
- A value** - The probability that an automated fixed fire protection system installed in a compartment will successfully extinguish the fire before FRI occurs.
- Alternative Data Set** - Data sets identified as "Alternative" have had the baseline input values to SAFE adjusted as necessary to reflect the impact of the proposed alterations or modifications which affect the ships' fire safety system.
- Baseline Data Set** - Data sets identified as "Baseline" utilize input values to the SAFE program based on the physical condition of the ship found during the ship visit and are not influenced by any modifications or alterations which may be proposed as a result of an analysis.
- CBO - Compartment Burnout** - The exhaustion of all fuel due to pyrolysis.
- CBR** - Chemical, biological and/or radiological
- CSRLI** - Cutter Standard Repair Locker Inventory
- CUI - Compartment Use Indicator** - The designation for a compartment selected from a list provided in SAFE used to define the type or function of the compartment and establish default values for various fire parameters.
- Data Set** - A data set describes those characteristics of a ship which affect its performance as a fire safety system. It includes information describing particular aspects of each compartment such as geometry, construction, fuel type and load, automatic detection and monitoring systems, ventilation and fire suppression systems.
- DCFF** - Damage Control/Firefighting
- EB - Established Burning** - The point in the fire growth curve between ignition and FRI when the fire starts to grow exponentially with respect to time. In SAFE, it is assumed that this exponential growth varies with the 2nd power of time. EB is usually considered equivalent

to a flame 10" high. EB also signifies the demarcation between fire prevention and the beginning the ship's response to the fire.

Fire Safety System - A term used to address the overall physical condition of a ship as it relates to fire safety. It considers the ship as a whole and accounts for such things as each compartment's geometry, construction, fuel type and load, automatic detection and monitoring systems, ventilation and fire suppression systems.

FRAM - Fleet Rehabilitation and Maintenance

Frequency of Acceptable Loss (years) - A component of "Fire Safety Objectives" which denotes the frequency with which a compartment can sustain a given Magnitude of Acceptable Loss. The Frequency and Magnitude of Acceptable Loss together establish the Fire Safety Objectives for a given compartment.

Frequency of EB - A frequency based on fire casualty data compiled from data provided by the U.S. Naval Safety Center and the Coast Guard's MISREP mishap reporting system.

FRI - Full Room Involvement - FRI is assumed when the temperature in a compartment has increased 500°C above ambient. FRI conditions include surface burning of all combustibles and survival for unprotected personnel is not possible.

FRI Time - The elapsed time (in minutes) from EB to FRI calculated in SAFE using the Beyler-Deal algorithm.

FSO - Fire Safety Objective - Performance standard established by cognizant authorities for a compartment accounting for mission protection, property protection and life safety. The SFSEM is designed to analyze, quantify and compare the ship's performance as a fire protection system to achieve the established Fire Safety Objectives on a compartment by compartment basis. The Frequency and Magnitude of Acceptable Loss together establish the Fire Safety Objectives for a given compartment.

I value - The probability that the fire will self-extinguish at some point between EB and FRI.

MMA - Mid-life Maintenance Availability

M value - The probability that manual firefighting efforts will successfully extinguish the fire before FRI occurs.

NAVSEA - Naval Sea Systems Command

NERAC - Document retrieval and forwarding service for reports, periodicals, conference papers, annual reports, product literature, test reports, U.S. and foreign patent information and other printed material.

Non-Standard Scenario - Similar in all respects to a Standard Scenario except that it considers reduced levels of available fire suppression systems.

NSTM - Naval Ship's Technical Manual

One-Shot Halon System - A total flooding system with the capability to completely flood the protected space one time with the required concentration level of Halon 1301.

P-250 - A portable gasoline-powered pump.

Passive Fire Protection - Fire protection features designed to limit the flame movement by their presence alone. Barriers are the best example of passive fire protection, intumescent coatings, fire doors, fuel load distribution, and insulation of hot surfaces are other examples. See "Active Fire Protection".

PIR - Polar Icebreaker Replacement - Design for the replacement of the Coast Guard's Polar Icebreaker class. This design was the first application utilizing the SFSEM to perform a fire safety analysis in 1987.

RLF - Relative Loss Factor - Relative loss factors are calculated in SAFE as a means of assessing whether a target compartment or set meets Fire Safety Objectives. A Relative Loss Factor > 1 indicates that a compartment has failed. This factor is determined by multiplying the target's relative frequency of loss given fire free state (calculated during a given run of SAFE) by the assigned Frequency of Acceptable Loss. A target is considered lost if its level of fire involvement for a given path exceeds the level specified by its Magnitude of Acceptable Loss rating.

SAFE - Ship Applied Fire Engineering - The computerized implementation of the SFSEM.

SCBA - Self contained breathing apparatus

Scenario - A situation defined by the user before executing SAFE probabilistic model run. Such parameters as run time, ship location, material condition of readiness and firefighting configuration are specified.

SCFP - Small Cutter Fire Protection

SFSEM - The Ship Fire Safety Engineering Methodology. A probabilistic based risk analysis methodology used to analyze all aspects of the ship's performance to a fire compared to preestablished Fire Safety Objectives.

SLEP - Service Life Extension Project

Standard Scenario - Scenarios used to fully define a ship's response to fire under the different operating conditions experienced by the vessel with full fire suppression capabilities available.

Two-Shot Halon System - A total flooding system with the capability to completely flood the protected space two times with the required concentration level of Halon 1301. This system is designed such that each shot of Halon is released from a different location in the vessel.

XRAY, YOKE and ZEBRA - Material Conditions of Readiness. Successively increasing readiness conditions for controlling loss. At each level additional access closures, valves and fittings are required to be closed to limit fire and flooding.

ACKNOWLEDGMENTS

The Small Cutter Fire Protection Project has taken well over three years to complete. During this period, virtually every employee of CompuCon, two project sponsors and two COTR's have contributed their time, talent, and suggestions to help make this project a success. Their contributions are too numerous to mention; however, at the risk of overlooking someone:

- ♦ Rob Richards had the vision to conceptualize the technical approach of using the Ship Fire Safety Engineering Methodology to analyze and compare the fire safety on the cutters in the project. He was also instrumental in obtaining approval of the project from Coast Guard Headquarters.
- ♦ Betty Romberg was the driving force behind the project team and one of the several individuals who contributed to winning the technical battles with the Method.
- ♦ Liz Clouthier, Doris Rich, and Betty Romberg were outstanding in overcoming the technical trials and tribulations with the Method.
- ♦ LCDR Marc Blanchard and LT Brian Dolph were especially effective in convincing the appropriate people to fund the project. Their technical insight was a major help as well.
- ♦ Dan Wolverton, Bettie Proctor, and Herb Holmstedt contributed numerous hours of technical effort. Some of this work was quite tedious but they never lost their resolve.

The author gratefully acknowledges the professional and dedicated contributions provided by the entire project team. Finally, the author wishes to acknowledge the tireless patience and loyal support provided by his wife and family who rarely complained about his protracted absences during the conduct of this project. Their support is truly appreciated.

CHAPTER 1. SMALL CUTTER FIRE PROTECTION PROJECT

1. INTRODUCTION

1.1. BACKGROUND

The office of Naval Engineering in Coast Guard Headquarters has sponsored Damage Control/Firefighting (DCFF) workshops annually since 1989 with the exception of 1992 and 1993. The purpose of these workshops was to discuss recent developments in damage control/firefighting, pass information concerning upcoming changes, and discuss how the Coast Guard should respond to recent and emergent U.S. Navy initiatives. In the first workshop (1989), 116 action items were considered, 20% of these pertained directly or indirectly to small cutters (generally less than 120' in length). As a result, the Small Cutter Fire Protection Project (SCFP) was initiated to examine all aspects of fire protection in small cutters. Progress achieved in the SCFP was presented in the DCFF workshops held in 1990 and 1991.

The "Machinery Space Firefighting Doctrine for Class Bravo Fires", COMDTINST M9555.1 [1] and the "Cutter Standard Repair Locker Inventory", COMDTINST M9664.1 [2] were promulgated by the Commandant, U.S. Coast Guard, in 1989 to provide guidance to the operational fleet of Coast Guard cutters. The impact of these documents on small cutters was discussed in depth during the DCFF workshops. The purpose of the "Machinery Space Firefighting Doctrine" [1] is to delineate the tactics, philosophy, and procedures associated with the use and operation of the various firefighting systems and equipment on board the cutter for combating machinery space fires. The doctrine is structured to provide a basis for the proper actions and decisions of the firefighting crew and the considerations necessary in choosing the correct firefighting equipment and agent. The doctrine also defines personnel responsibilities and scenarios such as a major oil leak which could result in a Class B fire.

The "Machinery Space Firefighting Doctrine" [1] for Coast Guard cutters was written in a general manner to apply to all floating units. It was designed primarily for the larger cutters; smaller cutters were supposed to tailor the doctrine to suit their individual needs. As noted in the DCFF workshops however, the doctrine is difficult to tailor to suit the needs of the small cutter which has considerably different crew size, state of training and installed equipment compared to the larger cutters. Consequently, a primary objective of the SCFP is to provide a firefighting doctrine designed primarily for the needs of the small cutter.

The "Cutter Standard Repair Locker Inventory" [2] updated and increased the authorized allowance for firefighting equipment and protective gear for large Coast Guard cutters and established the allowance for small cutters. The Instruction does not indicate where to stow the required gear or how and when to use

the new equipment such as smoke curtains and the firefighter ensemble. Moreover, there was a general consensus that the inventory contained redundant equipment in the various damage control kits that were now required. Another primary objective for the SCFP was thus established to examine the currently approved allowance compared to the actual needs of the small cutters.

The Ship Fire Safety Engineering Methodology (SFSEM) [3] is a probabilistic-based risk analysis methodology which provides an integrated framework to account for all relevant aspects of shipboard fire protection. The SFSEM is designed to evaluate the ship's performance compared to established fire safety objectives. The methodology quantifies the contribution of passive and active fire protection systems, thus it provides a means for analyzing and comparing alternatives to improve the overall fire protection on the cutter. The SFSEM was selected as the analytical tool to analyze the fire safety levels of the small cutters in the SCFP. Since the SFSEM had only been used in this manner once before in the Polar Icebreaker Replacement Project, a secondary objective was established to analyze the utility of this methodology and identify areas of improvement.

1.2. SCOPE

The scope of this portion of the project originally encompassed all cutters 120' or less in length. This included the 120' WPB "Heritage Class" Patrol Boat. When the SCFP started, the prototype vessel in the class was under construction at the Coast Guard Yard. Subsequently, the Heritage Class construction project was canceled before the prototype was completed. Consequently, the scope of the SCFP was reduced to all cutters 110' or less in length. A "cutter" is partially defined as an operating unit, with a permanently assigned crew, capable of self-sustaining operations. The smallest "cutter" in the Coast Guard fleet is a 65' WYTL Harbor Tugboat. Therefore, the revised scope of the initial SCFP includes all classes of Coast Guard cutters from the 65' Harbor Tug to the 110' WPB "Island Class" Patrol Boat.

The various classes of cutters within the scope of the SCFP can be categorized by type into Patrol Boats, Tugboats and Buoy Tenders. Cutters in these categories can be further grouped by class as shown in Table 1-1. The nine classes listed in Table 1-1 comprise 137 of the total of 142 cutters in the SCFP. The remaining five cutters are one-of-a-kind: 95REN WPB, 110B WYTM, 100A WLI, 100C WLI, and 80 WLR. These cutters are not being analyzed as part of this project.

A representative cutter from each of the nine classes shown in Table 1-1 was selected for analysis. The primary criteria for selecting a cutter was its proximity to the U.S. Coast Guard Research and Development Center. The cutter's schedule and proximity to other representative cutters was also a

consideration. Initially, one cutter from each category (patrol boat, tug and tender) was selected so that the first fire safety analyses would consider a broad spectrum of construction types, manning levels and operations. The results from these analyses were documented and presented before proceeding with the detailed fire safety analysis of the remaining six classes. The representative cutters selected for study are identified in Table 1-1.

TABLE 1-1 SMALL CUTTER CLASSES OF THE U.S. COAST GUARD

General Category (Quantity)	Classes Within Category (Quantity)	Representative of Class	
		Three Cutter Analysis	Six Cutter Analysis
Patrol Boats (92)	110 WPB (36)	MONOMOY (WPB 1326)	
	110 WSES (3)		PETREL (WSES 4)
	82 WPB (53)		POINT FRANCIS (WPB 82356)
Tugboats (14)	65 WYTL (14)	TOWLINE (WYTL 65605)	
Buoy Tenders (31)	75 WLIC (9)	SLEDGE (WLIC 75303)	
	75 WLR (9)		CHIPPEWA (WLR 75404)
	100 WLIC (3)		PRIMROSE (WLIC 316)
	65 WLR (6)		OBION (WLR 65503)
	65 WLI (4)		BLACKBERRY (WLI 65303)

1.3. OBJECTIVES

Three objectives (2-primary, 1-secondary) were established for the SCFP. The first and most important objective was to develop a tailored fire protection doctrine for each of the nine classes of small Coast Guard cutters identified in Table 1-1. The new fire protection doctrines are submitted as appendices to this report. The doctrines incorporate procedures for combating Class A, B, and C fires in port and at sea in all types of compartments. The scenarios are limited to those that are reasonable to expect, for example a Class A fire in the Berthing Area, a Class B fire in the Engine Room, and a Class C fire in the Electronics Space. Only procedures, tactics, and equipment currently authorized by ShipAlt and in consonance with published Commandant policy in the Naval Engineers Manual (COMDTINST M9000.6A) [4], and other official documents such as Naval Ships' Technical Manual, Chapters 555 and 079 [5] are incorporated in the new doctrines. In addition, the new doctrines incorporate documented recommendations and comments from Coast Guard Headquarters (G-ENE) in response to the following previously submitted interim reports in the SCFP:

- ◆ Analysis of the Cutter Standard Repair Locker Inventory, December 1990. [6]
- ◆ Preliminary Fire Safety Analysis of Three Small Coast Guard Cutters, June 1991. [7]
- ◆ Fire Safety Analysis of Three Small Coast Guard Cutter Classes, July 1992. [8]
- ◆ Fire Safety Analysis of Six Small Coast Guard Cutters Classes, September 1993. [9]

Another primary objective of the SCFP was to examine the currently approved allowance of damage control and firefighting equipment compared to the actual needs of the small cutters. The purpose of this analysis was to identify redundancies and gaps in the installed and portable damage control equipment authorized for small cutters. The results of this analysis are discussed in Chapter 3 and documented in reference [6].

A secondary, but nevertheless important, objective was to analyze the utility of the Ship Fire Safety Engineering Methodology [3] and identify areas of improvement to the cutter's current level of fire safety. The SFSEM had been used previously to analyze the preliminary design of a new Icebreaker in the Polar Icebreaker Replacement Project [10]. The construction of this vessel has been significantly delayed for a number of reasons unrelated to the fire safety analysis. The SCFP is the first opportunity to apply this methodology in a detailed fire safety analysis of existing Coast Guard cutters. The results of these analyses are documented in the interim reports previously submitted in this project [7,8,9] and are also summarized in

this report. The SCFP was the impetus for significant improvements to the SFSEM. The following documents discuss some of these areas of improvement:

- ◆ CompuCon Letter to Mr. Robert Richards and Mr. David Beene dated 1 June 1992 [11]. This letter provided a revised list of Compartment Use Indicators with some adjusted frequency of Established Burning values based on an analysis of historical fire data of Coast Guard fires. These revised CUI's were utilized on the remaining six cutter classes analyzed. Finally, thirteen SFSEM limitations and recommendations for improvement were cited involving a broad range of topics from the assignment of input data values to algorithms for handling ship geometry inconsistencies. Several of these limitations are currently being addressed.
- ◆ CompuCon Letter to Mr. Robert Richards and LT Brian Dolph dated 18 November 1992 [12]. A method was proposed in this correspondence for assigning Fire Safety Objectives (FSO's). This method was utilized in the analysis of the final six cutters.
- ◆ CompuCon Letter to LT Brian Dolph dated 18 March 1993 [13]. This letter fulfilled a deliverable requirement by identifying five concepts that would enhance the overall SCFP project. These concepts included the development of a fire protection doctrine for all nine classes of cutter analyzed, updating of the Theoretical Basis of the SFSEM, fire growth model and fuel load refinement, cataloging of barrier materials, and a sensitivity analysis of SAFE, the computer implementation of the SFSEM. All of these concepts are currently being addressed as enhancements to the methodology.
- ◆ CompuCon Letter to LT Brian Dolph dated 25 May 1993 [14]. This letter proposes grouping of U.S. Coast Guard cutters by size and function into two categories: small (less than 160') and large (greater than 160'). This effectively adds three classes of cutters to the small cutter classification defined in Section 1.2 of this chapter. It also suggests a plan for developing fire doctrines for the remaining cutter classes.

As stated before, the SFSEM was the analytical tool used to analyze the fire safety of the small cutter classes in the SCFP. The primary objective of the fire safety analysis was to determine the baseline fire protection level for each cutter class and compare it to the established fire safety objectives on a compartment basis [3]. Alternative enhancements to passive

and/or active fire protection features were then evaluated to determine if they improved the fire protection levels in compartments which fail to meet minimum fire safety objectives. Finally, a cost-benefit analysis of alternatives was performed to facilitate formulating recommendations for improving the fire safety of the cutter class. Figure 1-1 graphically depicts how the SFSEM is utilized to identify and analyze various alternatives as input to the development of the new fire protection doctrines.

Small cutters are minimally manned, often include aluminum barrier materials, and frequently contain high fuel loads with extraordinarily fast fire growth characteristics. As a result, manual firefighting efforts impose a considerable risk to the crew. Alternatives to enhance fire protection were therefore examined to determine their effectiveness in supplanting manual firefighting efforts without sacrificing existing fire protection levels.

1.4. TECHNICAL APPROACH

The SCFP was a multi-year project organized into four sequential phases:

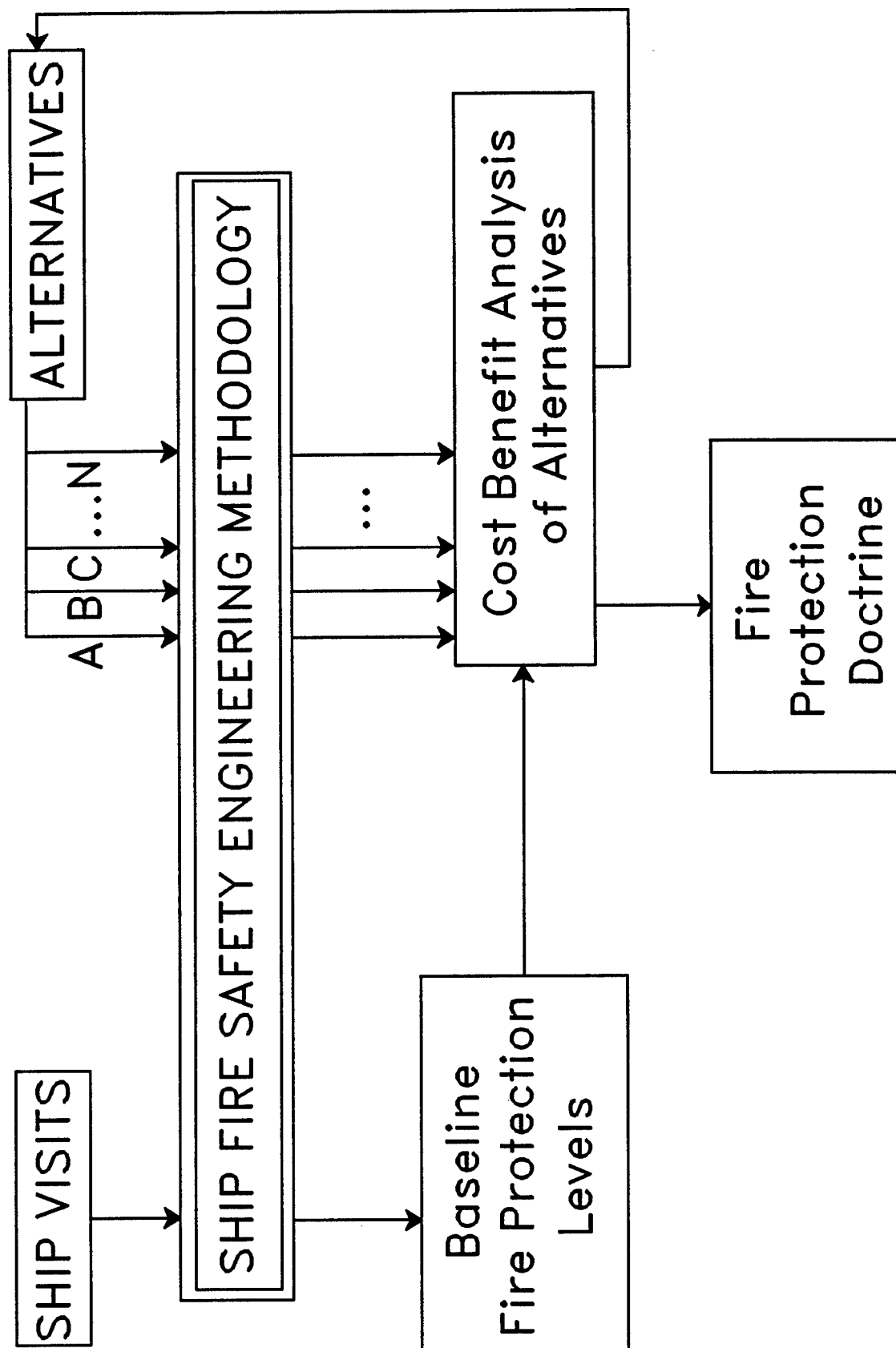
- ◆ Literature Search
- ◆ Research and Analysis
- ◆ Test and Evaluation
- ◆ Develop Fire Protection Doctrine

The literature search was conducted to identify new firefighting techniques and equipment suitable for use in small cutters. The research and analysis phase included a review of the Cutter Standard Repair Locker Inventory [2], and detailed fire safety analyses of the nine classes of small Coast Guard cutters using the SFSEM. The third phase was originally intended to test and evaluate the new techniques and equipment identified in the literature search. This was later modified to test and evaluate new techniques and equipment identified in two related projects:

- ◆ Fixed Halon System Alternatives Project
- ◆ Ship Fire Safety Engineering Methodology

Results from the test and evaluation phase will be documented in future reports as these tests are completed.

FIGURE 1-1. ROLE OF THE SFSEM IN THE SCFP



This report is the final report in this portion of the Small Cutter Fire Protection Project; it summarizes the results of work done in all phases of the project. In addition, the fire protection doctrine for the nine classes of small cutters are provided as appendices to this report. Significant conclusions and recommendations, documented in the previously submitted interim reports, will be discussed and summarized in this document. The interim reports are not generally available in the literature, therefore references to them are minimized in this report.

The basic technical approach used to develop the fire protection doctrines was to start by analyzing the existing main space fire protection doctrine for each class of cutter. This provided a good starting point for developing procedures to combat Class B fires in the machinery space. The new doctrine was then developed taking into account the feedback from Coast Guard Headquarters in previous phases of the SCFP. The new doctrine also needed to incorporate procedures for Class A and Class C fires in other compartments. Information from a variety of sources was utilized to develop these procedures and tactics including:

- ◆ Naval Ships' Technical Manual, Chapters 555 and 079, Vols. 1-4 [5]
- ◆ Surface Ship Survivability Manual, Naval Warfare Publication 62-1 (Rev C) [15]
- ◆ Cutter Casualty Control Manuals [16]
- ◆ Vessel Safety Manual [17]
- ◆ Marine Fire Prevention, Firefighting, and Fire Safety [18]
- ◆ Various articles in the literature

A thorough review of the existing doctrine revealed an extensive document that included basic information concerning fire science, tactics for fighting machinery space fires, and procedures promulgated by the Commandant that could be described as a philosophical approach to firefighting. Moreover it was organized into ten chapters that mixed this information throughout the document and included information applicable to a broad range of cutters. Therefore, it is difficult for a small cutter to tailor the document. In addition, a crew member transferred to another cutter was required to study the entire document to determine specific procedures applicable to his or her new unit. Accordingly the technical approach was modified to deal with the limitations identified in the review.

The approach for developing the new doctrine was altered to reformat the existing doctrine into three parts. Part A incorporates basic information concerning fire science. This information applies to all cutters and rarely needs to be updated. Part B includes procedures and a philosophical approach to firefighting promulgated by the Commandant applicable to small cutters. Large cutters would have a similar but different Part B. Developing Part B for large cutters is outside the scope of this project. Part C contains the specific tactics and procedures for combating Class A, B, and C fires in the various compartments on each class of small cutter. Each cutter in the class will have to tailor Part C of the new doctrine to account for any differences between themselves and the representative cutter studied to develop the doctrine for that class. Such differences may exist due to uncompleted (or unauthorized) ShipAlts and other changes inherent in the design of sub-classes. Crew members, who have been transferred from other small cutters will only have to study Part C of the doctrine for their new ship. In addition, damage control personnel or others generally familiar with fire science will not have to study Part A.

Maintenance of the new fire protection doctrine is also simplified. The Commandant would be the appropriate authority responsible for updating and maintaining Parts A and B of the doctrine. The individual cutter would be responsible for tailoring, then maintaining, Part C in accordance with the guidance provided in Parts A and B.

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CHAPTER 2. LITERATURE SEARCH

The literature search included a review of pertinent reports of state-of-the-art technology in firefighting equipment and techniques with a particular emphasis on small military ships. The open literature was reviewed by conducting key word searches of the library maintained by the Marine Fire & Safety Research Branch of the U.S. Coast Guard Research and Development Center as well as numerous commercial databases available through the services of NERAC. Results of literature searches in the closely related projects: Fixed Halon System Alternatives [19] and the Ship Fire Safety Engineering Methodology [3] were also used in this technology assessment. The following sections in this chapter are highlights from the report of the literature search documented in the Preliminary Fire Safety Analysis of Three Coast Guard Cutters, [7], and are not intended to be a comprehensive summary of the various documents reviewed in the conduct of the literature search.

2.1. SMOKE AND TOXIC GASES

Smoke generated by a shipboard fire presents a major hazard to the personnel and mission of a cutter. Most deaths result when crew members, lost in the obscuring smoke, inhale toxic products of combustion.

Two mechanisms of smoke transport in a ship are particularly important:

- ◆ Smoke transported to other spaces by the ship's ventilation system;
- ◆ Smoke transported to adjacent spaces by natural convection generated by the fire.

A fire in one space can result in fire gases reaching other spaces on the same ventilation system especially if the system is designed with a high recirculation ratio and fire dampers are not provided in the ductwork. Unfortunately, ship's ventilation systems are rarely fitted with fire dampers. Fire gases can easily enter adjacent spaces through poorly designed seals around existing ductwork, piping and electrical cables.

The ability to predict the spread of smoke and toxic gases is very important in estimating crew member survivability. Existing smoke movement algorithms, developed for use with building heating, ventilation, and air conditioning system analysis, could be added to existing computer models such as FIREMOD [20]. The SFSEM presently includes the ability to analyze flame movement; in the future, the smoke movement module will be incorporated into the methodology. [3]

2.2. INFORMATION PROCESSING SYSTEMS

In the past, the traditional methods of detecting shipboard fire and flooding was the sounding and security watch, below-decks watch, cold-iron watch, or roving patrol. As a result, certain portions of the ship may only be visited for a brief period every one to two hours. Moreover, the person on watch may not have access to locked spaces. This led to the installation in modern ships of automatic fire and flooding detection and monitoring systems. A shipboard fire and flooding detection system consisting of a central processor connected by power line carrier to a series of inexpensive detectors has the potential to directly reduce 48% of the losses due to fires and 61% of the losses due to flooding. [21] The system being installed on new U.S. Navy ships consists of two heat and smoke detectors per compartment or one for each 250 sq. ft. of deck area, whichever is greater, and sensors to detect high water in most engineering spaces.

A system called SNIPE (Standard Naval Information Program - Engineering) is designed to combine the concept of contingency planning with the technological capabilities of database management systems running on microcomputers. All relevant firefighting data gathered from applicable ships references were entered into a common database. The software for SNIPE is designed to retrieve required data to combat a fire instantly with minimal user involvement. The automation of information management provides faster response, a response more likely to be correct, and a needed discipline in the damage control process. SNIPE is relatively inexpensive and can be retrofitted to any ship [22].

2.3. ALUMINUM IN SHIP CONSTRUCTION

Steel has been the material of choice for naval ship construction because of its strength, durability, and protective qualities. With the advent of weight-critical high performance vessels such as hydrofoils, surface effect ships, and fast patrol boats, aluminum has found wide use for hull and primary structures. Aluminum is an excellent choice for these types of vessels because of its high strength to weight ratio, a density one third of steel, and its ability to withstand the marine environment. However, because of its lower heat resistance, the fire threat for these ships is greater than for conventional steel ships.

At 450 degrees Fahrenheit, aluminum loses 50% of its yield strength and at 700 degrees, nearly all of its strength. It has been shown that a 1/8th inch unprotected aluminum plate, exposed to 1500 degrees Fahrenheit will reach 700 degrees in 52 seconds. It is evident that fires on aluminum ships must be detected and extinguished early to prevent structural damage or collapse.

Under the joint sponsorship of Naval Sea Systems Command and the Naval Ship Engineering Center, a joint effort by the Naval Surface Weapons Center and Stanford Research Institute was conducted to define problems associated with fires in light weight aluminum ship structures. A series of reports was published that deal with the phenomenology of the environment and recommend structural designs and procedures to minimize the problem. A most useful result was the formulation of the "Ten Commandments for Ship Fire Protection" reproduced here as Table 2-1. [23]

Table 2-1 TEN COMMANDMENTS OF SHIP FIRE PROTECTION

1. Major fires usually result from a chain of unlikely events. The guiding design philosophy should embrace a sequence of steps beginning with prevention and retreating through detection, confinement, control, and extinguishment.
2. Limit the opportunities for ignition by separating the elements of the fire triangle.
3. Starve and imprison unwanted fires. Confine the fire to the point of origin with frequent fuel breaks and adequate fire barriers.
4. Plan ahead; during the ship design phase the modes of fire detection, escape and rescue, and suppression should be planned for each space.
5. Protect hazardous materials by isolation, insulation, and/or cooling but when cookoff can endanger the ship, incorporate provisions to jettison such hazards to the sea.
6. Protect the various ships systems according to their importance to the function and mission of the ship.
7. Extensive reliance on conventional hand-line procedures is not adequate for aluminum ships; therefore, extensive built-in protection systems are required.
8. Structural aluminum members are readily extruded into many shapes to serve dual functions such as agent containers, duct ways, and dispensing networks.
9. Avoid the problems of smoke and heat by provisions for suppressing the fire remotely.
10. Employ modular design and simplify the sacrifice and replacement of various systems.

2.4. SELF-CONTAINED BREATHING APPARATUS

Several problems with the Type A4 self contained breathing apparatus (SCBA), currently approved by the U.S. Navy, have been identified:

- ♦ The speaking diaphragm is not 100% efficient.
- ♦ The air the wearer breathes is warm.
- ♦ Canister disposal is a problem.
- ♦ When the breathing bags are compressed, air vents through the face mask seal instead of the relief valve.
- ♦ The exposed breathing bags are subject to damage.

The National Institute for Occupational Safety and Health (NIOSH) will require a positive pressure system in future designs of SCBA, wherein face mask and breathing hoses are always kept under slight pressure. In addition, NIOSH will require protection for the breathing bags. The Navy is not required to abide by NIOSH regulations, however it intends to phase out production of type A4 SCBA in favor of NIOSH-approved SCBA. [24]

2.5. SHIPBOARD ELECTRICAL CABLE

Polyvinyl chloride (PVC) used as electrical cable jacket insulation has several detrimental properties when ignited. The PVC has a high flame spread, thus the cableways become the routes of fire propagation from compartment to compartment. The heat release is substantial enough to ignite other combustibles. Burning PVC releases dark, dense smoke, and hydrogen chloride gas which represents a substantial health hazard.

Research conducted by the David Taylor Research Center showed that intumescent coatings on electrical cables provide significant reductions in the propagation of fire and thus enhance the survivability of the ship. To be acceptable, coatings must meet certain requirements for weight, ampacity, toxicity, and application. In addition, electrical cables must meet certain requirements regarding chemical, physical, environmental, thermal, physical, and electrical properties. These properties are included by NAVSEA in a preliminary military specification. [25]

2.6. FIRE PROTECTION REQUIREMENTS FOR SMALL SHIPS

Small ships differ from larger ships in the following ways which directly impact small cutter fire safety:

- ◆ Aluminum is frequently used in weight critical or high performance craft.
- ◆ Machinery spaces are generally operated unmanned.
- ◆ Limited manning usually results in an inability to man multiple repair parties.
- ◆ Non-redundant machinery spaces often results in the vessel being "dead in the water" as a result of a serious fire in the engine room.
- ◆ Non-redundant electric fire pumps are usually located in the Engine Room.
- ◆ Releasing halon results in loss of firefighting water pressure due to automatic shutdown of normal generators and lack of emergency generators.
- ◆ Higher speeds associated with high performance vessels result in high velocity air movement which can fan the flames and help spread fire and smoke. In addition, high speeds can act like an eductor to draw firefighting agents out of the Engine Room.
- ◆ Small ships are generally not equipped with emergency escape breathing devices or any type of smoke clearing equipment.
- ◆ Habitability materials, installed to improve the otherwise harsh and spartan living conditions, usually exhibit extremely high fuel loads.
- ◆ Automatic fire detection systems are usually not installed.

The conditions noted above indicate a high priority need to install complete fire detection systems throughout small cutters. In addition, the installation of automated fixed fire protection systems would reduce the need to manually fight fires.

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CHAPTER 3. REPAIR LOCKER INVENTORY ANALYSIS

Major fire incidents on the USS ROBERTS and USS STARK graphically demonstrate the severity of damage and loss of life that can result from fire induced by enemy action. The British experience on HMS SHEFFIELD in the Falklands Island conflict also revealed the severe problems with a major conflagration on ships with aluminum superstructures. These tragic fires resulted in numerous casualties and instigated significant changes to damage control equipment and procedures. Recent changes promulgated by the U.S. Navy and the U.S. Coast Guard have included additional equipment and revised damage control procedures as summarized in Table 3-1.

TABLE 3-1 RECENT CHANGES TO DC EQUIPMENT AND PROCEDURES

Additional Equipment
1. Vari-nozzles 2. Firefighting ensembles 3. Anti-Flash gear 4. Cyalume light sticks 5. Smoke curtains 6. Thermal imagers 7. Synthoglass pipe patching kits 8. Exothermal cutting torches 9. Emergency escape breathing devices
Procedures
1. Cutter Standard Repair Locker Inventory (COMDTINST M9664.1) [2] 2. Machinery Space Fire Doctrine (COMDTINST M9555.1) [1] 3. Surface Ship Survivability (NWP62-1 REV C) [15] 4. Naval Ships' Technical Manual (Chapter 555)[5]

The "Cutter Standard Repair Locker Inventory" (CSRLI) revised the allowance of damage control equipment for large Coast Guard cutters and established the allowance for small cutters. [2] This Instruction consists of 25 chapters of damage control equipment organized into functional groups. The allowances are established in a matrix where the rows represent the various equipments and the columns represent the different classes of Coast Guard cutter. After the CSRLI was issued on 19 July 1989, it became apparent that there was redundant equipment and there was concern there may be missing equipment. Moreover, there seemed to be more equipment than a small cutter could stow in designated areas on board. Accordingly, a primary objective of the SCFP was established to identify redundant and missing equipment in the CSRLI for small cutters (columns 4, 6, and 7). The Commandant (G-ENE) staff was tasked to address the configuration management issue involved with proper storage locations for required equipment.

The analysis of the Inventory was limited in scope to identify redundant and missing equipment to carry out the following functions:

- ◆ Combating fire (Class A, B and C),
- ◆ Controlling flooding (due to collision or grounding),
- ◆ Chemical, biological, and radiological (CBR) attack,
- ◆ Nuclear accident at commercial power plant,
- ◆ Rescue and assistance (ashore and at sea).

A final consideration in the analysis is the fact that damage control equipment is only one of many factors considered in damage control. As shown in Figure 3-1, success in dealing with an incident is dependent on four basic terms in the damage control equation: personnel, knowledge, training, and equipment. A change in one factor or term of this equation may require a corresponding change in other terms to ensure the equation stays in balance. For example, adding a piece of equipment may require an increase in the personnel assigned to the vessel to operate the equipment, who in turn may need training to learn the proper operating procedures for the equipment.

The recommended changes to the CSRLI are presented in detail in the "Analysis of the Cutter Standard Repair Locker Inventory" submitted as an interim report in the SCFP. [6] The major changes recommended in the report are summarized in Table 3-2. In general, the analysis of the CSRLI for small cutters revealed considerable redundancy in equipment. Accordingly, recommendations were made to consolidate damage control kits and minimize the equipment wherever possible consistent with the cutter's missions. The only change that is inconsistent with mission responsibilities, and therefore would require a change in

Figure 3-1. Damage Control Equation

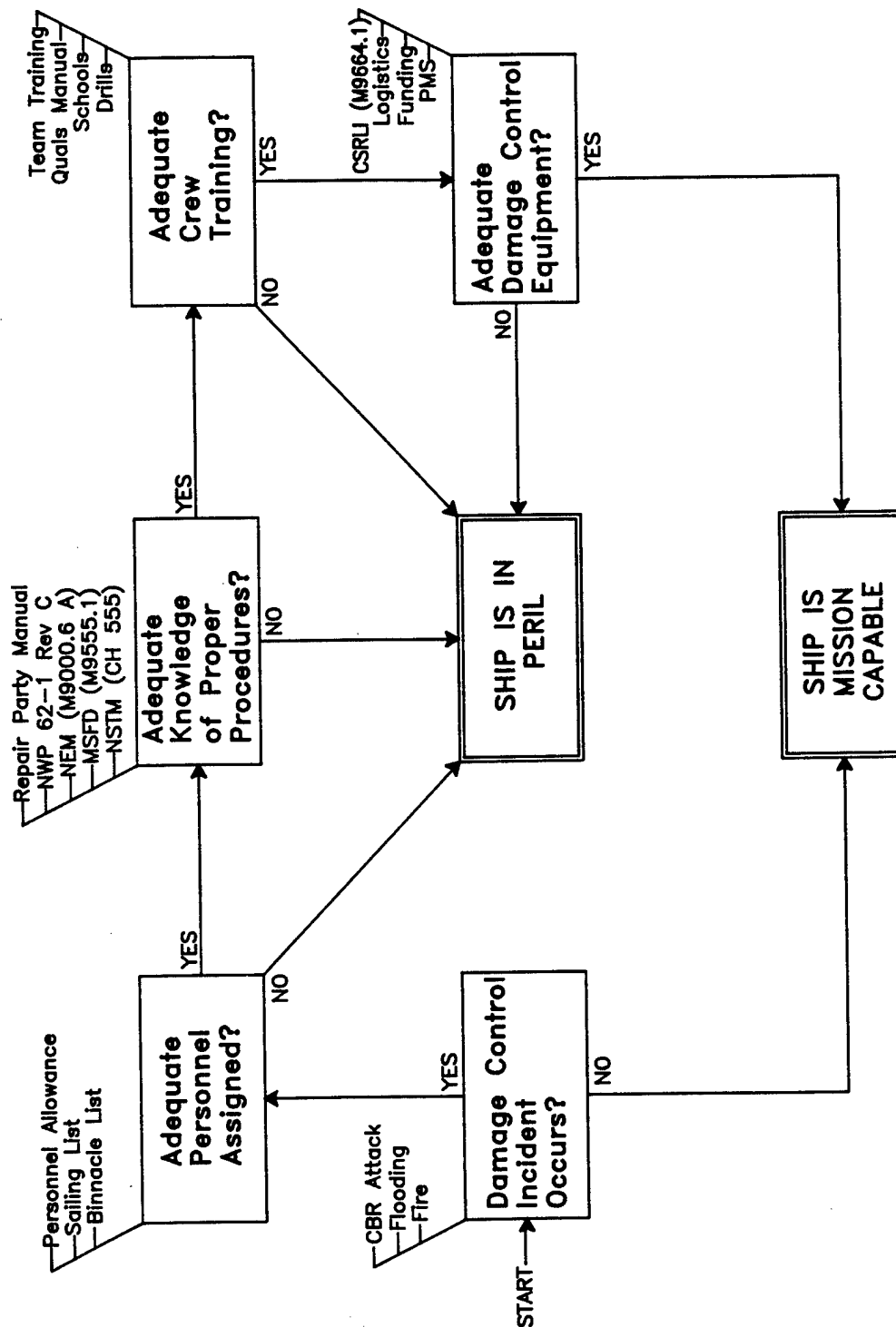


TABLE 3-2 SUMMARY OF RECOMMENDED CHANGES TO THE CSRLI

Chapter	Summary of Major Changes
I Firefighting Equipment	Add: 1 15 lb. CO ₂ Fire Extinguisher
II Personnel Protection Equipment	Delete: Helmets & Hood for Repair Locker personnel not in FFE
III DC Tools & Equipment	Delete: 60" Pinch Bar Smoke Curtain Ripping Hammer Hydraulic & Screw Jacks Scaling Ladder 26" Cross Cut Saw Add: 2 Hand Held Thermal Imagers ("Firefinders")
IV DC Atmospheric Testing Kit	Add: Entire Kit and all gas detector tubes to Cols. 6 & 7
V DC Publications	No Changes
VI Submersible Pump	No Changes
VII DC Ventilation Equipment	Add: Red Devil Blower & Hose Assy's to Cols. 6 & 7
VIII DC Electrical	No Changes
IX Casualty Power	No Changes
X Shoring, Patching & Plugging Equip. not in kits	Delete: Wood Shoring, Nails, Sand, and tools for wood shoring
XI CBR Equipment	Delete: Entire kit
XII Cutting Outfit, Portable kit	Delete: Entire kit
XIII Access and Overhaul Kit	No Changes
XIV DC Emergency Communications Kit	Delete: Entire kit

**TABLE 3-2 SUMMARY OF RECOMMENDED CHANGES TO THE CSRLI
(continued)**

Chapter	Summary of Major Changes
XV Investigator/Tender Kit	Add: Non-redundant equipment from sounding kit
XVI Sounding Kit	Delete: Entire kit (combined with Investigator /Tender kit)
XVII Plugging Kit (Change name to: Plugging/Patching Kit)	Add: Non-redundant equipment from pipe patching kit
XVIII Pipe Patching Kit	Delete: Entire kit (combined with plugging kit)
XIX Electrical Repair Kit	Delete: 100-600 amp fuse puller Change: "Indicator, Volts Freq." to "Indicator, Volts" similar to Wiggins type
XX Shoring Kit	Delete: Entire kit
XXI CBR Monitoring Kit	Delete: Entire kit
XXII CBR Gross Decontamination Kit	Delete: Entire kit
XXIII Engineering Space Repair Kit	Delete: Entire kit
XXIV Gas Free Engineering Kit	Delete: Entire kit
XXV 378 WHEC Eng. Assist Team Locker	N/A to small cutters

COMDTINST 3501.26, "Mission Areas and Required OPS CAP/PROJ OPS Environment Statements" [26], is the deletion of all CBR equipment on Patrol Boats. Since it is conceivable that the Island Class Patrol Boats could be deployed for a CBR attack, they could retrieve the necessary equipment from shoreside storage provided for each cutter. CBR equipment could also be needed by Patrol Boats to respond to nuclear incidents at commercial power plants. For this event, equipment needed could be tailored for certain designated cutters. The other significant change is the addition of red-devil blowers or ram-fans to remove smoke and toxic gases. Presently, there is no portable equipment for removing smoke on most small cutters and installed ventilation systems are considered inadequate for the purpose.

CHAPTER 4. FIRE SAFETY ANALYSIS

The primary objective of the SCFP is to develop fire protection doctrine for nine classes of small Coast Guard cutters. The basic technical approach included a thorough analysis of the cutter's existing fire protection levels and potential improvements where the cutter failed to achieve preestablished fire safety objectives. A cost-benefit analysis, conducted to analyze and compare potential improvements, served as a basis for recommendations to achieve fire safety objectives in interim reports. Fire protection doctrines were then developed for each class of cutter that encompassed firefighting procedures for all classes of fires in all types of compartments, in port and at sea. The new doctrine incorporates all documented recommendations that were submitted in interim reports during the course of this project [6,7,8,9].

The technical approach in this project specified the use of the Ship Fire Safety Engineering Methodology (SFSEM) [3] to methodically analyze the fire safety of a cutter. The SFSEM, under development at the Coast Guard Research and Development Center, is a comprehensive probabilistic-based risk analysis methodology. When it is fully developed it will be capable of analyzing all aspects of fire safety including flame movement, smoke movement, and people movement. In addition, the capability for structural analysis may be incorporated. Presently, only the flame movement module is fully developed and integrated in the SFSEM. Flame movement is analyzed by "starting" a fire in each compartment and predicting the spread of the fire to other compartments based on the probability of failure of existing barriers between compartments and the probability of flame limitation in each compartment on every possible fire path. Results are accumulated and compared to fire safety objectives which establish a permissible magnitude and frequency of damage for each compartment.

The SFSEM is particularly useful in examining a wide range of hypothetical improvements to fire safety including a better material for a fire barrier, a better firefighting technique, or better firefighting equipment. The tool is robust in that these usually incomparable entities can be compared to examine their relative ability to achieve fire safety objectives.

The following sections of this report will address various aspects of the process used to analyze cutter fire safety which ultimately resulted in the development of fire protection doctrine. These aspects included:

- ◆ Historical Fire Data Analysis. The SFSEM relies on historical data for the calculation of the "frequency of established burning (EB)", which in turn is used to calculate the probability of flame limitation.

- ◆ Preliminary Fire Safety Analysis. A preliminary analysis of existing firefighting procedures and documentation is conducted in conjunction with the initial ship visit. Information required to run the computer programs associated with the SFSEM is also collected during this ship visit.
- ◆ Fire Safety Analysis using SFSEM/SAFE. The SFSEM and its implementing computer programs, SAFE, is used to perform a detailed fire safety analysis of existing fire protection levels and to compare hypothetical improvements to fire safety in compartments which fail to meet fire safety objectives.
- ◆ Fire Protection Doctrine for Small Coast Guard Cutters. The doctrine includes basic information concerning fire science, policies promulgated by responsible authorities, and procedures and tactics for combating all classes of fires in all types of compartments.

4.1. HISTORICAL FIRE DATA ANALYSIS

The following five events must occur for fire to spread beyond the room of origin:

- ◆ Ignition occurs.
- ◆ Established Burning (EB) occurs.
- ◆ Flames do not self-extinguish.
- ◆ Flames are not suppressed by fixed fire extinguishing system.
- ◆ Flames are not suppressed manually.

Each of these events is dependent on the occurrence of the previous event in the list. Established Burning is a concept which describes the size of the fire that is considered to be the start of the fire safety design process for the ship. It is the demarcation between fire prevention and the beginning of the ship's response to the fire. The probability that EB will occur is equivalent to the probability that fire prevention failed. The probability of EB can be calculated by multiplying the probability of ignition times the probability that the fire will grow to the critical size defined as EB. Calculating this probability is primarily useful in a study of the fire prevention phase.

The probability of EB and the frequency of EB are two alternative ways of expressing the likelihood of the event EB occurring in a given compartment. Military ships, including

Coast Guard cutters, are required to report all fires that result in damage or personnel injury. This provides the opportunity to utilize historical records to determine the frequency of EB. Historical data does not involve the subjective judgment required in determining probabilities. Moreover, in the SCFP, the ship's response to a fire is the focus of the study (opposed to the fire prevention phase), therefore the alternative "frequency of EB" is utilized in the SFSEM. The next section describes how this frequency was calculated.

4.1.1. Frequency of Established Burning

The original data on the probability of fire in shipboard compartments was based on historical reports of fires, obtained from the U.S. Naval Safety Center. Data was collected on 21 classes of large naval vessels for the period 1975 through 1986. This data was analyzed in conjunction with the "Fire Safety Analysis of the Polar Icebreaker Replacement (PIR) Design" [10] and a frequency of EB value determined for each type of compartment. Experience has shown that some fires which reach EB do little or no damage to the vessel, thus they are unreported. As a result, the frequency of EB based on historical data was doubled and called "adjusted fire frequency" to account for the possibility of unreported fires. This data was used in the PIR analysis, and in the analysis of the first three small cutter classes.

Subsequently, historical reports of fires on all classes of Coast Guard cutters was obtained from the Commandant (G-KSE-4), U.S. Coast Guard, for the period 1986 through 1991. This data was combined with the Navy data to refine the reported fire frequencies. For the purposes of the SFSEM, similar compartments were grouped by "compartment use indicator (CUI)". CUI categories used for the PIR analysis were adapted from the standard nomenclature used by the Coast Guard and Navy to identify compartment usage. As a result of the Commandant (G-KSE) data some CUI's were further subdivided in order to reflect a more accurate assignment of adjusted fire frequency. The reported and adjusted fire frequency values from the combined Navy and Coast Guard data is shown in Table 4-1 grouped according to CUI.

The number of fires reported were divided by the number of compartment years to obtain reported fire frequency. This number was doubled and shown in Table 4-1 as "adjusted fire frequency". Compartment years were determined by adding the number of years each ship in the class was in commission and not undergoing FRAM, SLEP or MMA during the period data was collected.

The data provided by the Commandant (G-KSE-4) was also analyzed to obtain information such as: the frequency that arson is a problem, the frequency of fires that spread to other compartments from the room of origin, the class of fires that

TABLE 4-1 FIRE FREQUENCY DATA
(Combined Data Sources)

Type of Compartment	Compartment Use Indicator (CUI)	Number of Fires Reported	Adjusted Fire Frequency (1) (Fires per Compt Year)
Main Propulsion Mechanical (4)	EM	148	0.0272
Emergency Aux Generator Room (4)	QE	23	0.0204
Helicopter Hangar	QH	3	0.0036
Main Propulsion Electrical (4)	EE	7	0.0031
Laundry	QL	5	0.0031
Auxiliary Machine Space (4)	QA	89	0.0029
Galley, Pantry, Scullery	QG	13	0.0026
Shops, Labs	QS	15	0.0018
Stack, Uptake	TU	5	0.0013
Hazardous Material Storage	K	4	0.0013
Ship Control Area	C	4	0.0012
Gear Locker	AG	19	0.0010
Storeroom	AS	34	0.0009
Refrigerated Storage	AR	3	0.0009
Berthing Space	L1, L2, L5	20	0.0008
Wardroom, Mess, Lounge Space	LL	7	0.0008
Fan Room	QF	7	0.0004
Office Space (4)	QO	5	0.0004
Water, Peak, Ballast Tank	W	1 (2)	0.0004
Sanitary Space	LW	4	0.0002
Passageway, Staircase, Vestibule	LP	3	0.0001
Medical, Dental Space (4)	LM	0	0.0001 (3)
Fuel Oil, Lube Oil Tank	F	0 (2)	0.0001 (3)
JP-5 Fuel Tank	J	0 (2)	0.0001 (3)
Trunk, Hoist, Dumbwaiter	TH	0 (2)	0.0001 (3)
Void, Cofferdam	V	1	0.0001 (3)
Explosives Storage	M	1	0.0001
Cargo Hold	AA	0 (2)	0.0001 (3)

NOTES:

- (1) Taken as twice the reported fire frequency.
- (2) Based on 1986-91 USCG data only. (All other numbers of fires based on both USN and USCG data.)
- (3) Default value used in cases where no fires have been reported, or when calculated adjusted frequency is below 0.00005.
- (4) New compartment types added since analysis of three small cutters.

most frequently occur, the type of compartment where high dollar loss fires occur, etc. The next section describes the results of this analysis.

4.1.2. Historical Records

Coast Guard data included reports of 29 fires and explosions over a five year period (FY86 thru FY91) on cutters that represent 95% of the Coast Guard fleet. Three of the 29 fires (10%) occurred in 378' High Endurance cutters; 13 fires (45%) occurred in 270' and 210' Medium Endurance cutters, 180' Seagoing Buoy Tenders, and 140' Icebreaking Tugboats; the remaining 15 (45%) occurred in cutters ranging from 65' Harbor Tugboats to 110' Island Class Patrol Boats, and Construction Tenders.

Most reported fires are relatively minor. Only 7 fires resulted in damage estimated to exceed \$1000. There were no deaths, 6 minor injuries, and 25 fires with no injuries. Arson was not considered a factor in any fire. Additional mishap report data provided by Commandant (G-KSE-4) shows that the majority of high dollar loss fires originate in Engine Rooms.

An analysis of the data showed 18 Class A, 4 Class B, 5 Class C fires and 4 explosions. Forty-two percent of the fires occurred in port, 29% underway, 23% during a Yard period, and 6% unknown. Note the period of time a vessel was undergoing FRAM, SLEP or MMA was excluded. For comparison, COMDTINST M9000.6A [4], Table 081-1 lists the required maintenance days for each class of cutter. The remaining days are available for operations, and the cutter can be assumed to be underway. Small cutters are shown to be underway 64 to 79% of the time. Therefore the percentage of fires that occur underway is much less than the percentage of time the cutter could be underway. On the other hand, a disproportionately high percentage of fires occur in port.

Most fires were quickly extinguished by the crew; 90% (24 fires and 4 explosions) were extinguished within 5 minutes. Only three fires took longer than 5 minutes to extinguish. This fact probably accounts for the related fact that 94% of all fires were contained to the room of origin, only two fires spread to involve multiple compartments.

4.2. PRELIMINARY FIRE SAFETY ANALYSIS

Information required to conduct a preliminary fire safety analysis is collected during an initial ship visit. The ship visit has the following specific purposes as explained in the Theoretical Basis of the SFSEM [3]:

- ◆ Conduct fire safety audit.
- ◆ Collect detailed information to accomplish the fire safety analysis using the SFSEM/SAFE.

- ◆ Collect and review all relevant documentation concerning firefighting procedures.
- ◆ Observe fire drill.

The fire safety audit is conducted to identify existing passive and active fire protection features and procedures as well as to determine any fire hazards. When possible, a fire drill is observed to assess the characteristic time it takes to set ZEBRA and to enable the analyst to assess manual firefighting effectiveness. The cutter's Main Space Fire Protection Doctrine, Casualty Control Manual, Compartment Check-off Lists, and Repair Locker Inventory and other critical information regarding the cutter's firefighting procedures is collected and reviewed.

The SFSEM/SAFE requires an extensive amount of data to facilitate an analysis of the cutter's fire safety. This data includes:

- ◆ Information concerning the cutter's compartmentation,
- ◆ Thermal and physical data for the bulkheads and deck materials,
- ◆ Location and identification of firefighting and detection equipment,
- ◆ Ventilation details including compartments served and air exchange rates,
- ◆ Estimates of fuel loads and distribution.

Preprinted ship visit forms, prepared in advance, ensure information concerning fuel loads, compartmentation, and ventilation is collected in an efficient manner. This information is also used by the engineer/analyst to temper the engineering judgment required to develop the probabilistic values entered into SAFE.

The probabilities of flame termination and barrier failure in each compartment are the key values the analyst determines based on engineering judgment. There are three ways a fire can occur in a compartment:

1. It can originate in the compartment.
2. It can enter via a thermal "hot spot" barrier failure.
3. It can enter via a massive durability barrier failure.

There are also three ways a fire can terminate in a compartment:

1. Self-extinguishment,
2. Suppression by fixed fire extinguishing systems,
3. Manual suppression.

Therefore, a matrix of nine probabilities of flame termination are required for each compartment. Barriers themselves are assigned a curve for both the probability of thermal failure and the probability of durability failure based on the type of material composing the barrier. This curve plots the probability of failure versus heat energy impact for each barrier material for each failure mode.

The following sections describe the key results from the fire safety audit conducted as part of the preliminary fire safety analysis of the nine classes of small cutters in the SCFP.

4.2.1. 110' WPB "Island Class" Patrol Boat (CGC MONOMOY)

The "Island Class" Patrol Boat is constructed primarily of light weight aluminum and is capable of speeds in excess of 30 knots. Active fin stabilizers provide dynamic stability, thus high speeds are achievable even in high sea states. The installed turbocharged diesel engines are a potential source of Class B spray fires due to high fuel flow rates and hot exhaust temperatures required to achieve 30 knots.

The Engine Room is protected by a one-shot, Halon 1301 total flooding system. A secondary set of halon bottles is stored in the auxiliary machinery space, but not installed in the system. The crew estimates that it would take 15 minutes under ideal conditions to exchange the secondary bottles and the expended bottles. Accomplishing this exchange underway could be very dangerous.

Normal egress from the eight-man Berthing Area is through the Engine Room. An emergency escape hatch in the overhead is in close proximity to the port exhaust vent serving the Engine Room. Therefore, a serious fire in the Engine Room could present a considerable risk to life safety by preventing escape from this compartment. An automatic fire detection system is installed throughout the ship serving virtually all accessible spaces.

4.2.2. 110' WSES Surface Effect Ship (CGC PETREL)

These vessels achieve very high speeds in relatively high sea states due to their ability to pressurize the "wet deck" which reduces the wetted surface area, and therefore drag, on the ship. Light weight construction mandates the exclusive use of aluminum throughout the ship. There are four large diesels in

the port, starboard and lift Engine Rooms, two provide propulsion power and two drive large centrifugal fans for pressurizing the wet deck. These vessels are constructed to commercial, as opposed to military standards, thus large holes to accommodate piping, electrical wiring, and ventilation ducting are evident throughout the ship. These holes provide a potential path for fire spread.

The port and starboard Engine Rooms, Lift Engine Room, Generator Room, port and starboard Pump Rooms and associated bilge areas are all protected by a single, one-shot, Halon 1301 total flooding system. The effectiveness of this system is seriously degraded by large clearance holes for exhaust piping and an open hatchway in the Uptake Decks which prevent a tight seal to contain the halon. Releasing the halon automatically shuts down the generators, rendering the electric fire pumps useless. The P-250 would then become the only source of firefighting water pressure as is the case on most small cutters.

There is no way to isolate certain compartments due to the absence of watertight doors. There is virtually no insulation of the exposed aluminum bulkheads. This affects the performance of the ship as a fire safety system since it potentially affects the time to full room involvement. It also permits the potential collapse of the bulkheads due to the relatively low melting temperature of aluminum which is 630°C.

Interior communications on this cutter class is extremely poor. There is a general lack of well-placed sound powered phones and other means of contacting the Bridge. Due to the extremely high noise levels underway, the human voice cannot be heard for any appreciable distance. Communications from the repair party leader to the CO on the Bridge is reportedly satisfactory using hands-free headsets. There is a pending SHIPALT to improve the general alarm and interior communications.

Three of four fire stations on the ship are located aft on the Main Weather Deck and grouped such that a fire near any two might preclude access to the remaining third station; the fourth is in the generator space. Moreover, due to the location of fire stations, 100 foot hoses have to be routed most of the length of the ship and through interior compartments to manually fight fires in the forward part of the ship. Due to the design of the new stack houses, fighting a fire in the engineering spaces is essentially limited to one available path (from the Weather Deck down an inclined ladder to Engineers Stores, forward through the Pump Rooms to the Engine Rooms, and then to the Lift Engine Room (if necessary). The inability to attack machinery space fires from more than one direction, and the excessively long path through all engineering spaces, is a very serious limitation.

4.2.3. 100' WLIC Inland Construction Tender (CGC PRIMROSE)

The age of this cutter class is approximately 50 years. This cutter class has an installed CO₂ flooding system protecting the Engine Room. The Forward Hold is² a large compartment, contains an extensive workshop, and a large quantity of combustible materials. The ship is constructed entirely of steel.

The escape scuttle located in the forward starboard corner of the Engine Room was frozen shut and could not be opened from either side. This is the only other means of egress from the Engine Room. This malfunction cannot be considered common to this class of cutter but it does point out the vulnerability of this scuttle.

This class of cutter is normally operated with an unmanned Engine Room and there is no installed fire detection system in this compartment.

The Atlantic Beach Fire Department (ABFD) is located 2.5 miles from the location of PRIMROSE's homeport. The response time for the ABFD is 6-8 minutes. Volunteer members of the fire department have included as many as four crewmembers from the PRIMROSE. The ABFD visits the Coast Guard Base twice a year to test fire hoses/hydrants and conduct familiarization tours of PRIMROSE. The other cutters in this class have different homeports, but it is assumed that local fire departments have similar familiarity with the cutters. Response times of less than ten minutes from local fire departments is also assumed.

4.2.4. 82' WPB Patrol Boat (CGC PT FRANCIS)

This Patrol Boat class is being phased out by the Island Class Patrol Boat class. The 82' WPB patrol boats were constructed with wooden bifold doors installed between the mess area and the dry stores/SPO berthing with excessive clearances. Joiner bulkheads in the Mess Area and Crews Head are 1/16th inch aluminum with very low structural strength. The smoke detector in the Mess Area serves the SPO Berthing as well since these two spaces are not isolated from each other. The installed two-shot Halon 1301 total flooding system appears to be well designed and installed without obvious problems that would degrade performance.

4.2.5. 75' WLIC Inland Construction Tender (CGC SLEDGE)

There is an 84' barge semi-permanently faced up to the Tender (also referred to as the "tug"). The barge can provide an alternate source of firefighting water pressure by hooking up a 100' length of 1.5" fire hose to the forward fire station on the tug.

The CO₂ hose reel system installed on the tug is virtually useless due to its nearly inaccessible location. The only fire detectors on the tug consist of two battery powered residential type smoke detectors in the berthing area. The Engine Room has a live watch underway (even though not required) due to the fact there are no remote alarms for the main engines (overheat, low oil pressure, overspeed, etc.).

There are a number of conditions, suspected to be unauthorized SHIPALTS, which affect fire safety and may be indicative of the class. The door to the Laundry Room has been permanently removed. This removes a potentially critical barrier to a fire. TV's, VCR's, microwaves, laundry machines, refrigerators, air conditioners, and joiner bulkhead materials represent potentially hazardous fuel loads.

4.2.6. 75' WLR River Buoy Tender (CGC CHIPPEWA)

This class of cutter, like other WLR/WLIC vessels, have a barge which can provide an alternate source of firefighting water pressure by hooking up a 100' length of 1.5" fire hose to the forward fire station on the tug. A jetting pump on the barge serves as an alternate fire pump.

This cutter class has no automated fire suppression system installed in the Machinery Space. A manual CO₂ hose and reel assembly is located in the Fidley to facilitate manual firefighting efforts. Several joiner doors have been removed in some berthing and office compartments thus permitting a potential path for fire and smoke to spread. This vessel is normally operated with an unmanned Engine Room and there is no installed fire detection system installed in this compartment. All berthing spaces have battery powered smoke detectors, although several dead or missing batteries were noted. The Galley and Fidley watertight doors are classified ZEBRA, thus they may normally be open during XRAY and YOKE conditions, which represent the majority of normal operating conditions.

The Weather Deck door adjacent to the #1 fire station interferes with firehose deployment when the door is open. If the hose rack were only 12" further forward, this problem would not exist.

4.2.7. 65' WLR River Buoy Tender (CGC OBION)

This cutter class is very similar to the 75' WLR class. They both have barges and neither have an automated fire suppression system installed in the machinery space. A manual CO₂ hose and reel assembly is located in the Fidley to facilitate manual firefighting efforts. Several joiner doors have been removed in some berthing and office compartments thus permitting a potential path for fire and smoke to spread. This vessel is normally operated with an unmanned engine room and there is no

installed fire detection system installed in this compartment. Galley and Fidley watertight doors are classified ZEBRA, thus they may normally be open during XRAY and YOKE conditions, which represent the majority of normal operating conditions.

4.2.8. 65' WLI Inland Buoy Tender (CGC BLACKBERRY)

This cutter class has an installed CO₂ flooding system protecting the Engine Room. The two 100 pound CO₂ bottles for this system are permanently installed in the Engine Room; since this is the protected space perhaps an alternate location, such as the Cargo Hold would be more appropriate.

The vessel has a single electric fire pump. The P-250 portable pump serves as a backup. The Forward Hold is a large compartment with an abundance of combustible materials. This ship normally operates with an unmanned Engine Room.

The Caswell Beach Fire Department (CBFD) is the local fire department for the BLACKBERRY. It is located three miles away and has a response time of ten minutes. While the CBFD visits the Coast Guard Station periodically, they have not been on board BLACKBERRY recently.

4.2.9. 65' WYTL Harbor Tugboat (CGC TOWLINE)

The ventilation to each compartment essentially consists of 3" natural vents which are equipped with tompons (expandable plugs). The CO₂ hose reel system was removed and a 2-shot Halon 1301 total flooding system was installed to protect the Engine Room.

The primary source of firefighting water pressure is the fire pump driven by a power take-off from the main engine. In the event of a fire in the Engine Room, the P-250 is the primary source of firefighting water pressure.

The "Cutter Standard Repair Locker Inventory" [2] does not include desmoking equipment for this class cutter. Primarily due to lack of storage space, there is an unusually high fuel loading on this class cutter. The berthing area has a great quantity of exposed clothing for the crew compared to other cutters. Dry stores are filled to capacity with paper and plastic products. The CPO Stateroom has 2000 rounds of ammo stowed in the room. The Steering Gear compartment contains a five-gallon can of transmission fluid as the source of hydraulic fluid for the steering gear.

There is no installed fire detection system in the Main Hold or Steering Gear Room. These spaces are checked half hourly underway and hourly in port. This permits a fire to grow to unacceptable proportions before detection.

4.2.10. General Observations in Small Cutters

Fire Safety is adversely affected by the following conditions which generally exist on small cutters:

- ◆ Fire detection systems are generally nonexistent. Some Berthing Areas and Engine Rooms are protected only by battery powered smoke detectors. Frequently, these detectors have dead or missing batteries. The 110' Island Class Patrol Boat is a notable exception, this class of cutter has an automatic fire detection system installed throughout the ship.
- ◆ Desmoking equipment is notably absent in the ships inventory of damage control equipment. There is also a general lack of installed ventilation systems. The Engine Rooms are usually the only space served by forced ventilation supply fans.
- ◆ The P-250 is usually the backup source of firefighting water pressure and primary source in the event of an Engine Room fire (vessels equipped with barges are notable exceptions). Tests have demonstrated it takes an average of 4 minutes and 15 seconds to rig and energize a P-250 under ideal conditions; it takes an additional 45 seconds to obtain AFFF from two hoses. Reliable operation of this equipment is crucial to successful manual suppression.
- ◆ The Engine Rooms on small cutters are generally unmanned underway.
- ◆ There are very few automatic fixed fire protection systems. The crew must be relied upon to extinguish fires using first aid.

4.3. FIRE SAFETY ANALYSIS USING SFSEM/SAFE

The Theoretical Basis of the Ship Fire Safety Engineering Methodology (SFSEM) provides the details for conducting a fire safety analysis of a ship. [3] The SFSEM is a probabilistic-based risk analysis methodology which utilizes subjective engineering judgment guided by computer fire modeling, analytical calculations, and fire tests for development of certain critical input parameters. These include the probabilities that flames will terminate in a compartment should a fire start and the probability that a barrier will fail once the fire becomes fully involved. The analyst must also estimate the fuel loads and the type of combustibles in each compartment which dictate fire growth characteristics. To facilitate these estimates and input parameters, a detailed ship check is performed as a first step in the fire safety analysis. Fire safety objectives (FSO's) are established for each compartment because the SFSEM is a

performance based methodology and FSO's establish acceptable performance. A powerful feature of the SFSEM is its capability to analyze alternatives to improve fire safety of compartments which fail to achieve minimal standards of performance. Lastly, a cost benefit analysis is conducted to assist the analyst in determining which of the acceptable alternatives is the most cost-effective. The following sections describe each of these major areas with particular emphasis on their applicability to small cutters.

4.3.1. Fire Safety Objectives

As noted above, FSO's establish the minimal acceptable performance standards for each compartment in the vessel being analyzed. FSO's should be established by "cognizant authorities" in terms of magnitude and frequency of acceptable loss taking into account the following considerations:

- ◆ Life Safety. This includes all persons on board such as the crew on watch and off watch, as well as passengers.
- ◆ Property Protection. This includes the ships outfit and furnishings as well as cargo.
- ◆ Mission Protection. The ship may have multiple missions that may be prioritized into primary and secondary missions.

Cognizant authorities for small cutters should include, as a minimum, the Commandant, U.S. Coast Guard, Offices of Engineering and Operations. In the absence of such input, the FSO's for small cutters were established by the analyst and submitted as an integral part of the interim reports which described the results of the fire safety analysis.

Each compartment in the nine cutter classes analyzed in this project were rated for Magnitude and Frequency of Acceptable Loss considering flame movement only. The Magnitude of Acceptable Loss was permitted to be one of the following four ratings:

- 1 Established Burning (EB) is not acceptable.
- 2 EB is acceptable but Full Room Involvement (FRI) is not.
- 3 FRI is acceptable but Compartment Burnout (CBO) is not.
- 4 CBO is acceptable.

Compartments whose total loss would not significantly affect the ship's primary mission are normally assigned a rating of 4. For example, redundant sanitary spaces, gear lockers,

passageways, voids, redundant water tanks, ladders, cofferdams, and certain storerooms, if totally lost, would not prevent the ship from performing its mission. Note, a compartment may contain a significant fuel load and contribute materially to the spread of a fire, but if its loss does not affect the ship's primary mission, it receives a rating of 4. At the other extreme, flammable materials storage lockers, paint lockers, magazines and other compartments containing highly volatile or explosive materials representing a significant fire hazard are normally assigned a rating of 1.

The balance of the compartments are normally assigned a rating of 2 or 3 depending on their essentiality to the ship's primary mission. In general, if the compartment contains equipment vital to the ship's mission, and if its loss would likely result in the ship aborting its patrol and returning to homeport for repairs, it would be assigned a 2. On the other hand, if the compartment's loss would degrade, but not prevent, the ship's ability to perform its mission, it would receive a 3 rating. Examples of compartments typically rated 2 are the Engine Room, Bridge, and Galley. Berthing Areas, Ship's Offices and Labs/Workshops are typically assigned a 3 rating.

The above discussion was applied when assigning Magnitude ratings considering only the primary mission. A similar approach is applied when assigning ratings to the remaining three components of secondary mission, life safety and property protection, yielding four ratings for each compartment.

The Frequency of Acceptable Loss is loosely coupled to the Magnitude of Acceptable Loss. For example a compartment rated 1 can be lost much less frequently than a compartment rated 4. The FAL ratings were assigned based on engineering judgment of the analyst and integrating the considerations mentioned above: life safety, property protection, primary mission, and secondary mission. The analyst mentally integrated these considerations when assigning the FSO's for the first three cutter classes analyzed. This process was improved for the last six cutters where weighting factors were assigned to each consideration.

Establishing FSO's is a complex and contentious issue. It includes identification of cognizant authorities and then ensuring they are trained and knowledgeable to assign FSO's. In addition it involves integrating multiple considerations for flame movement. In the future the SFSEM will include the ability to analyze smoke movement which will further complicate the process. Moreover there has been some discussion that assigning FSO's on a compartment basis may not be appropriate; assigning FSO's at the ship or even ship class level has been discussed. Finally FSO's presently do not take into account the effect that losing one compartment has on another. For example ships with redundant engine rooms may require the loss of both engine rooms

simultaneously before a given ship's mission would have to be aborted. Consequently, the subject and methodology of establishing FSO's is under continued study.

4.3.2. Baseline Analysis

The first step in the fire safety analysis of a ship using the SFSEM is a determination of the existing fire protection levels. To facilitate discussion, this result is referred to as the "Baseline". Data sets identified as "Baseline" utilize input values to the SAFE program based on the physical condition of the ship found during the ship visit and are not influenced by any modifications or alterations which may be proposed as a result of this analysis. A Standard Scenario is specified when SAFE is run that includes user-defined parameters such as barrier failure criteria, simulation run time, ship location, material condition of readiness, etc. Standard Scenarios are established to describe operating conditions for the cutter over the majority of its life cycle.

A cutter is typically in material readiness condition XRAY (all access closures, valves and fittings marked "X" closed) or YOKE (all access closures, valves and fittings marked "X" or "Y" closed). It is either in port or at sea. The firefighting configuration includes the three lines of defense ("I" probability that the fire will self-extinguish; "A" probability that an automated/fixed fire protection system will limit the fire, and "M" the probability that the manual firefighting efforts of the crew will extinguish the fire). Standard Scenarios are thus established that include different combinations of these parameters that describes the cutter over its life cycle.

The Standard Scenarios are shown in Table 4-2. The baseline analysis represents the results of running SAFE with the individual target option on the Baseline Data Set using all applicable Standard Scenarios.

TABLE 4-2
STANDARD SCENARIOS

Scenario #	1	2	3
Readiness	X-RAY	YOKE	YOKE
Location	In-Port	In-Port	At-Sea
Configuration	I, A, & M	I, A, & M	I, A, & M

The target option in SAFE permits a fire safety analysis where EB is assumed in each compartment and fire is permitted to spread according to the probabilities of barrier failure and the probabilities of the three lines of defense in action to limit the spread of the fire. Results are accumulated and then reported such that the loss of any compartment can be traced to the compartment where the fire originated. SAFE has the capability to examine separately the relative effect on the fire safety of the ship of each line of defense. Therefore if the analyst wanted to examine the effect of manual firefighting efforts, this could easily be done by turning off "M". The results would show increased damage to the vessel because a major component of firefighting has been removed. This would permit, for example, the analysis of alternatives to supplant manual firefighting. The next section will discuss this aspect of the analysis.

4.3.3. Analysis of Alternatives

A desirable objective in the Small Cutter Fire Protection Project was to identify viable alternatives that would reduce the reliance on the crew of a small cutter for manual firefighting. The SFSEM facilitates this objective because it quantifies the contribution of each line of defense. Thus, alternatives can be examined that would provide at least as much fire protection as manual firefighting efforts presently contribute. A non-standard scenario is created that eliminates one or more lines of defense for the purposes of analysis.

Analyzing alternatives to supplant manual firefighting was a secondary objective. Alternatives were also developed and analyzed whenever a compartment failed to achieve FSO's in the baseline analysis. In either event an alternative data set modifies the parameters of the baseline data set such that it represents the conditions that would be in effect if that alternative were installed on the cutter.

The outputs from SAFE running the target option include Relative Loss Factors (RLF's) for each compartment. RLF's represent a relative comparison to the FSO's. Baseline or Alternative Data Sets may be analyzed in combination with Standard or Non-Standard Scenarios to consider various alternatives. Once the situation is defined by the analyst, values are assigned by the analyst to numerically represent the appropriate probabilities involved. These inputs and the rest of the parameters unaffected by this alternative are then loaded into SAFE which then calculates RLF's for this alternative. RLF's greater than 1.0 indicates a compartment has failed to meet the FSO's.

The goal of analyzing various alternatives is to maximize the benefit (improvement in fire safety), while minimizing the cost (dollars and other intangible factors) of the

changes. Thus, a cost-benefit analysis is the last step in the fire safety analysis. The next section will discuss the criteria for the cost benefit analysis conducted in the Small Cutter Fire Protection Project.

4.3.4. Cost-Benefit Analysis

The benefits associated with an alternative take into account the improvement to the baseline fire protection levels quantified by the change in RLF's. There are also two objectives which each alternative could achieve:

- ♦ Primary Objective - meeting or exceeding FSO's in all compartments, and
- ♦ Secondary Objective - equivalence to manual firefighting in terms of contribution to fire protection levels. This objective was later modified to: elimination of reliance on manual firefighting without sacrificing existing fire protection levels.

Table 4-3 summarizes the criteria for the cost benefit analysis used in the analysis of the first three cutter classes. The benefits criteria were later modified for the analysis of the last six cutter classes as shown in Table 4-4.

The direct costs necessary to implement the alternatives are categorized according to magnitude and source of funding. Indirect or intangible costs include effect on the crew or the Coast Guard. For example, installing an additional barrier to improve passive fire protection may require a change in watchstanding policies which may be a hardship on a minimally manned vessel. Another example would be the indirect costs to the Coast Guard of installing an environmentally hazardous alternative such as Halon 1301.

Table 4-5 summarizes the ratings for every possible combination of cost and benefit. This permits a relative comparison of alternatives considering direct costs. Note that an alternative with substantial benefit at low cost receives the highest rating of five stars. An alternative with marginal benefit and high cost receives the worst rating of one star. It is common for more than one alternative to receive the same rating. In this event indirect or intangible costs are factored in to determine the most cost effective alternative.

4.4. FIRE PROTECTION DOCTRINE FOR SMALL COAST GUARD CUTTERS

4.4.1. Organization

The original "Machinery Space Firefighting Doctrine", published as Commandant Instruction M9555.1 [1], applied only to Class B fires in the machinery spaces. The doctrine was written

TABLE 4-3
COST-BENEFIT CRITERIA FOR FIRST THREE CUTTER CLASSES

Benefit	
Marginal:	Achieves at least one of the two objectives. Minor improvement in relative loss factors of majority of compartments.
Moderate:	Achieves at least one of the two objectives. Improvement in relative loss factors of most compartments.
Substantial:	Achieves both objectives. Improvement in relative loss factors in all compartments.
Cost	
Low:	No cost. Funding feasible at unit level.
Moderate:	Funding at District or MLC level without significant impact on current budget.
High:	Significant expense requiring funding at Headquarters level; potential impact on budget cycle.

TABLE 4-4
COST-BENEFIT CRITERIA FOR LAST SIX CUTTER CLASSES

Benefit	
Marginal:	Fails to meet the secondary objective but results in reductions in some RLF's. One or more RLF's still exceed 1.0.
Moderate:	Fails to meet the secondary objective but results in all RLF's less than 1.0.
Substantial:	Meets the secondary objective. All RLF's reduced to levels equal to or less than those determined in the baseline analysis considering I/A/M.
Cost	
Low:	Funding at unit level.
Moderate:	Funding at District or MLC level without significant impact on current budget.
High:	Significant expense requiring funding at Headquarters level; potential impact on budget cycle.

TABLE 4-5
RATINGS FOR COST-BENEFIT ANALYSIS OF ALTERNATIVES

Benefit			Cost			Rating
Marginal	Moderate	Substantial	Low	Moderate	High	
X			X			***
X				X		**
X					X	*
	X		X			*****
	X			X		***
	X				X	**
		X	X			*****
		X		X		*****
		X			X	***

in a generic manner that applied to all cutters, and each cutter was supposed to tailor it to suit their specific ship. Since the doctrine had to include all necessary information for large cutters, it was necessarily voluminous and some of it did not apply to small cutters. Finally, the format of the doctrine was organized such that general information pertaining to fire science, guidance from the Commandant and other authorities, and specific tactical procedures for a particular cutter were mixed throughout the document.

The new fire protection doctrine proposed for the small cutters is organized into three parts:

- ◆ Part A includes information and facts concerning fire science and firefighting such as the effectiveness of various firefighting agents on the different classes of fires. This part applies equally to all ships and rarely changes over time.
- ◆ Part B incorporates guidance promulgated by the Commandant, U.S. Coast Guard for small cutters. At the Commandant's discretion, portions of this guidance may be similar to that provided for large cutters. Circumstances for activating a gas turbine enclosure local fire extinguishing system is an example of guidance the Commandant would document in Part B for large cutters only since gas turbines are not used on small cutters. On the other hand, since crews on small cutters are generally able to safely abandon ship due to their proximity to shore, the Commandant may provide guidance of when that would be appropriate for small cutters only.
- ◆ Part C contains the tactical procedures to combat all classes of fires, in all types of compartments, in port and at sea. Other cutters in the class will have to tailor this part to account for uncompleted (or unauthorized) ShipAlts and other differences that would require different tactics. The Commanding Officer of the cutter has the responsibility to ensure this tailoring is accomplished in a timely manner and that such changes do not contradict the guidance provided in Parts A and B.

4.4.2. Scope

This report summarizes the results of the SCFP project and provides a tailored fire protection doctrine for nine classes of small Coast Guard cutters. Of the 142 small Coast Guard cutters 110' in length or less, these nine classes account for 137 vessels. The other five cutters are one-of-a-kind ships that could develop their own Part C by tailoring one of the nine Part C's included in this report as Appendix C. Obviously, they

should select a cutter that closely resembles their own cutter in terms of firefighting equipment, crew size, and compartmentation.

Part A, included as Appendix A to this report applies equally to all Coast Guard cutters. Part B, included as Appendix B to this report applies to "small" cutters in the Coast Guard. For the purposes of fire protection doctrine, "small" cutters are defined as 157' WLM Coastal Buoy Tenders and other cutters less than 157' (in length). Large cutters are therefore 180' WLB Seagoing Buoy Tenders and above (in length). This distinction is based on several factors including crew size, type of hazard due to main propulsion equipment, quantity and timeliness of support likely to be available, and area of operations. While Parts A and B apply to the four classes of "small" cutters not discussed in this report (133' WLM, 140' WTGB, 157' WLM, and 160' WLIC), development of Part C for these four classes should only be accomplished following a detailed fire safety analysis.

4.4.3. Future Revisions

Part A of the doctrine presents facts concerning the principles of fire science and other facts and information to enable a crewmember to make the proper selection of firefighting equipment and agents to combat a particular class of fire. Revisions to this part should rarely be required. The introduction of a new firefighting agent or equipment by industry is the most likely scenario that would require updating Part A. This revision is only required if the new agent or equipment is used somewhere in the Coast Guard fleet. Part B represents guidance from the Commandant and other Naval authorities applicable to either large cutters or small cutters. Recent conflagrations on the USS STARK and USS ROBERTS provided many lessons learned; these fires are examples of scenarios that would likely result in new or additional guidance provided to the fleet. Changes to Part C will usually be required in the event of ShipAlts that affect the firefighting capabilities or compartmentation of the cutter. In addition, new Commanding Officers would be able to change Part C (within the constraints of Parts A and B) due to their own beliefs, experiences, and desires.

It is expected that the Commandant, U.S. Coast Guard will issue revisions to Parts A and B as necessary, while Commanding Officers will be responsible for revising Part C for their own cutter. The revision page of the doctrine will document the authority who issued the change.

CHAPTER 5. CONCLUSIONS AND RECOMMENDATIONS

Three objectives (2-primary, 1-secondary) were established for the SCFP. There have been four interim technical reports during the course of this project. These reports are not generally available in the literature, however they may be obtained upon request from the Marine Fire and Safety Research Branch, U. S. Coast Guard Research and Development Center. Since this is the final report in the project, the conclusions and recommendations presented herein include those documented in the interim reports. They are organized in a manner that corresponds to the objectives.

5.1. FIRE PROTECTION DOCTRINE

The first and most important primary objective was to develop tailored fire protection doctrines for nine classes of small Coast Guard cutters. The new doctrines, submitted with this report as Appendices A through C, describe procedures and tactics for combating all classes of fire in all types of compartments. The doctrines are in consonance with official Coast Guard policy published in the Naval Engineering Manual (COMDTINST M9000.6A) [4], and other official publications such as the Naval Ships' Technical Manuals [5]. In addition, they incorporate approved recommendations and comments from Coast Guard Headquarters received in response to the interim technical reports previously submitted in the SCFP.

Since the new doctrines pertain to nine different classes of small Coast Guard cutters, significant recommendations that resulted from the detailed fire safety analysis are documented here organized by the relevant cutter class.

5.1.1. 110' WPB "Island Class" Patrol Boat (CGC MONOMOY)

An analysis of the existing fire protection levels with all active and passive fire protection features in effect indicate that all compartments in this cutter class meet the established fire safety objectives with the exception of the Bridge. It was determined, by examining the fire paths associated with the baseline results, that the Engine Room was the room of origin for many of the fire paths that contributed to the high relative loss factor for the Bridge.

- ◆ A detailed analysis of alternatives to improve the baseline fire protection levels of the Bridge revealed that a two-shot Halon system would not only improve the fire safety of the Bridge, but it would also improve the fire safety of the Engine Room.

This recommendation was accepted by Coast Guard Headquarters; a SHIPALT will be issued to permanently install the secondary set of halon bottles in the Auxiliary Machinery space into the existing halon flooding system.

An emergency escape hatch in the overhead of the 8-person Berthing Area is in close proximity to the natural port exhaust vent serving the Engine Room. The normal egress route from this berthing area is through the Engine Room. Therefore, a serious fire in the Engine Room could present a considerable risk to life safety by preventing escape from this compartment.

- ◆ It is recommended that a SHIPALT be considered to install a watertight escape scuttle in the after bulkhead of the After Berthing area which would permit emergency egress to the Auxiliary Machinery Space.

5.1.2. 110' WSES Surface Effect Ship (CGC PETREL)

An analysis of the existing fire protection levels with all active and passive fire protection features in effect indicate that all compartments in this cutter class meet the established fire safety objectives. If the automated and manual firefighting capabilities are ignored however, several compartments fail to achieve fire safety objectives. A detailed analysis of fire paths show that the Lift Engine Room, and port/starboard Engine Rooms are the greatest contributor to the loss of these compartments. Therefore, the following recommendations are submitted to further improve the fire safety of this cutter class.

- ◆ Convert the existing one-shot halon system to a two-shot halon system.
- ◆ Remove the halon nozzles in the generator room and the pump rooms. Presently, discharging halon will automatically shut down the generators thus disabling the electric fire pumps. This forces reliance on the P-250 as the sole source of firefighting water pressure and is considered more problematic than a lack of a halon flooding system for the generator and pump rooms.
- ◆ Seal the existing large holes in the port and starboard uptake decks. This recommendation becomes higher priority if the existing one-shot halon system is not converted to a two-shot system.
- ◆ Change the port and starboard Engine Room watertight doors classification from Y to X.

5.1.3. 100' WLIC Inland Construction Tender (CGC PRIMROSE)

An analysis of the existing fire protection levels with all active and passive fire protection features in effect indicate that all compartments in this class cutter meet the established fire safety objectives. When manual firefighting

capability is not taken into account, however, the Bridge fails to meet fire safety objectives. A review of the fire paths established the Fidley as the greatest contributor to this outcome. Therefore, the following recommendation is submitted to further improve the fire safety of this cutter class.

- ◆ Expand the capacity of the existing CO₂ flooding system in the Engine Room to include the Fidley.

5.1.4. 82' WPB Patrol Boat (CGC PT FRANCIS)

An analysis of the existing fire protection levels with all active and passive fire protection features in effect indicate that all compartments in this cutter class meet the established fire safety objectives. Even when automated and/or manual firefighting capabilities are not taken into account, all compartments meet established fire safety objectives. Therefore, no recommendations for improvements to fire safety are warranted.

5.1.5. 75' WLIC Inland Construction Tender (CGC SLEDGE)

An analysis of the existing fire protection levels with all active and passive fire protection features in effect indicate that all compartments in this cutter class meet the established fire safety objectives. There is no automated installed fixed firefighting system in this cutter class. When the manual firefighting capability is ignored, the CPO Stateroom fails to meet established fire safety objectives. The following recommendation is submitted to further improve the fire safety of this cutter class:

- ◆ Install a new two-shot Halon 1301 total flooding system to protect the Engine Room, Fidley, and Uptake spaces. Alternatively, a new steel deck and watertight hatch installed between the Engine Room and Fidley would be equally effective. Note, an environmentally acceptable substitute for Halon 1301 is required.

5.1.6. 75' WLR River Buoy Tender (CGC CHIPPEWA)

This class of cutter has no automated, fixed firefighting systems. An analysis of the existing fire protection levels with all active and passive fire protection features in effect indicate that all compartments in this cutter class meet the established fire safety objectives. However, if manual firefighting capability is ignored, the Galley does not meet fire safety objectives. A cost benefit analysis was conducted on alternatives that permitted the Galley to meet fire safety objectives. The following recommendations will permit all compartments to meet fire safety objectives without reliance on manual firefighting capabilities:

- ◆ Replace the existing manual CO₂ system in the Engine Room and Fidley with an automated CO₂ system.
- ◆ Change the damage control classification of the Galley and Fidley doors from Z to X.
- ◆ Change the damage control classification of the Galley windows from Z to normally closed.

5.1.7. 65' WLR River Buoy Tender (CGC OBION)

This class of cutter has no automated, fixed firefighting systems. An analysis of the existing fire protection levels with all active and passive fire protection features in effect indicate that all compartments in this cutter class meet the established fire safety objectives with the exception of the Galley and Mess Deck. A cost benefit analysis was conducted on alternatives that permitted the Galley and Mess Deck to meet fire safety objectives. The following recommendations will permit all compartments to meet fire safety objectives without reliance on manual firefighting capabilities:

- ◆ Replace the existing manual CO₂ system in the Engine Room and Fidley with a two-shot Halon 1301 (or environmentally acceptable substitute) total flooding system.
- ◆ Change the damage control classification of the Galley and Fidley doors from Z to X.

5.1.8. 65' WLI Inland Buoy Tender (CGC BLACKBERRY)

An analysis of the existing fire protection levels with all active and passive fire protection features in effect indicate that all compartments in this cutter class meet the established fire safety objectives. Even when automated and/or manual firefighting capabilities are not taken into account, all compartments meet established fire safety objectives. Therefore, no recommendations for improvements to fire safety are warranted.

5.1.9. 65' WYTL Harbor Tugboat (CGC TOWLINE)

An analysis of the existing fire protection levels with all active and passive fire protection features in effect indicate that all compartments in this cutter class meet the established fire safety objectives. Even when automated and/or manual firefighting capabilities are not taken into account, all compartments meet established fire safety objectives. An analysis was conducted to determine the effect of eliminating the intentional and system delays in the Halon 1301 total flooding system. The results show that there is a substantial improvement in the fire safety of the cutter. Therefore, the following recommendation is submitted to further improve the fire safety of this cutter class:

- ◆ Eliminate the intentional and system delays in discharging the Halon 1301 in the total flooding system. This recommendation could be implemented by permitting the on-scene leader to authorize the discharge of halon. In addition, an operating P-250 should not be a criteria for discharging halon.

5.2. DAMAGE CONTROL EQUIPMENT

The second primary objective was to analyze the currently approved allowance of damage control equipment for small Coast Guard cutters as documented in the Cutter Standard Repair Locker Inventory (COMDTINST M9664.1) [2]. The analysis of this Instruction revealed that there was considerable redundancy in required equipment for small cutters. Accordingly, appropriate recommendations were submitted to consolidate damage control kits and minimize equipment consistent with the cutter's missions. A summary of the major recommended changes is provided in Table 3-2 in Chapter 3 of this report.

Two other significant changes were recommended, documented in Table 3-2, and discussed in Chapter 3 as well as in the interim report submitted previously in the project [6]. These changes are repeated here to emphasize their significance:

- ◆ Eliminate CBR equipment on all small cutters.
- ◆ Add "red devil" blowers, ram-fans, or other appropriate de-smoking equipment to the allowance for small cutters.

5.3. THE SHIP FIRE SAFETY ENGINEERING METHODOLOGY

The technical approach in the SCFP required the use of the SFSEM as an analytical tool to evaluate ship fire safety. Thus the SCFP provided an opportunity to thoroughly exercise the methodology in an analysis of existing Coast Guard cutters. Prior to this project, the SFSEM had only been used to analyze a proposed Polar Icebreaker Design. The results in the SCFP indicate that fire protection levels in all compartments of small cutters, with their active and passive fire protection features in effect, generally meet fire safety objectives. These results appear to be validated by historical records as discussed in Chapter 2 of this report.

5.3.1. Use of the SFSEM

Extensive and comprehensive analyses of these nine classes of cutters has resulted in the formulation of conclusions concerning the use of the SFSEM for further ship fire safety analysis. Many uncertainties about the SFSEM were resolved, yet previously unknown issues were found. In addition, these analyses have served to identify some areas of the methodology

which should be considered for improvement. Accordingly, the following recommendations are submitted concerning the use of the SFSEM:

- ◆ The SFSEM provides a singularly effective approach for comparing heretofore incomparable entities such as barriers, fire protection equipment, and firefighting tactics for effect on the ship as a fire safety system.
- ◆ The SFSEM is particularly appropriate to determine relative fire protection levels on existing vessels where detailed data required to run SAFE can be obtained. Moreover, it is conceivable that different ship classes can be rank ordered for their relative fire protection levels and compared to each other in their relative ability to meet or exceed fire safety objectives.
- ◆ The SFSEM is particularly useful to compare various hypothetical improvements to fire safety. This can be implemented by comparing alternatives to determine their ability to supplant manual firefighting capabilities or comparing alternatives in order to choose a cost effective solution.
- ◆ The SFSEM is useful for comparing a conceptual design but only if adequate detail is known concerning the potential ship's characteristics such as thermal and physical properties of the bulkheads and decks, fuel loads, compartmentation geometries, firefighting systems and equipment etc. Otherwise significant assumptions would have to be made which could affect the value of the study.
- ◆ The SFSEM is not suitable for use by contractors to analyze their design in a competitive procurement. Because of the engineering judgment required in many input parameters, consistency of results dictate that a single, knowledgeable analyst should use this methodology to compare competing designs.
- ◆ The SFSEM is not useful at the present time for analyzing smoke movement, people movement or to analyze the effect on the ship's structure. These modules are either under development or planned for future implementation.
- ◆ The SFSEM is not suitable for use by inexperienced analysts. Variables assigned by engineering judgment require knowledge of shipboard naval engineering/damage control, the SFSEM itself, and knowledge of fire science.

5.3.2. Areas of Improvement

The value of the SFSEM could be enhanced if certain areas of improvement were pursued. These areas have been the subject of separate correspondence, some of these areas are repeated here to emphasize their importance.

- ◆ The issue of fire safety objectives is critically important because this is a performance based method and fire safety objectives establish the standard to which performance is compared. This area is the subject of current study.
- ◆ Full room involvement is a critically important concept in the SFSEM. The Beyler-Deal algorithm is the presently accepted method for calculating the time for this phenomenon to occur in each compartment. This algorithm is being validated in a separate study. The results from this study should be incorporated in the SFSEM.
- ◆ The catalog of barrier materials is presently limited in scope. An effort should be made to expand the number of different materials and combination of materials available for selection by the analyst.
- ◆ Presently fuel loads are estimated by engineering judgment. The analyst could be greatly assisted in this task by the development of rules of thumb and better estimating techniques.
- ◆ The present fire growth models are used to calculate important entities such as maximum heat release values of the burning fuel and the fire growth rate. The existing models should be validated and brought up to date.
- ◆ The need to integrate remaining modules to analyze smoke, people movement and ship's structure into the SFSEM is considered critically important.
- ◆ Numerous variables are utilized in the SFSEM. A sensitivity analysis would permit the analyst to concentrate effort on quantifying those variables which affect the results the most. It would also serve to identify the level of precision to which a variable should be expressed.

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PART A
FIRE PROTECTION DOCTRINE
PERTINENT FIRE SCIENCE

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Part A
FIRE PROTECTION DOCTRINE
Pertinent Fire Science

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1. Purpose

The purpose of this fire protection doctrine is to provide useful information pertinent to fire science (Part A), guidance promulgated by Commandant for small Coast Guard cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered, in port and underway (Part C). Part A of this doctrine applies to all Coast Guard cutter classes. Part B applies only to "small" Coast Guard cutter classes which are defined, for the purposes of firefighting doctrine applicability, to be all cutter classes ranging in size from 65' WYTL Harbor Tugboats to 157' WLM Coastal Buoy Tenders inclusive. Part C is Coast Guard cutter class specific and should be individually tailored to suit each ship in the class to account for minor differences. A complete fire doctrine for a cutter is therefore composed of three parts.

2. Shipboard Fire Protection

2.1. Philosophy

The guiding design philosophy of shipboard fire protection embraces a series of steps beginning with prevention and continuing in sequence through detection, confinement, control, extinguishment and finally post-extinguishment. It would be ideal if fires could be prevented from occurring in the first place, therefore considerable effort is made to prevent fires. If an unwanted fire does occur, it is desirable to detect the fire as early as possible and before the fire has a chance to grow. Detection can be accomplished with installed smoke, heat and flame detectors or the crew can detect the presence of smoke or fire. Once a fire is detected, the approach is to contain or isolate the fire to the "room of origin". If this is successful, the damage will be minimized. In some cases the fire will spread to involve other compartments through poorly designed (or maintained) bulkheads or open access fittings. In either event, the next step is to extinguish the fire. Extinguishment can be accomplished manually or with an automated, fixed fire protection system. The post-extinguishment step includes restoration of ship's systems to enable continuation of the ship's mission.

2.2. Fundamental Concepts of Fire

In a ship, fuels are present in solid, liquid and gaseous forms. Solid fuels include paper products, clothing, furniture, plastics and other common "ash-producing" substances. They are capable of smoldering for hours before bursting into visible flames. Plastic fuels (polyethylene, nylon, vinyls, etc.) usually produce higher burning rates and a higher heat content per unit weight than cellulosic fuels. In addition, plastics usually burn with extremely dense smoke and produce toxic gases such as carbon monoxide, hydrogen chloride and phosgene gas. Flammable liquids such as lube oil, hydraulic oil, diesel fuel, JP-5, paints and solvents are usually found in engineering spaces

and are often contained under pressure. Pound for pound, flammable liquids produce 2.5 times more heat than wood, and they release this heat 3 to 10 times faster. When flammable liquids spill, or worse, spray under pressure on a hot surface, the resulting fire burns with tremendous intensity. Many of the major conflagrations on ships are a result of flammable liquid spray fires in the Engine Room. There are both natural and manufactured flammable gases. Those commonly found on board ship include acetylene, propane, and butane. Gases, like flammable liquids, usually produce visible flames and will not smolder.

2.2.1. Fire Tetrahedron

Combustion or rapid oxidation describes a process in which a fuel pyrolyzes or turns into a vapor and mixes with oxygen at a high rate of speed; heat and light, visibly seen as flames, are by-products of this process. The heat generated by combustion travels in all directions including back toward the fuel surface which in turn pyrolyzes more fuel and thus a chain reaction is established. Fuel, heat and oxygen are thus required for the existence of fire as well as the chain reaction process described. The fire tetrahedron, shown in Figure A-1, is a graphic representation of the combustion process. If any of the four faces of the tetrahedron are removed, the fire will be extinguished.

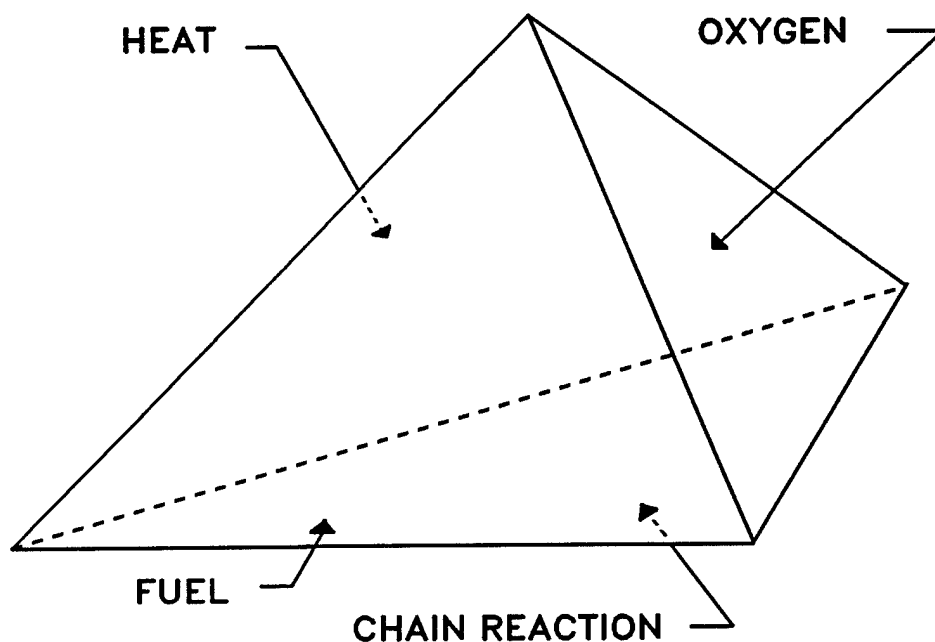


Figure A-1 The Fire Tetrahedron

2.2.2. Classification of Fire

Fires are grouped into four classes according to the type of fuel as shown in Table A-1. Sometimes due to the presence of multiple fuel types a combination of classes of fire will occur. Electrical fires, for example, almost always involve a solid or liquid fuel as well.

TABLE A-1 CLASSES OF FIRE

CLASS	FUEL
A	Solid Fuels
B	Flammable Liquids or Gases
C	Electrical
D	Combustible Metals

2.2.3. Extinguishing Agents

An extinguishing agent operates by removing one or more faces of the fire tetrahedron using one of the following four methods:

- ♦ Cooling. This is a direct attack on the heat face of the tetrahedron. The goal is to reduce the temperature of the fuel below its ignition temperature.
- ♦ Smothering. This is an attack on the edge of the tetrahedron where the fuel and oxygen meet. The action is to separate the fuel from the oxygen.
- ♦ Oxygen Dilution. This is an attack on the oxygen face where the goal is to reduce the oxygen content below that necessary to sustain combustion.
- ♦ Chain Reaction Breaking. The goal here is to interrupt the chain reaction long enough for the fuel to cool below its ignition point.

There are six fire extinguishing agents normally encountered in shipboard firefighting. These agents are in the

form of liquids (3), gases (2) or solids (1). The choice of agent is based on the class of fire and the agents available to fight the fire. The following sections discuss the agents available, their advantages and disadvantages.

2.2.3.1. Liquid

By far the most common extinguishing agent is water. Salt or fresh water is very effective on Class A fires while aqueous film-forming foam (AFFF) is effective against Class B fires and deep seated Class A fires. The advantage of using water is its inexhaustible supply; the disadvantage is that water conducts electricity and adversely affects the stability of the ship if too much accumulates. AFFF has persistence and will remain effective as a blanketing agent for several hours, but has to be washed from machinery after the fire is out. Aqueous potassium carbonate is primarily used to combat galley deep fat fryer fires and their exhaust systems.

2.2.3.2. Gas

Halon is a manufactured chlorofluorocarbon (CFC) and is extremely effective against all classes of fire. The advantages of Halon are that it is clean, non lethal (in concentrations sufficient to extinguish fire), non-conducting, and extremely fast in extinguishing fires. Like freon and other CFCs, it apparently damages the ozone in the atmosphere and is being phased out of production. CO₂ is an effective agent against Class C fires and is non-conductive and non-corrosive. CO₂ is clean, effective, and environmentally acceptable, but it is lethal in quantities sufficient to extinguish fire.

2.2.3.3. Solid

Potassium bicarbonate powder (PKP) is the only dry chemical authorized for use in portable extinguishers on Coast Guard cutters and boats and is effective against all classes of fires. This agent is non-lethal and non-conducting but on the other hand it is corrosive to electronic equipment and difficult to clean up.

3. Prevention

There are four basic principles of fire prevention which should be observed routinely to reduce shipboard fire hazards.

3.1. Frequent Inspections

It is the responsibility of every crewmember to prevent fires. Accordingly, the entire crew should be constantly alert to eliminate fire hazards. Fire hazards should be brought to the attention of the Commanding Officer/Officer-in-Charge who can take appropriate action.

3.2. Proper Stowage of Combustibles

Paint, flammable liquids, ordnance and munitions should only be stowed on board in spaces specifically designed for the purpose or on Weather Decks. These spaces will be protected with explosion proof lights, noncombustible shelving, fire detectors, and an automated total flooding fire protection system. Paint lockers, magazines and other spaces specifically designed for extremely flammable or explosive products are not generally found on small cutters.

3.3. Training and Education

Frequent fire drills and team training should be conducted so that in an emergency the crew will respond correctly and automatically. Education in the principles of fire science will permit the proper selection of a firefighting agent and equipment depending on the class of fire encountered. Training will permit the proper use of the firefighting equipment installed or available on board.

3.4. Enforcement of Fire Prevention Policies and Practices

The following policies and practices will minimize fire hazards and reduce the chances of uncontrolled growth if a fire should occur.

- ◆ Maintain flange shields on flammable liquid piping.
- ◆ Maintain proper covers on flammable liquid strainers.
- ◆ Keep sounding tube caps in place and isolation valves closed.
- ◆ Take immediate action to stop and repair all oil leaks.
- ◆ Keep ventilation ducts clean and free from oily residue.
- ◆ Keep bilges free of trash and oil.
- ◆ Do not allow unauthorized flammable materials on board.
- ◆ Do not stow combustible materials in voids or uptakes.
- ◆ Do not stow combustibles in direct contact with bulkheads and decks - allow for at least one foot stand-off distance.

- ◆ Perform preventive maintenance on firefighting equipment in accordance with authorized procedures.
- ◆ Ensure all interlocks work properly.
- ◆ Operate firefighting equipment in accordance with procedures established in this doctrine and other authorized documents.
- ◆ Maintain damage control closures and fittings in accordance with the authorized material condition of readiness.
- ◆ Comply with authorized tag-out procedures for electrical and mechanical equipment.

4. Detection

There are two types of fire detectors: the installed smoke, heat and flame detectors found in berthing compartments, magazines, engine rooms, and other spaces, and the crew, who should be constantly vigilant to the presence of smoke or flames. A crew member has two basic duties to perform in the event that fire or smoke is detected: sounding the alarm, and making an effort to extinguish or at least contain the fire. The person discovering the fire should sound the alarm first then attempt to apply first aid. The crew member should attempt to extinguish the fire with the nearest available extinguisher that dispenses the appropriate firefighting agent if this first aid can be accomplished safely. If first aid is not immediately effective, the crew member should evacuate the space and contain the fire by closing the door to the compartment.

4.1. Equipment

Fire detectors sense, and initiate a signal in response to, heat, smoke, flame or some other indication of fire. The types of detectors that are in common use are discussed in the next section.

4.1.1. Smoke Detectors (products of combustion)

The smoke detector continuously samples the air for the products of combustion, specifically smoke particles. There are various types of smoke detector, the most common include the ionization and photoelectric types. Ionization detectors operate on the principle that smoke interferes with the flow of ionized particles created in the detector. The photoelectric type measures the amount of obscurity in a light beam created by the detector.

4.1.2. Heat-actuated Fire Detectors (fixed temperature, rate of rise)

The primary classes of heat-actuated devices are fixed-temperature detectors and rate-of-rise detectors. A fixed-temperature detector initiates an alarm when the temperature of the device reaches a pre-set value. Note the device itself has to reach this temperature - not just the air around it. This thermal lag is proportional to the rate of rise of the air temperature. Rate of rise detectors sense the rate at which the temperature is rising and sounds an alarm when this rate exceeds the allowable value. Rate of rise detectors will reset themselves, whereas fixed temperature detectors will not.

4.1.3. Flame Detectors (optical)

Flame detectors are designed to recognize certain characteristics of flames such as light intensity, flicker (pulsation) frequency and radiant energy levels. Flame detectors are not commonly found on board ship due to false alarms. For example arcs from welding, or light reflecting off the water's surface sometimes cause flickering which are misinterpreted by the detector. Electric light bulbs also tend to flicker if the ship is vibrating.

4.2. Operation

Detectors are designed to operate continuously with minimal maintenance and are inherently reliable. They are usually battery powered or wired for 110 volt electrical power. In general, on Coast Guard cutters, detectors sound the alarm only, they do not automatically discharge a firefighting agent.

5. Confinement

The initial actions by the person who discovers a fire can make the difference between a controllable fire and one which threatens life of the ship. Any crew member discovering a fire or an indication of fire must immediately sound the alarm. The report of a fire must reach the Officer of the Deck by whatever method available, such as messenger, telephone, announcing system, intercom, installed fire alarm system, or human voice. If the fire is small and appears capable of being controlled, then an initial attack can be attempted by personnel with little or no protection. The use of more than one portable extinguisher simultaneously is more effective than using them one at a time. If the fire is large, or if the compartment of origin is unknown, or if the fire is fed by a pressurized fuel source, then the initial actions should be to contain and isolate the fire. This can be accomplished by taking advantage of the design of the vessel (passive measures) and by isolating the fire from sources of fuel and oxygen (active measures). The following sections discuss these passive and active measures.

5.1. Passive Measures

Passive measures include features that are designed into the cutter that serve to inhibit fire growth.

5.1.1. Compartmentation

A ship is subdivided into compartments for several purposes, not the least of which is to provide barriers to fire, smoke, and flooding.

5.1.1.1. Barriers.

Barriers include the bulkheads, decks and overheads that define a compartment's boundaries. Watertight bulkheads are designed to resist both fire and flooding. Non-watertight joiner bulkheads serve a useful purpose to slow the spread of fire and smoke but are generally ineffective to prevent progressive flooding. Doors, windows and portholes are often open to provide ventilation and access for the crew; these must be immediately closed in the event of fire or flooding to maximize the barriers' effectiveness.

5.1.1.2. Fuel Loading.

A fire cannot burn without fuel. Therefore if the fire can be isolated in a compartment that has minimal fuel loading, the fire will go out on its own. The distribution of the fuel loading is an important factor in fire growth. For example, if the fuel is stacked vertically (opposed to horizontally) the fire will grow more quickly for the same amount of fuel. Fire will also spread more quickly in bookcases with the glass doors open than with the doors closed. Simply closing the doors on bookcases before leaving the ship's office is a good example of how one can take advantage of the ship's passive fire protection features to prevent fire growth.

The type of fuel is a very important factor. There are two basic types of solid fuel: cellulosic and plastic. Cellulosic fuels are basically wood-based products such as paper, wood, and cotton. Plastics include a lot of the modern manufactured products such as polystyrene (liners in refrigerators), foams and vinyls (padding and upholstery used in cushions), and polyesters (clothing). Plastics, in general, have heat release rates that are five to ten times greater than cellulosics. Sleeping bags brought on board by the crew for example, may be five to ten times more hazardous than wool blankets.

5.1.2. Construction Materials

Non-flammable construction materials are normally specified in new construction. The crew is cautioned that decorative sheathing or paneling installed during habitability

improvement projects should not include flammable materials. Likewise, if the cushions on the Mess Deck benches are reupholstered, the selection of materials should be in accordance with guidance on acceptable products and materials. This guidance should be obtained from the Naval Engineering Manual, COMDTINST M9000.6 (Series), or from the MLC (v) division.

5.2. Active Measures

Active measures include actions that the ship's crew can take to isolate and contain a fire.

5.2.1. Setting Material Condition ZEBRA

One of the most basic procedures in shipboard firefighting is setting material condition ZEBRA which is intended to close all doors and windows in all the barriers to a fire.

5.2.2. Securing Ventilation

Securing supply and exhaust ventilation fans and installing available covers over the inlet or exhaust will reduce the available oxygen to a fire. Positive ventilation should be provided where possible to spaces outside the smoke boundaries. In addition, desmoking efforts during firefighting will help to improve the visibility for the firefighters.

5.2.3. Securing Fuel

In a Class B fire it is absolutely essential to secure the fuel to operating engines. Attempts to extinguish the fire will be frustrated until the source of the fuel is secured. Remote fuel shutoffs are provided outside the machinery space to safely secure the fuel supply. It should be noted that after securing the fuel supply the engine will continue to run for a short time to consume the in-line fuel.

5.2.4. Securing Electrical Power.

Securing the electrical power will extinguish a Class C fire. Additional extinguishment efforts may be required if a Class A or B fire is also involved. The fire pumps on most cutters are electrically operated. Therefore an alternate source of firefighting water pressure may be required in the event electrical power is secured.

6. Extinguishment

6.1. Firefighting Equipment

The firefighting systems described below are installed on Coast Guard cutters. Each has capabilities and limitations which must be understood by firefighting personnel to ensure quick and

proper selection of equipment. Each cutter has a subset of these systems and it is important to know which systems/equipment are available for use. This specific information is located in Part C of the fire protection doctrine for each cutter. The following information is a basic introduction to firefighting equipment typically found on board Coast Guard cutters. All personnel should read the following publications for more detailed information:

- ◆ Naval Ship's Technical Manuals (Chapters 555, 077 and 079, Vol 1-3)
- ◆ Naval Engineering Manual (COMDTINST M9000.6 (Series))
- ◆ Surface Ship Survivability Manual (NWP 62-1 (Series))

6.1.1. Firemain System

The firemain system consists of installed piping to distribute water to fire stations located throughout the ship. This piping may be exposed to freezing temperatures, the weight of the water in the system would adversely affect stability, and operating the fire pumps without overboard reliefs would burn up the pumps, therefore this system is normally dry and has to be charged with water from an installed electric pump or a portable pump. The system is normally used to energize fire hoses for fighting Class A fires or for the production of AFFF water mixture for Class B fires. When a hose line attack is needed to attack a flammable liquid fire, water fog may be used (fog position on the Coast Guard vari-nozzle) as the primary extinguishing agent. However, the time required to fight the fire will be longer, more firefighters will be required, increased fire damage can be expected, and risk of reflash is greater than if AFFF were used.

6.1.2. Firehose and Nozzle

The standard hose used on Coast Guard cutters is an orange colored, chlorosulfonated, polyethylene (hypolon), impregnated, double jacketed, synthetic rubber hose in two sizes - 1 1/2" and 2 1/2", and one length - 50 ft. The hose is configured with a brass male coupling on one end and a brass female coupling on the other. The male end always goes to the scene of the fire. The exposed brass threads on the male coupling are easily damaged which may prevent installation of a nozzle. Two lengths may be connected and the couplings should be hand tightened. The spanner wrench at the fire station should not be used for this purpose, this wrench should be used to loosen the connection between the fire station and the firehose. Fire stations are located on the cutter such that two hoses can be brought to bear in any compartment. This may require the installation of two lengths of fire hose on some fire stations.

The Coast Guard Vari-nozzle is manufactured by Akron Brass (style 3019) and Elkhart Brass (SFL-GN-95). It is designed for a 95 gpm flow rate and is used to produce AFFF with a style 2901 inline proportioner.

6.1.3. Portable Pumps

Portable pumps serve a dual purpose. First, they may be used to provide a source of firefighting water on the cutter itself or for another vessel in distress. The portable pump can serve as a backup to the installed electric pump or as the primary source in case the electric pump is unavailable. This is often the case in an engine room fire where most electric pumps are installed. Secondly, they can be used as a means of dewatering. Since a portable pump is driven by an internal combustion engine, it must be operated on the Weather Deck. The designation of portable pumps includes the rate in gallons per minute the pump is designed to produce.

6.1.3.1. P-250 Mod 1 Pump

This pump is a portable, gasoline engine driven pump. It is designed for use in firefighting and dewatering operations. It will produce 250 gpm at 100 psi using two 1 1/2" hoses and one 2 1/2" eductor. For dewatering contaminated spaces, the P-250 Mod 1 pump can be used in conjunction with a peri-jet eductor; the pump can draw a suction directly on uncontaminated spaces if the suction hose will reach the space from the Weather Deck. The peri-jet eductor is a venturi that is designed to discharge approximately two times the amount of water pumped through it. If the eductor discharge becomes blocked, the eductor will very quickly flood the compartment it is supposed to be dewatering. A careful and frequent check must be conducted to ensure the eductor is working satisfactorily.

6.1.3.2. CG P-1B Pump

These pumps are portable, lightweight, self contained pumps used for dewatering only. The CG P-1B will dewater at the rate of 120 gpm with a 10' suction lift and 20' discharge head.

6.1.3.3. CG P-5 Pump

The CG P-5 pump can be used for dewatering and limited firefighting and AFFF application at the rate of 200 gpm with a 10' suction lift.

6.1.4. Automated Fixed Flooding Systems

A Class B fire in the Engine Room is capable of extremely rapid growth to major conflagration proportions in a matter of minutes if not seconds. Since it typically requires

ten minutes or more for a ship to set Zebra, man repair parties, rig firehoses, and dress out a firefighting party in firefighting ensembles, an automated fixed flooding system may be installed to combat this type of problem. Magazines are usually protected by an automated fixed flooding system as well.

6.1.4.1. CO₂ System

Fixed CO₂ systems are installed in Paint Lockers, Flammable Liquid Storerooms, and Engine Rooms. These systems are normally designed to totally flood the space and include automatic shutdown of installed ventilation systems. The system normally includes a manually activated remote pull box, audible and visual alarms. If the space protected is normally occupied and there is a vertical exit to the Weather Deck, a 60 second discharge time delay is mandatory to permit evacuation of personnel since CO₂ is lethal in the concentrations required to extinguish fires. CO₂ is heavier than air and will persist in the protected space even if openings in the overhead are present.

Some cutters are equipped with fixed CO₂ hose-reel systems in the Main Machinery Space. These systems are normally designed with a high pressure hose stowed on a trunnion type reel and two CO₂ cylinders. The discharge horn on the end of the hose is fitted with a wooden handle and squeeze lever. CO₂ is discharged by squeezing the lever. There are no alarms or time delays built into the system. Caution: CO₂ displaces air and can be fatal to a person without a self-contained breathing apparatus in an enclosed space.

6.1.4.2. Halon 1301 System

Halon 1301 is installed in the Engine Room since halon is extremely effective against Class B fires and accidental discharge is non-lethal in the concentrations required to extinguish fires. However, if halon is ingested by internal combustion engines, or if halon is exposed to the fire itself for more than ten seconds, the by-products from the combustion of halon are toxic to humans. Therefore the design of Halon 1301 total flooding systems include discharge times of less than ten seconds, and include automatic shutdown of internal combustion engines and ventilation equipment in the protected spaces. A 60 second time delay, visual and audible alarms, similar to CO₂ systems, are included in the design of Halon 1301 flooding systems to permit evacuation of the space before discharging Halon. When it is released, Halon 1301 vaporizes to a colorless, odorless gas with a density approximately five times that of air. Halon concentrations between 5% and 7% are required to extinguish fires. Sufficient volume is provided to maintain this concentration for at least 15 minutes, therefore it is important to seal the protected space to prevent escape of the agent. In addition, two "shots" are usually provided that are capable of completely flooding the protected space twice. The second shot is designed to be used if the first shot is ineffective or in the event of a reflash.

6.1.4.3. Aqueous Film Forming Foam (AFFF)

AFFF is composed of synthetically produced materials similar to liquid detergents. For shipboard use, six parts of AFFF concentrate are mixed with 94 parts water. The bilge area in Engine Rooms may be protected by installed nozzles which distribute pre-mixed AFFF. AFFF, when proportioned with water provides three firefighting advantages: First, due to its low viscosity it quickly spreads over the surface of burning fuel, the aqueous film thus formed excludes air. Second, the foam layer prevents the escape of fuel vapors. Third, the water content of the foam provides a cooling effect.

6.1.4.4. Aqueous Potassium Carbonate

Aqueous potassium carbonate (APC) is used to extinguish burning cooking oil and grease in deep fat fryers and galley ventilation exhaust ducts. APC solution consists of 42.2% potassium carbonate and 57.8% water. When APC comes in contact with the burning surface, it generates a soaplike froth that excludes air from the surface of the grease or oil and thus extinguishes the fire.

6.1.5. Portable Fire Extinguishers

"First-aid" in the context of firefighting is the immediate attempt to extinguish a discovered fire. Portable extinguishers are installed throughout the ship to facilitate this effort. The location of the various types of extinguishers take into account the most likely class of fire that will occur considering the fuel loading. The following information is provided to assist in the selection of an appropriate extinguisher.

6.1.5.1. Carbon Dioxide (CO₂)

CO₂ is primarily used to extinguish small Class C fires. They have limited effectiveness on small Class A and Class B fires of low heat intensity and an involved surface area of four square feet or less. A successful attack requires a close approach due to an effective range of four to six feet. Caution is required when using CO₂, especially when more than one extinguisher is used, as CO₂ displaces oxygen.

6.1.5.2. Purple-K-Powder (PKP)

Purple K gets its name from the purple color of the potassium (chemical symbol "K") bicarbonate chemical stored in the extinguisher. The agent is expelled under pressure from a CO₂ or nitrogen cartridge installed in the extinguisher. PKP is very effective on small, isolated Class B pool fires (fires less than 10 square feet). PKP is not effective against spray fires. The maximum range for a portable PKP extinguisher is 20 feet.

PKP is intended for use by the unprotected operator who is in the best position to take initial action to extinguish a fire at its onset. Successful use of PKP is time critical.

6.2. Personnel Protection

6.2.1. Emergency Escape Breathing Device (EEBD)

The EEBD is designed to provide breathing air and eye protection during emergency escape from areas containing toxic gases and smoke. Each EEBD has a flame retardant hood and plastic face shield. It generates 15 minutes of breathable air by means of a low pressure chemical oxygen generator. The EEBD is designed for emergency escape only and shall not be used as a piece of offensive firefighting equipment. Naval Ships' Technical Manual, chapters 077 and 079 vol 2 provide operation and maintenance instructions.

6.2.2. Oxygen Breathing Apparatus (OBA)

The only breathing apparatus authorized for use on board cutters and boats is the Navy Type A-4 OBA. The green, self-starting, single candle type canister is the only authorized canister for use with the Type A-4 OBA. Red canisters are to be used for training only and shall not be stored in repair lockers. Immediately after a wearer activates a canister, the timer shall be turned to 60 minutes and then turned back to 45 minutes.

If a person wearing an OBA is working alone in a smoke-filled or oxygen-deficient compartment, an insulated tending line shall be used with a tender. The tender shall wear 7500-volt rubber gloves, inside leather gloves, and rubber boots. The tender shall ground the end of the line to bare metal ships structure and be observant of signals from the OBA wearer. It is not recommended for an OBA wearer to enter a machinery space alone with a tending line due to the number of interferences. Two OBA wearers should enter the area together. If a second OBA wearer is not available, then a tending line must be used when a machinery space is entered.

6.2.3. Clothing

A fire can reach temperatures exceeding 2000 degrees Fahrenheit and produce dangerous concentrations of smoke and toxic gases. Cutters less than 133' and the 160' WLIC class have an allowance of two firefighters ensembles (FFE); larger cutters have an allowance of four FFE's. The optimum time to don a FFE is approximately 2 minutes, with another 1 to 2 minutes to don and activate an OBA. Under ideal conditions, it takes 2.5 to 5 minutes to don full personnel protection clothing. The scene leader should consider the time it takes to dress out in FFE's allows the fire to grow. In certain situations, rapid response with less protected personnel may result in quick knockdown of a

fire. The scene leader makes the decision to request the FFE taking into account the tenability of the area, stage of the fire, and success of the initial attack.

The FFE consists of firefighter's coveralls, firefighter's antifiash hood, damage control/firefighter's helmet, firefighter's gloves, and fireman's boots. Repair party personnel not required to wear the FFE shall wear fire retardant long sleeved uniforms/coveralls, hard shell battle helmet, antifiash hood and gloves. The FFE helmet shall not be altered in any way.

The aluminized firefighting suits are only used aboard Flight Deck equipped cutters. Description and maintenance instructions are provided in Naval Ships' Technical Manual, Chapter 077, and the Shipboard Helicopter Operational Procedures Manual, COMDTINST M3710.2.

6.2.4. Naval Firefighting Thermal Imager (NFTI)

The NFTI is a device that permits the user to see through dense smoke and light steam. It can be used to:

- ◆ Investigate reported fires;
- ◆ locate the seat of a fire;
- ◆ locate and facilitate rescue of injured personnel;
- ◆ set and maintain fire boundaries;
- ◆ locate ignition sources during fire overhaul.

The scene leader shall decide when to deploy the NFTI. The NFTI cannot "see" through glass, therefore it is not useful to determine the effectiveness of a Halon 1301 release by "looking" through a viewing port.

Naval Ships' Technical Manual, chapter 555, provides detailed operating instructions and information concerning the tactics for using the NFTI.

6.2.5. Firefinder

The firefinder is a small handheld version of the larger NFTI but the principles of operation are the same. Firefinders are sometimes found on small cutters which are not authorized an allowance for a NFTI.

7. Post-Extinguishment Activities

Overhaul of a fire is an examination and cleanup operation. In addition, ship systems are restored to permit a ship to continue its mission if possible.

7.1. Desmoking

Small cutters are not equipped with portable desmoking equipment, therefore these cutters should use installed ventilation systems, natural means, or borrowed equipment for desmoking operations. The following sections describe desmoking equipment commonly found on board larger cutters.

7.1.1. Red-Devil Blower

The rated capacity of the red devil blower is 500 cfm with 200 ft of 8 inch hose attached. This blower is driven by an explosion proof motor. This blower should not be used to handle air containing explosive vapors. The ram fan discussed in the next section is appropriate for this type of problem.

7.1.2. Ram-Fan

The ram fan uses the water pressure for firefighting to drive a turbine for exhausting air. Because it is water driven it can be used below decks in confined areas and is suitable for exhausting explosive vapors.

7.2. Compartment Testing

The post-fire atmosphere in a compartment shall be tested in sequence for oxygen, combustible gases and toxic gases. Ventilating and retesting is required if initial test results are unsatisfactory.

7.3. Dewatering

Free water can dramatically impair the stability of a vessel. Every effort should be made to limit the amount of water used; for example preference should be given to the use of water fog over solid streams. Only as much water as is absolutely necessary should be used. Dewatering operations should commence as soon as possible if water is used as an extinguishing agent.

7.4. Restoration of Ship's Systems

Electrical power should be restored as soon as possible so that installed ventilation equipment can be operated for desmoking and so that the electric fire pumps are potentially ready for use. Preference in restoring ship systems should be given to electrical power first, then main propulsion, then support systems for crew comfort such as air conditioning and other "hotel" services.

7.5. Examination and Investigation

The objectives of post-fire examination and investigation are to find and extinguish hidden fire and hot embers. This is an important aspect of firefighting and should be conducted as

seriously as extinguishment of the fire itself. Overhaul personnel should investigate ventilation ducts and determine the extent the fire has traveled. Spaces behind paneling and false overheads should be carefully inspected. Wiring and piping penetrations in bulkheads and decks should be carefully inspected because fire can penetrate through extremely small spaces. Signs of structural weakness (especially in aluminum structures) should be reported and strengthened if necessary by shoring and other means. Finally a thorough investigation of the cause of the fire should be conducted and lessons learned documented so that similar fires can be prevented.

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PART B
FIRE PROTECTION DOCTRINE
"SMALL" COAST GUARD CUTTER CLASSES

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Part B
FIRE PROTECTION DOCTRINE
"Small" Coast Guard Cutter Classes

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1. Introduction

The approach to firefighting is quite different depending on the classification of the cutter as large or small. "Large" Coast Guard cutters spend extended periods of time underway, routinely operate offshore where assistance in the first hour of a fire may not be available, and generally carry hazardous substances such as munitions, paint and flammable substances to facilitate self-sustaining operations. Moreover, the crew size is adequate to man multiple repair parties and the cutters' missions often include military readiness which increases the risk of fire damage from enemy action. All of these considerations distinguish these cutters from "small" cutters which generally make day trips and put into port at night. Their area of operations is close to shore where assistance is readily available and/or abandoning ship is quite feasible. Small cutters do not generally carry paint and other extremely flammable substances on board, this type of material is usually stored ashore in the cutter's homeport. Small cutter crew size is minimal and often does not permit manning multiple repair parties. Finally, these cutters do not generally have a military readiness mission, therefore the fire threat from enemy action is virtually nonexistent.

In the Coast Guard all vessels with a permanently assigned crew are considered cutters. The smallest cutter is a 65' WYTL Harbor Tugboat and the largest is a 399' WAGB Polar Icebreaker. Presently, for the purposes of fire protection doctrine, large cutters are classified as 180' WLB Seagoing Buoy Tenders and above; small cutters are 157' WLM Coastal Buoy Tenders and below. The purpose of Part B of the fire protection doctrine is to define the philosophical approach and policy applicable to firefighting on "small" cutters. This approach and philosophy is guidance provided by the Commandant and is mandatory for Coast Guard cutters. The Commandant will issue revisions to this guidance periodically. Part A of the fire protection doctrine provides information pertinent to fire science. Part C of the fire protection doctrine provides firefighting procedures and tactics specific to a class of cutter. The Commanding Officer is required to tailor Part C of the doctrine (within the guidelines provided in Parts A and B) to suit the particular needs of the individual cutter.

2. Firefighting Philosophy and Approach

In very general terms, the firefighting approach on a small cutter employs the following sequence:

- ◆ Sound the alarm.
- ◆ Apply first aid on fires that are small enough to extinguish quickly with a portable extinguisher.
- ◆ Activate installed fixed fire extinguishing systems.

- ◆ Manually combat the fire until the Commanding Officer/Officer-in-Charge decides that abandoning ship is required.

On fires declared "out of control" in the engineering spaces, the general approach is to activate the installed total flooding system and abandon ship if this attack is unsuccessful and the fire spreads beyond the engine room. On larger fires in other spaces the crew should attempt to fight the fire with the installed firemain system/water, AFFF, or CO₂ depending on the class of fire. This approach is in contrast² to that generally used on a large cutter where multiple repair parties dress out in firefighting ensembles and attack the fire using water, AFFF, or CO₂ depending on the class of fire. First aid is attempted with a portable extinguisher if the size of the fire is small enough but abandoning ship is usually not feasible. The following sections provides guidance on the philosophy and approach that should be employed on small cutters in the various stages of firefighting from prevention through post-extinguishment activities.

2.1. Prevention

The Commanding Officer/Officer-in-Charge and the Engineering Petty Officer shall make frequent inspections of the cutter for the presence of fire hazards, unauthorized stowage of flammable materials, and proper operation/installation of fire and smoke detectors. In general, paint and other flammable materials are not permitted on board small Coast Guard cutters unless there is suitable compartmentation to safely stow this type of material. For example, paint shall only be stowed in designated Paint Lockers that are protected with an installed CO₂ or Halon 1301 flooding system. Ammunition and ordnance shall² only be stowed in magazines protected with a water flooding system. Flammable liquids shall only be stowed on board in designated storage tanks; drums of lube oil, hydraulic oil etc., shall be stowed ashore.

The inspections conducted by the Commanding Officer/Officer-in-Charge and the EPO shall also determine that the installed fire protection systems and detectors are installed properly and ready for instant use. Battery powered smoke detectors shall be tested frequently to ensure the batteries have not been removed or discharged. Discrepancies discovered during these inspections shall be given the highest priority.

2.2. Detection

The watchstanders shall make rounds at least hourly underway and once every four hours in port (except at night) of every space that has significant fuel loading to detect the presence of fire and smoke.

Where fixed fire alarm systems are not provided, the installation of self-contained, battery operated, smoke detectors shall be required for the protection of personnel in sick bays and berthing areas in accordance with the guidelines contained in the Naval Engineering Manual (COMDTINST M9000.6 (Series) chapter 985).

If a fire is reported, the general quarters alarm shall be sounded and the location and class of fire shall be announced over the general announcing system (1MC). A P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The crew shall muster at their general quarters station.

2.3. Containment

Historically, the majority of high dollar value fire losses have occurred as a result of Class B fires in the main machinery space. Moreover, fires can easily spread from one compartment to the next through open doors and hatches. Therefore, all doors and hatches to main machinery spaces shall be normally closed in port and underway in accordance with the material condition of readiness in effect. In addition, the crew should be constantly vigilant to control the quantity, type, and distribution of fuel loads to maximize the benefits from passive fire protection features that serve to inhibit fire growth.

The Commanding Officer/Officer-in-Charge shall maneuver the cutter underway to minimize the relative wind which could "fan" the fire. An important exception to this rule is for engine room fires. All fires in the engine room include the possibility of a flammable liquid spray fire, therefore the main engines shall normally be secured for all fires reported in the engine room. The Commanding Officer/Officer-in-Charge may delay securing the main engines due to a navigation hazard. The generators shall be secured in the event of a fire in the engine room; a P-250 Mod 1 portable pump shall be immediately rigged and energized to provide a source of firefighting water pressure.

For major fires, especially where extreme heat denies access to the fire compartment, boundary cooling of surrounding bulkheads and decks is essential to prevent horizontal and vertical fire spread. Use intermittent bursts of water from a partially open vari-nozzle.

The fire shall be isolated by setting material condition ZEBRA, securing ventilation and installing all available inlet and exhaust ventilation covers. Electrical power shall be secured in the compartment where the fire was reported; however lighting shall be secured at the scene leader's discretion.

2.4. Extinguishment

Standard damage control communications shall be used in firefighting operations. The priority of communications shall be

in accordance with the following list: Note, not all cutters have all of these systems but the order of precedence still applies. This list takes into account the fact that on most small cutters the human voice can be heard throughout the cutter.

- ◆ Primary - Voice
- ◆ Handheld Radio
- ◆ Sound Powered Phone
- ◆ Salt and Pepper Line
- ◆ Damage Control Messages - Runners

The use of damage control wirefree communications (DC WIFCOM) is authorized to supplement, not replace, standard interior communications hard wired circuits (i.e., sound powered phones) for repair party personnel. Where DC WIFCOM is available it may be used as the primary means of communications within the repair locker organization (scene leaders and investigators). DC WIFCOM users must continue to train in message writing to maintain their skills.

The crew shall attempt to extinguish fires until the Commanding Officer/Officer-in-Charge determines that it is necessary to abandon ship. In general there are two basic approaches to extinguish fires - passive and active. The passive approach is preferred and includes completely isolating the fire and letting the fire extinguish itself. This is feasible if the compartmentation permits closing doors and hatches, the ventilation and electrical power can be completely secured, and pressurized sources of fuel can be secured. The active approach includes discharging a firefighting agent on the fire. This can be accomplished with an indirect attack by activating an installed fixed total flooding system or direct attack by a manual application of the agent. In either event it is critical that the agent used is appropriate for the class of fire. The crew should prepare to aggressively attack the fire if the passive approach is unsuccessful. In port, the majority of the crew may be ashore, but there are usually other ships in port, and professional firefighters may be nearby. The basic approach for small cutters in port is to summon additional help. The following sections provide specific guidance for firefighting underway and in port.

2.4.1. Underway

The person discovering a fire underway should ensure that the alarm is passed to the Bridge before attempting to extinguish the fire. The class of fire (Class A, B or C) and its location shall be immediately passed to the Bridge so that the crew can take appropriate action. The location shall include the

compartment's noun name and identification ("Engine Room, Compartment 3-46-0-E" for example).

The next step involves application of "first aid" with a portable extinguisher on fires small enough to attempt extinguishment safely. On larger fires the person discovering the fire should close all doors, hatches, windows and other accesses to the compartment to isolate the fire. CO₂ and PKP portable extinguishers are strategically located on small cutters. Either agent is more or less effective against all classes of fire but Table B-1 specifies the preferred agent for each class of fire. Do not attempt to extinguish a flammable liquid spray fire until the source of the pressurized fuel is secured.

TABLE B-1 FIRST AID FIREFIGHTING AGENTS

CLASS	PREFERRED AGENT
A	PKP
B	PKP
C	CO ₂

In the event of a Class B fire in the machinery spaces that cannot be extinguished immediately with PKP, the fire shall be declared "out of control", the space shall be evacuated and the installed total flooding system shall be activated. The on scene leader shall ascertain the effectiveness of the firefighting agent and recommend discharging a second "shot" of firefighting agent if available. The following actions can be used to make this determination:

- ◆ Monitoring the fire through a viewing port in the door,
- ◆ Monitoring temperatures in the space,
- ◆ Observing smoke discharging from vents,
- ◆ Observing paint blistering and discoloring on bulkheads.

In either event, 15 minutes shall elapse before attempting reentry to permit cooling of hot surfaces below the ignition point. Reentry shall only be attempted by personnel properly dressed in a FFE and prepared to apply AFFF as the primary firefighting agent.

A flammable liquid spray fire shall be automatically considered a Class B fire out of control. Past experience and fire testing have shown that a pressurized release of a flammable liquid can create a fire that is unapproachable. Life threatening conditions created by extreme heat, smoke and toxic gases can occur in as little as 60 seconds. Under such conditions the only prudent course of action is to evacuate the space, secure the fuel source and activate the installed total flooding system.

An oil leak in the engine room shall be repaired immediately, a major oil leak shall be automatically considered equivalent to a Class B fire. That is, it shall be reported immediately to the bridge, engines shall be secured and preparations to fight a Class B fire with AFFF shall be accomplished.

The decision to secure lighting in affected spaces shall be made by the on scene leader. Every effort shall be made to mechanically and electrically (other than lighting) isolate the affected spaces. The decision to commence firefighting efforts may be made by the on scene leader before electrical isolation is complete.

Reentry into a machinery space that has been evacuated because a fire was declared out of control is the most critical and hazardous part of the firefighting evolution. The decision to reenter the space should be made only if there is reasonable evidence that the fire is out. Reentry personnel shall be dressed out in firefighter's ensembles (FFE) including one piece coverall, gloves, anti-flash hood, helmet, and steel toed rubber boots. Reentry teams shall use 1 1/2" hoses and AFFF as the primary firefighting agent. AFFF for the lead hose may be supplied from 5 gallon cans using an in line proportioner designed for use with 95 gpm vari-nozzles. The primary functions of the reentry team is to rescue trapped personnel, to ensure the fuel source is secured, to overhaul the fire, and to lay a blanket of foam on any flammable liquids to prevent a reflash.

2.4.2. In Port

The local fire department (military or civilian) should be familiar with the cutter. Periodic visits should be conducted to acquaint new members of the fire department with the cutter and its fire protection doctrine. A copy of the cutter's fire protection doctrine shall be made available to the fire department and kept up to date by the cutter.

The Coast Guard uses two types of threads in its firemain system: National Standard Hose Threads for 2.5" and larger connections, and National Pipe Straight Hose Threads for 1.5" connections. These threads may not be compatible with municipal fire departments. On cutters which do not have 2.5" topside hose connections, it is necessary to install a 2.5" male

by 1.5" female adapter to the International Shore Connection (Ship). All cutters shall ensure that local fire departments have the companion flange to the International Shore Connection (Ship).

Watchstanders are often alone on the cutter for the major part of a day. Before attempting to fight a fire in port, the local fire department shall be notified and assistance requested.

2.5. Post-Extinguishment Actions

Combustible gases may be present after a compartment fire has been extinguished. Carbon monoxide will be the predominant gas generated in a Class A or Class C fire; substantial concentrations are required (12.5% is the lower flammable limit) before carbon monoxide will ignite. Therefore, after a Class A or Class C fire, desmoking with installed ventilation equipment can proceed with minimal risk. If the fire involved Class B materials, the presence of flammable liquids can create a flammable atmosphere. Operating electric controllers to start ventilation fans may ignite these gases. After a Class B fire, the presence of combustible gases should be assumed; desmoking with installed ventilation equipment can proceed with minimal risk under the following conditions:

- ◆ The Class B fire has been extinguished.
- ◆ AFFF has been used to cover flammable liquids.
- ◆ The source of fuel has been secured.
- ◆ The space has been allowed to cool for at least 15 minutes.
- ◆ All fuel has been washed into the bilge.
- ◆ No damage has been sustained to the ventilation equipment.
- ◆ No damage has been sustained by the ships service generator.

If desmoking with the installed ventilation system is prudent, all fans (supply and exhaust) should be operated on high speed for at least 15 minutes. Desmoking shall precede atmospheric testing because combustible gas analyzers will not operate reliably in a halon atmosphere and oxygen analyzers will not operate reliably if the sensor is exposed to excessive moisture, heat or particulates found in a post-fire atmosphere. When the space is tested for oxygen and combustible gases, oxygen shall be between 20 - 22 percent, combustible gases shall be less than 10 percent of the lower explosive limit, and all toxic gases

below their threshold limit values before the space can be certified safe to enter without OBA's.

Shipboard personnel authorized to conduct post-fire atmospheric tests for the purpose of certifying the space safe for personnel are gas-free engineers and gas-free petty officers (E-5 and above) as defined by the Naval Ships Technical Manual, Chapter 074, Volume 3. When emergency conditions exist and the gas-free engineer or gas free petty officer are not available, a performance qualification standard (PQS) qualified repair party post fire gas free test assistant may perform testing with the approval of the Commanding Officer. The repair party post-fire gas-free test assistant may not perform "safe for hot work" gas free tests unless he is qualified per the requirements of NSTM 074 Vol 3.

The extent of testing for toxic gases is dependent on the effectiveness of desmoking. When the installed ventilation system is operated on high speed for at least 15 minutes, the only toxic gas test required is for carbon monoxide. If desmoking is accomplished by less effective means, tests are required for carbon monoxide, carbon dioxide, hydrogen chloride, hydrogen cyanide, and hydrocarbons. In addition if halon has been discharged a test for hydrogen fluoride must be conducted if the installed ventilation system was not operated on high speed for 15 minutes to desmoke.

A compartment is considered safe only after satisfactory test results have been achieved at all test locations during the latest round of tests.

PART C
FIRE PROTECTION DOCTRINE
110' WSES "SURFACE EFFECT SHIP"

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Part C
FIRE PROTECTION DOCTRINE

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1. Introduction

One of the most life threatening and hazardous activities that may be encountered on board ship is fighting a fire. Unlike a building fire, the crew often can not evacuate and leave the firefighting to trained professionals. The crew must extinguish the fire, often without assistance, and using only the available equipment on board. Once a fire occurs, it is too late to read this doctrine, it is too late to obtain training, and it is too late to repair and maintain damage control equipment. Finally, the procedures in this doctrine are not a substitute for the exercise of good judgment based on experience and the particular conditions that exist at the time.

The purpose of this doctrine is to provide useful background information pertinent to fire science (Part A), guidance promulgated by Commandant for "small" classes of Coast Guard cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered on this class of vessel, in port and underway (Part C). Note, the Commanding Officer is responsible for tailoring Part C of this doctrine within the guidelines set forth in the following documents:

- ◆ Naval Ships' Technical Manual (NSTM) Chapter 074, Volume 3
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 077
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 079
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 555
- ◆ FXP-4
- ◆ Surface Ship Survivability, NWP 62-1
- ◆ COMDTINST M9000.6, Naval Engineering Manual
- ◆ The Cutter's Fire Protection Doctrine, Parts A and B
- ◆ The Cutter's Engineering Casualty Control Manual

2. Vessel Characteristics

The 110' Surface Effect Ship is a patrol boat; its primary missions are Law Enforcement and Search and Rescue. To safely carry out its primary missions the cutter requires high speed capability. This capability is permitted by light weight aluminum construction and turbocharged propulsion diesel engines.

In addition, the area between the side hulls and below the Second Deck (referred to as the wet deck) is pressurized by diesel engine driven "lift" fans; this significantly reduces the drag on the vessel and permits the ship to achieve very high speeds. The following is a description of the cutter's compartmentation and other characteristics pertinent to firefighting.

2.1. Compartmentation

2.1.1. Below the Main Deck

Below the Main Deck the cutter is divided into the following nine areas, each separated by aluminum watertight bulkheads:

2.1.1.1. Plenum

This is a sealed compartment accessible through a small watertight scuttle on the Weather Deck. This compartment is pressurized when the "lift fans" are operating and opening the hatch could result in personnel injury.

2.1.1.2. Storage/Rope Locker

The rope locker is a centerline compartment with storage compartments on either side - port and starboard. All three spaces are accessible through watertight scuttles on the Main Weather Deck. Egress from the Rope Locker is also possible through a watertight door in the aft bulkhead to the Boatswain's Hold.

2.1.1.3. Dry Stores/Boatswain's Hold/Air Conditioning Space

The Dry Stores compartment is accessible from the port Mess Deck aft through a joiner door. The Boatswain's Hold is accessible from the starboard Mess Deck aft through a joiner door and the Rope Locker forward through a watertight door. The Air Conditioning space on the starboard side is accessible from the starboard Mess Deck aft through a joiner door.

2.1.1.4. Galley/Mess Decks/Berthing Area

The Galley is accessible from the port Mess Deck through a large permanent opening in the inboard longitudinal bulkhead as well as a door opening that is not fitted with a door. The port and starboard Mess Decks are separated by a longitudinal centerline bulkhead and a joiner door. A joiner door in the forward bulkhead of the starboard Mess Deck provides the only access to the air conditioning space forward; a joiner door in the forward bulkhead of the starboard Mess Deck also provides access to the Boatswain's Hold. A joiner door in the starboard bulkhead of the starboard Mess Deck

provides the only access to the starboard 2-man Berthing Area. A watertight door in the aft bulkhead of the starboard Mess Deck provides access to the starboard Passageway which in turn is the only accessible route to the starboard 4-man Berthing Area and Head. There is an inclined ladder, which cannot be isolated, in the starboard Mess Deck that terminates in the Main Deck Passageway. The port Mess Deck provides access to the port Passageway through a watertight door which in turn leads to the port 4-man Berthing Area and Head. A joiner door in the forward bulkhead of the port Mess Deck leads to the Dry Stores forward.

2.1.1.5. Port and Starboard Berthing Areas

The port and starboard Berthing Areas and Heads are accessible through joiner doors from longitudinal passageways that lead to the port and starboard Mess Decks respectively. There is also a joiner door in the centerline bulkhead between the port and starboard Berthing Areas. There is a vertical ladder in the port 4-man Berthing Area that leads to the Main Deck Passageway through a watertight hatch.

2.1.1.6. Port and Starboard Engine Rooms/Lift Engine Room

The port and starboard Engine Rooms are accessible from the port and starboard Pump Rooms aft, through watertight doors. In addition, each Engine Room has a vertical ladder leading to its respective stack space. There is a watertight door to the Main Weather Deck from each stack space. The Lift Engine Room is on the centerline between the port and starboard Engine Rooms; the two longitudinal bulkheads separating these three compartments have open doorways near the aft bulkhead of each compartment. The three Engine Rooms, the port and starboard Pump Rooms, the Generator Room, as well as their associated bilge areas are all protected by a single-shot, Halon 1301 total flooding system. This system, if activated, will automatically secure the four diesel engines, the generators and the ventilation system. This action would therefore, result in disabling the electric fire pumps located in the port and starboard Pump Rooms.

2.1.1.7. Port and Starboard Pump Rooms/Generator Room

The port and starboard Pump Rooms contain the electric fire pumps and the fuel oil transfer equipment. The Generator Room contains the port and starboard ship service generators. The Pump Rooms are separated from the Generator Room by open doors which are not fitted with doors. The Generator Room can be accessed from the Engineering Stores aft through a watertight door and from the Main Weather Deck through a watertight scuttle. There are accessible bilge areas below the

Pump Rooms and the Generator Room. As noted above, these spaces and the Engine Rooms are all protected by a single-shot Halon 1301 total flooding system.

2.1.1.8. Engineering Stores

The Engineering Stores contains the halon storage bottle for the total flooding system installed in the Engine Rooms, Pump Rooms and Generator Room. The Engineering Stores can be accessed through a watertight door on the centerline forward from the Generator Room, from the Main Weather Deck, through a watertight scuttle, down an inclined ladder, and from the After Steering Room through a large permanent opening in the aft bulkhead of Engineering Stores.

2.1.1.9. Aft Steering Room

This compartment contains the steering gear equipment. This space is accessible through a watertight scuttle on the port side, and from the Engineering Stores through a permanent opening in the forward bulkhead of the Aft Steering Room.

2.1.2. Above the Main Deck

The Main Deckhouse contains the Bridge, CO, XO, and MKC Staterooms, Ship's Office, Gyro Room and Armory. The deckhouse is all aluminum and contains a "T" shaped passageway that provides egress to the Main Weather Deck on the port side and the starboard stack space on the starboard side. This passage also provides access through joiner doors to the CO Stateroom, XPO Stateroom, MKC Stateroom, Ship's Office, PO1 Berthing, PO1 Head and Officer's Head. There is a joiner door in the passage that isolates the ladder up to the Bridge, and there is an open ladder down to the starboard Mess Deck. Access to the Armory is from the XPO Stateroom through a locked joiner door. Access to the Gyro Room is through a joiner door in the MKC Stateroom. There are fixed, non operable windows in the CO Stateroom, the XPO Stateroom and the PO1 Berthing Area. The ship's communications equipment, radios and other electronic equipment is stored in racks forward on the port side of the Main Deck Passageway. The ship's allowance for OBA's and FFE's are stowed in this Passageway.

2.1.3. The Weather Deck

The P-250 Mod 1 pump and its gasoline cans are stowed on the after Main Weather Deck.

2.2. Diesel Engine and Remote Fuel Shutdowns

There are two main propulsion diesel engines, two diesel engines directly coupled to "lift" fans and two ship service diesel generators. The primary diesel oil fuel tank is located

aft of the Lift Engine Room, between the port and starboard Pump Rooms and forward of the Generator Room. Individual remote fuel oil shutdowns for the six engines and the fuel tank are located in the Main Deck Passageway on the aft bulkhead. In addition each diesel engine can be started and stopped locally at the engine gauge panel and remotely from the Bridge.

2.3. Ventilation

The port and starboard Engine Rooms and Lift Engine Room are served by four supply fans and two intake vents. The supply vents are located on the Main Deck above the Engine Room at frame 52 port and starboard. The controllers for these fans are located in the Generator Room (2-63-0-E) and are labeled: 2-64-5, 2-64-9, 2-63-10, and 2-63-10. Covers for the supply intake vents are stowed in the Engineering Stores (2-71-0-A) next to the reefer. The Generator Room is served by a supply fan on the port side and a natural exhaust vent on the starboard side. The controller for the supply vent is located in the Generator Room, labeled 2-63-18. The covers for the supply and exhaust vent are stowed with the vents themselves. In addition to the local controllers, all ventilation fans can be secured by a remote stop switch located on the Bridge. The ventilation fans are secured automatically if the Halon 1301 total flooding system is activated.

2.4. Fire Detection Equipment

Monitoring devices, sensitive to smoke or combustion products, are installed in the port and starboard Engine Rooms, Lift Engine Room, Generator Room, all Berthing Areas and Staterooms, Galley, port and starboard Mess Decks and Ship's Office. These devices are either ionization smoke detectors or fixed temperature fire detectors as noted in Table C-110SES-1. All sensors are connected into the "Tracor" monitoring system with remote readouts and audible alarms on the Bridge and Ship's Office. The Tracor system also includes high water sensors to detect flooding in various bilge areas throughout the ship.

2.5. Firefighting Equipment

2.5.1. Firemain Stations

There are five firemain stations located throughout the cutter as follows:

- ◆ Main Deck, port side, stackhouse
- ◆ Main Deck, starboard side, stackhouse
- ◆ Main Deck, starboard side, frame 66
- ◆ Second Deck, port Engine Room
- ◆ Second Deck, Generator Room

TABLE C-110SES-1 LOCATION OF FIRE/SMOKE DETECTORS

Location	Type
MKC Stateroom	Ionization - Smoke
XPO Stateroom	Ionization - Smoke
CO Stateroom	Ionization - Smoke
PO1 Berthing	Ionization - Smoke
Starboard 2-man Berthing	Ionization - Smoke
Port 2-man Berthing	Ionization - Smoke
Starboard 4-man Berthing	Ionization - Smoke
Port 4-man Berthing	Ionization - Smoke
Ship's Office	Ionization - Smoke
Starboard Mess Deck	Ionization - Smoke
Port Mess Deck	Fixed Temperature - Fire
Galley	Fixed Temperature - Fire
Port Engine Room	Fixed Temperature - Fire
Starboard Engine Room	Fixed Temperature - Fire
Lift Engine Room	Fixed Temperature - Fire
Generator Room	Fixed Temperature - Fire

These fire stations are pressurized from either of two electric fire pumps located in the port and starboard Pump Rooms. AFFF foam canisters are stowed on the step deck.

2.5.2. Engine Room Halon 1301 Total Flooding System

The Halon 1301 gas storage cylinder is located in the Engineering Stores Room (2-71-0-A), starboard side, forward bulkhead. The system is initiated by operation of halon remote actuation controls located on the Bridge or locally in the Engineering Stores Room. Actuation of the system sounds an audible alarm and automatically shuts down the main engines, lift engines, generators, and ventilation fans. There is an automatic delay of 60 seconds built into the system to allow personnel to evacuate and for the ventilation fans to coast down. If activated, the system will completely flood the Generator Room, port and starboard Pump Rooms, port and starboard Engine Rooms, Lift Engine Room, and all associated bilge areas one time - there is no second shot available or on board spare Halon cylinder.

2.5.3. P-250 Mod 1 Pump

One P-250 Mod 1 portable pumps and its associated gasoline cans is installed on the Main Deck, aft on the starboard side.

2.5.4. Portable Fire Extinguishers

Portable PKP and CO₂ fire extinguishers are located throughout the cutter to facilitate first aid. Table C-110SES-2 is a summary of portable fire extinguishers located throughout the cutter.

TABLE C-110SES-2 LOCATION OF PORTABLE EXTINGUISHERS

Location	Number of Portable Extinguishers	
	CO ₂	PKP
Bridge	1 15-lb	
Main Deck Passageway	1 15-lb	1 18-lb
Starboard Mess Deck		1 18-lb
Port Mess Deck/Galley	1 15-lb	1 18-lb
Port Crews Berthing Psgwy		1 18-lb
Stbd Crews Berthing Psgwy		1 18-lb
Stbd Engine Room	1 15-lb	
Port Engine Room	1 15-lb	
Generator Room	1 15-lb	
Stbd Pump Room		1 15-lb
Port Pump Room		1 18-lb
Engineer's Stores		1 10-lb

2.5.5. Protective Equipment

Four (4) Navy Type A-4 oxygen breathing apparatuses (OBA's) and two (2) firefighting ensembles (FFE's) are stowed in the cutter. There are twelve (12) canisters per OBA. Two of the OBA's are located in the Main Deck Passageway, one in the Engineering Stores under the DC locker, and the fourth OBA is stowed under the forward bunk, port side of P01 Berthing, (1-15-3-L).

2.5.6. Desmoking Equipment

The red devil blower and 8" hoses are stowed on the port side, Engineering Stores (2-71-0-A).

3. Firefighting Procedures

In this section 12 different shipboard fire scenarios are described. The recommended procedures for fighting each fire are detailed, from the alarm through post-fire activities. The last procedure is for fires in port.

3.1. Compartments Forward of Frame 13, Second Deck

3.1.1. Scenario

The following compartments are located forward of frame 13, Second Deck:

- ◆ Plenum (2-A-0-V)
- ◆ Storage (2-0-2-A)
- ◆ Rope Locker (2-0-0-A)
- ◆ Storage (2-0-1-A)
- ◆ Dry Stores (2-7-2-A)
- ◆ Boatswain's Hold (2-6-0-Q)
- ◆ A/C Space (2-7-1-Q).

The most likely fire in these compartments is a Class A fire.

3.1.2. Confining the Fire

The fire boundaries are the bow of the ship forward, bulkhead 13 aft, the Main Deck and Second Deck.

3.1.3. Sizeup

These spaces are normally unoccupied so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.1.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.1.5. Indirect Attack

An indirect attack is feasible in the Plenum, port and starboard Storage Lockers, Rope Locker, and Boatswain's Hold from the Main Weather Deck through watertight scuttles. The Dry Stores can only be accessed from the port Mess Deck, and the A/C space only from the starboard Mess Deck. If the affected compartment can be completely isolated the fire may be indirectly

attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the scuttle or door without entering the affected space. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.1.6. Direct Attack

If the scene leader decides that a direct attack is needed, the #1 firefighting hose team should enter the A/C Space or Boatswain's Hold from the starboard Mess Deck. The Dry Stores should be entered from the port Mess Deck. In either event, the #1 hose team should access the starboard Mess Deck from the inclined ladder in the Main Deck Passageway with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the affected space without an OBA. The #1 and #2 hose tenders should wear an OBA, but should not enter the affected space.

3.1.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. When the atmosphere has been tested and proven free of explosive gases, desmoke using the red devil blower.

3.1.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting forward of frame 13.

3.2. Berthing Areas, Second Deck

3.2.1. Scenario

The following berthing areas are located on the Second Deck:

- ◆ Port 2-man Berthing (2-27-6-L)
- ◆ Starboard 2-man Berthing (2-15-1-L)
- ◆ Port 4-man Berthing (2-27-2-L)
- ◆ Starboard 4-man Berthing (2-27-1-L)

The most likely fire in these compartments is a Class A fire in bedding materials.

3.2.2. Confining the Fire

Except for the starboard 2-man Berthing, the fire boundaries are bulkhead 27 forward, bulkhead 40 aft, the Main Deck and Second Deck. The fire boundaries for the starboard 2-man Berthing are bulkhead 13 forward, bulkhead 27 aft, the Main Deck and Second Deck.

3.2.3. Sizeup

Due to the likelihood of sleeping crewmembers in these space there is a strong possibility that personnel may need to be rescued. There are no Emergency Evacuation Breathing Devices (EEBD's) in these spaces; personnel may escape through the escape hatch located in the overhead of the port 4-man Berthing. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.2.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.2.5. Indirect Attack

An indirect attack is feasible in the port 4-man Berthing Area through the emergency escape hatch on the Main Deck. The other berthing areas must be accessed through the port or starboard Mess Decks.

3.2.6. Direct Attack

If the scene leader decides that a direct attack is needed the #1 firefighting hose team should enter the starboard Mess Deck from the inclined ladder in the Main Deck Passageway and proceed to the affected compartment through the port Mess Deck and the port Passage (2-27-4-L), or the starboard passage (2-27-3-L) with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team following the same access path as the #1 team, with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFE's and should not enter the affected space without an OBA. The #1 and #2 hose tenders should wear an OBA, but should not enter the affected space.

3.2.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. When the atmosphere has been tested and proven free of explosive gases, desmoke using the red devil blower.

3.2.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting between frames 13 and 40, Second Deck.

3.3. Port and Starboard Mess Decks/Galley

3.3.1. Scenario

The most likely fire in these compartments is a Class A fire in the foam cushions on the Mess Deck benches located on the Mess Deck. There is also a significant possibility of a Class C fire in the electronics equipment located on the starboard Mess Deck. There is also a good possibility of a Class B grease fire on the stove in the Galley.

3.3.2. Confining the Fire

The fire boundaries are bulkhead 13 forward, bulkhead 27 aft, the Main Deck and Second Deck. Note this includes both Mess Decks and the Galley. The ladder leading to the starboard Mess Deck from the Main Deck Passageway can not be secured, therefore it is likely that fire may spread upwards to the Main Deck Passageway.

3.3.3. Sizeup

Due to the likelihood that crewmembers in this space are awake and alert, and the ease of egress forward, and upward, there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are usually extinguished when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire. Class B fires are efficiently extinguished with PKP if the fire is small and AFFF if the fire is larger.

3.3.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A and B fires and a CO₂ portable extinguisher on Class C fires.

3.3.5. Indirect Attack

Due to the open ladder from the Main Deck to the starboard Mess Deck an indirect attack is not feasible. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.3.6. Direct Attack

Class A fires in these spaces should be attacked directly; the #1 firefighting hose team should enter from the Main Deck Passageway down the inclined ladder to the starboard Mess Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter from the Main Deck Passageway down the inclined ladder with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but should not enter the affected space. Class B fires should be attacked directly with PKP portable extinguishers if the fire is confined to the stove area in the Galley. If the Class B fire has spread, the fire should be attacked directly with water fog or AFFF. Class C fires should be extinguished with a portable CO₂ extinguisher after the electrical power to the affected equipment is secured.

3.3.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. When the atmosphere has been tested and proven free of explosive gases, desmoke using the red devil blower.

3.3.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the port and starboard Mess Decks and Galley.

3.4. Port and Starboard Engine Rooms/Lift Engine Room

3.4.1. Scenario

The most likely fire in these compartment is a Class B spray fire as a result of a ruptured lube oil or fuel oil line on a diesel engine.

3.4.2. Confining the Fire

The fire boundaries are bulkhead 40 forward, bulkhead 56 aft, the Main Deck, and hull. Note the stack houses cannot be isolated from the Engine Rooms due to large openings in the Main Deck; therefore, the fire boundaries have to include the stack houses on the Main Deck. The Engine Room supply fans, main engines, and lift engines shall be secured. The generators shall not be secured unless the fire spreads aft to the Generator Room. If the generators are secured, it is crucial that the P-250 Mod 1 be rigged and energized as a backup source of firefighting water.

3.4.3. Sizeup

The port and starboard Engine Rooms and Lift Engine Room in this cutter is normally unmanned, and the possibility of egress through the stack houses or aft through the Pump Rooms and Generator Room, make it unlikely that personnel will need to be rescued. Class B combustibles are best extinguished by AFFF or Halon 1301.

3.4.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.4.5. Indirect Attack

A Class B fire out of control in these spaces may be indirectly attacked with minimal risk to personnel by shutting down the main engines, lift engines, generators, and ventilation fans; evacuating the space; and activating the Halon 1301 total flooding system. The scene leader and investigator shall monitor the effectiveness of the Halon by monitoring bulkhead temperatures with temp-sticks or observing blistering paint, and other appropriate means such as cracking open the joiner door to the Engine Room on the Main Deck Passageway. The scene leader may direct reentry in accordance with the direct attack procedures described in the next section after waiting a minimum of 15 minutes for the temperature to cool below the ignition point. The ignition temperatures of common combustible materials are in the range of 300°F to 1000°F (lube oil, for example is 400°F). Since there is no second shot capability with the Halon system installed in this class cutter, the fire party shall reenter the space and prepare to combat a reflash with AFFF.

3.4.6. Direct Attack

When the scene leader directs, #1 firefighting hose team should enter the Engineering Stores through the watertight hatch 1-72-2 and proceed forward through watertight door 2-71-0 into the Generator Room and then through watertight doors 2-56-1 or 2-56-2 into the port or starboard Engine Rooms and Lift Engine Room if necessary with a 1.5" fire hose configured to apply AFFF. The #2 firefighting hose team should back up the first team and follow the same route as #1 hose team with a 1.5" fire hose configured to dispense AFFF. The bilges shall be blanketed with a minimum of 1/2 inch AFFF. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but should not enter the affected space.

3.4.7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply and exhaust fans on high for at least 15 minutes after the Engine Room atmosphere has been tested and proven free of flammable gases. When the atmosphere has been tested and proven free of explosive gases, desmoke surrounding compartments using the red devil blower.

3.4.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Engine Rooms and Lift Engine Room. The covers should be installed over the Engine Rooms supply and exhaust vents.

3.5. Generator Room/Port and Starboard Pump Rooms

3.5.1. Scenario

The most likely fire in these compartment is a Class B spray fire as a result of a ruptured lube oil or fuel oil line on a diesel engine. A Class B fire is also likely in the port Pump Room in way of the fuel oil transfer equipment.

3.5.2. Confining the Fire

The fire boundaries are bulkhead 56 forward, bulkhead 71 aft, the Main Deck, and hull. The Generator Room supply fan, main engines, and lift engines shall be secured. The operating ship service generator should only be secured if it is the source of the fire. If the generators are secured, it is crucial that the P-250 Mod 1 be rigged and energized as a backup source of firefighting water.

3.5.3. Sizeup

The port and starboard Pump Rooms and Generator Room in this cutter is normally unmanned, and the possibility of egress to the Engine Rooms forward and the Engineering Stores aft, make it unlikely that personnel will need to be rescued. Class B combustibles are best extinguished by AFFF or Halon 1301.

3.5.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.5.5. Indirect Attack

A Class B fire out of control in these spaces may be indirectly attacked with minimal risk to personnel by shutting down the main engines, lift engines, generators, and ventilation fans; evacuating the space; and activating the Halon 1301 total flooding system. The scene leader and investigator shall monitor the effectiveness of the Halon by monitoring bulkhead temperatures with temp-sticks, or observing blistering paint, and other appropriate means such as cracking open the joiner door to the Engine Room on the Main Deck Passageway. The scene leader may direct reentry in accordance with the direct attack procedures described in the next section after waiting a minimum of 15 minutes for the temperature to cool below the ignition point. The ignition temperatures of common combustible materials are in the range of 300°F to 1000°F (lube oil, for example is 400°F). Since there is no second shot capability with the Halon system installed in this class cutter, the fire party shall reenter the space and prepare to combat a reflash with AFFF.

3.5.6. Direct Attack

When the scene leader directs, #1 firefighting hose team should enter the Engineering Stores through the watertight hatch 1-72-2 and proceed forward through watertight door 2-71-0 into the Generator Room and the port and starboard Pump Rooms if necessary with a 1.5" fire hose configured to apply AFFF. The #2 firefighting hose team should back up the first team and follow the same route as #1 hose team with a 1.5" fire hose configured to dispense AFFF. The bilges shall be blanketed with a minimum of 1/2 inch AFFF. The #1 and #2 nozzlemen should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA, but should not enter the affected space.

3.5.7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply fan on high for at least 15 minutes after the atmosphere

has been tested and proven free of flammable gases. When the atmosphere has been tested and proven free of explosive gases, desmoke surrounding compartments using the red devil blower.

3.5.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Pump Rooms and Generator Room. The covers should be installed over the Generator Room supply and exhaust vents.

3.6. Engineering Stores/Aft Steering

3.6.1. Scenario

The most likely fire in this compartment is a Class A fire.

3.6.2. Confining the Fire

The fire boundaries are bulkhead 71 forward, the transom aft, the Main Deck and hull.

3.6.3. Sizeup

These spaces are normally unoccupied, thus there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.6.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.6.5. Indirect Attack

Due to the permanent opening in bulkhead 79 an indirect attack may not be feasible through the watertight hatches on the Main Weather Deck above each compartment. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.6.6. Direct Attack

When the scene leader directs, #1 firefighting hose team should enter the Engineering Stores through the watertight

hatch 1-72-2 and proceed aft through the permanent opening in bulkhead 79 to the Aft Steering if necessary with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and follow the same route as #1 hose team with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but should not enter the affected space.

3.6.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. When the atmosphere has been tested and proven free of explosive gases, desmoke using the red devil blower.

3.6.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power to the Battery Storage Room.

3.7. Main Deck Passageway

3.7.1. Scenario

The most likely fire in this compartment is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.7.2. Confining the Fire

The fire boundaries are the superstructure forward, aft, port and starboard, the Main Deck and the 01 Deck. Note the open ladder to the starboard Mess Deck cannot be secured; however, the likelihood of a fire spreading downwards is not very great.

3.7.3. Sizeup

Crewmembers in the surrounding compartments (CO Stateroom, XPO Stateroom, MKC Stateroom) could be trapped by a fire in the Main Deck Passageway since the only means of egress from these compartments is through this Passageway. Personnel may need to be rescued since there are no EEBD's or escape hatches in these spaces. Class C fires are usually extinguished when electrical power is secured, however a Class A fire may be

burning in conjunction with the equipment that was the cause of the Class C fire.

3.7.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.7.5. Indirect Attack.

Due to the open ladder from the starboard Mess Deck an indirect attack is not feasible. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and 01 Deck as needed.

3.7.6. Direct Attack

Class C fires in these spaces should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly. (Charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The #1 firefighting hose team should enter through the watertight door on the port side aft with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and follow the same route as #1 hose team with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA, but they should not enter the space.

3.7.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. When the atmosphere has been tested and proven free of explosive gases, desmoke using the red devil blower

3.7.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the compartments in the superstructure with the exception of the Bridge.

3.8. Staterooms/Ship's Office, Main Deck

3.8.1. Scenario

The following staterooms and other compartments are located on the Main Deck in the superstructure:

- ◆ CO Stateroom (1-23-2-L)
- ◆ XPO Stateroom (1-15-2-L)
- ◆ MKC Stateroom (1-15-1-L)
- ◆ PO1 Berthing (1-15-3-L)
- ◆ Ship's Office (1-23-1-Q)
- ◆ Armory (1-7-2-M)
- ◆ Gyro Room (1-7-0-Q)

This scenario will address fires in these compartments with the exception of the Armory and Gyro Room which are discussed in other scenarios.

The most likely fire in the Staterooms or Ship's Office is a Class A fire in bedding materials.

3.8.2. Confining the Fire

The fire boundaries are the superstructure forward, aft, port and starboard, Main Deck, and 01 Deck. Due to the open ladder leading to the starboard Mess Deck from the Main Deck Passageway, it is not possible to totally isolate the compartments in the superstructure on the Main Deck. However, the likelihood of a fire spreading downwards is considered remote.

3.8.3. Sizeup

Due to the likelihood of sleeping crewmembers in these spaces there is a strong possibility that personnel may need to be rescued. There are no EEBD's in these spaces and there are no escape hatches, however there are fixed windows in the CO and XPO Staterooms as well as PO1 Berthing which could be broken out to permit escape. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.8.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.8.5. Indirect Attack

An indirect attack is not feasible since these compartments must be accessed from the Main Deck Passageway.

3.8.6. Direct Attack

If the scene leader decides that a direct attack is needed the #1 firefighting hose team should enter the Main Deck Passageway through the watertight door on the starboard Weather Deck and proceed to the affected compartment with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team following the same access path as the #1 team, with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the affected space without an OBA. The #1 and #2 hose tenders should wear an OBA but should not enter the affected space.

3.8.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. When the atmosphere has been tested and proven free of explosive gases, desmoke using the red devil blower.

3.8.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the compartments in the superstructure with the exception of the Bridge.

3.9. Armory

3.9.1. Scenario

The most likely fire in the Armory is a Class A fire.

3.9.2. Confining the Fire

The fire boundaries are the superstructure forward, aft, port and starboard, Main Deck, and 01 Deck. Due to the open

ladder leading to the starboard Mess Deck from the Main Deck Passageway, it is not possible to totally isolate the compartments in the superstructure on the Main Deck. However, the likelihood of a fire spreading downwards is considered remote.

3.9.3. Sizeup

The Armory is normally unoccupied, therefore, the likelihood of personnel being trapped is remote. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.9.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.9.5. Indirect Attack

An indirect attack is not feasible since this compartments must be accessed from the XPO Stateroom.

3.9.6. Direct Attack

If the scene leader decides that a direct attack is needed the #1 firefighting hose team should enter the Main Deck Passageway through the watertight door on the starboard Weather Deck, to the XPO Stateroom and then to the Armory with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team following the same access path as the #1 team, with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFE's and should not enter the affected space without an OBA. The #1 and #2 hose tenders should wear an OBA but should not enter the affected space.

3.9.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. When the atmosphere has been tested and proven free of explosive gases, desmoke using the red devil blower.

3.9.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the compartments in the superstructure with the exception of the Bridge.

3.10. Gyro Room

3.10.1. Scenario

The most likely fire in this compartment is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.10.2. Confining the Fire

The fire boundaries are the superstructure forward, aft, port and starboard, Main Deck, and the 01 Deck.

3.10.3. Sizeup

The Gyro Room is normally unoccupied, therefore the likelihood of personnel being trapped is remote. Class C fires are usually extinguished when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.10.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.10.5. Indirect Attack

An indirect attack on a fire in this compartment is not feasible since the only access is through the MKC Stateroom. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and Main Deck as needed.

3.10.6. Direct Attack

Class C fires in these spaces should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly (charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The #1 firefighting hose team should enter through the MKC Stateroom from the Main

Deck Passageway with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and follow the same route as #1 hose team with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

3.10.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. When the atmosphere has been tested and proven free of explosive gases, desmoke using the red devil blower.

3.10.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the compartments in the superstructure except the Bridge.

3.11. Bridge

3.11.1. Scenario

The most likely fire in this compartment is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.11.2. Confining the Fire

The fire boundaries are the superstructure forward, aft, port and starboard, and the 01 Deck.

3.11.3. Sizeup

Due to the ease of egress to weather from the Bridge, the likelihood of personnel being trapped is remote. Class C fires are usually extinguished when electrical power is secured; however, a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.11.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a

CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.11.5. Indirect Attack

A Class A fire in this space may be indirectly attacked through the port and starboard weather doors. A Class C fire should be extinguished by securing the electrical power to the affected equipment. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and 01 Deck as needed.

3.11.6. Direct Attack

Class C fires in these spaces should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly (charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The #1 firefighting hose team should enter through the watertight door on the opposite side of the fire on the Bridge with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and follow the same route as #1 hose team with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

3.11.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. When the atmosphere has been tested and proven free of explosive gases, desmoke using the red devil blower.

3.11.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the compartments in the superstructure.

3.12. In Port Fires

3.12.1. Scenario

The most likely fire in port is a Class A fire in one of the Berthing Areas in bedding materials. A Class B fire in the Galley is the next most likely fire in port.

3.12.2. Confining the Fire

The fire boundaries are stated above and depend on the involved compartment.

3.12.3. Sizeup

Due to the likelihood of sleeping crewmembers, there is a strong possibility that personnel may need to be rescued. There are no EEED's in this class of cutter. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.12.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.12.5. Indirect Attack

An indirect or direct attack can only be attempted in the event additional help arrives on scene. This help can come from another Coast Guard cutter, the Group or Station where the cutter is berthed, or from the local fire department. An indirect attack may be attempted as described in Sections 3.1 - 3.11 above for the particular compartment involved. Preplanning for in port fires and the familiarity of the local fire department with the cutter and this doctrine are considered extremely important.

3.12.6. Direct Attack

A direct attack may be attempted if the scene leader directs in accordance with the procedures described above for the particular compartment involved. The scene leader is the person on watch (in a one man duty section) until properly relieved by the normal scene leader in the crew, or by a qualified person in the firefighting team from the local fire department.

3.12.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. When the atmosphere has been tested and proven free of explosive gases, desmoke using the red devil blower.

3.12.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water if the scene leader so directs. The electrician should secure electrical power with the exception of lighting to the affected space.

PART C

FIRE PROTECTION DOCTRINE

110' WPB "ISLAND" CLASS PATROL BOAT

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Part C
FIRE PROTECTION DOCTRINE

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1. Introduction

One of the most life threatening and hazardous activities that may be encountered on board ship is fighting a fire. Unlike a building fire, the crew often can not evacuate and leave the firefighting to trained professionals. The crew must extinguish the fire, often without assistance, and using only the available equipment on board. Once a fire occurs, it is too late to read this doctrine, it is too late to obtain training, and it is too late to repair and maintain damage control equipment. Finally, the procedures in this doctrine are not a substitute for the exercise of good judgment based on experience and the particular conditions that exist at the time.

The purpose of this doctrine is to provide useful background information pertinent to fire science (Part A), guidance promulgated by Commandant for "small" classes of Coast Guard cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered on this class of vessel, in port and underway (Part C). Note, the Commanding Officer is responsible for tailoring Part C of this doctrine within the guidelines set forth in the following documents:

- ◆ Naval Ships' Technical Manual (NSTM) Chapter 074, Volume 3
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 077
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 079
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 555
- ◆ FXP-4
- ◆ Surface Ship Survivability, NWP 62-1
- ◆ COMDTINST M9000.6, Naval Engineering Manual
- ◆ The Cutter's Fire Protection Doctrine, Parts A and B
- ◆ The Cutter's Engineering Casualty Control Manual

2. Vessel Characteristics

The 110' "Island" Class WPB is a patrol boat; its primary missions are law enforcement and search and rescue. To safely carry out its primary missions the cutter requires high speed capability. This capability is permitted by light weight aluminum construction and very powerful turbocharged high speed

diesels. Only the hull and watertight bulkheads below the Main Deck are steel. The following is a description of the cutter's compartmentation and other characteristics pertinent to firefighting.

2.1. Compartmentation

2.1.1. Below the Main Deck

Below the Main Deck the cutter is divided into the following eight areas, each separated by a steel watertight bulkhead:

2.1.1.1. Forepeak

This is a sealed compartment accessible through a small hatch on the Weather Deck.

2.1.1.2 Forward Berthing Area

This Berthing Area accommodates six (6) persons and includes a head. A watertight door in the aft bulkhead permits egress to the Passageway between the CPO Stateroom and the Magazine. A watertight hatch in the overhead near the aft bulkhead permits emergency escape to the Weather Deck.

2.1.1.3 CPO Stateroom and Magazine Space

The Magazine Space is equipped with an installed water sprinkling system and is located on the port side of a longitudinal Passageway. The CPO Stateroom, on the starboard side of the Passageway, accommodates two persons. Egress from the Stateroom is to the longitudinal Passageway which connects to the Berthing Area forward and the Mess Deck aft through watertight doors. There is also a watertight hatch in the overhead of the Passageway for emergency escape to the Weather Deck. Below the Passageway, an Auxiliary Machinery Space containing potable water pumps, reverse osmosis plant, ultraviolet purifier and the sewage plant/equipment is accessible through a flush mounted watertight hatch.

2.1.1.4 Galley and Mess Area

The Galley and Mess Area provide access to the Engine Room aft of the Mess Deck via the forward sound lock and two (2) watertight doors. Access to the Passageway forward of the Mess Deck is also through a watertight door. In addition, an open ladder leads to the Main Deck Passageway. The master fire detection panel is located on the port side of the Mess Deck. Some of the ships in this class also have a head in the Mess Deck Area.

2.1.1.5. Engine Room

The Engine Room can be accessed through separate sound locks fore and aft from the Mess Deck and After Berthing Area respectively. The Engine Room has an emergency escape hatch located in the overhead near the aft bulkhead on the starboard side. There are three exhaust louvers on the aft bulkhead near the overhead. Supply air for ventilation and combustion are provided by two large centrifugal supply fans located in the forward portion of the Engine Room.

2.1.1.6. After Berthing Area

The two means of egress from the After Berthing Area, which accommodates eight (8) persons, is through the aft sound lock to the Engine Room and through an escape hatch on the overhead to the Main Weather Deck. This escape hatch is located in way of the Engine Room exhaust louvers. The crew should be cautioned that in the event of fire in the Engine Room, smoke and heat may issue from the Engine Room exhaust louvers until the covers are installed.

2.1.1.7. Battery Space

This space contains the halon cylinders for the total flooding system installed in the Engine Room as well as the diesel start batteries and the air conditioning plant. The only access is through a watertight hatch in the overhead from the Weather Deck on the starboard side.

2.1.1.8. Steering Gear Compartment

This compartment contains the steering gear and the hydraulic power unit for the RHI crane on the 01 Deck. This space is accessible through a watertight hatch on the starboard side Main Deck.

2.1.2. Above the Main Deck

The Main Deckhouse contains the Bridge, CO and XO Staterooms and Electronics Space. The Deckhouse is all aluminum and contains an "L" shaped Passageway that provides egress to the port and starboard Main Weather Deck, and internal access to the Mess Deck (via an open ladder) and Staterooms for the Commanding Officer and Executive Officer. This passage also connects to the Electronics Space which contains most of the electronics and communications equipment, as well as the ladder leading to the Bridge. Aft of the Bridge is an Auxiliary Equipment Room that contains ventilation equipment accessible through a quick acting cover plate.

2.1.3. The Weather Deck

The 25 MM machine gun is mounted on the Weather Deck forward of the Deckhouse. The rigid hull inflatable and its associated gasoline cans are stowed on the Boat Deck aft above the Engine Room. The P-250 Mod 1 pump and its gasoline cans are also stowed on the After Main Weather Deck.

2.2. Diesel Engine Shutdowns

There are two main diesel engines and two ship service diesel generators. The following sections provide information for securing these engines in the event of a fire.

2.2.1. Main Diesel Engines

On the gauge board located at the after end of the Engine Room is a stop button for each engine. Pressing the button energizes the governor shutdown solenoid and secures the engine. A stop button is also located in the pilot house and on the open bridge console. Emergency shutdowns are located in the Pilot House between the steps on the port side and by the forward entrance to the Engine Room.

2.2.2. Ship Service Generators

A stop button is located on the control panel of each generator. Pressing this button energizes the fuel oil shutdown solenoid and secures the engine.

2.3. Ventilation

The ventilation equipment on this cutter primarily consists of two large 460 volt centrifugal fans which provide ventilation and combustion air in the Engine Room. Note these fans must be running when the main engines are in operation to prevent creating a negative pressure (vacuum) in the Engine Room. The controllers for these fans are located in the Engine Room on the port and starboard bulkheads at frame 23. In addition there is a 460 volt "kill" switch by the forward entrance to the Engine Room.

There are five air conditioning/heating recirculating systems which provide conditioned air to the interior compartments. None of these units can draw outside air into the cutter. Freon piping is routed from the battery space to each of the five air conditioning units.

2.4. Fire Detection Equipment

Monitoring devices sensitive to smoke or combustion products are installed in the eleven zones shown in Table C-110WPB-1. In addition, detectors sensitive to rate of heat rise and fixed temperature limits are installed in the Engine Room, Galley and

Magazine compartments. Manual call stations are also located in vulnerable areas throughout the ship to permit the crew to sound the alarm. The call stations and detectors trigger a visual and audible alarm on the master fire detection control panel located on the port side of the Mess Deck. The main control panel re-transmits these alarms to a remote fire detection panel located in the Bridge and to an alarm horn and fire indicator light on the open bridge.

TABLE C-110WPB-1
LOCATION OF FIRE DETECTORS AND MANUAL CALL STATIONS

ZONE	LOCATION
1	Steering Gear Compartment
2	Battery Stowage Compartment
3	After Berthing Area
4	Engine Room
5	Galley/Mess Deck
6	CPO Stateroom
7	Magazine Space
8	Forward Berthing Area
9	Main Deckhouse
10	Bridge
11	Magazine Sprinkling System

An external alarm circuit can be switched on at the fire detection control panel to route any fire alarm received to the cutters loud hailer system. This signal is routed to the loudhailer via the remote fire detection panel on the Bridge. This configuration may be used at night or other times when the manning levels are minimal.

2.5. Firefighting Equipment

2.5.1. Firemain Stations

There are five firemain stations configured for water or AFFF located throughout the cutter as follows:

- ◆ No. 1 Main Deck, centerline, Weather Deck forward of the Deckhouse (water)
- ◆ No. 2 Second Deck, centerline, aft on the Mess Deck (AFFF)
- ◆ No. 3 Main Deck, starboard side, Weather Deck (water)
- ◆ No. 4 Main Deck, port side, Weather Deck (water)
- ◆ No. 5 Main Deck, starboard side, Weather Deck (AFFF)

These fire stations are pressurized from either of two 30 hp electric fire pumps located at the forward end of the Engine Room. These pumps can be started locally or remotely from the Bridge.

2.5.2. Engine Room Halon 1301 Total Flooding System

Two Halon 1301 gas cylinders located in the battery storage area provide enough halon to totally flood the Engine Room. A spare set of halon cylinders identical to the first set is installed on the after bulkhead of the battery storage area. A SHIPALT (presently being prototyped) will be issued in the near future to connect the spare set of cylinders into the existing flooding system to provide a two shot capability. The system is initiated by operation of either halon remote actuation controls located on the Bridge and the forward sound lock. Actuation of the system sounds an audible alarm and automatically shuts down the Main Engines and generators. The installed Engine Room supply fans need to be secured manually. In addition, there is an automatic delay of 60 seconds built into the system to allow personnel to evacuate and for the ventilation fans to coast down. Covers are provided for the exhaust louvers aft near the overhead which help to contain the halon in the Engine Room. Canvas covers are made up for the supply vent intakes on some cutters and should be installed if available to contain the halon in the Engine Room in the event it is released.

2.5.3. Magazine Space Sprinkling System

The Magazine is protected with an installed water sprinkling system, fed from the firemain system and controlled from the Bridge. If the system is used, accumulated water can be removed with the bilge system.

2.5.4. P-250 Mod 1 Pump

One P-250 Mod 1 portable pumps and its associated gasoline cans is installed on the Main Deck, aft on the starboard side.

2.5.5. Portable fire extinguishers

Portable PKP and CO₂ fire extinguishers are located throughout the cutter to facilitate first aid. Table C-110WPB-2 is a summary of portable fire extinguishers located throughout the cutter.

2.5.6. Protective Equipment

Five (5) Navy Type A-4 oxygen breathing apparatuses (OBA's) and two (2) firefighting ensembles (FFE) are stowed in the cutter; some cutters have six (6) OBA's. There are twelve (12) canisters per OBA. OBA's are located in the After Berthing Area and in the Main Deckhouse interior locker.

TABLE C-110WPB-2 LOCATION OF PORTABLE EXTINGUISHERS

Location	Number of Portable Extinguishers	
	CO ₂	PKP
Bridge	1 15-lb	
Electronics Space	1 15-lb	1 18-lb
Fwd Crews Berthing		1 18-lb
Passageway, 2nd Deck	1 15-lb	
Galley/Mess Deck	1 15-lb	2 18-lb
Aft Crews Berthing		1 18-lb
Engine Room	1 15-lb	1 18-lb
Aux. Machinery Room		1 18-lb

3. Firefighting Procedures

In this section 11 different shipboard fire scenarios are described. The recommended procedures for fighting each fire are detailed, from the alarm through post-fire activities. The last procedure is for fires in port. This class of cutter is not equipped with red devil blowers or ramfans, therefore desmoking has to be accomplished by natural means or the installed ventilation system. Some cutters are equipped with electric high capacity box fans.

3.1. Forward Berthing Area

3.1.1. Scenario

The most likely fire in this compartment is a Class A fire in bedding materials.

3.1.2. Confining the Fire

The fire boundaries are bulkhead 8 forward, bulkhead 13 aft, the Main Deck and Second Deck. The Magazine is just aft on the port side.

3.1.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a strong possibility that personnel may need to be rescued. There are no EEBD's in the space; personnel may escape

through the watertight hatch located in the overhead near the aft bulkhead. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.1.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.1.5. Indirect Attack

If the compartment can be completely isolated the fire may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch on the Main Deck. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed. The magazine sprinkling system should be energized, with the Commanding Officer's permission, if the magazine fire alarm sounds.

3.1.6. Direct Attack

If the scene leader decides that a direct attack is needed, the #1 firefighting hose team should enter through the aft watertight door from the Second Deck Passageway with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA, but they should not enter the space.

3.1.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.1.8. Other Actions

During firefighting actions the investigator, wearing an OBA, shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Forward Berthing Area. The contents of the Ready Service Locker should be relocated aft on the Weather Deck.

3.2. CPO Stateroom

3.2.1. Scenario

The most likely fire in this compartment is a Class A fire in bedding materials.

3.2.2. Confining the Fire

The fire boundaries are bulkhead 13 forward, bulkhead 17 aft, the Main Deck and Second Deck. Note this includes the Passageway outside the Stateroom and the Magazine. In addition, the Ready Service Lockers on the Main Deck are directly above this space.

3.3.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a strong possibility that personnel may need to be rescued. There are no Emergency Evacuation Breathing Devices (EEBD's) in the space; personnel may escape through the escape hatch located in the overhead of the Passageway outside the Stateroom. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.3.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.3.5. Indirect Attack

If the accesses on the fire boundaries can be completely isolated, the fire may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch on the Main Deck. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed. The Magazine sprinkling system should be energized if the Magazine fire alarm sounds.

3.3.6. Direct Attack

If the scene leader decides that a direct attack is needed, the #1 firefighting hose team should enter through the aft watertight door in the CPO Passageway from the Mess Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter through the aft watertight door in the CPO

Passageway from the Mess Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

3.3.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.3.8. Other Actions

During firefighting actions, the investigator, wearing an OBA, shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the CPO Stateroom and Passageway area. The contents of the ready service locker should be relocated aft on the Weather Deck.

3.3. Mess Deck/Galley

3.3.1. Scenario

The most likely fire in this compartment is a Class A fire in the foam cushions on the Mess Deck benches located on the Mess Deck. There is also a significant possibility of a Class C fire in the electronics equipment located on the Mess Deck. There is also a good possibility of a Class B grease fire on the stove in the Galley.

3.3.2. Confining the Fire

The fire boundaries are bulkhead 17 forward, bulkhead 22 aft, the Main Deck and Second Deck. Note this includes both the Mess Deck and the Galley area. The Magazine is located just forward on the port side. The ladder leading to the Mess Area/Galley from the Main Deck Passageway can not be secured, therefore it is likely that fire may spread upwards to the Main Deck Passageway.

3.3.3. Sizeup

Due to the likelihood that crewmembers in this space are awake and alert, and the ease of egress forward, aft, and upward, there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with

water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are usually extinguished when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire. Class B fires are efficiently extinguished with PKP if the fire is small and AFFF if the fire is larger.

3.3.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A and B fires and a CO₂ portable extinguisher on Class C fires.

3.3.5. Indirect Attack

Due to the open ladder from the Main Deck to the Mess Deck/Galley an indirect attack is not feasible. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed. The magazine sprinkling system should be energized if the magazine fire alarm sounds.

3.3.6. Direct Attack

Class A fires in these spaces should be attacked directly; the #1 firefighting hose team should enter through the forward watertight door in the Mess Deck from the CPO Passageway with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter from the Main Deck Passageway down the open ladder with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space. The watertight door to the forward sound lock should not be opened until the fire is completely out and the atmosphere tested safe. Class B fires should be attacked directly with PKP portable extinguishers if the fire is confined to the stove area in the Galley. If the Class B fire has spread, the fire should be attacked directly with water fog or AFFF. Class C fires should be extinguished with a portable CO₂ extinguisher after the electrical power to the affected equipment is secured.

3.3.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.3.8. Other Actions

During firefighting actions, the investigator, wearing an OBA, shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Mess Deck and Galley.

3.4. Engine Room

3.4.1. Scenario

The most likely fire in this compartment is a Class B spray fire as a result of a ruptured lube oil or fuel oil line on the main engines. A Class C fire is also likely in a controller, switchboard, or motor.

3.4.2. Confining the Fire

The fire boundaries are bulkhead 22 forward, bulkhead 28 aft, the Main Deck, Boat Deck and hull. The rigid hull inflatable (RHI) boat and its associated gasoline containers are stowed on the Boat Deck directly above the Engine Room. The gasoline containers should be relocated as far aft as possible on the main Weather Deck, and the RHI off-loaded if time and conditions permit. The Engine Room supply fans shall be secured and the main engines shall be secured. The generators shall be secured in the event of a Class B fire but need not be secured for a Class C fire (unless they are the source of the fire). If the generators are secured, it is crucial that the P-250 Mod 1 be rigged and energized as a backup source of firefighting water.

3.4.3. Sizeup

The Engine Room in this cutter is normally unmanned, and the ease of egress fore and aft make it unlikely that personnel will need to be rescued. There are no EEBD's in the space but personnel may escape through the escape hatch located in the overhead near the aft bulkhead. Class B combustibles are best extinguished by AFFF or Halon 1301. Class C fires are best extinguished with CO₂.

3.4.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on a Class B fire and a CO₂ portable extinguisher on a Class C fire.

3.4.5. Indirect Attack

If the compartment can be completely isolated, a Class B fire may be indirectly attacked with minimal risk to personnel

by shutting down the main engines, generators, and ventilation fans; evacuating the space; and activating the Halon 1301 total flooding system. The scene leader and investigator shall monitor the effectiveness of the Halon by monitoring bulkhead temperatures and other appropriate means. The scene leader may direct re-entry in accordance with the direct attack procedures described in the next section after waiting a minimum of 15 minutes for the temperature to cool below the ignition point. If a second shot halon system is installed in the cutter, it shall be reserved for use as directed by the Commanding Officer in the event of a reflash. A Class C fire in the switchboard, motor, or controller shall be attacked directly as described in the next section. If the Class C fire grows out of control, the procedures for the indirect attack apply.

3.4.6. Direct Attack

When the scene leader directs, #1 firefighting hose team should enter through the aft watertight door from the Aft Sound Lock with a 1.5" fire hose configured to apply AFFF. The #2 firefighting hose team should back up the first team and enter through the same door with a 1.5" fire hose configured to dispense AFFF. The bilges shall be blanketed with a minimum of 1/2 inch AFFF. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space. A Class C fire shall be attacked directly, by first securing the source of electrical power, then attacking the remaining Class A or B fire with PKP or CO₂ portable extinguishers.

3.4.7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply and exhaust fans on high for at least 15 minutes after the Engine Room atmosphere has been tested and proven free of flammable gases. In the event electrical power is unavailable, it is feasible to desmoke the Engine Room with a water-driven ram-fan powered by a P-250 Mod 1. If a ram-fan is also not available, natural ventilation may be used by opening all weather accesses to the Engine Room (ventilation fittings and emergency escape hatch).

3.4.8. Other Actions

During firefighting actions, the investigator, wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Engine Room. The covers should be installed over the Engine Room exhaust louvers, and if available, over the

supply vent intakes. The contents of the pyrotechnics locker shall be relocated aft on the main Weather Deck.

3.5. After Berthing Area

3.5.1. Scenario

The most likely fire in this compartment is a Class A fire in bedding materials.

3.5.2. Confining the Fire

The fire boundaries are bulkhead 28 forward, bulkhead 31.5 aft, the Main Deck and Second Deck. In addition the gasoline containers for the RHI and portable pumps on the Main Deck are directly above this space.

3.5.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a strong possibility that personnel may need to be rescued. There are no EEBD's in the space but personnel may escape through the escape hatch located in the overhead near the forward bulkhead on the port side. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.5.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.5.5. Indirect Attack

If the accesses on the fire boundaries can be completely isolated the fire may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch on the Main Deck. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.5.6. Direct Attack

If the scene leader decides that a direct attack is needed the #1 firefighting hose team should enter through the watertight escape hatch on the Main Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter through the same hatch with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2

nozzlemen should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space. The forward watertight door into the aft sound lock should not be opened until the fire is completely extinguished and the atmosphere tested safe.

3.5.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.5.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power in the Berthing Area with the exception of lighting. The contents of the pyrotechnics locker should be relocated forward on the Main Weather Deck.

3.6. Battery Storage Room

3.6.1. Scenario

The most likely fire in this compartment is a Class A fire in the nylon hawser reel or other Class A combustibles in the space. There is also a significant possibility of a Class C fire in the batteries or electrical equipment installed in this space.

3.6.2. Confining the Fire

The fire boundaries are bulkhead 31.5 forward, bulkhead 33 aft, the Main Deck and hull.

3.6.3. Sizeup

This is an unmanned space, thus there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are usually extinguished when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.6.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A fires and a CO₂ portable extinguisher on Class C fires.

3.6.5. Indirect Attack

If the compartment can be completely isolated the fire may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch on the Main Deck. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.6.6. Direct Attack

A direct attack on Class A fires in this spaces is not recommended, however if the scene leader directs the only access to the compartment is through the Main Deck hatch on the starboard side. The #1 firefighting hose team should enter through the hatch in the Main Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter through the same hatch with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA, but they should not enter the space. Caution: Charging batteries produces hydrogen gas which is highly explosive.

3.6.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.6.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power to the Battery Storage Room.

3.7. Steering Gear Room

3.7.1. Scenario

The most likely fire in this compartment is a Class C fire in the steering gear motor. There is also a significant

possibility of a Class B fire in the steering gear equipment installed in this space.

3.7.2. Confining the Fire

The fire boundaries are bulkhead 33 forward, the transom aft, the Main Deck and hull.

3.7.3. Sizeup

This is an unmanned space, thus there is little possibility that personnel may need to be rescued. Class C combustibles are best extinguished by securing the electrical power to the affected equipment and then extinguishing the remaining Class A or B fire with PKP or CO₂ extinguishers or water.

3.7.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A fires and a CO₂ portable extinguisher on Class C fires.

3.7.5. Indirect Attack

If the compartment can be completely isolated, the fire may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch on the Main Deck. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.7.6. Direct Attack

A direct attack on Class A or Class B fires in this spaces is not recommended; however, if the scene leader directs, the only access to the compartment is through the hatch on the Main Deck, starboard side. The #1 firefighting hose team should enter through the hatch in the Main Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter through the same hatch with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

3.7.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for

oxygen and toxic gas levels before entering the space without an OBA.

3.7.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power to the Steering Gear Room.

3.8. CO/XO Staterooms

3.8.1. Scenario

The most likely fire in this compartment is a Class A fire in bedding materials.

3.8.2. Confining the Fire

The fire boundaries are the superstructure forward and aft, the Main Deck and the 01 Deck. The CO and XO Staterooms, as well as the Electronics Equipment Room, have joiner doors with open louvers for ventilation. Therefore, the fire boundaries are expanded to include the entire superstructure. Note this includes the Main Deck Passageway outside the Staterooms, the Electronics Equipment Room, and the Bridge since the ladder from the Electronics Equipment Room to the Bridge can not be secured. Therefore, confining the fire to a particular room in the superstructure is difficult.

3.8.3. Sizeup

Due to the likelihood of sleeping crewmembers in these spaces, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in the spaces and personnel must escape through the Main Deck Passageway outside the Staterooms. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.8.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.8.5. Indirect Attack

Due to the inability to isolate the compartments in the superstructure an indirect attack is not feasible. Use a 1.5"

fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.8.6. Direct Attack

The #1 firefighting hose team should enter the Main Deck Passageway through the windward weather door on the Main Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter through the same watertight door in the Main Deck Passageway with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

3.8.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.8.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the CO/XO Staterooms and Main Deck Passageway area.

3.9. Electronics Equipment Room

3.9.1. Scenario

The most likely fire in this compartment is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.9.2. Confining the Fire

The fire boundaries are the superstructure forward and aft, the Main Deck and the 01 Deck. The Electronics Equipment Room has a joiner door with open louvers for ventilation. Therefore, the fire boundaries are expanded to include the entire superstructure. Note this includes the Main Deck Passageway outside the CO/XO Staterooms, the Electronics Equipment Room, and the Bridge since the ladder from the Electronics Equipment Room to the Bridge can not be secured. Therefore, confining the fire to a particular room in the superstructure is difficult.

3.9.3. Sizeup

Due to the likelihood that crewmembers in this space are awake and alert, and the ease of egress up and aft, there is little possibility that personnel may need to be rescued. Class C fires are usually extinguished when electrical power is secured; however, a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.9.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.9.5. Indirect Attack.

Due to the open ladder from the Electronics Equipment Room to the Bridge an indirect attack is not feasible. Use a 1.5" fire hose equipped with a vari-nozzle to cool the 01 Deck and other fire boundaries as needed.

3.9.6. Direct Attack

Class C fires in these spaces should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly. (Charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The #1 firefighting hose team should enter through the joiner door in the Main Deck Passageway with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter from the Bridge down the open ladder with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzle men should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

3.9.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.9.8. Other Actions

During firefighting actions the investigator, wearing an OBA, shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The

electrician should secure electrical power with the exception of lighting to the Electronics Equipment Room.

3.10. Bridge

3.10.1. Scenario

The most likely fire in this compartment is a Class C fire in the electronics equipment installed on the Bridge. There is also a significant possibility of a Class C fire in the electronics equipment located on the Bridge.

3.10.2. Confining the Fire

The fire boundaries are the superstructure forward and aft, and the 01 Deck. There is an open ladder leading to the Electronics Equipment Room below the Bridge; this space has a joiner door with open louvers for ventilation. Therefore, the fire boundaries are expanded to include the entire superstructure. Note this includes the Main Deck Passageway outside the CO/XO Staterooms, the Electronics Equipment Room, and the Bridge. Therefore, confining the fire to a particular room in the superstructure is difficult.

3.10.3. Sizeup

Due to the likelihood that crewmembers in this space are awake and alert, and the ease of egress to weather, there is little possibility that personnel may need to be rescued. Class C fires are usually extinguished when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.10.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.10.5. Indirect Attack

Due to the open ladder from the Electronics Equipment Room to the Bridge an indirect attack is not feasible. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and other fire boundaries as needed.

3.10.6. Direct Attack

Class C fires in this space should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly (charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The #1 firefighting

hose team should enter by ascending the ladder from the Electronics Equipment Room with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter by ascending the same ladder with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFE's and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

3.10.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.10.8. Other Actions

During firefighting actions the investigator, wearing an OBA, shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Bridge.

3.11. In Port Fires

3.11.1. Scenario

The most likely fire in port is a Class A fire in one of the Berthing Areas in bedding materials. A Class B fire in the Galley is the next most likely fire in port.

3.11.2. Confining the Fire

The fire boundaries are stated above and depend on the involved compartment.

3.11.3. Sizeup

Due to the likelihood of sleeping crewmembers, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in this class of cutter. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.11.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.11.5. Indirect Attack

An indirect or direct attack can only be attempted in the event additional help arrives on scene. This help can come from another Coast Guard cutter, the Group or Station where the cutter is berthed, or from the local fire department. An indirect attack may be attempted as described in Sections 3.1 through 3.10 above for the particular compartment involved. Preplanning for in port fires and the familiarity of the local fire department with the cutter and this doctrine are considered extremely important.

3.11.6. Direct Attack

A direct attack may be attempted if the scene leader directs in accordance with the procedures described above for the particular compartment involved. The scene leader is the person on watch (in a one man duty section) until properly relieved by the normal scene leader in the crew, or by a qualified person in the firefighting team from the local fire department.

3.11.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.11.8. Other Actions

During firefighting actions the investigator, wearing an OBA, shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water if the scene leader so directs. The electrician should secure electrical power with the exception of lighting to the affected space.

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PART C

FIRE PROTECTION DOCTRINE

82' WPB PATROL BOAT

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Part C
FIRE PROTECTION DOCTRINE

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Part C
FIRE PROTECTION DOCTRINE

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1. Introduction

One of the most life threatening and hazardous activities that may be encountered on board ship is fighting a fire. Unlike a building fire, the crew often can not evacuate and leave the firefighting to trained professionals. The crew must extinguish the fire, often without assistance, and using only the available equipment on board. Once a fire occurs, it is too late to read this doctrine, it is too late to obtain training, and it is too late to repair and maintain damage control equipment. Finally, the procedures in this doctrine are not a substitute for the exercise of good judgment based on experience and the particular conditions that exist at the time.

The purpose of this doctrine is to provide useful background information pertinent to fire science (Part A), guidance promulgated by Commandant for "small" classes of Coast Guard cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered on this class of vessel, in port and underway (Part C). Note, the Commanding Officer or Officer-in-Charge is responsible for tailoring Part C of this doctrine within the guidelines set forth in the following documents:

- ◆ Naval Ships' Technical Manual (NSTM) Chapter 074, Volume 3
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 077
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 079
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 555
- ◆ FXP-4
- ◆ Surface Ship Survivability, NWP 62-1
- ◆ COMDTINST M9000.6, Naval Engineering Manual
- ◆ The Cutter's Fire Protection Doctrine, Parts A and B
- ◆ The Cutter's Engineering Casualty Control Manual

2. Vessel Characteristics

The 82' "Point Class" WPB is a twin shaft, diesel-powered, Patrol Boat. The primary missions of this cutter class are Law Enforcement, Defense Operations, and Search and Rescue. The vessel has a complement of twelve (12) crewmembers, a maximum speed of 20 knots, and maximum range of 490 miles. The vessel is steel below the Main Deck with an aluminum deckhouse. This cutter does not have the hotel facilities to accommodate extended deployments and usually puts into port at night. The following is a description of the cutter's compartmentation and other characteristics pertinent to firefighting.

2.1. Compartmentation

2.1.1. Below the Main Deck

Below the Main Deck, the cutter is divided into the following six areas, each separated by steel watertight bulkheads:

2.1.1.1. Forepeak

This compartment is accessible through a small watertight hatch on the Weather Deck.

2.1.1.2. Crews Berthing/Head

The Crews Berthing has a joiner door on the forward bulkhead leading to the Crews Head and a watertight door aft leading to the Mess Deck. In addition, there is an emergency escape hatch in the overhead of Crews Berthing to weather.

2.1.1.3. SPO Berthing/Mess Deck/Galley/Dry Stores

The Mess Deck is accessible from the athwartship Main Deck Passageway through a joiner door and down an inclined ladder. The Dry Stores, Galley and SPO Berthing are all accessible from the Mess Deck through wooden bi-fold joiner doors.

2.1.1.4. Engine Room

The Engine Room contains the main engines, diesel-driven ship service generators, heating boiler, and electric fire pump. The Engine Room is normally accessed from the Main Deck Passageway through a joiner door and down an inclined ladder. There is an emergency escape hatch aft on the starboard side in the overhead. The Halon 1301 total flooding system serves this compartment.

2.1.1.5. Main Hold

The Main Hold is accessible through a hatch on the Main Deck in the overhead of the compartment. The Halon storage cylinders for the Engine Room total flooding system are stored in this compartment. The suction hose for the P-250 Mod 1 Pump is also stowed in this compartment.

2.1.1.6. Lazarette

The Lazarette contains the steering gear and is accessible from the Main Deck through a watertight hatch in the overhead. The ship's allowance of two Navy Type A-4 OBA's and one firefighting ensemble (FFE) are stowed in the Lazarette.

2.1.2. Above the Main Deck

The aluminum deckhouse contains the Officer-in-Charge (OinC) Stateroom, Main Deck Passageway, and the Bridge. The Passageway provides access to four compartments: (1) the Engine Room through a joiner door and down a ladder; (2) the Bridge through a joiner door and up a ladder; (3) the Mess Deck, through a joiner door and down a ladder; and (4) the OinC Stateroom through a joiner door. The Passageway can be accessed from the Main Weather Deck through a watertight door aft on the starboard side. The Bridge also permits egress to weather through a watertight door.

2.1.3. The Weather Deck

The P-250 Mod 1 pump and its associated gasoline containers are stowed on the Main Weather Deck, aft on the starboard side. The rigid hull inflatable (RHI) boat is stowed on the Main Deck above the Engine Room.

2.2. Diesel Engine and Heating Boiler Shutdowns

The main propulsion diesel engines, diesel-driven ship service generators, and heating boiler can be started and stopped locally in the Engine Room. Remote controls for the main engines and ship service generators are located on the Bridge console beneath the helm. Remote control for the heating boiler is located above the Engine Room door on bulkhead 40 in the Main Deck Passageway. All four diesel engines and the heating boiler can be secured by closing the remote fuel oil shut-off valve 1-40-0 located in the Main Deck Passageway inboard of the Engine Room door.

2.3. Ventilation

The ventilation on this cutter consists of two supply and two exhaust fans in the Engine Room and a supply and exhaust fan in the Galley/Mess Deck. The controllers for the Engine Room fans are located on Bulkhead 40 in the Main Deck Passageway. The

Galley/Mess Deck controllers are located in the Mess Deck, frame 29, port side. The intake and exhaust vents are located on the Main Weather Deck at frames 43 and 63 port and starboard for the Engine Room, and frames 28 and 33 on the 01 Deck for the Galley exhaust and supply respectively.

2.4. Fire Detection Equipment

The Engine Room is equipped with two rate-of-rise heat detectors that provide a visual and audible alarm. The Crews Berthing, OinC Stateroom, and Mess Deck are each equipped with one ionization type smoke detector. The Forepeak, Main Hold, Lazarette, and Bridge are not equipped with any form of automatic fire or smoke detection.

2.5. Firefighting Equipment

2.5.1. Firemain Stations

There are two firemain stations located on the Main Weather Deck, port and starboard sides of the deckhouse at frame 42. These fire stations are normally pressurized from the electric fire pump located in the Engine Room.

2.5.2. Engine Room Halon 1301 Total Flooding System

The halon gas storage cylinders for the two-shot Halon 1301 total flooding system are located in the Main Hold (2-61-0-A). The system is initiated by operation of halon remote actuation controls located on the Bridge or locally in the Main Hold. Actuation of the system activates an audible and visual alarm and automatically shuts down the main engines, generators, boiler, and Engine Room ventilation fans. There is an automatic delay of 60 seconds built into the system to allow personnel time to evacuate and for the ventilation fans to coast down.

2.5.3. P-250 Mod 1 Pump

One P-250 Mod 1 portable pump and its associated gasoline containers is stowed on the Main Deck, aft on the starboard side.

2.5.4. Portable fire extinguishers

Portable PKP and CO₂ fire extinguishers are located throughout the cutter to facilitate first aid. Table C-82WPB-1 is a summary of portable fire extinguishers located throughout the cutter.

2.5.5. Protective Equipment

Two (2) Navy Type A-4 oxygen breathing apparatus (OBA) and one (1) firefighting ensemble (FFE) stowed in the Lazarette. There are twelve (12) canisters per OBA.

TABLE C-82WPB-1 LOCATION OF PORTABLE EXTINGUISHERS

Location	Number of Portable Extinguishers	
	CO ₂	PKP
Bridge	1 15-lb	
OinC Stateroom		1 7-lb
Crews Berthing		1 7-lb
Mess Deck/Galley		1 7-lb
Main Hold		1 7-lb
Lazarette		1 15-lb

2.5.6. Desmoking Equipment

There is no portable desmoking equipment in this class cutter.

3. Firefighting Procedures

In this section 9 different shipboard fire scenarios are described. The recommended procedures for fighting each fire are detailed, from the alarm through post-fire activities. The last procedure is for fires in port.

3.1. Forepeak

3.1.1. Scenario

The most likely fire in the Forepeak is a Class A fire.

3.1.2. Confining the Fire

The primary fire boundaries are the bow of the ship forward, bulkhead 6 aft, the Main Deck and the hull.

3.1.3. Sizeup

This space is normally unoccupied so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment.

Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.1.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.1.5. Indirect Attack

A fire in the Forepeak may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch on the Main Weather Deck without entering the space. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.1.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Forepeak through the watertight hatch in the Main Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Forepeak without an OBA. The hose tender should wear an OBA, but should not enter the Forepeak.

3.1.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.1.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting in the Forepeak.

3.2. Crews Berthing

3.2.1. Scenario

The most likely fire in this compartments is a Class A fire in bedding materials.

3.2.2. Confining the Fire

The primary fire boundaries are bulkhead 10 forward, bulkhead 20 aft, the Main Deck and Second Deck.

3.2.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a strong possibility that personnel may need to be rescued. There are no Emergency Evacuation Breathing Devices (EEBD's) in this space; egress is possible through the emergency escape hatch to weather, located in the overhead of the Crews Berthing. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.2.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.2.5. Indirect Attack

An indirect attack is feasible through the emergency escape hatch on the Main Deck with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.2.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Crews Berthing from the Mess Deck through watertight door 2-20-0 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Crews Berthing without an OBA. The hose tender should wear an OBA, but should not enter the Crews Berthing.

3.2.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.2.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting in the Crews Berthing.

3.3. Mess Deck/Galley/Dry Stores/SPO Berthing

3.3.1. Scenario

The most likely fire in these compartments is a Class C fire in the electronics equipment such as the stereo, TV or microwave. There is also a significant possibility of a Class A fire in the Dry Stores or SPO Berthing compartments. There is also a good possibility of a Class B grease fire on the stove in the Galley.

3.3.2. Confining the Fire

The primary fire boundaries are bulkhead 20 forward, bulkhead 39 aft, the Main Deck and Second Deck. Note the wooden bi-fold joiner doors on the SPO Berthing, Galley and Dry Stores may serve as smoke barriers but are ineffective as barriers to fire spread. Therefore it is likely that fire may spread to involve all of the compartments in this area.

3.3.3. Sizeup

Even though it is likely that crewmembers in SPO Berthing may be asleep, there is little possibility that personnel may need to be rescued due to the ease of egress forward and aft. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are most efficiently extinguished with CO₂ when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire. Class B fires are efficiently extinguished with PKP if the fire is small and AFFF if the fire is larger.

3.3.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A and B fires and a CO₂ portable extinguisher on Class C fires.

3.3.5. Indirect Attack

Due to the compartmentation in this area, an indirect attack is not feasible in the SP0 Berthing, Dry Stores, or Galley. A Class A fire in the Mess Deck, however, may be indirectly attacked with a minimum of danger to personnel. The firefighting team should use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position and attack the fire from the Passage through the joiner door at the top of the ladder leading to the Mess Deck. To prevent contamination of interior spaces, open the watertight door to weather in the Main Deck Passageway and secure the joiner doors to the OinC Stateroom, Bridge, and Engine Room. Use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.3.6. Direct Attack

Class C fires in the Galley/Mess Deck should be extinguished with a portable CO₂ extinguisher after the electrical power to the affected equipment is secured and then attacking the remaining Class A fire with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The firefighting hose team should enter the Mess Deck from the Main Deck Passageway through the joiner door and down the ladder. To prevent contamination of interior spaces, open the watertight door to weather in the Main Deck Passageway and secure the joiner doors to the OinC Stateroom, Bridge, and Engine Room. If the fire is near the ladder in the Mess Deck, the alternate direct attack route is from the Crews Berthing through watertight door 2-20-0. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Galley/Mess Deck without an OBA. The hose tender should wear an OBA, but should not enter the Galley/Mess Deck. Class B fires should be attacked directly with PKP portable extinguishers if the fire is confined to the stove area in the Galley. If the Class B fire has spread, the fire should be attacked directly with water fog or AFFF.

3.3.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.3.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting to the Galley/Mess Deck. Be prepared to secure power to all compartments forward of the Engine Room.

3.4. Engine Room

3.4.1. Scenario

The most likely fire in this compartment is a Class B spray fire as a result of a ruptured lube oil or fuel oil line on the main engine. A Class C fire is also likely in a controller, switchboard, or motor.

3.4.2. Confining the Fire

The primary fire boundaries are bulkhead 39 forward, bulkhead 61 aft, the Main Deck, and hull. The four Engine Room supply and exhaust fans shall be secured and the main engines shall be secured. The ship service generator shall be secured in the event of a Class B fire but need not be secured for a Class C fire (unless it is the source of the fire). If the ship service generator is secured, it is crucial that the P-250 Mod 1 pump be rigged and energized as a backup source of firefighting water.

3.4.3. Sizeup

The Engine Room in this cutter is normally unmanned, and the ease of egress forward and upward through the emergency escape hatch make it unlikely that personnel will need to be rescued. Class B fires are efficiently extinguished by AFFF or Halon 1301. Class C fires are best extinguished with CO₂.

3.4.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on a Class B fire and a CO₂ portable extinguisher on a Class C fire. A flammable liquid spray fire shall be immediately declared out of control; first aid should not be attempted for a flammable liquid fire out of control.

3.4.5. Indirect Attack

If the Engine Room can be completely isolated, a Class B fire may be indirectly attacked with minimal risk to personnel by shutting down the main engines, generators, heating boiler, and ventilation fans; evacuating the space; and activating the Halon 1301 total flooding system. The scene leader and investigator shall monitor the effectiveness of the Halon by monitoring bulkhead temperatures with temp-sticks or observing blistering paint, and other appropriate means such as cracking open the joiner door to the Engine Room on the Main Deck Passageway. The scene leader may direct reentry in accordance with the direct attack procedures described in the next section after waiting a minimum of 15 minutes for the temperature to cool below the ignition point. The ignition temperatures of common combustible materials are in the range of 300°F to 1000°F (lube

oil, for example is 400°F). The second shot for the Halon system shall be reserved for use as directed by the Commanding Officer in the event of a reflash. A Class C fire in the switchboard, motor, or controller shall be attacked directly as described in the next section. If the Class C fire grows out of control, the procedures for the indirect attack apply.

3.4.6. Direct Attack

When the scene leader directs, the firefighting hose team should enter the Engine Room through joiner door 1-40-2 from the Main Deck Passageway and down the inclined ladder with a 1.5" fire hose configured to apply AFFF. Caution: The aluminum ladder from the Main Deck Passageway is likely to be severely weakened from the heat of the fire in the Engine Room. The nozzleman should be dressed out in the FFE and should not enter the space without an OBA. The hose tender should wear an OBA, but should not enter the Engine Room. A Class C fire shall be attacked directly, by first securing the source of electrical power, then attacking the remaining Class A or B fire with PKP or CO₂ portable extinguishers.

3.4.7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply and exhaust fans on high for at least 15 minutes after the Engine Room atmosphere has been tested and proven free of flammable gases.

3.4.8. Other Actions

During firefighting actions, the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged and energized as the primary source of firefighting water. Secure electrical power with the exception of lighting to the Engine Room.

3.5. Main Hold

3.5.1. Scenario

The most likely fire in this compartment is a Class A fire.

3.5.2. Confining the Fire

The primary fire boundaries are bulkhead 61 forward, bulkhead 70 aft, the Main Deck and the hull.

3.5.3. Sizeup

This space is normally unoccupied, so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.5.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.5.5. Indirect Attack

An indirect attack is feasible through the hatch on the Main Deck with minimal risk to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.5.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Main Hold from the Main Weather Deck through the raised watertight hatch with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Main Hold without an OBA. The hose tender should wear an OBA, but should not enter the Main Hold.

3.5.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.5.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Weather Deck forward and energized as a backup source of firefighting water. All gasoline containers aft of the Engine Room on the Main Deck shall be relocated forward on the Main Deck. Secure electrical power with the exception of lighting aft of the Engine Room.

3.6. Lazarette

3.6.1. Scenario

The most likely fire in this compartment is a Class A fire.

3.6.2. Confining the Fire

The primary fire boundaries are bulkhead 70 forward, the transom aft, the Main Deck and the hull.

3.6.3. Sizeup

This space is normally unoccupied so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.6.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.6.5. Indirect Attack

An indirect attack is feasible through the hatch on the Main Deck with minimal risk to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.6.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Lazarette from the Main Weather Deck through the raised watertight hatch with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Lazarette without an OBA. The hose tender should wear an OBA, but should not enter the Lazarette.

3.6.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.6.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Weather Deck forward and energized as a backup source of firefighting water. All gasoline containers aft of the Engine Room on the Main Deck shall be relocated forward on the Main Deck. Secure electrical power with the exception of lighting aft of the Engine Room.

3.7. Officer-in-Charge Stateroom

3.7.1. Scenario

The most likely fire in this compartments is a Class A fire in bedding materials.

3.7.2. Confining the Fire

The primary fire boundaries are the superstructure forward aft, port and starboard, the 01 Deck and the Main Deck.

3.7.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a strong possibility that personnel may need to be rescued. There are no EEBD's in this space; the only egress is through the joiner door aft in the compartment to the Main Deck Passageway. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.7.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.7.5. Indirect Attack

An indirect attack is feasible through the joiner door on the Main Deck with a minimal risk to personnel. To prevent contamination of interior spaces, open the watertight door to weather in the Main Deck Passageway and secure the joiner doors to the Mess Deck, Bridge, and Engine Room. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.7.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the OinC Stateroom from the Passage through joiner door 1-39-1 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. To prevent contamination of interior spaces, open the watertight door to weather in the Main Deck Passageway and secure the joiner doors to the Mess Deck, Bridge, and Engine Room. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the OinC Stateroom without an OBA. The hose tender should wear an OBA, but should not enter the OinC Stateroom.

3.7.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.7.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting above the Main Deck.

3.8. Bridge

3.8.1. Scenario

The most likely fire in the Bridge is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.8.2. Confining the Fire

The primary fire boundaries are the superstructure forward, aft, port and starboard and the 01 Deck.

3.8.3. Sizeup

Due to the ease of egress to weather from the Bridge the likelihood of personnel being trapped is remote. Class C fires are usually extinguished when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.8.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.8.5. Indirect Attack

A Class A fire in this space may be indirectly attacked through the watertight door to weather with a minimal risk to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. A Class C fire should be extinguished by securing the electrical power to the affected equipment first. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and 01 Deck as needed.

3.8.6. Direct Attack

A Class C fire in the Bridge should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly. (Charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The firefighting hose team should enter through the watertight door aft on the starboard side of the Bridge with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the space without an OBA. The hose tender should wear an OBA but should not enter the Bridge.

3.8.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.8.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting above the Main Deck.

3.9. In Port Fires

3.9.1. Scenario

The most likely fire in port is a Class A fire in the Crews Berthing or OinC Stateroom in bedding materials. A Class B fire in the Galley is the next most likely fire in port.

3.9.2. Confining the Fire

The primary fire boundaries are stated above and depend on the involved compartment.

3.9.3. Sizeup

Due to the likelihood of sleeping crewmembers, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in this class of cutter. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.9.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.9.5. Indirect Attack

An indirect or direct attack can only be attempted in the event additional help arrives on scene. This help can come from another Coast Guard cutter, the Group or Station where the cutter is berthed, or from the local fire department. An indirect attack may be attempted as described in Sections 3.1 through 3.8 above for the particular compartment involved. Preplanning for in port fires and the familiarity of the local fire department with the cutter and this doctrine are considered extremely important.

3.9.6. Direct Attack

A direct attack may be attempted if the scene leader directs in accordance with the procedures described above for the particular compartment involved. The scene leader is the person on watch (in a one man duty section) until properly relieved by the normal scene leader in the crew or by a qualified person in the firefighting team from the local fire department.

3.9.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.9.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged and energized as a backup source of firefighting water if the scene leader so directs. Secure electrical power at the shore connection.

PART C
FIRE PROTECTION DOCTRINE
65' WYTL HARBOR TUGBOAT

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Part C
FIRE PROTECTION DOCTRINE

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1. Introduction

One of the most life threatening and hazardous activities that may be encountered on board ship is fighting a fire. Unlike a building fire, the crew often can not evacuate and leave the firefighting to trained professionals. The crew must extinguish the fire, often without assistance, and using only the available equipment on board. Once a fire occurs, it is too late to read this doctrine, it is too late to obtain training, and it is too late to repair and maintain damage control equipment. Finally, the procedures in this doctrine are not a substitute for the exercise of good judgment based on experience and the particular conditions that exist at the time.

The purpose of this doctrine is to provide useful background information pertinent to fire science (Part A), guidance promulgated by Commandant for "small" classes of Coast Guard cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered on this class of vessel, in port and underway (Part C). Note, the Commanding Officer is responsible for tailoring Part C of this doctrine within the guidelines set forth in the following documents:

- ◆ Naval Ships' Technical Manual (NSTM) Chapter 074, Volume 3
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 077
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 079
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 555
- ◆ FXP-4
- ◆ Surface Ship Survivability, NWP 62-1
- ◆ COMDTINST M9000.6, Naval Engineering Manual
- ◆ The Cutter's Fire Protection Doctrine, Parts A and B
- ◆ The Cutter's Engineering Casualty Control Manual

2. Vessel Characteristics

The 65' Surface Effect Ship is a Harbor Tugboat; its primary missions are Domestic Ice Operations, Pollution Response (Marine Environmental Protection), and Search and Rescue. The vessel has a complement of seven (7) crewmembers, a maximum speed of 10 knots, and maximum range of 850-900 miles. This vessel does not

have the hotel facilities to accommodate extended deployments and usually puts into port at night. The following is a description of the cutter's compartmentation and other characteristics pertinent to firefighting.

2.1. Compartmentation

2.1.1. Below the Main Deck

Below the Main Deck the cutter is divided into the following six areas, each separated by steel watertight bulkheads:

2.1.1.1. Forepeak

This compartment is accessible through a small watertight scuttle on the Weather Deck and through a watertight door to the Crews Berthing. A fire monitor for fighting fires on other ships is stowed in this compartment.

2.1.1.2. Crews Berthing

The Crews Berthing has watertight doors forward and aft to the Forepeak and Passage, respectively. In addition, there is an emergency escape hatch in the overhead to weather.

2.1.1.3. CPO Stateroom/Passage/Dry Stores

A centerline Passage running longitudinally connects the Crews Berthing forward, with the Engine Room aft (down a small ladder) and the Galley/Mess Deck aft (up a small ladder). The CPO Stateroom accessible through a plastic curtain, is on the starboard side of the Passage, and the Dry Stores and Head are on the port side.

2.1.1.4. Engine Room

The Engine Room contains the main engine and a fire pump driven by a power takeoff from the main engine. The ship service generator is also in this compartment. The Engine Room is normally accessed from the Passage forward through a watertight door fitted with a glass viewing port. There is an emergency escape hatch aft on the starboard side in the overhead. The Halon 1301 total flooding system serves this compartment.

2.1.1.5. Main Hold

The Main Hold is accessible through a hatch on the Main Deck in the overhead of the compartment. The Halon storage cylinders for the Engine Room total flooding system are stored in this compartment.

2.1.1.6. Lazarette

The Lazarette contains the steering gear and is accessible from the Main Deck through a watertight scuttle.

2.1.2. Above the Main Deck

The Main Deckhouse contains the Galley/Mess Deck and the Bridge. The Galley/Mess Deck is one compartment and contains the recreational electronic equipment for the crew such as the television and video cassette recorder. It is accessible from the Weather Deck through a watertight door aft on the starboard side. The Bridge is accessible from the Galley/Mess Deck up a small ladder and through a plastic curtain. The Passage is also accessible forward of the Galley/Mess Deck down a small ladder and through a plastic curtain. The Bridge is also accessible from the Weather Deck through watertight doors on the port and starboard sides, as well as from the Galley/Mess Deck via a small ladder.

2.1.3. The Weather Deck

The P-250 Mod 1 pump and its gasoline cans are stowed on the after Main Weather Deck.

2.2. Diesel Engine Shutdowns

The main propulsion diesel engine and diesel-driven ship service generator can be started and stopped locally in the Engine Room or remotely from the Bridge. There are no remote fuel shutdowns installed in this vessel.

2.3. Ventilation

The ventilation on this cutter consists of an electric exhaust fan for the Crews Head and a supply fan for the Engine Room. Natural exhaust vents fitted with tompons (expandable plugs) serve most of the compartments below the Main Deck. The switch for the Crews Head fan is located on the Second Deck, frame 17. The supply fan for the Engine Room can be secured by the switch located on the port side frame 27 and the emergency stop switch is located frame 17 port side. The intake supply vents are slots cut into the stack and cannot be secured.

2.4. Fire Detection Equipment

The Engine Room is equipped with two smoke and two heat detectors that provide a visual and audible alarm. The Berthing Area also has a smoke detector installed which is not audible if the watertight door to the Passage is closed. There is a smoke detector in the Passage that serves the Dry Stores, Head, and CPO Stateroom. The Forepeak, Main Hold, Lazarette, Galley/Mess Deck, and Bridge are not equipped with any form of automatic fire or smoke detection.

2.5. Firefighting Equipment

2.5.1. Firemain Stations

There are two firemain stations located on the port and starboard sides of the deckhouse at frame 20. These fire stations are pressurized from the fire pump driven by a power takeoff from the main engine. AFFF foam canisters are stowed in the Main Hold and the Forepeak.

2.5.2. Engine Room Halon 1301 Total Flooding System

The halon gas storage cylinders for the two-shot Halon 1301 total flooding system are located in the Main Hold (2-31-0-A). The system is initiated by operation of halon remote actuation controls located on the Bridge or locally in the Main Hold. Actuation of the system sounds an audible alarm and automatically shuts down the main engine, generator, and Engine Room supply fan. There is an automatic delay of 60 seconds built into the system to allow personnel time to evacuate and for the ventilation fans to coast down.

2.5.3. P-250 Mod 1 Pump

One P-250 Mod 1 portable pumps and its associated gasoline cans is stowed on the Main Deck, aft on the starboard side.

2.5.4. Portable Fire Extinguishers

To facilitate first aid, portable PKP and CO₂ fire extinguishers are located throughout the ship as listed in Table C-65WYTL-1.

TABLE C-65WYTL-1 LOCATION OF PORTABLE EXTINGUISHERS

Location	Number of Portable Extinguishers	
	CO ₂	PKP
Main Hold		1 15-lb
Passage	1 5-lb	
Pilot House	1 5-lb	
Lazarette		1 10-lb
Galley/Mess Deck		1 5-lb
Crews Berthing		1 5-lb
Forepeak		1 5-lb

2.5.5. Protective Equipment

Three (3) Navy Type A-4 oxygen breathing apparatuses (OBA's) and one (1) firefighting ensemble (FFE) are stowed in the cutter. There are twelve (12) canisters per OBA. One of the OBA's is located under the ladder to the Galley/Mess Deck in the Passage, the other two are located in the Main Hold and Forepeak. The FFE is also stowed in the Main Hold.

2.5.6. Desmoking Equipment

There is no portable desmoking equipment in this class cutter.

3. Firefighting Procedures

In this section, 9 different shipboard fire scenarios are described. The recommended procedures for fighting each fire are detailed, from the alarm through post-fire activities. The last procedure is for fires in port.

3.1. Forepeak

3.1.1. Scenario

The most likely fire in the Forepeak is a Class A fire.

3.1.2. Confining the Fire

The fire boundaries are the bow of the ship forward, bulkhead 5 aft, the Main Deck and the hull.

3.1.3. Sizeup

This space is normally unoccupied so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.1.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.1.5. Indirect Attack

If the Forepeak can be completely isolated by closing the watertight door to Crews Berthing, the fire may be indirectly attacked with minimal risk to personnel by applying water fog

from a 1.5" hose equipped with a vari-nozzle through the scuttle on the Main Weather Deck without entering the space. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed. Note: The main engine should not be secured so that it can be used to provide firemain pressure.

3.1.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Forepeak through the watertight hatch in the Main Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. Note: The main engine should not be secured so that it can be used to provide firemain pressure. Do not open the watertight door to Crews Berthing unless the fire is completely out. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Forepeak without an OBA. The hose tender should wear an OBA, but should not enter the Forepeak.

3.1.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.1.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting in the Forepeak. The tompions (expandable plugs) shall be inserted in the natural vents on the Main Deck serving Second Deck compartments.

3.2. Crews Berthing

3.2.1. Scenario

The most likely fire in this compartments is a Class A fire in bedding materials.

3.2.2. Confining the Fire

The fire boundaries are bulkhead 5 forward, bulkhead 13 aft, the Main Deck and Second Deck.

3.2.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a strong possibility that personnel may need to be

rescued. There are no Emergency Evacuation Breathing Devices (EEBD's) in this space; egress is possible through the emergency escape hatch to weather, located in the overhead of the Crews Berthing. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.2.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.2.5. Indirect Attack

An indirect attack is feasible through the emergency escape hatch on the Main Deck. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed. Note: The main engine should not be secured so that it can be used to provide firemain pressure.

3.2.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Crews Berthing from the Passage through watertight door 2-13-0 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. Note: The main engine should not be secured so that it can be used to provide firemain pressure. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Crews Berthing without an OBA. The hose tender should wear an OBA, but should not enter the Crews Berthing.

3.2.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.2.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting in the

Crews Berthing. The tompons (expandable plugs) shall be inserted in the natural vents on the Main Deck serving Second Deck compartments.

3.3. CPO Stateroom/Dry Stores/Passage

3.3.1. Scenario

The most likely fire in these compartments is a Class A fire in bedding materials.

3.3.2. Confining the Fire

The fire boundaries are bulkhead 13 forward, bulkhead 19 aft, the Main Deck and Second Deck. The ladder up to the Galley/Mess Deck from the Passage is secured at the top by a plastic curtain. The CPO Stateroom is accessible from the Passage through a plastic curtain. These curtains may serve as a smoke barrier but they are ineffective as a barrier to fire spread.

3.3.3. Sizeup

Due to the likelihood of sleeping crewmembers in the CPO Stateroom, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in these spaces; personnel may escape through the escape hatch located in the overhead of the Crews Berthing or up the ladder to the Galley/Mess Deck. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.3.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.3.5. Indirect Attack

An indirect attack is not feasible in these compartments due to the inability to totally isolate the compartments. Use a 1.5" hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed. **Note:** The main engine should not be secured so that it can be used to provide firemain pressure.

3.3.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Passage from

the Galley/Mess Deck down the inclined ladder and proceed to the affected compartment with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. **Note: The main engine should not be secured so that it can be used to provide firemain pressure.** The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Passage without an OBA. The hose tender should wear an OBA, but should not enter the Passage.

3.3.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.3.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting forward of the Engine Room. The tompons (expandable plugs) shall be inserted in the natural vents on the Main Deck serving Second Deck compartments.

3.4. Engine Room

3.4.1. Scenario

The most likely fire in this compartment is a Class B spray fire as a result of a ruptured lube oil or fuel oil line on the main engine. A Class C fire is also likely in a controller, switchboard, or motor.

3.4.2. Confining the Fire

The fire boundaries are bulkhead 19 forward, bulkhead 31 aft, the Main Deck, and hull. The Engine Room supply fan shall be secured and the main engine shall be secured. The generator shall be secured in the event of a Class B fire but need not be secured for a Class C fire (unless it is the source of the fire). Since the main engine provides the motive power for the fire pump, it is crucial that the P-250 Mod 1 be rigged and energized as a backup source of firefighting water.

3.4.3. Sizeup

The Engine Room in this cutter is normally unmanned, and the ease of egress forward and upward through the emergency escape hatch make it unlikely that personnel will need to be

rescued. Class B fires are best extinguished by AFFF or Halon 1301. Class C fires are best extinguished with CO₂.

3.4.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on a Class B fire and a CO₂ portable extinguisher on a Class C fire.

3.4.5. Indirect Attack

If the Engine Room can be completely isolated, a Class B fire may be indirectly attacked with minimal risk to personnel by shutting down the main engine, generator, and ventilation fan; evacuating the space; and activating the Halon 1301 total flooding system. The scene leader and investigator shall monitor the effectiveness of the Halon by monitoring bulkhead temperatures with temp-sticks or observing the fire through the viewing port in watertight door 2-19-2, and other appropriate means such as cracking open the joiner door to the Engine Room on the Main Deck Passageway. The scene leader may direct reentry in accordance with the direct attack procedures described in the next section after waiting a minimum of 15 minutes for the temperature to cool below the ignition point. The ignition temperatures of common combustible materials are in the range of 300°F to 1000°F (lube oil, for example is 400° F). The second shot for the Halon system shall be reserved for use as directed by the Commanding Officer in the event of a reflash. A Class C fire in the switchboard, motor, or controller shall be attacked directly as described in the next section. If the Class C fire grows out of control, the procedures for the indirect attack apply.

3.4.6. Direct Attack

When the scene leader directs, the firefighting hose team should enter through the watertight door 2-19-2 from the Passage with a 1.5" fire hose configured to apply AFFF. The nozzleman should be dressed out in the FFE and should not enter the space without an OBA. The hose tender should wear an OBA but should not enter the Engine Room. A Class C fire shall be attacked directly, by first securing the source of electrical power, then attacking the remaining Class A or B fire with PKP or CO₂ portable extinguishers.

3.4.7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply fan on high for at least 15 minutes after the Engine Room atmosphere has been tested and proven free of flammable gases.

3.4.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as the primary source of firefighting water. Secure electrical power with the exception of lighting to the Engine Room. The tompons (expandable plugs) shall be inserted in the natural vents on the Main Deck serving Second Deck compartments.

3.5. Main Hold

3.5.1. Scenario

The most likely fire in this compartment is a Class A fire.

3.5.2. Confining the Fire

The fire boundaries are bulkhead 31 forward, bulkhead 41 aft, the Main Deck and the hull.

3.5.3. Sizeup

This space is normally unoccupied so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.5.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.5.5. Indirect Attack

An indirect attack is feasible through the hatch on the Main Deck. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed. Note: The main engine should not be secured so that it can be used to provide firemain pressure.

3.5.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Main Hold from the Main Weather Deck through the raised watertight hatch with a 1.5" fire hose equipped with a vari-nozzle set to the

water fog position. Note: The main engine should not be secured so that it can be used to provide firemain pressure. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Main Hold without an OBA. The hose tender should wear an OBA, but should not enter the Main Hold.

3.5.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.5.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck forward and energized as a backup source of firefighting water. All gasoline containers aft of the Engine Room on the Main Deck shall be relocated forward on the Main Deck. Secure electrical power with the exception of lighting aft of the Engine Room. The tompons (expandable plugs) shall be inserted in the natural vents on the Main Deck serving Second Deck compartments.

3.6. Lazarette

3.6.1. Scenario

The most likely fire in this compartment is a Class A fire.

3.6.2. Confining the Fire

The fire boundaries are bulkhead 41 forward, the transom aft, the Main Deck and the hull.

3.6.3. Sizeup

This space is normally unoccupied so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.6.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.6.5. Indirect Attack

An indirect attack is feasible through the watertight scuttle on the Main Weather Deck. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed. Note: The main engine should not be secured so that it can be used to provide firemain pressure.

3.6.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Lazarette from the Main Weather Deck through the watertight scuttle with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. Note: The main engine should not be secured so that it can be used to provide firemain pressure. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Lazarette without an OBA. The hose tender should wear an OBA, but should not enter the Lazarette.

3.6.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.6.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged on the Weather Deck forward and energized as a backup source of firefighting water. All gasoline containers aft of the Engine Room on the Main Deck shall be relocated forward on the Main Deck. Secure electrical power with the exception of lighting aft of the Engine Room. The tompons (expandable plugs) shall be inserted in the natural vents on the Main Deck serving Second Deck compartments.

3.7. Galley/Mess Deck

3.7.1. Scenario

The most likely fire in these compartments is a Class A fire in the foam cushions on the Mess Deck benches located on the Mess Deck. There is also a significant possibility of a Class C fire in the electronics equipment located in this compartment. There is also a good possibility of a Class B grease fire on the stove in the Galley.

3.7.2. Confining the Fire

The fire boundaries are bulkhead 19 forward, the superstructure including the Bridge, the 01 Deck and the Main Deck. Note the plastic curtains on the ladders leading to the Bridge and the Passage forward of bulkhead 19 may serve as smoke barriers, but are ineffective as barriers to fire spread. Therefore, it is likely that fire may spread forward and up to the Bridge and possibly forward and down to the Passage.

3.7.3. Sizeup

Due to the likelihood that crewmembers in this space are awake and alert, and the ease of egress forward, or directly to weather, there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are usually extinguished when electrical power is secured; however, a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire. Class B fires are efficiently extinguished with PKP if the fire is small and AFFF if the fire is larger.

3.7.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A and B fires and a CO₂ portable extinguisher on Class C fires.

3.7.5. Indirect Attack

Due to the inability to completely isolate the fire in the Galley/Mess Deck due to the plastic curtains on the ladders leading forward, an indirect attack is not feasible. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and other fire boundaries as needed. **Note: The main engine should not be secured so that it can be used to provide firemain pressure.**

3.7.6. Direct Attack

Class A fires in the Galley/Mess Deck should be attacked directly; the firefighting hose team should enter the Galley/Mess Deck from the Main Weather Deck through the watertight door with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. **Note: The main engine should not be secured so that it can be used to provide firemain pressure.** The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Galley/Mess Deck without an OBA.

The hose tender should wear an OBA, but should not enter the Galley/Mess Deck. Class B fires should be attacked directly with PKP portable extinguishers if the fire is confined to the stove area in the Galley. If the Class B fire has spread, the fire should be attacked directly with water fog or AFFF. Class C fires should be extinguished with a portable CO₂ extinguisher after the electrical power to the affected equipment is secured.

3.7.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.7.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread, particular attention shall be paid to the Passage, CPO Stateroom and other compartments forward of bulkhead 19. The P-250 Mod 1 shall be rigged on the Weather Deck aft and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting to the Galley/Mess Deck, and Bridge. Be prepared to secure power to all compartments forward of the Engine Room. The tompons (expandable plugs) shall be inserted in the natural vents on the Main Deck serving Second Deck compartments.

3.8. Bridge

3.8.1. Scenario

The most likely fire in the Bridge is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.8.2. Confining the Fire

The fire boundaries are the superstructure including the Galley/Mess Deck, the 01 Deck and the Main Deck. Note the plastic curtains on the ladder leading to the Bridge from the Galley/Mess Deck may serve as a smoke barrier, but is ineffective as a barrier to fire spread. Therefore, it is possible that fire may spread downward to the Galley/Mess Deck.

3.8.3. Sizeup

Due to the ease of egress to weather from the Bridge the likelihood of personnel being trapped is remote. Class C fires are usually extinguished when electrical power is secured,

however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.8.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.8.5. Indirect Attack

A Class A fire in this space may be indirectly attacked through the port or starboard weather doors. A Class C fire should be extinguished by securing the electrical power to the affected equipment. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and 01 Deck as needed. Note: The main engine should not be secured so that it can be used to provide firemain pressure.

3.8.6. Direct Attack

A Class C fire in the Bridge should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly. (Charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The firefighting hose team should enter through the watertight door on the opposite side of the fire on the Bridge with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. Note: The main engine should not be secured so that it can be used to provide firemain pressure. The nozzleman should be dressed out in the FFE if time permits and should not enter the space without an OBA. The hose tender should wear an OBA, but should not enter the Bridge.

3.8.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.8.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting to the Galley/Mess Deck, and Bridge. Be prepared to secure power to all compartments forward of the Engine Room. The tompions (expandable plugs) shall be inserted in the natural vents on the Main Deck serving Second Deck compartments.

3.9. In Port Fires

3.9.1. Scenario

The most likely fire in port is a Class A fire in the Crews Berthing or CPO Stateroom in bedding materials. A Class B fire in the Galley is the next most likely fire in port.

3.9.2. Confining the Fire

The fire boundaries are stated above and depend on the involved compartment.

3.9.3. Sizeup

Due to the likelihood of sleeping crewmembers, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in this Class of cutter. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.9.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.9.5. Indirect Attack

An indirect or direct attack can only be attempted in the event additional help arrives on scene. This help can come from another Coast Guard cutter, the Group or Station where the cutter is berthed, or from the local fire department. An indirect attack may be attempted as described in Sections 3.1 through 3.8 above for the particular compartment involved. Preplanning for in port fires and the familiarity of the local fire department with the cutter and this doctrine are considered extremely important.

3.9.6. Direct Attack

A direct attack may be attempted if the scene leader directs in accordance with the procedures described above for the particular compartment involved. The scene leader is the person on watch (in a one man duty section) until properly relieved by the normal scene leader in the crew, or by a qualified person in the firefighting team from the local fire department.

3.9.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.9.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 shall be rigged and energized as a backup source of firefighting water if the scene leader so directs. Secure electrical power at the shore connection. The tompons (expandable plugs) shall be inserted in the natural vents on the Main Deck serving Second Deck compartments.

PART C

FIRE PROTECTION DOCTRINE

75' WLIC INLAND CONSTRUCTION TENDER

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1. Introduction

One of the most life threatening and hazardous activities that may be encountered on board ship is fighting a fire. Unlike a building fire, the crew often can not evacuate and leave the firefighting to trained professionals. The crew must extinguish the fire, often without assistance, and using only the available equipment on board. Once a fire occurs, it is too late to read this doctrine, it is too late to obtain training, and it is too late to repair and maintain damage control equipment. Finally, the procedures in this doctrine are not a substitute for the exercise of good judgment based on experience and the particular conditions that exist at the time.

The purpose of this doctrine is to provide useful background information pertinent to fire science (Part A), guidance promulgated by Commandant for "small" classes of Coast Guard cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered on this class of vessel, in port and underway (Part C). Note, the Commanding Officer or Officer-in-Charge is responsible for tailoring Part C of this doctrine within the guidelines set forth in the following documents:

- ◆ Naval Ships' Technical Manual (NSTM) Chapter 074, Volume 3
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 077
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 079
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 555
- ◆ FXP-4
- ◆ Surface Ship Survivability, NWP 62-1
- ◆ COMDTINST M9000.6, Naval Engineering Manual
- ◆ The Cutter's Fire Protection Doctrine, Parts A and B
- ◆ The Cutter's Engineering Casualty Control Manual

2. Vessel Characteristics

The 75' WLIC is an Inland Construction Tender. The primary missions of this cutter class are Short Range Aids to Navigation, and Search and Rescue. The vessel has a complement of approximately twelve (12) crewmembers, and a maximum speed of 8-10 knots. The vessel is constructed entirely of steel. This cutter does not have the hotel facilities to accommodate extended deployments and usually puts into port at night.

There is an 84' barge semi-permanently faced up to the tug. The tug rarely operates independently of the barge. The barge is 84' x 22' and serves as a working platform for the diesel-powered crane mounted on the bow portion of the Main Deck. There is a diesel engine on the barge which drives an air compressor to serve the spud winches and a jetting pump which can also be used as an alternate source of firefighting water pressure for the tug.

The following is a description of the tug's compartmentation and other characteristics pertinent to firefighting.

2.1. Compartmentation

2.1.1. Below the Main Deck

Below the Main Deck, the cutter is divided into the following five areas, each separated by steel watertight bulkheads:

2.1.1.1. Marine Sanitation Device (MSD) Space

This compartment is accessible through a small watertight hatch on the Weather Deck. The sewage tank occupies the majority of this space.

2.1.1.2. Forward Hold

The Forward Hold is a very large storeroom which contains the Galley stores, Dry Stores, Quartermaster Stores, Storekeeper Stores, and MAA Stores. It is accessible only from a hatch on the aft starboard side in the overhead that leads to the Laundry compartment.

2.1.1.3. Engine Room

The Engine Room on the Second Deck, and the Fidley on the Main Deck, are separated by an open steel grating and connected by an open ladder. The Fidley can be accessed from the Main Deck Passageway through a joiner door or from weather through a watertight door. The Engine Room is also accessible directly from the After Hold through a watertight door. The Fidley contains the 50 lb CO₂ Hose Reel system with a 25' hose that serves the Engine Room.

2.1.1.4. After Hold

The After Hold contains the Engineer's Stores and is accessible from the Engine Room through a watertight door on the starboard side. In addition egress is permitted through a watertight hatch in the overhead on the starboard side.

2.1.1.5. Lazarette

The Lazarette contains the steering gear and is accessible from the Main Deck through a watertight hatch in the overhead starboard side.

2.1.2. Above the Second Deck

There are three levels above the Second Deck. The following is a description of the compartmentation and characteristics pertinent to firefighting on the Main Deck, 01 Deck and 02 Deck:

2.1.2.1. Main Deck

The compartments on the Main Deck include the Crews Berthing forward and the Galley/Mess Deck aft connected by a "Z" shaped longitudinal Passageway accessible through joiner doors. The Ship's Office, Laundry and Fidley are also accessible on the starboard side from the Passage through joiner doors. The Passageway can also be accessed from weather through a watertight door on the port side. Crews Berthing, Ship's Office, Laundry and the Galley/Mess Deck have operable windows that open to weather.

2.1.2.2. 01 Deck

The Commanding Officer (CO) and Chief Petty Officer (CPO) Staterooms are located on the 01 Deck separated by a common Head and Passageway. The Passageway is accessible via a ladder leading down to the Main Deck Passageway. There is also a ladder leading up to the Bridge from the Passageway. Both staterooms have operable windows that open to weather and joiner doors that access the Head and the Passageway.

2.1.2.3. 02 Deck

The Bridge occupies the 02 Deck and is accessible via a ladder to the 01 Deck (and via another ladder down to the Main Deck). There is also a watertight door to weather aft and eight (8) operable windows that open to weather.

2.2. Diesel Engine Shutdowns

The main propulsion diesel engines and diesel-driven ship service generator can be started and stopped locally in the Engine Room. The emergency remote engine shutdown system is located in the Main Deck Passageway adjacent to the joiner door leading to the Engine Room (1-24-2). The main engines are secured by pulling and holding the main engine shutdowns which physically moves the fuel control rod of the fuel pump into the "no-fuel" position. By pulling on the ship service generator shutdown, a spring loaded damper in the air inlet starves the engine of air thereby securing the generator. The emergency

remote fuel cut off valve located in the Main Deck on the port side frame 24 will shut off fuel coming from fuel tank 2-18-2-F. An identical mechanism located on the Main Deck at frame 23 secures the fuel from fuel tank 2-18-1-F.

2.3. Ventilation

The ventilation on this cutter consists of a supply fan in the Engine Room. The switch for the Engine Room supply fan is located in the Main Deck Passageway at frame 29 port side. The exhaust for the Engine Room consists of slots cut into the stack. (These slots can not be secured).

2.4. Fire Detection Equipment

The CO Stateroom, CPO Stateroom, Laundry, and Galley/Mess Deck have one ionization type smoke detector installed in each compartment. The Crews Berthing has two installed ionization type smoke detectors. There is no requirement to have a live watch in the Engine Room. However, it is routinely manned underway due to the fact that there are no remote engine alarms for lube oil pressure, overheating etc., on the Bridge. There is no automatic fire or smoke detection system installed in all other compartments.

2.5. Firefighting Equipment

2.5.1. Firemain Stations

There are three firemain stations located on the Main Weather Deck of the tug. The jetting pump discharge fitting is located on the crane pedestal. A fire hose connecting the #1 firemain station on the forward port side of the tug to the jetting pump fitting on the barge will permit the barge to provide firefighting water pressure to the tug.

2.5.2. P-60 Pump

The P-60 portable pump stored on the barge can be set up on the after end of the barge and energized as an alternate source of firefighting water pressure.

2.5.3. Portable Fire Extinguishers

Portable PKP and CO₂ fire extinguishers are located throughout the cutter to facilitate first aid. In addition, the Galley contains an aqueous potassium carbonate system for the stove and deep fat fryer. Location and number of fire extinguishers are listed in Table C-75WLIC-1.

TABLE C-75WLIC-1 LOCATION OF PORTABLE EXTINGUISHERS

Location	Number of Portable Extinguishers		
	CO ₂	PKP	K ₂ CO ₃
Forward Hold		1	
Engine Room	1	3	
After Hold		1	
Crews Berthing		1	
Main Dk Passgwy	1		
Galley/Mess Deck		1	1 Fixed System
CO Stateroom		1	
CPO Stateroom		1	
Bridge	1		

2.5.4. Protective Equipment

Two (2) Navy Type A-4 oxygen breathing apparatuses (OBA's) and one (1) firefighting ensemble (FFE) are stowed in the Damage Control Equipment Locker (1-20-4-A). There are twelve (12) canisters per OBA.

2.5.5. Desmoking Equipment

There is no portable desmoking equipment in this class cutter.

3. Firefighting Procedures

In this section 11 different shipboard fire scenarios are described. The recommended procedures for fighting each fire are detailed, from the alarm through post-fire activities. The last procedure is for fires in port.

3.1. Forward Hold

3.1.1. Scenario

The most likely fire in the Forward Hold is a Class A fire in the various materials stored in this compartment.

3.1.2. Confining the Fire

The primary fire boundaries are bulkhead 7 forward, bulkhead 18 aft, the Main Deck and the hull.

3.1.3. Sizeup

The Forward Hold is normally unoccupied; however, since the removal of the watertight door to the MSD Space, there is no longer a second means of egress from this space. The only egress route is through the watertight hatch in the aft starboard side of the Hold to the Laundry above and then to the Main Deck Passageway to weather. Therefore, there is a good possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.1.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.1.5. Indirect Attack

A fire in the Forward Hold may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch in the Laundry without entering the Forward Hold. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed. The firefighting team should don OBA's before opening the hatch to the Main Hold in the Laundry Room.

3.1.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Forward Hold through the watertight hatch in the Laundry with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Forward Hold without an OBA. The hose tender should wear an OBA, but should not enter the Forward Hold.

3.1.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.1.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Forward Hold.

3.2. Engine Room

3.2.1. Scenario

The most likely fire in this compartment is a Class B spray fire as a result of a ruptured lube oil or fuel oil line on the main engine. A Class C fire is also likely in a controller, switchboard, or motor.

3.2.2. Confining the Fire

The primary fire boundaries are bulkhead 18 forward, bulkhead 35 aft, the Main Deck, and hull. Note the Fidley is separated from the Engine Room by an open steel grating, therefore the outer boundaries of the Fidley also form boundaries for an Engine Room fire. The Engine Room supply fan shall be secured and the main engines shall be secured. The ship service generator shall be secured in the event of a Class B fire but need not be secured for a Class C fire (unless it is the source of the fire). If the ship service generator is secured, it is crucial that the P-60 pump and jetting pump on the barge be energized as a backup source of firefighting water.

3.2.3. Sizeup

The Engine Room in this cutter is normally manned underway when the main engines are on the line, but the ease of egress aft through the After Hold and upward through the Fidley make it unlikely that personnel will need to be rescued. Class B spray fires may be efficiently extinguished by securing the source of the fuel and then applying AFFF from a 1.5" hose. A Halon 1301 total flooding system is the most efficient means of extinguishing this type of fire, but Halon 1301 is not installed in this cutter class. Class C fires are best extinguished with CO₂.

3.2.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on a Class B fire and a CO₂ portable extinguisher on a Class C fire. A flammable liquid spray fire shall be immediately declared out of control; first

aid should not be attempted for a flammable liquid fire out of control.

3.2.5. Indirect Attack

Due to the absence of an installed fixed fire protection system, an indirect attack on a Class B fire in this space is not feasible. A Class C fire in the switchboard, motor, or controller shall also be attacked directly as described in the next section.

3.2.6. Direct Attack

When the scene leader directs, the firefighting hose team should enter the Engine Room through watertight door 2-35-3 from the After Hold with a 1.5" fire hose configured to apply AFFF. This attack will be futile unless the fuel source is secured first. The nozzleman should be dressed out in the FFE and should not enter the space without an OBA. The hose tender should wear an OBA, but should not enter the Engine Room. A Class C fire shall be attacked directly, by first securing the source of electrical power, then attacking the remaining Class A or B fire with PKP or CO₂ portable extinguishers.

3.2.7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply fan on high for at least 15 minutes after the Engine Room atmosphere has been tested and proven free of flammable gases.

3.2.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Engine Room.

3.3. After Hold

3.3.1. Scenario

The most likely fire in the After Hold is a Class A fire in the various materials stored in this compartment.

3.3.2. Confining the Fire

The primary fire boundaries are bulkhead 35 forward, bulkhead 45 aft, the Main Deck and the hull.

3.3.3. Sizeup

The After Hold is normally unoccupied and there are two means of egress: through the watertight door 2-35-3 to the Engine Room and watertight hatch 1-41-1 to weather. Therefore, there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.3.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.3.5. Indirect Attack

A fire in the After Hold may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the watertight hatch from the Main Deck. Do not open watertight door 2-35-3 to the Engine Room unless the scene leader decides that a direct attack is required. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.3.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the After Hold through watertight door 2-35-3 from the Engine Room with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the After Hold without an OBA. The hose tender should wear an OBA, but should not enter the After Hold.

3.3.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.3.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft

and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the After Hold.

3.4. Lazarette

3.4.1. Scenario

The most likely fire in this compartment is a Class A fire.

3.4.2. Confining the Fire

The primary fire boundaries are bulkhead 45 forward, the transom aft, the Main Deck and the hull.

3.4.3. Sizeup

This space is normally unoccupied, so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.4.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.4.5. Indirect Attack

An indirect attack is feasible through the hatch on the Main Deck with minimal risk to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.4.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Lazarette from the Main Weather Deck through the watertight hatch with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Lazarette without an OBA. The hose tender should wear an OBA, but should not enter the Lazarette.

3.4.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.4.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Lazarette.

3.5. Crews Berthing

3.5.1. Scenario

The most likely fire in this compartments is a Class A fire in bedding materials.

3.5.2. Confining the Fire

The primary fire boundaries are bulkhead 8 forward, bulkhead 16 aft, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.5.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a strong possibility that personnel may need to be rescued. There are no Emergency Evacuation Breathing Devices (EEBD's) in this space; egress may be possible through four operable windows that open to weather. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.5.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.5.5. Indirect Attack

An indirect attack is feasible through one of the windows on the Main Deck with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.5.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Crews Berthing from the Main Deck Passageway through joiner door 1-16-0 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Crews Berthing without an OBA. The hose tender should wear an OBA, but should not enter the Crews Berthing.

3.5.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.5.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Crews Berthing.

3.6. Laundry

3.6.1. Scenario

The most likely fire in this compartments is a Class A fire in clothing.

3.6.2. Confining the Fire

The primary fire boundaries are bulkhead 16 forward, bulkhead 21 aft, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.6.3. Sizeup

This space is unmanned, therefore there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.6.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.6.5. Indirect Attack

An indirect attack is feasible through the window on the Main Deck with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the fire boundaries as needed.

3.6.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Laundry from the Main Deck Passageway through joiner door 1-17-1 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Laundry without an OBA. The hose tender should wear an OBA, but should not enter the Laundry.

3.6.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.6.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Laundry.

3.7. Ship's Office

3.7.1. Scenario

The most likely fire in this compartment is a Class A fire in papers or files.

3.7.2. Confining the Fire

The primary fire boundaries are bulkhead 21 forward, bulkhead 25 aft, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.7.3. Sizeup

This space is unmanned, therefore there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.7.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.7.5. Indirect Attack

An indirect attack is feasible through the watertight door on the Main Deck with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the fire boundaries as needed.

3.7.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Ship's Office from the Main Weather Deck through watertight door 1-23-1 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Ship's Office without an OBA. The hose tender should wear an OBA, but should not enter the Ship's Office.

3.7.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.7.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Ship's Office.

3.8. Mess Deck/Galley

3.8.1. Scenario

The most likely fire in this compartment is a Class C fire in the electronics equipment such as the stereo, TV or microwave. There is also a significant possibility of a Class A fire in the foam cushions on the Mess Deck benches. There is also a good possibility of a Class B grease fire on the stove in the Galley.

3.8.2. Confining the Fire

The primary fire boundaries are bulkhead 30 forward, the superstructure aft, port and starboard, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.8.3. Sizeup

Crewmembers are likely to be awake and alert in the Mess Deck/Galley. In addition, there is ease of egress forward to the Main Deck Passageway through joiner door 1-30-6 and to weather through watertight doors 1-34-1 & 2. Therefore there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are most efficiently extinguished with CO₂ when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire. Class B fires are efficiently extinguished

with PKP if the fire is small and AFFF if the fire is larger. In the special case of a grease fire on the stove or deep fat fryer a fixed aqueous potassium carbonate system is very effective.

3.8.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A and B fires and a CO₂ portable extinguisher on Class C fires. For a grease fire on the stove or deep fat fryer, the person discovering the fire should activate the installed aqueous potassium carbonate system.

3.8.5. Indirect Attack

A Class A fire in the Mess Deck may be indirectly attacked with a minimum of danger to personnel through one of the watertight doors from the Main Weather Deck. The firefighting team should use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.8.6. Direct Attack

Class C fires in the Galley/Mess Deck should be extinguished with a portable CO₂ extinguisher after the electrical power to the affected equipment is secured and then attacking the remaining Class A fire with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The firefighting hose team should enter the Mess Deck from the Main Weather Deck through watertight door 1-34-1 or 2 depending on the location of the fire. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Galley/Mess Deck without an OBA. The hose tender should wear an OBA, but should not enter the Galley/Mess Deck. After discharging the K₂CO₃ system, remaining Class B fires should be attacked directly with PKP portable extinguishers if the fire is confined to the stove area in the Galley. If the Class B fire has spread, the fire should be attacked directly with water fog or AFFF.

3.8.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.8.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft

and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Galley/Mess Deck.

3.9. CO/CP0 Staterooms

3.9.1. Scenario

The most likely fire in these compartments is a Class A fire in bedding materials.

3.9.2. Confining the Fire

The primary fire boundaries are bulkhead 11 forward, bulkhead 27 aft, the 01 Deck and 02 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.9.3. Sizeup

Due to the likelihood of sleeping crewmembers in these spaces, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in these spaces; egress is feasible through operable windows to weather as well as joiner doors to the 01 Deck Passageway. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.9.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.9.5. Indirect Attack

An indirect attack is feasible through the windows on the 01 Deck with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the fire boundaries as needed.

3.9.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the affected compartment from the 01 Deck Passageway through joiner door 01-19-2 or 01-21-2 with a 1.5" fire hose equipped with a vari-

nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Stateroom without an OBA. The hose tender should wear an OBA, but should not enter the Stateroom.

3.9.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.9.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting on the 01 Deck.

3.10. Bridge

3.10.1. Scenario

The most likely fire in the Bridge is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.10.2. Confining the Fire

The primary fire boundaries are the superstructure forward, aft, port and starboard and the 01 Deck.

3.10.3. Sizeup

Due to the ease of egress to weather from the Bridge, the likelihood of personnel being trapped is remote. Class C fires are usually extinguished when electrical power is secured; however, a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.10.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.10.5. Indirect Attack

A Class A fire in this space may be indirectly attacked through watertight door 02-20-2 to weather with a minimal risk to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. A Class C fire should be extinguished by securing the electrical power to the affected equipment first. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and 01 Deck as needed.

3.10.6. Direct Attack

A Class C fire in the Bridge should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly. (Charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The firefighting hose team should enter the Bridge through watertight door 02-20-1 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the space without an OBA. The hose tender should wear an OBA, but should not enter the Bridge.

3.10.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.10.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting on the 02 Deck.

3.11. In Port Fires

3.11.1. Scenario

The most likely fire in port is a Class A fire in the Crews Berthing or CO/CPO Staterooms in bedding materials. A Class B fire in the Galley is the next most likely fire in port.

3.11.2. Confining the Fire

The primary fire boundaries are stated above and depend on the involved compartment.

3.11.3. Sizeup

Due to the likelihood of sleeping crewmembers, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in this class of cutter. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.11.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.11.5. Indirect Attack

An indirect or direct attack can only be attempted in the event additional help arrives on scene. This help can come from another Coast Guard cutter, the Group or Station where the cutter is berthed, or from the local fire department. An indirect attack may be attempted as described in Sections 3.1 through 3.10 above for the particular compartment involved. Preplanning for in port fires and the familiarity of the local fire department with the cutter and this doctrine are considered extremely important.

3.11.6. Direct Attack

A direct attack may be attempted if the scene leader directs in accordance with the procedures described above for the particular compartment involved. The scene leader is the person on watch (in a one man duty section) until properly relieved by the normal scene leader in the crew, or by a qualified person in the firefighting team from the local fire department.

3.11.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.11.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-60 shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The

jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power at the shore connection box.

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PART C

FIRE PROTECTION DOCTRINE

75' WLR RIVER BUOY TENDER

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Part C
FIRE PROTECTION DOCTRINE

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FIRE PROTECTION DOCTRINE

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Part C
FIRE PROTECTION DOCTRINE

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1. Introduction

One of the most life threatening and hazardous activities that may be encountered on board ship is fighting a fire. Unlike a building fire, the crew often can not evacuate and leave the firefighting to trained professionals. The crew must extinguish the fire, often without assistance, and using only the available equipment on board. Once a fire occurs, it is too late to read this doctrine, it is too late to obtain training, and it is too late to repair and maintain damage control equipment. Finally, the procedures in this doctrine are not a substitute for the exercise of good judgment based on experience and the particular conditions that exist at the time.

The purpose of this doctrine is to provide useful background information pertinent to fire science (Part A), guidance promulgated by Commandant for "small" classes of Coast Guard cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered on this class of vessel, in port and underway (Part C). Note, the Commanding Officer or Officer-in-Charge is responsible for tailoring Part C of this doctrine within the guidelines set forth in the following documents:

- ◆ Naval Ships' Technical Manual (NSTM) Chapter 074, Volume 3
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 077
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 079
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 555
- ◆ FXP-4
- ◆ Surface Ship Survivability, NWP 62-1
- ◆ COMDTINST M9000.6, Naval Engineering Manual
- ◆ The Cutter's Fire Protection Doctrine, Parts A and B
- ◆ The Cutter's Engineering Casualty Control Manual

2. Vessel Characteristics

The 75' WLR class cutter is a River Buoy Tender. The primary missions of this cutter class are Short Range Aids to Navigation, and Search and Rescue. The vessel has a complement of approximately twelve (12) crewmembers, and a maximum speed of 10 knots. The vessel is constructed entirely of steel. This cutter does not have the hotel facilities to accommodate extended deployments and usually puts into port at night.

There is an 84' barge semi-permanently faced up to the tug. The tug rarely operates independently of the barge. The barge is 84' x 22' and serves as a working platform for the diesel-powered crane mounted on the bow portion of the Main Deck. There is a diesel engine on the barge which drives an air compressor to serve the spud winches and a jetting pump which can also be used as an alternate source of firefighting water pressure for the tug.

The following is a description of the tug's compartmentation and other characteristics pertinent to firefighting.

2.1. Compartmentation

2.1.1. Below the Main Deck

Below the Main Deck, the cutter is divided into the following five areas, each separated by steel watertight bulkheads:

2.1.1.1. Forward Hold

The Forward Hold is a large storeroom which contains paper products, laundry supplies and, dry stores. It is accessible only from a hatch on the aft starboard side in the overhead that leads to the Crews Berthing compartment.

2.1.1.2. Engine Room

The Engine Room on the Second Deck, and the Fidley on the Main Deck, are separated by an open steel grating and connected by an open ladder. The Fidley can be accessed from the Main Deck Passageway through a joiner door or from weather through a watertight door. The Engine Room is also accessible directly from the Shaft Alley through a watertight door. The Fidley contains the 50 lb CO₂ Hose Reel system with a 25' hose that serves the Engine Room.

2.1.1.3. Shaft Alley

The Shaft Alley contains the Engineer's Stores and is accessible from the Engine Room through a watertight door on the starboard side. In addition, egress is permitted through a watertight hatch in the overhead on the starboard side.

2.1.1.4. Lazarette

The Lazarette contains the steering gear and is accessible from the Main Deck through a watertight hatch in the overhead port side.

2.1.2. Above the Second Deck

There are three levels above the Second Deck. The following is a description of the compartmentation and characteristics pertinent to firefighting on the Main Deck, 01 Deck and 02 Deck:

2.1.2.1. Main Deck

The compartments on the Main Deck include the Crews Berthing forward and the Galley/Mess Deck aft connected by a "L" shaped longitudinal Passageway accessible through joiner doors. The Log Office, Crews Head, and Fidley are also accessible on the starboard side from the Passageway through joiner doors. The Laundry is accessible from the Crews Head through a joiner door. The Passageway can also be accessed from weather through two watertight doors on the port side. Crews Berthing, Crews Head, Laundry and the Galley/Mess Deck have operable windows that open to weather. The Crews Berthing and the Galley/Mess Deck are also accessible through watertight doors from the Main Weather Deck.

2.1.2.2. 01 Deck

The Officer in Charge (OinC) and Chief Petty Officer (CPO) Staterooms are located on the 01 Deck separated by a common Head and Passageway. The Passageway is accessible via a ladder leading down to the Main Deck Passageway. There is also a ladder leading up to the Bridge from the Passageway. Both Staterooms have operable windows that open to weather and joiner doors that access the Head and the Passageway.

2.1.2.3. 02 Deck

The Bridge occupies the 02 Deck and is accessible via a ladder to the 01 Deck (and via another ladder down to the Main Deck). There is also a watertight door to weather aft and four (4) operable windows that open to weather.

2.2. Diesel Engine Shutdowns

The main propulsion diesel engines and diesel-driven ship service generator can be started and stopped locally in the Engine Room. The emergency remote fuel cut off valves secures the fuel from fuel tanks 2-18-1 & 2-F.

2.3. Ventilation

The ventilation on this cutter consists of a supply fan in the Engine Room. The switch for the Engine Room supply fan is located in the Main Deck Passageway at frame 28 centerline. The exhaust for the Engine Room consists of slots cut into the stack. (These slots can not be secured).

2.4. Fire Detection Equipment

The OinC Stateroom, CPO Stateroom, and Crews Berthing have one ionization type smoke detector installed in each compartment. There is no automatic fire or smoke detection system installed in any of the other compartments.

2.5. Firefighting Equipment

2.5.1. Firemain Stations

There are three firemain stations located on the Main Weather Deck of the tug. The jetting pump discharge fitting is located on the crane pedestal. A fire hose connecting the #1 firemain station on the forward port side of the tug to the jetting pump fitting on the barge will permit the barge to provide firefighting water pressure to the tug.

2.5.2. P-250 Mod 1 Pump

The P-250 Mod 1 portable pump can provide an alternate source of firefighting water pressure.

2.5.3. Portable Fire Extinguishers

Portable PKP and CO₂ fire extinguishers are located throughout the cutter to facilitate first aid. In addition the Galley contains an aqueous potassium carbonate system for the stove and deep fat fryer. Table C-75WLR-1 is a summary of portable fire extinguishers located throughout the cutter.

2.5.4. Protective Equipment

Two (2) Navy Type A-4 oxygen breathing apparatuses (OBA's) and one (1) firefighting ensemble (FFE) are stowed in the cutter. There are twelve (12) canisters per OBA.

2.5.5. Desmoking Equipment

There is no portable desmoking equipment in this class cutter.

TABLE C-75WLR-1 LOCATION OF PORTABLE EXTINGUISHERS

Location	Number of Portable Extinguishers	
	CO ₂	PKP
Engine Room		2
Shaft Alley	1	
Crews Berthing		1
Main Deck Passageway		1
Galley/Mess Deck		1
CPO Stateroom		1
Bridge	1	

3. Firefighting Procedures

In this section, 11 different shipboard fire scenarios are described. The recommended procedures for fighting each fire are detailed, from the alarm through post-fire activities. The last procedure is for fires in port.

3.1. Forward Hold

3.1.1. Scenario

The most likely fire in the Forward Hold is a Class A fire in the various materials stored in this compartment.

3.1.2. Confining the Fire

The primary fire boundaries are bulkhead 7 forward, bulkhead 18 aft, the Main Deck and the hull.

3.1.3. Sizeup

The Forward Hold is normally unoccupied. The only egress route is through the watertight hatch in the aft starboard side of the Hold to the Crews Berthing above and then to the Main Deck Passageway to weather. Therefore, there is a remote possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.1.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.1.5. Indirect Attack

A fire in the Forward Hold may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch in the Crews Berthing without entering the Forward Hold. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed. The firefighting team should don OBA's before opening the hatch to the Forward Hold in the Crews Berthing.

3.1.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Forward Hold through the watertight hatch in the Crews Berthing with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Forward Hold without an OBA. The hose tender should wear an OBA, but should not enter the Forward Hold.

3.1.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.1.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Forward Hold.

3.2. Engine Room

3.2.1. Scenario

The most likely fire in this compartment is a Class B spray fire as a result of a ruptured lube oil or fuel oil line on the main engine. A Class C fire is also likely in a controller, switchboard, or motor.

3.2.2. Confining the Fire

The primary fire boundaries are bulkhead 18 forward, bulkhead 35 aft, the Main Deck, and hull. Note the Fidley is separated from the Engine Room by an open steel grating, therefore the outer boundaries of the Fidley also form boundaries for an Engine Room fire. The Engine Room supply fan shall be secured and the main engines shall be secured. The ship service generator shall be secured in the event of a Class B fire but need not be secured for a Class C fire (unless it is the source of the fire). If the ship service generator is secured, it is crucial that the P-250 Mod 1 pump and jetting pump on the barge be energized as a backup source of firefighting water.

3.2.3. Sizeup

The Engine Room in this cutter is normally unmanned underway and the ease of egress aft through Shaft Alley and upward through the Fidley make it unlikely that personnel will need to be rescued. Class B spray fires may be efficiently extinguished by securing the source of the fuel and then applying AFFF from a 1.5" hose. A Halon 1301 total flooding system is the most efficient means of extinguishing this type of fire, but Halon 1301 is not installed in this cutter class. Class C fires are best extinguished with CO₂.

3.2.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on a Class B fire and a CO₂ portable extinguisher on a Class C fire. A flammable liquid spray fire shall be immediately declared out of control; first aid should not be attempted for a flammable liquid fire out of control.

3.2.5. Indirect Attack

Due to the absence of an installed fixed fire protection system, an indirect attack on a Class B fire in this space is not feasible. A Class C fire in the switchboard, motor, or controller shall also be attacked directly as described in the next section.

3.2.6. Direct Attack

When the scene leader directs, the firefighting hose team should enter the Engine Room through watertight door 2-35-1 from the Shaft Alley with a 1.5" fire hose configured to apply AFFF. This attack will be futile unless the fuel source is secured first. The nozzleman should be dressed out in the FFE and should not enter the space without an OBA. The hose tender should wear an OBA, but should not enter the Engine Room. A

Class C fire shall be attacked directly, by first securing the source of electrical power, then attacking the remaining Class A or B fire with PKP or CO₂ portable extinguishers.

3.2.7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply fan on high for at least 15 minutes after the Engine Room atmosphere has been tested and proven free of flammable gases.

3.2.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Engine Room.

3.3. Shaft Alley

3.3.1. Scenario

The most likely fire in the Shaft Alley is a Class A fire in the various materials stored in this compartment.

3.3.2. Confining the Fire

The primary fire boundaries are bulkhead 35 forward, bulkhead 45 aft, the Main Deck and the hull.

3.3.3. Sizeup

The Shaft Alley is normally unoccupied and there are two means of egress: through the watertight door 2-35-1 to the Engine Room, and watertight hatch 1-43-1 to weather. Therefore there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.3.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.3.5. Indirect Attack

A fire in the Shaft Alley may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the watertight hatch from the Main Deck. Do not open watertight door 2-35-1 to the Engine Room unless the scene leader decides that a direct attack is required. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.3.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Shaft Alley through watertight door 2-35-1 from the Engine Room with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Shaft Alley without an OBA. The hose tender should wear an OBA, but should not enter the Shaft Alley.

3.3.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.3.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Shaft Alley.

3.4. Lazarette

3.4.1. Scenario

The most likely fire in this compartment is a Class A fire.

3.4.2. Confining the Fire

The primary fire boundaries are bulkhead 45 forward, the transom aft, the Main Deck and the hull.

3.4.3. Sizeup

This space is normally unoccupied so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.4.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.4.5. Indirect Attack

An indirect attack is feasible through the hatch on the Main Deck with minimal risk to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.4.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Lazarette from the Main Weather Deck through the watertight hatch with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Lazarette without an OBA. The hose tender should wear an OBA, but should not enter the Lazarette.

3.4.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.4.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Lazarette.

3.5. Crews Berthing

3.5.1. Scenario

The most likely fire in this compartments is a Class A fire in bedding materials.

3.5.2. Confining the Fire

The primary fire boundaries are bulkhead 7 forward, bulkhead 16 aft, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.5.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a strong possibility that personnel may need to be rescued. There are no Emergency Evacuation Breathing Devices (EEBD's) in this space; egress may be possible through two joiner doors to weather as well as an operable window that opens to weather. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.5.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.5.5. Indirect Attack

An indirect attack is feasible through one of the joiner doors or the window on the Main Deck with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.5.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Crews Berthing from the Main Weather Deck through one of the two joiner doors depending on the location of the fire with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or

she should not enter the Crews Berthing without an OBA. The hose tender should wear an OBA, but should not enter the Crews Berthing.

3.5.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.5.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Crews Berthing.

3.6. Laundry

3.6.1. Scenario

The most likely fire in this compartments is a Class A fire in clothing.

3.6.2. Confining the Fire

The primary fire boundaries are bulkhead 23 forward, bulkhead 28 aft, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.6.3. Sizeup

This space is unmanned; therefore, there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.6.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.6.5. Indirect Attack

An indirect attack is feasible through the window on the Main Deck starboard side with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the fire boundaries as needed.

3.6.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Laundry from the Crews Head through joiner door 1-23-1 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Laundry without an OBA. The hose tender should wear an OBA, but should not enter the Laundry.

3.6.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.6.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Laundry.

3.7. Log Office

3.7.1. Scenario

The most likely fire in this compartment is a Class A fire in papers or files.

3.7.2. Confining the Fire

The primary fire boundaries are bulkhead 24 forward, bulkhead 28 aft, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.7.3. Sizeup

This space is unmanned; therefore, there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.7.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.7.5. Indirect Attack

An indirect attack is feasible through the joiner door from the Main Deck Passageway with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the fire boundaries as needed.

3.7.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Log Office from the Main Deck Passageway through joiner door 1-26-2 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Ship's Office without an OBA. The hose tender should wear an OBA, but should not enter the Log Office.

3.7.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.7.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Log Office.

3.8. Mess Deck/Galley

3.8.1. Scenario

The most likely fire in this compartment is a Class C fire in the electronics equipment such as the stereo, TV or microwave. There is also a significant possibility of a Class A fire in the foam cushions on the Mess Deck benches. There is also a good possibility of a Class B grease fire on the stove in the Galley.

3.8.2. Confining the Fire

The primary fire boundaries are bulkhead 33 forward, the superstructure aft, port and starboard, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.8.3. Sizeup

Crewmembers are likely to be awake and alert in the Mess Deck/Galley. In addition, there is ease of egress forward to the Main Deck Passageway through joiner door 1-33-2 and to weather through watertight door 1-39-1. Therefore there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are most efficiently extinguished with CO₂ when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire. Class B fires are efficiently extinguished with PKP if the fire is small and AFFF if the fire is larger.

3.8.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A and B fires and a CO₂ portable extinguisher on Class C fires.

3.8.5. Indirect Attack

A Class A fire in the Mess Deck may be indirectly attacked with a minimum of danger to personnel through the watertight doors from the Main Weather Deck starboard side. The firefighting team should use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.8.6. Direct Attack

Class C fires in the Galley/Mess Deck should be extinguished with a portable CO₂ extinguisher after the electrical power to the affected equipment is secured and then attacking the remaining Class A fire with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The firefighting hose team should enter the Mess Deck from the Main Weather Deck through watertight door 1-39-1. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Galley/Mess Deck without an OBA. The hose tender should wear an OBA, but should not enter the Galley/Mess Deck. Class B fires should be attacked directly with PKP portable extinguishers if the fire is confined to the stove area in the Galley. If the Class B fire has spread, the fire should be attacked directly with water fog or AFFF.

3.8.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.8.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Galley/Mess Deck.

3.9. CO/CP0 Staterooms

3.9.1. Scenario

The most likely fire in these compartments is a Class A fire in bedding materials.

3.9.2. Confining the Fire

The primary fire boundaries are bulkhead 7 forward, bulkhead 28 aft, the 01 Deck and 02 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.9.3. Sizeup

Due to the likelihood of sleeping crewmembers in these spaces, there is a strong possibility that personnel may need to be rescued. There are no EEED's in these spaces; egress is feasible through operable windows to weather as well as joiner doors to the 01 Deck Passageway. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.9.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.9.5. Indirect Attack

An indirect attack is feasible through the windows on the 01 Deck with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the fire boundaries as needed.

3.9.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the affected compartment from the 01 Deck Passageway through joiner door 01-17-1 or 01-20-1 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Stateroom without an OBA. The hose tender should wear an OBA, but should not enter the Stateroom.

3.9.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.9.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and

cross connected into the tug's firemain system. Secure electrical power with the exception of lighting on the 01 Deck.

3.10. Bridge

3.10.1. Scenario

The most likely fire in the Bridge is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.10.2. Confining the Fire

The primary fire boundaries are the superstructure forward, aft, port and starboard and the 01 Deck.

3.10.3. Sizeup

Due to the ease of egress to weather from the Bridge the likelihood of personnel being trapped is remote. Class C fires are usually extinguished when electrical power is secured; however, a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.10.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.10.5. Indirect Attack

A Class A fire in this space may be indirectly attacked through watertight door 02-16-2 to weather with a minimal risk to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. A Class C fire should be extinguished by securing the electrical power to the affected equipment first. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and 01 Deck as needed.

3.10.6. Direct Attack

A Class C fire in the Bridge should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly. (Charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The firefighting hose team should enter the Bridge through watertight door 02-16-2 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the space without an OBA. The hose tender should wear an OBA but should not enter the Bridge.

3.10.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.10.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting on the 02 Deck.

3.11. In Port Fires

3.11.1. Scenario

The most likely fire in port is a Class A fire in the Crews Berthing or CO/CPO Staterooms in bedding materials. A Class B fire in the Galley is the next most likely fire in port.

3.11.2. Confining the Fire

The primary fire boundaries are stated above and depend on the involved compartment.

3.11.3. Sizeup

Due to the likelihood of sleeping crewmembers, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in this class of cutter. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.11.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.11.5. Indirect Attack

An indirect or direct attack can only be attempted in the event additional help arrives on scene. This help can come from another Coast Guard cutter, the Group or Station where the cutter is berthed, or from the local fire department. An

indirect attack may be attempted as described in Sections 3.1 through 3.10 above for the particular compartment involved. Preplanning for in port fires and the familiarity of the local fire department with the cutter and this doctrine are considered extremely important.

3.11.6. Direct Attack

A direct attack may be attempted, if the scene leader directs, in accordance with the procedures described above for the particular compartment involved. The scene leader is the person on watch (in a one man duty section) until properly relieved by the normal scene leader in the crew, or by a qualified person in the firefighting team from the local fire department.

3.11.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.11.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power at the shore connection box.

PART C

FIRE PROTECTION DOCTRINE

100' WLIC INLAND CONSTRUCTION TENDER

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Part C
FIRE PROTECTION DOCTRINE

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1. Introduction

One of the most life threatening and hazardous activities that may be encountered on board ship is fighting a fire. Unlike a building fire, the crew often can not evacuate and leave the firefighting to trained professionals. The crew must extinguish the fire, often without assistance, and using only the available equipment on board. Once a fire occurs, it is too late to read this doctrine, it is too late to obtain training, and it is too late to repair and maintain damage control equipment. Finally, the procedures in this doctrine are not a substitute for the exercise of good judgment based on experience and the particular conditions that exist at the time.

The purpose of this doctrine is to provide useful background information pertinent to fire science (Part A), guidance promulgated by Commandant for "small" classes of Coast Guard cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered on this class of vessel, in port and underway (Part C). Note, the Commanding Officer or Officer-in-Charge is responsible for tailoring Part C of this doctrine within the guidelines set forth in the following documents:

- ◆ Naval Ships' Technical Manual (NSTM) Chapter 074, Volume 3
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 077
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 079
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 555
- ◆ FXP-4
- ◆ Surface Ship Survivability, NWP 62-1
- ◆ COMDTINST M9000.6, Naval Engineering Manual
- ◆ The Cutter's Fire Protection Doctrine, Parts A and B
- ◆ The Cutter's Engineering Casualty Control Manual

2. Vessel Characteristics

The 100' WLIC is an Inland Construction Tender. The primary missions of this cutter class are Short Range Aids to Navigation, and Search and Rescue. The vessel can accommodate approximately 18 crewmembers and achieve a maximum speed of 10 knots. The vessel is constructed entirely of steel. This cutter has an endurance of 8 days. The following is a description of the cutter's compartmentation and other characteristics pertinent to firefighting.

2.1. Compartmentation

2.1.1. Below the Main Deck

Below the Main Deck, the cutter is divided into the following seven (7) areas, separated by steel watertight bulkheads:

2.1.1.1. Forward Peak Tank

This compartment is a normally empty water tank and is not accessible.

2.1.1.2. Cargo Hold

The Cargo Hold is a very large storeroom. It is accessible through a large hatch to the Buoy Deck and an open ladder to the starboard vestibule on the Main Deck.

2.1.1.3. Crews Berthing

The Crews Berthing has accommodations for 15 crewmembers and is accessible from the port and starboard Vestibules through joiner doors and down a ladder on the port and starboard sides. The Crews Berthing contains 10 operable airports that open to weather.

2.1.1.4. Engine Room

The Engine Room on the Second Deck, and the Fidley on the Main Deck, are separated by an open steel grating and connected by an open ladder. The Fidley can be accessed from the Main Weather Deck through a watertight door. There is an emergency escape scuttle to the Main Weather Deck located in the forward starboard corner of the Engine Room. Two electric fire pumps are installed in the Engine Room which are designed to pressurize the firemain system. The Engine Room is protected by a CO₂ flooding system; the CO₂ bottles are located in the Cargo Hold, two remote releases are located at frames 41 and 63, starboard side (near the starboard Vestibule and the starboard Engine Room exhaust, respectively). The CO₂ flooding system will also automatically flood the Engine Room with no warning if the fusible link in the Engine Room reaches the preset temperature.

2.1.1.5. Wardroom/Mess Deck

The Mess Deck on the port side is accessible through a watertight door and down a ladder from the Main Weather Deck. The Mess Deck provides access to the Wardroom on the starboard side through a joiner door, the Galley aft through a joiner door, and the Shaft Alley below through a quick acting watertight scuttle. The Wardroom, which serves as the Ship's Office, is also accessible through a watertight door and down a ladder from the Main Weather Deck.

2.1.1.6. Galley/Port and Starboard Dry Stores

The Galley provides access to the port and starboard Dry Stores through joiner doors. The Galley itself is accessible from the Mess Deck through a joiner door. The Galley is equipped with an aqueous potassium carbonate fixed fire protection system for grease fires on the stove and deep fat fryer.

2.1.1.7. Lazarette

The Lazarette contains the steering gear equipment and is accessible from the Main Weather Deck through a watertight hatch fitted with a quick acting watertight scuttle on the port side of the compartment. The aqueous potassium carbonate system that serves the Galley is located in the Lazarette and can be manually released from this space.

2.1.2. Above the Second Deck

There are two levels above the Second Deck. The following is a description of the compartmentation and characteristics pertinent to firefighting on the Main Deck, and 01 Deck:

2.1.2.1. Main Deck

The compartments on the Main Deck include the Workshop, Crews Head, port and starboard Vestibules, Commanding Officer's Cabin, CPO Quarters, and Fidley. The workshop is accessible from the Main Weather Deck through a watertight door. The Crews Head is accessible from the port Vestibule through a joiner door. The port and starboard Vestibules are accessible from the Main Weather Deck through watertight doors and both provide access to the Crews Berthing below through joiner doors and down ladders. The starboard Vestibule provides access to the Cargo Hold down an open ladder. The Commanding Officer's Cabin and CPO Quarters are accessible from the Main Weather Deck through watertight doors and share a common Head accessible through joiner doors. The Commanding Officer's Cabin includes the Ship's Armory. The Workshop, CO Cabin, CPO Quarters and CO/CPO Head all contain operable airports that open to weather. The Fidley is accessible from weather and includes an open ladder to the Engine Room below.

2.1.2.2. 01 Deck

The Bridge occupies the 01 Deck and is accessible from the port and starboard sides of the 01 Deck through watertight doors.

2.1.3. The Weather Deck

The P-250 Mod 1 and P-60 portable pumps are stowed on the Main Weather Deck.

2.2. Diesel Engine Shutdowns

The main propulsion diesel engines and diesel-driven ship service generators can be started and stopped locally in the Engine Room. The emergency remote engine shutdowns are located on the Engine Room entrance bulkhead (frame 68). Individual remote shutdowns are labeled as follows:

- ◆ 1-68-2 #1 Ship Service Diesel Generator
- ◆ 1-68-4 #1 Main Diesel Engine
- ◆ 1-68-6 #2 Ship Service Diesel Generator
- ◆ 1-68-8 #2 Main Diesel Engine

Remote fuel shutoff valves are located frame 56, port and starboard sides, Main Weather Deck.

2.3. Ventilation

The ventilation on this cutter consists of a supply and exhaust fans for the Engine Room and a supply fan in the Galley. The ventilation fans for the Engine Room can be secured at frame 68, starboard side near the remote engine shutdowns. The vent fan for the Galley can be secured at frame 89, starboard side, Second Deck.

2.4. Fire Detection Equipment

The CO Cabin and CPO Quarters have one ionization type smoke detector installed in each compartment. The Crews Berthing has two installed ionization type smoke detectors. There is no automatic fire or smoke detection system installed in all other compartments.

2.5. Firefighting Equipment

2.5.1. Firemain Stations

There are two firemain stations located on the Main Weather Deck at frame 36 on the centerline of the Buoy Deck and frame 68 port side. The firemain stations are pressurized from either of two electric fire pumps installed in the Engine Room.

2.5.2. Portable Pumps

A P-60 portable pump is stored on the starboard side Main Deck and a P-250 Mod 1 pump is also stored at frame 90 on the Main Weather Deck.

2.5.3. Portable Fire Extinguishers

Portable PKP and CO₂ fire extinguishers are located throughout the cutter to facilitate first aid. In addition, the Galley contains an aqueous potassium carbonate system for the stove and deep fat fryer. Table C-100WLIC-1 is a summary of portable fire extinguishers located throughout the cutter.

TABLE C-100WLIC-1 LOCATION OF PORTABLE EXTINGUISHERS

Location	Number of Portable Extinguishers		
	CO ₂	PKP	K ₂ CO ₃
Cargo Hold	1 15-lb	2 18-lb	
Engine Room	2 15-lb	1 18-lb	
Fidley	1 15-lb	1 18-lb	
Workshop		1 10-lb	
Crews Berthing		1 10-lb	
Port Vestibule		1 18-lb	
Galley/Mess Deck		1 10-lb	Fixed System
CO Cabin		1 10-lb	
CO/CPO Head		1 10-lb	
Bridge	1 5-lb		

2.5.4. Protective Equipment

Two (2) Navy Type A-4 oxygen breathing apparatus (OBA) and one (1) firefighting ensemble (FFE) are stowed in the cutter. There are twelve (12) canisters per OBA.

2.5.5. Desmoking Equipment

There is no portable desmoking equipment in this class cutter.

3. Firefighting Procedures

In this section 10 different shipboard fire scenarios are described. The recommended procedures for fighting each fire are detailed, from the alarm through post-fire activities. The last procedure is for fires in port.

3.1. Cargo Hold

3.1.1. Scenario

The most likely fire in the Cargo Hold is a Class A fire in the various materials stored in this compartment.

3.1.2. Confining the Fire

The primary fire boundaries are bulkhead 7 forward, bulkhead 44 aft, the Buoy Deck and the hull.

3.1.3. Sizeup

The Cargo Hold is normally unoccupied and egress is possible through the hatch to the Buoy Deck forward and up the ladder to the starboard Vestibule aft, therefore there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.1.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.1.5. Indirect Attack

A fire in the Cargo Hold may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch in the Buoy Deck without entering the Cargo Hold. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.1.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Cargo Hold through the watertight door in the starboard Vestibule and down the ladder with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Cargo Hold without an OBA. The hose tender should wear an OBA, but should not enter the Cargo Hold.

3.1.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.1.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Main Weather Deck aft and energized as a backup source of firefighting water. The P-60 pump on the cutter shall be broken out as a backup to the P-250 Mod 1 pump. Secure electrical power with the exception of lighting in the Cargo Hold.

3.2. Crews Berthing

3.2.1. Scenario

The most likely fire in this compartment is a Class A fire in bedding materials.

3.2.2. Confining the Fire

The primary fire boundaries are bulkhead 44 forward, bulkhead 56 aft, the Main Deck and hull.

3.2.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a strong possibility that personnel may need to be rescued. There are no Emergency Evacuation Breathing Devices (EEBD's) in this space; egress is possible up a ladder on the port or starboard sides through the Vestibules to weather. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.2.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.2.5. Indirect Attack

An indirect attack is feasible through one of the portlights on the Main Weather Deck with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to

the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.2.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Crews Berthing from either the port or starboard Vestibule (enter from Vestibule which is upwind), through a joiner door and down a ladder into the Crews Berthing with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Crews Berthing without an OBA. The hose tender should wear an OBA, but should not enter the Crews Berthing.

3.2.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.2.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Main Weather Deck aft and energized as a backup source of firefighting water. The P-60 pump on the cutter shall be broken out as a backup to the P-250 Mod 1 pump. Secure electrical power with the exception of lighting in the Crews Berthing.

3.3. Engine Room

3.3.1. Scenario

The most likely fire in this compartment is a Class B spray fire as a result of a ruptured lube oil or fuel oil line on a diesel engine. A Class C fire is also likely in a controller, switchboard, or motor.

3.3.2. Confining the Fire

The primary fire boundaries are bulkhead 56 forward, bulkhead 70 aft, the Main Deck, and hull. Note the Fidley is separated from the Engine Room by an open steel grating, therefore the outer boundaries of the Fidley also form boundaries for an Engine Room fire. The Engine Room supply and exhaust fans shall be secured and the main engines shall be secured. The ship service generator shall be secured in the event of a Class B fire but need not be secured for a Class C fire (unless it is the source of the fire). If the ship service generator is secured,

it is crucial that the P-250 Mod 1 pump be energized as the primary source of firefighting water. In this event, the P-60 pump shall be rigged and energized as a backup source of firefighting water.

3.3.3. Sizeup

The Engine Room in this cutter is normally unmanned, and the ease of egress through the quick acting emergency escape scuttle, and upward through the Fidley make it unlikely that personnel will need to be rescued. Class B spray fires may be efficiently extinguished by securing the source of the fuel and then applying AFFF from a 1.5" hose. The CO₂ total flooding system installed in the Engine Room shall be released only if the source of the fuel in a spray fire can be secured. Halon 1301 is the most efficient means of extinguishing a flammable liquid spray fire, but Halon 1301 is not installed in this cutter class. Class C fires are best extinguished with CO₂.

3.3.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on a Class B fire and a CO₂ portable extinguisher on a Class C fire. A flammable liquid spray fire shall be immediately declared out of control; first aid should not be attempted for a flammable liquid fire out of control.

3.3.5. Indirect Attack

If the personnel in the Engine Room can be evacuated, ventilation fans and internal combustion engines secured, and the Engine Room mechanically isolated by closing all access fittings, the installed CO₂ total flooding system can be used to extinguish the fire with minimal risk to personnel. A Class C fire in the switchboard, motor, or controller shall be attacked directly as described in the next section. Caution: The CO₂ system in this class cutter will automatically flood the Engine Room with a lethal concentration of CO₂ if the fusible link reaches the preset temperature.

3.3.6. Direct Attack

When the scene leader directs, the firefighting hose team should enter the Engine Room through watertight door 1-68-0 from the Main Weather Deck, through the Fidley, and down the ladder into the Engine Room with a 1.5" fire hose configured to apply AFFF. This attack will be futile unless the fuel source is secured first. The nozzleman should be dressed out in the FFE and should not enter the space without an OBA. The hose tender should wear an OBA but should not enter the Engine Room. A Class C fire shall be attacked directly, by first securing the source of electrical power, then attacking the remaining Class A or B

fire with PKP or CO₂ portable extinguishers. Caution: The CO₂ system in this class cutter will automatically flood the Engine Room with a lethal concentration of CO₂ if the fusible link reaches the preset temperature.

3.3.7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply fan on high for at least 15 minutes after the Engine Room atmosphere has been tested and proven free of flammable gases.

3.3.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Main Weather Deck aft and energized as a backup source of firefighting water. The P-60 pump on the cutter shall be rigged and energized as a backup to the P-250 Mod 1 pump. Secure electrical power with the exception of lighting in the Engine Room.

3.4. Mess Deck/Wardroom

3.4.1. Scenario

The most likely fire in the Mess Deck is a Class C fire in the electronics equipment. There is also a significant possibility of a Class A fire in the foam cushions on the Mess Deck benches or the paper products in the Wardroom.

3.4.2. Confining the Fire

The primary fire boundaries are bulkhead 70 forward, bulkhead 82 aft, the Main Deck and hull. The Shaft Alley is below the Mess Deck and actually serves as a fire boundary since there is virtually no fuel load in the Shaft Alley.

3.4.3. Sizeup

Crewmembers are likely to be awake and alert in the Mess Deck/Wardroom. In addition, there is ease of egress up the ladders to weather on the port side of the Mess Deck and the starboard side of the Wardroom. Therefore, there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are most efficiently extinguished with CO₂ when electrical power is secured; however, a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.4.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A and B fires and a CO₂ portable extinguisher on Class C fires.

3.4.5. Indirect Attack

A Class A fire in the Wardroom may be indirectly attacked with a minimum of danger to personnel from the Mess Deck through the joiner door. Use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed. A Class C fire in the Mess Deck should be attacked directly as described in the next section.

3.4.6. Direct Attack

Class C fires in the Mess Deck should be extinguished with a portable CO₂ extinguisher after the electrical power to the affected equipment is secured and then attacking the remaining Class A fire with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The firefighting hose team should enter the Mess Deck from the Wardroom through the joiner door. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Mess Deck without an OBA. The hose tender should wear an OBA, but should not enter the Mess Deck. Class A fires in the Wardroom/Mess Deck should be attacked directly by entering the affected compartment through the watertight door from weather and down the ladder into the affected compartment with a 1.5" hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Wardroom/Mess Deck without an OBA. The hose tender should wear an OBA, but should not enter the Wardroom/Mess Deck.

3.4.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.4.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Main Weather Deck aft and energized as a backup source of firefighting water. The P-60 pump on the cutter shall be broken out as a backup to the P-250 Mod 1 pump. Secure electrical power with the exception of lighting in the Wardroom/Mess Deck.

3.5. Galley/Dry Stores

3.5.1. Scenario

The most likely fire in this compartment is a Class A fire in the Dry Stores. There is also a significant possibility of a Class B grease fire on the stove or deep fat fryer in the Galley.

3.5.2. Confining the Fire

The primary fire boundaries are bulkhead 82 forward, bulkhead 90 aft, the Main Deck and the hull.

3.5.3. Sizeup

Crewmembers are likely to be awake and alert in the Galley/Dry Stores and egress is possible forward through the Mess Deck and up the ladder to weather. Therefore, there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class B fires are efficiently extinguished with PKP if the fire is small and AFFF if the fire is larger. In the special case of a grease fire on the stove or deep fat fryer, the fixed aqueous potassium carbonate system is very effective.

3.5.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A and B fires and a CO₂ portable extinguisher on Class C fires. For a grease fire on the stove or deep fat fryer, the person discovering the fire should activate the installed aqueous potassium carbonate system in the Mess Deck.

3.5.5. Indirect Attack

An indirect attack on a fire in the port or starboard Dry Stores is not feasible. A Class A fire in the Galley may be indirectly attacked with a minimum of danger to personnel through one of the airports from the Main Weather Deck. The firefighting team should use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.5.6. Direct Attack

If the scene leader decides that a direct attack is needed the firefighting hose team should enter the Galley from the Mess Deck through joiner door 2-82-2 with a 1.5" hose equipped with a vari-nozzle set to the water fog position and directly attack a Class A fire in the affected Dry Stores compartment. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Galley without an OBA. The hose tender should wear an OBA, but should not enter the Galley. After discharging the K_2CO_3 system, remaining Class B fires in the Galley should be attacked directly with PKP portable extinguishers if the fire is confined to the stove area in the Galley. If the Class B fire has spread, the fire should be attacked directly with water fog or AFFF.

3.5.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.5.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Main Weather Deck aft and energized as a backup source of firefighting water. The P-60 pump on the cutter shall be broken out as a backup to the P-250 Mod 1 pump. Secure electrical power with the exception of lighting in the Galley/Dry Stores.

3.6. Lazarette

3.6.1. Scenario

The most likely fire in this compartment is a Class A fire.

3.6.2. Confining the Fire

The primary fire boundaries are bulkhead 90 forward, the transom aft, the Main Deck and the hull.

3.6.3. Sizeup

This space is normally unoccupied so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to

the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.6.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.6.5. Indirect Attack

An indirect attack is feasible through the hatch on the Main Deck with minimal risk to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.6.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Lazarette from the Main Weather Deck through watertight hatch 1-90-2 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Lazarette without an OBA. The hose tender should wear an OBA, but should not enter the Lazarette.

3.6.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.6.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Main Weather Deck forward and energized as a backup source of firefighting water. The P-60 pump on the cutter shall be broken out as a backup to the P-250 Mod 1 pump. Secure electrical power with the exception of lighting in the Lazarette.

3.7. Workshop

3.7.1. Scenario

The most likely fire in the Workshop is a Class A fire in the various materials stored in this compartment.

3.7.2. Confining the Fire

The primary fire boundaries are bulkhead 32 forward, bulkhead 38 aft, the Main Deck and the 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.7.3. Sizeup

The Workshop is normally unoccupied, therefore there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.7.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.7.5. Indirect Attack

A fire in the Workshop may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through one of the portlights from the Main Weather Deck. Do not open watertight door 1-36-2 to the Workshop unless the scene leader decides that a direct attack is required. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.7.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Workshop through watertight door 1-36-2 from the Main Weather Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Workshop without an OBA. The hose tender should wear an OBA, but should not enter the Workshop.

3.7.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.7.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Main Weather Deck aft and energized as a backup source of firefighting water. The P-60 pump on the cutter shall be broken out as a backup to the P-250 Mod 1 pump. Secure electrical power with the exception of lighting in the Workshop.

3.8. CO Cabin/CPQ Quarters

3.8.1. Scenario

The most likely fire in these compartments is a Class A fire in bedding materials.

3.8.2. Confining the Fire

The primary fire boundaries are bulkhead 44 forward, bulkhead 59 aft, the 01 Deck and Main Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.8.3. Sizeup

Due to the likelihood of sleeping crewmembers in these spaces there is a strong possibility that personnel may need to be rescued. There are no EEBD's in these spaces; egress is feasible through watertight doors to weather. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.8.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.8.5. Indirect Attack

An indirect attack is feasible through the portlights on the 01 Deck with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the fire boundaries as needed.

3.8.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the affected compartment from the 01 Deck through watertight doors 1-55-1 or 2 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Stateroom without an OBA. The hose tender should wear an OBA, but should not enter the Stateroom.

3.8.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.8.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Main Weather Deck aft and energized as a backup source of firefighting water. The P-60 pump on the cutter shall be broken out as a backup to the P-250 Mod 1 pump. Secure electrical power with the exception of lighting on the 01 Deck.

3.9. Bridge

3.9.1. Scenario

The most likely fire in the Bridge is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.9.2. Confining the Fire

The primary fire boundaries are the superstructure forward, aft, port and starboard and the Main Deck.

3.9.3. Sizeup

Due to the ease of egress to weather from the Bridge, the likelihood of personnel being trapped is remote. Class C fires are usually extinguished when electrical power is secured; however, a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.9.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.9.5. Indirect Attack

A Class A fire in this space may be indirectly attacked through watertight doors 02-41-1 or 2 from the 01 Deck with a minimal risk to personnel. Enter the Bridge through the weather door which is upwind. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. A Class C fire should be extinguished by securing the electrical power to the affected equipment first. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and 01 Deck as needed.

3.9.6. Direct Attack

A Class C fire in the Bridge should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly. (Charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The firefighting hose team should enter the Bridge through watertight door 02-41-1 or 2 depending on the location of the fire with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the space without an OBA. The hose tender should wear an OBA but should not enter the Bridge.

3.9.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.9.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Main Weather Deck aft and energized as a backup source of firefighting water. The P-60 pump on the cutter shall be broken out as a backup to the P-250 Mod 1 pump. Secure electrical power with the exception of lighting on the 01 Deck.

3.10. In Port Fires

3.10.1. Scenario

The most likely fire in port is a Class A fire in the Crews Berthing or CO/CPO Staterooms in bedding materials. A Class B fire in the Galley is the next most likely fire in port.

3.10.2. Confining the Fire

The primary fire boundaries are stated above and depend on the involved compartment.

3.10.3. Sizeup

Due to the likelihood of sleeping crewmembers, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in this class of cutter. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.10.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.10.5. Indirect Attack

An indirect or direct attack can only be attempted in the event additional help arrives on scene. This help can come from another Coast Guard cutter, the Group or Station where the cutter is berthed, or from the local fire department. An indirect attack may be attempted as described in Sections 3.1 through 3.9 above for the particular compartment involved. Preplanning for in port fires and the familiarity of the local fire department with the cutter and this doctrine are considered extremely important.

3.10.6. Direct Attack

A direct attack may be attempted if the scene leader directs in accordance with the procedures described above for the particular compartment involved. The scene leader is the person on watch (in a one man duty section) until properly relieved by the normal scene leader in the crew or by a qualified person in the firefighting team from the local fire department.

3.10.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.10.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Main Weather Deck aft and energized as a backup source of firefighting water. The P-60 pump on the cutter shall be broken out as a backup to the P-250 Mod 1 pump. Secure electrical power at the shore connection box.

PART C

FIRE PROTECTION DOCTRINE

65' WLR RIVER BUOY TENDER

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Part C
FIRE PROTECTION DOCTRINE

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1. Introduction

One of the most life threatening and hazardous activities that may be encountered on board ship is fighting a fire. Unlike a building fire, the crew often can not evacuate and leave the firefighting to trained professionals. The crew must extinguish the fire, often without assistance, and using only the available equipment on board. Once a fire occurs, it is too late to read this doctrine, it is too late to obtain training, and it is too late to repair and maintain damage control equipment. Finally, the procedures in this doctrine are not a substitute for the exercise of good judgment based on experience and the particular conditions that exist at the time.

The purpose of this doctrine is to provide useful background information pertinent to fire science (Part A), guidance promulgated by Commandant for "small" classes of Coast Guard cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered on this class of vessel, in port and underway (Part C). Note, the Officer-in-Charge is responsible for tailoring Part C of this doctrine within the guidelines set forth in the following documents:

- ◆ Naval Ships' Technical Manual (NSTM) Chapter 074, Volume 3
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 077
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 079
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 555
- ◆ FXP-4
- ◆ Surface Ship Survivability, NWP 62-1
- ◆ COMDTINST M9000.6, Naval Engineering Manual
- ◆ The Cutter's Fire Protection Doctrine, Parts A and B
- ◆ The Cutter's Engineering Casualty Control Manual

2. Vessel Characteristics

The 65' WLR class cutter is a River Buoy Tender. The primary missions of this cutter class are Short Range Aids to Navigation, and Search and Rescue. The vessel has a complement of approximately twelve (12) crewmembers, and a maximum speed of 10 knots. The vessel is constructed entirely of steel. This

cutter does not have the hotel facilities to accommodate extended deployments and usually puts into port at night.

There is a barge semi-permanently faced up to the tug. The tug rarely operates independently of the barge. The barge serves as a working platform for the diesel-powered crane mounted on the bow portion of the Main Deck. There is a diesel engine on the barge which drives an air compressor to serve the spud winches and a jetting pump which can also be used as an alternate source of firefighting water pressure for the tug.

The following is a description of the tug's compartmentation and other characteristics pertinent to firefighting.

2.1. Compartmentation

2.1.1. Below the Main Deck

Below the Main Deck, the cutter is divided into the following five areas, each separated by steel watertight bulkheads:

2.1.1.1. Forward Rake

The Forward Rake contains inaccessible Trim Tanks and Voids.

2.1.1.2. Forward Hold

The Forward Hold is a large storeroom which contains Bosn's Stores, Engineering Stores and paper products. It is accessible from a hatch on the forward starboard side in the overhead that leads to the Petty Officer's Berthing compartment and through a watertight hatch fitted with a watertight scuttle to the Main Weather Deck at frame 11 starboard side.

2.1.1.3. Engine Room

The Engine Room on the Second Deck, and the Fidley on the Main Deck, are separated by an open steel grating and connected by an open ladder. The Fidley can be accessed from the Main Deck Passageway through a joiner door or from weather through a watertight door. The Engine Room is also accessible directly from the Shaft Alley through a watertight door. The Fidley also contains a watertight hatch which provides access to the Shaft Alley and a 50 lb CO₂ hose reel system.

2.1.1.4. Shaft Alley

The Shaft Alley contains the Engineer's Stores and is accessible from the Fidley through a watertight hatch on the port side. In addition, egress is permitted to the Mess Deck through a watertight hatch in the overhead on the starboard side.

2.1.1.5. Lazarette

The Lazarette contains the steering gear and is accessible from the Main Deck through a watertight hatch in the overhead starboard side.

2.1.2. Above the Second Deck

There are three levels above the Second Deck. The following is a description of the compartmentation and characteristics pertinent to firefighting on the Main Deck, 01 Deck and 02 Deck:

2.1.2.1. Main Deck

The compartments on the Main Deck include the Crews Berthing forward and the Galley/Mess Deck aft connected by a longitudinal Passageway accessible through joiner doors. Petty Officer's Berthing and the Ship's Office are forward of the Crews Berthing. The Crews Head and Fidley are also accessible on the port side from the Passageway through joiner doors as is a ladder to the 01 Deck Passageway. The Passageway can also be accessed from weather through two watertight doors on the starboard side. The Ship's Office, Fidley and the Galley/Mess Deck are also accessible through watertight doors from the Main Weather Deck. The Galley/Mess Deck includes the Dry Stores accessible from the Mess Deck through a joiner door.

2.1.2.2. 01 Deck

The Officer in Charge (OinC) and Engineering Petty Officer (EPO) Staterooms are located on the 01 Deck as well as a Head and a Passageway. The Passageway is accessible via a ladder leading down to the Main Deck Passageway. There is also a ladder leading up to the Bridge from the 01 Deck Passageway. Both staterooms have joiner doors that access the 01 Deck Passageway.

2.1.2.3. 02 Deck

The Bridge occupies the 02 Deck and is accessible via a ladder to the 01 Deck (and via another ladder down to the Main Deck). There are also watertight doors to weather port and starboard that open to weather.

2.2. Diesel Engine Shutdowns

The main propulsion diesel engine and diesel-driven ship service generator can be started and stopped locally in the Engine Room.

2.3. Ventilation

The ventilation on this cutter consists of a supply fan in the Engine Room. The switch for the Engine Room supply fan is located in the Crews Head at frame 17 port side. The Galley has an exhaust fan with a start/stop switch at frame 28 port side in the Dry Stores and a remote stop/start switch at frame 33 port side in the Galley. The forward Hold also has two exhaust fans controlled by switches at frames 7 and 11 starboard side in the Forward Hold.

2.4. Fire Detection Equipment

The OinC Stateroom, EPO Stateroom, Crews Berthing, and Petty Officer Berthing have one ionization type, battery powered, residential type, smoke detector installed in each compartment. There is no automatic fire or smoke detection system installed in any of the other compartments.

2.5. Firefighting Equipment

2.5.1. Firemain Stations

There are two firemain stations located on the Main Weather Deck of the tug (1-17-1 and 1-16-2). The jetting pump discharge on the barge is located near the stern of the barge. A fire hose connecting a firemain station on the tug to the jetting pump fitting on the barge will permit the barge to provide firefighting water pressure to the tug.

2.5.2. P-250 Mod 1 Pump

The P-250 Mod 1 portable pump can provide an alternate source of firefighting water pressure.

2.5.3. Portable fire extinguishers

Portable PKP and CO₂ fire extinguishers are located throughout the cutter to facilitate first aid. Table C-65WLR-1 shows the location and number of such extinguishers.

2.5.4. Protective Equipment

Two (2) Navy Type A-4 oxygen breathing apparatus (OBA) and one (1) firefighting ensemble (FFE) are stowed in the cutter. There are twelve (12) canisters per OBA.

2.5.5. Desmoking Equipment

There is no portable desmoking equipment in this class cutter.

TABLE C-65WLR-1 LOCATION OF PORTABLE EXTINGUISHERS

Location	Number of Portable Extinguishers	
	CO ₂	PKP
Engine Room	2 15-lb	2
Fidley	1 50-lb hose reel/ 25' hose	
Forward Hold	3 15-lb	1
01 Deck Passageway	1 15-lb	1
Galley/Mess Deck		1
Main Deck Passageway	1	
Bridge	1	1

3. Firefighting Procedures

In this section, 10 different shipboard fire scenarios are described. The recommended procedures for fighting each fire are detailed, from the alarm through post-fire activities. The last procedure is for fires in port.

3.1. Forward Hold

3.1.1. Scenario

The most likely fire in the Forward Hold is a Class A fire in the various materials stored in this compartment.

3.1.2. Confining the Fire

The primary fire boundaries are bulkhead 4 forward, bulkhead 12 aft, the Main Deck and the hull.

3.1.3. Sizeup

The Forward Hold is normally unoccupied. The two egress routes are through watertight hatches on the starboard side of the Hold to the Petty Officer's Berthing and to weather. Therefore there is a remote possibility that personnel may need

to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.1.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.1.5. Indirect Attack

A fire in the Forward Hold may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch in the Forward Hold that leads to weather without entering the Forward Hold. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.1.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Forward Hold through the watertight hatch from the Main Weather Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Forward Hold without an OBA. The hose tender should wear an OBA, but should not enter the Forward Hold.

3.1.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.1.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Forward Hold.

3.2. Engine Room

3.2.1. Scenario

The most likely fire in this compartment is a Class B spray fire as a result of a ruptured lube oil or fuel oil line on the main engine. A Class C fire is also likely in a controller, switchboard, or motor.

3.2.2. Confining the Fire

The primary fire boundaries are bulkhead 12 forward, bulkhead 28 aft, the Main Deck, and hull. Note the Fidley is separated from the Engine Room by an open steel grating; therefore, the outer boundaries of the Fidley also form boundaries for an Engine Room fire. The Engine Room supply fan shall be secured and the main engine shall be secured. The ship service generator shall be secured in the event of a Class B fire but need not be secured for a Class C fire (unless it is the source of the fire). If the ship service generator is secured, it is crucial that the P-250 Mod 1 pump and jetting pump on the Barge be energized as a backup source of firefighting water.

3.2.3. Sizeup

The Engine Room in this cutter is normally unmanned underway and the ease of egress up through Crews Berthing and up through the Fidley make it unlikely that personnel will need to be rescued. Class B spray fires may be efficiently extinguished by securing the source of the fuel and then applying AFFF from a 1.5" hose. A Halon 1301 total flooding system is the most efficient means of extinguishing this type of fire, but Halon 1301 is not installed in this cutter class. Class C fires are best extinguished with CO₂.

3.2.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on a Class B fire and a CO₂ portable extinguisher on a Class C fire. A flammable liquid spray fire shall be immediately declared out of control; first aid should not be attempted for a flammable liquid fire out of control.

3.2.5. Indirect Attack

Due to the absence of an installed fixed fire protection system, an indirect attack on a Class B fire in this space is not feasible. A Class C fire in the switchboard, motor, or controller shall also be attacked directly as described in the next section.

3.2.6. Direct Attack

When the scene leader directs, the firefighting hose team should enter the Engine Room through watertight door 1-25-2 from weather into the Fidley and down the open ladder with a 1.5" fire hose configured to apply AFFF. This attack will be futile unless the fuel source is secured first. The nozzleman should be dressed out in the FFE and should not enter the space without an OBA. The hose tender should wear an OBA but should not enter the Engine Room. A Class C fire shall be attacked directly, by first securing the source of electrical power, then attacking the remaining Class A or B fire with PKP or CO₂ portable extinguishers.

3.2.7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply fan on high for at least 15 minutes after the Engine Room atmosphere has been tested and proven free of flammable gases.

3.2.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Engine Room.

3.3. Shaft Alley

3.3.1. Scenario

The most likely fire in the Shaft Alley is a Class A fire in the various materials stored in this compartment.

3.3.2. Confining the Fire

The primary fire boundaries are bulkhead 28 forward, bulkhead 38 aft, the Main Deck and the hull.

3.3.3. Sizeup

The Shaft Alley is normally unoccupied and there are two means of egress: through the watertight hatch 1-28-2 to the Fidley and a watertight hatch on the starboard side to the Mess Deck. Therefore, there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is

minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.3.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.3.5. Indirect Attack

Due to the compartmentation, an indirect attack on a fire in the Shaft Alley is not feasible. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.3.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Shaft Alley through the watertight hatch in the Mess Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Shaft Alley without an OBA. The hose tender should wear an OBA, but should not enter the Shaft Alley.

3.3.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.3.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Shaft Alley.

3.4. Lazarette

3.4.1. Scenario

The most likely fire in this compartment is a Class A fire.

3.4.2. Confining the Fire

The primary fire boundaries are bulkhead 38 forward, the transom aft, the Main Deck and the hull.

3.4.3. Sizeup

This space is normally unoccupied so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.4.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.4.5. Indirect Attack

An indirect attack is feasible through the hatch on the Main Deck with minimal risk to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.4.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Lazarette from the Main Weather Deck through the watertight hatch with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Lazarette without an OBA. The hose tender should wear an OBA, but should not enter the Lazarette.

3.4.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.4.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge

Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Lazarette.

3.5. Petty Officer Berthing/Ship's Office

3.5.1. Scenario

The most likely fire in this compartment is a Class A fire in papers or files or in bedding materials.

3.5.2. Confining the Fire

The primary fire boundaries are bulkhead 5 forward, bulkhead 10 aft, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.5.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a strong possibility that personnel may need to be rescued. There are no Emergency Evacuation Breathing Device's (EEBD's) in this space; egress may be possible through the Ship's Office to weather or through the Crews Berthing to the Main Deck Passage and then to weather, therefore there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.5.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.5.5. Indirect Attack

An indirect attack is feasible through the upwind windows on the Main Deck with a minimum of danger to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the fire boundaries as needed.

3.5.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Ship's Office

from the Main Deck through joiner door 1-4-2 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Ship's Office without an OBA. The hose tender should wear an OBA, but should not enter the Ship's Office.

3.5.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.5.8. Other Actions

During firefighting actions, the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Ship's Office/Petty Officer Berthing.

3.6. Crews Berthing

3.6.1. Scenario

The most likely fire in this compartments is a Class A fire in bedding materials.

3.6.2. Confining the Fire

The primary fire boundaries are bulkhead 10 forward, bulkhead 18 aft, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.6.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a good possibility that personnel may need to be rescued. There are no EEBD's in this space; egress is possible forward through the Petty Officer's Berthing and Ship's Office to weather or aft through the Main Deck Passageway to weather. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid

stream should not be used unless electrical power (including lighting) is secured.

3.6.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.6.5. Indirect Attack

An indirect attack on a fire in Crews Berthing is not feasible. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.6.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Crews Berthing from the Main Deck Passageway through the joiner door with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Crews Berthing without an OBA. The hose tender should wear an OBA, but should not enter the Crews Berthing.

3.6.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.6.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Crews Berthing.

3.7. Mess Deck/Galley/Dry Stores

3.7.1. Scenario

The most likely fire in this compartment is a Class C fire in the electronics equipment such as the stereo, TV or microwave. There is also a significant possibility of a Class A

fire in the foam cushions on the Mess Deck benches. There is also a good possibility of a Class B grease fire on the stove in the Galley.

3.7.2. Confining the Fire

The primary fire boundaries are bulkhead 27 forward, the superstructure aft, port and starboard, the Main Deck and 01 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.7.3. Sizeup

Crewmembers are likely to be awake and alert in the Mess Deck/Galley. In addition, there is ease of egress forward to the Main Deck Passageway and to weather through watertight door 1-29-4. Therefore, there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are most efficiently extinguished with CO₂ when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire. Class B fires are efficiently extinguished with PKP if the fire is small and AFFF if the fire is larger.

3.7.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A and B fires and a CO₂ portable extinguisher on Class C fires.

3.7.5. Indirect Attack

A Class A fire in the Mess Deck may be indirectly attacked with a minimum of danger to personnel through watertight door 1-29-4 from the Main Weather Deck port side. The firefighting team should use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.7.6. Direct Attack

Class C fires in the Galley/Mess Deck should be extinguished with a portable CO₂ extinguisher after the electrical power to the affected equipment is secured and then attacking the remaining Class A fire with a 1.5" fire hose

equipped with a vari-nozzle set to the water fog position. The firefighting hose team should enter the Galley/Mess Deck from the Main Weather Deck through watertight door 1-29-4. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Galley/Mess Deck without an OBA. The hose tender should wear an OBA, but should not enter the Galley/Mess Deck. Class B fires should be attacked directly with PKP portable extinguishers if the fire is confined to the stove area in the Galley. If the Class B fire has spread, the fire should be attacked directly with water fog or AFFF.

3.7.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.7.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting in the Galley/Mess Deck.

3.8. Officer in Charge/EPO Staterooms

3.8.1. Scenario

The most likely fire in these compartments is a Class A fire in bedding materials.

3.8.2. Confining the Fire

The primary fire boundaries are bulkhead 7 forward, bulkhead 23 aft, the 01 Deck and 02 Deck. Note fire boundaries in the superstructure are difficult to define due to the ventilation grills frequently installed in joiner doors. This may require expanding the fire boundaries to the outer boundaries of the entire deckhouse.

3.8.3. Sizeup

Due to the likelihood of sleeping crewmembers in these spaces, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in these spaces; egress is possible through joiner doors to the 01 Deck Passageway. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment.

Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.8.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.8.5. Indirect Attack

An indirect attack on a fire in either of these staterooms is not feasible. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the fire boundaries as needed.

3.8.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the affected compartment from the 01 Deck Passageway through joiner door 01-11-2 or 01-18-2 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the Stateroom without an OBA. The hose tender should wear an OBA, but should not enter the Stateroom.

3.8.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.8.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting on the 01 Deck.

3.9. Bridge

3.9.1. Scenario

The most likely fire in the Bridge is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.9.2. Confining the Fire

The primary fire boundaries are the superstructure forward, aft, port and starboard and the 01 Deck.

3.9.3. Sizeup

Due to the ease of egress to weather from the Bridge, the likelihood of personnel being trapped is remote. Class C fires are usually extinguished when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.9.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.9.5. Indirect Attack

A Class A fire in this space may be indirectly attacked through watertight door 02-10-1 or 2 from weather with a minimal risk to personnel. Enter the Bridge through the watertight door to weather which is upwind. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. A Class C fire should be extinguished by securing the electrical power to the affected equipment first. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and 01 Deck as needed.

3.9.6. Direct Attack

A Class C fire in the Bridge should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly. (Charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The firefighting hose team should enter the Bridge through watertight door 02-10-1 or 2 depending on the location of the fire with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he or she should not enter the space without an OBA. The hose tender should wear an OBA but should not enter the Bridge.

3.9.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.9.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power with the exception of lighting on the 02 Deck.

3.10. In Port Fires

3.10.1. Scenario

The most likely fire in port is a Class A fire in the Crews Berthing or CO/EPO Staterooms in bedding materials. A Class B fire in the Galley is the next most likely fire in port.

3.10.2. Confining the Fire

The primary fire boundaries are stated above and depend on the involved compartment.

3.10.3. Sizeup

Due to the likelihood of sleeping crewmembers, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in this class of cutter. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.10.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.10.5. Indirect Attack

An indirect or direct attack can only be attempted in the event additional help arrives on scene. This help can come from another Coast Guard cutter, the Group or Station where the cutter is berthed, or from the local fire department. An indirect attack may be attempted as described in Sections 3.1 through 3.9 above for the particular compartment involved. Preplanning for in port fires and the familiarity of the local fire department with the cutter and this doctrine are considered extremely important.

3.10.6. Direct Attack

A direct attack may be attempted if the scene leader directs in accordance with the procedures described above for the particular compartment involved. The scene leader is the person on watch (in a one man duty section) until properly relieved by the normal scene leader in the crew or by a qualified person in the firefighting team from the local fire department.

3.10.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.10.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the barge Main Deck aft and energized as a backup source of firefighting water. The jetting pump on the barge shall be energized and cross connected into the tug's firemain system. Secure electrical power at the shore connection box.

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PART C

FIRE PROTECTION DOCTRINE

65' WLI INLAND BUOY TENDER

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Part C
FIRE PROTECTION DOCTRINE

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1. Introduction

One of the most life threatening and hazardous activities that may be encountered on board ship is fighting a fire. Unlike a building fire, the crew often can not evacuate and leave the firefighting to trained professionals. The crew must extinguish the fire, often without assistance, and using only the available equipment on board. Once a fire occurs, it is too late to read this doctrine, it is too late to obtain training, and it is too late to repair and maintain damage control equipment. Finally, the procedures in this doctrine are not a substitute for the exercise of good judgment based on experience and the particular conditions that exist at the time.

The purpose of this doctrine is to provide useful background information pertinent to fire science (Part A), guidance promulgated by Commandant for "small" classes of Coast Guard cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered on this class of vessel, in port and underway (Part C). Note, the Officer-in-Charge is responsible for tailoring Part C of this doctrine within the guidelines set forth in the following documents:

- ◆ Naval Ships' Technical Manual (NSTM) Chapter 074, Volume 3
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 077
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 079
- ◆ Naval Ships' Technical Manual (NSTM) Chapter 555
- ◆ FXP-4
- ◆ Surface Ship Survivability, NWP 62-1
- ◆ COMDTINST M9000.6, Naval Engineering Manual
- ◆ The Cutter's Fire Protection Doctrine, Parts A and B
- ◆ The Cutter's Engineering Casualty Control Manual

2. Vessel Characteristics

The 65' WLI class cutter is an Inland Buoy Tender. The primary missions of this cutter class are Short Range Aids to

Navigation, Domestic Ice Operations, and Search and Rescue. The vessel has a complement of approximately nine (9) crewmembers, and a maximum speed of 10 knots. The vessel is constructed entirely of steel. This cutter does not have the hotel facilities to accommodate extended deployments and usually puts into port at night.

The following is a description of the cutter's compartmentation and other characteristics pertinent to firefighting.

2.1. Compartmentation

2.1.1. The Hold Deck

The Hold Deck is divided into the following six areas, each separated by steel watertight bulkheads:

2.1.1.1. Peak Tank

The Peak Tank is utilized as a storeroom. It is accessible through a watertight hatch in the overhead to weather.

2.1.1.2. Main Hold

The Forward Hold is a large storeroom which contains Bosn's Stores, Engineering Stores and paper products. It is accessible through a watertight hatch fitted with a watertight scuttle to the Main Weather Deck at frame 11 centerline.

2.1.1.3. Engine Room

The Engine Room and the Fidley above are connected by an open ladder. The Engine Room is protected by an installed CO₂ flooding system. The remote release for this system is located at 01-25-3. The CO₂ storage bottles are located in the Engine Room.

2.1.1.4. Galley/Mess Deck

The Galley/Mess Deck is accessible from the Crews Berthing aft through a joiner door and from the Passage aft of the Fidley through a joiner door and down a ladder.

2.1.1.5. Crews Berthing

The Crews Berthing is accessible from the Mess Deck forward through a joiner door and from the weather aft through a watertight door.

2.1.1.6. After Steering

The After Steering contains the steering gear and is accessible from the Weather Deck through a watertight hatch in the overhead on the centerline.

2.1.2. The Bridge Deck

The Bridge Deck contains the Bridge, Fidley, Passageway, Head and various lockers for storage of equipment. The following is a description of the compartmentation and significant characteristics pertinent to firefighting in compartments on this deck:

2.1.2.1. Bridge

The Bridge is accessible from the weather on the port and starboard sides through watertight doors and from the Fidley aft through a joiner door.

2.1.2.2. Fidley

The Fidley can be accessed from the Passageway aft up a ladder and through a joiner door from the Galley/Mess Deck or from the Bridge through a joiner door or from the weather through a watertight door on the port side.

2.2. Diesel Engine Shutdowns

The main propulsion diesel engine and diesel-driven ship service generator can be started and stopped locally in the Engine Room. Remote fuel shutdowns for the main engine and generator are located at 01-21-1, 2, 3, & 4 on the Bridge.

2.3. Ventilation

The ventilation on this cutter consists of a supply and exhaust fan in the Engine Room. The controllers are located in the Passageway at 01-26-1 & 3 for the exhaust and supply fans respectively. The supply vent is located at 01-25-2 and the exhaust vent is located at 01-25-1.

2.4. Fire Detection Equipment

The Crews Berthing and the Galley/Mess Deck has one ionization type, battery powered, residential type, smoke detector installed in each compartment. The Engine Room is equipped with four temperature rate of rise fire detectors. There is no automatic fire or smoke detection system installed in any of the other compartments.

2.5. Firefighting Equipment

2.5.1. Firemain Stations

There is one firemain station on the cutter located at 01-20-2 on the Weather Deck which is pressurized from the electric fire pump located in the Engine Room.

2.5.2. P-250 Mod 1 Pump

The P-250 Mod 1 portable pump can provide an alternate source of firefighting water pressure.

2.5.3. Portable fire extinguishers

Portable PKP and CO₂ fire extinguishers are located throughout the cutter to facilitate first aid. Table C-65WLI-1 shows the number and locations of such extinguishers.

TABLE C-65WLI-1 LOCATION OF PORTABLE EXTINGUISHERS

Location	Number of Portable Extinguishers	
	CO ₂	PKP
Engine Room	1 15-lb	1 5-lb
Main Hold	1 15-lb	
Galley/Mess Deck	1 15-lb	1 2.5-lb
Crews Berthing	1	

2.5.4. Protective Equipment

Two (2) Navy Type A-4 oxygen breathing apparatus (OBA) and one (1) firefighting ensemble (FFE) are stowed in the cutter. There are twelve (12) canisters per OBA.

2.5.5. Desmoking Equipment

There is no portable desmoking equipment in this class cutter.

3. Firefighting Procedures

In this section, 8 different shipboard fire scenarios are described. The recommended procedures for fighting each fire are detailed, from the alarm through post-fire activities. The last procedure is for fires in port.

3.1. Peak Tank

3.1.1. Scenario

The most likely fire in the Peak Tank is a Class A fire in the various materials stored in this compartment.

3.1.2. Confining the Fire

The primary fire boundaries are the bow forward and bulkhead 5 aft, the Main Deck and the hull.

3.1.3. Sizeup

The Peak Tank is normally unoccupied. The egress route is through a watertight hatch on the centerline to weather. Therefore there is a remote possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.1.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.1.5. Indirect Attack

A fire in the Peak Tank may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch on the Weather Deck without entering the Peak Tank. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.1.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Peak Tank through the watertight hatch from the Weather Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he should not enter the Peak Tank without an OBA. The hose tender should wear an OBA, but should not enter the Peak Tank.

3.1.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket

of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.1.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Weather Deck and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting in the Peak Tank.

3.2. Main Hold

3.2.1. Scenario

The most likely fire in the Main Hold is a Class A fire in the various materials stored in this compartment.

3.2.2. Confining the Fire

The primary fire boundaries are bulkhead 5 forward, bulkhead 20 aft, the Main Deck and the hull.

3.2.3. Sizeup

The Main Hold is normally unoccupied. The egress route is through watertight hatch 1-11-0 on the centerline of the Hold to weather. Therefore, there is a remote possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.2.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.2.5. Indirect Attack

A fire in the Main Hold may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari-nozzle through the hatch in the Main Hold that leads to weather without entering the Main Hold. Use a 1.5" fire hose equipped with a vari-nozzle to cool the Main Deck and other fire boundaries as needed.

3.2.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Main Hold through the watertight hatch from the Main Weather Deck with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he should not enter the Main Hold without an OBA. The hose tender should wear an OBA, but should not enter the Main Hold.

3.2.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.2.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Weather Deck and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting in the Main Hold.

3.3. Engine Room

3.3.1. Scenario

The most likely fire in this compartment is a Class B spray fire as a result of a ruptured lube oil or fuel oil line on the main engine. A Class C fire is also likely in a controller, switchboard, or motor.

3.3.2. Confining the Fire

The primary fire boundaries are bulkhead 20 forward, bulkhead 30 aft, the Main Deck, and hull. Note the Fidley is separated from the Engine Room by an open ladder, therefore the outer boundaries of the Fidley also form boundaries for an Engine Room fire. The Engine Room supply and exhaust fans shall be secured and the main engine shall be secured. The ship service generator shall be secured in the event of a Class B fire but need not be secured for a Class C fire (unless it is the source of the fire). If the ship service generator is secured, it is crucial that the P-250 Mod 1 pump be energized as a backup source of firefighting water.

3.3.3. Sizeup

The Engine Room in this cutter is normally unmanned, and the ease of egress upward through the Fidley make it unlikely that personnel will need to be rescued. Class B spray fires may be efficiently extinguished by securing the source of the fuel and then applying AFFF from a 1.5" hose. The CO₂ total flooding system installed in the Engine Room shall be released only if the source of the fuel in a spray fire can be secured. Halon 1301 is the most efficient means of extinguishing a flammable liquid spray fire, but Halon 1301 is not installed in this cutter class. Class C fires are best extinguished with CO₂.

3.3.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on a Class B fire and a CO₂ portable extinguisher on a Class C fire. A flammable liquid spray fire shall be immediately declared out of control; first aid should not be attempted for a flammable liquid fire out of control.

3.3.5. Indirect Attack

If the personnel in the Engine Room can be evacuated, ventilation fans and internal combustion engines secured, and the Engine Room mechanically isolated by closing all access fittings, the installed CO₂ total flooding system can be used with the permission of the OinC to extinguish the fire with minimal risk to personnel. A Class C fire in the switchboard, motor, or controller shall be attacked directly as described in the next section. Caution: The CO₂ system will flood the Engine Room with a lethal concentration of CO₂.

3.3.6. Direct Attack

When the scene leader directs, the firefighting hose team should enter the Fidley through watertight door 1-25-2 from the Weather Deck and down the ladder into the Engine Room with a 1.5" fire hose configured to apply AFFF. This attack will be futile unless the fuel source is secured first. The nozzleman should be dressed out in the FFE and should not enter the space without an OBA. The hose tender should wear an OBA, but should not enter the space. A Class C fire shall be attacked directly, by first securing the source of electrical power, then attacking the remaining Class A or B fire with PKP or CO₂ portable extinguishers. Caution: The CO₂ system will flood the Engine Room with a lethal concentration of CO₂.

3.3.7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the

supply and exhaust fan on high for at least 15 minutes after the Engine Room atmosphere has been tested and proven free of flammable gases.

3.3.8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Weather Deck and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting in the Engine Room.

3.4. Mess Deck/Galley

3.4.1. Scenario

The most likely fire in this compartment is a Class C fire in the electronics equipment such as the stereo, TV or microwave. There is also a significant possibility of a Class A fire in the foam cushions on the Mess Deck benches. There is also a good possibility of a Class B grease fire on the stove in the Galley.

3.4.2. Confining the Fire

The primary fire boundaries are bulkhead 30 forward, bulkhead 35 aft, the Main Deck, and hull.

3.4.3. Sizeup

Crewmembers are likely to be awake and alert in the Mess Deck/Galley. In addition, there is ease of egress forward to the Fidley and aft to weather through Crews Berthing. Therefore, there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are most efficiently extinguished with CO₂ when electrical power is secured; however, a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire. Class B fires are efficiently extinguished with PKP if the fire is small and with AFFF if the fire is larger.

3.4.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher on Class A and B fires and a CO₂ portable extinguisher on Class C fires.

3.4.5. Indirect Attack

Due to the compartmentation on this cutter class an indirect attack on a fire in Galley/Mess Deck is not feasible. Use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.4.6. Direct Attack

Class C fires in the Galley/Mess Deck should be extinguished with a portable CO₂ extinguisher after the electrical power to the affected equipment is secured and then attacking the remaining Class A fire with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The firefighting hose team should enter the Galley/Mess Deck from the Crews Berthing aft through watertight door 1-40-2. The nozzleman should be dressed out in the FFE if time permits, he should not enter the Galley/Mess Deck without an OBA. The hose tender should wear an OBA, but should not enter the Galley/Mess Deck. Class B fires should be attacked directly with PKP portable extinguishers if the fire is confined to the stove area in the Galley. If the Class B fire has spread, the fire should be attacked directly with water fog or AFFF.

3.4.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.4.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Weather Deck and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting in the Galley/Mess Deck.

3.5. Crews Berthing

3.5.1. Scenario

The most likely fire in this compartments is a Class A fire in bedding materials.

3.5.2. Confining the Fire

The primary fire boundaries are bulkhead 35 forward, bulkhead 40 aft, the Main Deck and hull.

3.5.3. Sizeup

Due to the likelihood of sleeping crewmembers in this space there is a good possibility that personnel may need to be rescued. There are no Emergency Evacuation Breathing Device's (EEBD's) in this space; egress is possible forward through the Galley/Mess Deck and up to the Fidley to weather or aft directly to weather. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.5.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.5.5. Indirect Attack

An indirect attack on a fire in Crews Berthing is possible through watertight door 1-40-2 from the Weather Deck without entering the space using a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.5.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the Crews Berthing from the Weather Deck through watertight door 1-40-2 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he should not enter the Crews Berthing without an OBA. The hose tender should wear an OBA, but should not enter the Crews Berthing.

3.5.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.5.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Weather Deck and energized as a backup source of firefighting water.

Secure electrical power with the exception of lighting in the Crews Berthing.

3.6. After Steering

3.6.1. Scenario

The most likely fire in this compartment is a Class A fire.

3.6.2. Confining the Fire

The primary fire boundaries are bulkhead 40 forward, the transom aft, the Main Deck and the hull.

3.6.3. Sizeup

This space is normally unoccupied so there is little likelihood that personnel will need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.6.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.6.5. Indirect Attack

An indirect attack is feasible through the hatch on the Weather Deck with minimal risk to personnel. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position. Use a 1.5" hose equipped with a vari-nozzle set to the water fog position to cool the Main Deck and other fire boundaries as needed.

3.6.6. Direct Attack

If the scene leader decides that a direct attack is needed, the firefighting hose team should enter the After Steering from the Weather Deck through watertight hatch 1-40-1 with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he should not enter the After Steering without an OBA. The hose tender should wear an OBA, but should not enter the After Steering.

3.6.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.6.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Weather Deck and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting in the After Steering.

3.7. Bridge

3.7.1. Scenario

The most likely fire in the Bridge is a Class C fire in the electronics equipment located in this space. There is also a significant possibility of a Class A fire in conjunction with the Class C fire.

3.7.2. Confining the Fire

The primary fire boundaries are the superstructure forward, bulkhead 24 aft, the superstructure port and starboard and the Main Deck.

3.7.3. Sizeup

Due to the ease of egress to weather from the Bridge the likelihood of personnel being trapped is remote. Class C fires are usually extinguished when electrical power is secured, however a Class A fire may be burning in conjunction with the equipment that was the cause of the Class C fire.

3.7.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a CO₂ portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

3.7.5. Indirect Attack

A Class A fire in this space may be indirectly attacked through watertight door 01-22-1 or 2 from weather with a minimal risk to personnel. Enter the Bridge from the watertight door to weather which is upwind. Use a 1.5" hose equipped with a

vari-nozzle set to the water fog position. A Class C fire should be extinguished by securing the electrical power to the affected equipment first. Use a 1.5" fire hose equipped with a vari-nozzle to cool the superstructure and Main Deck as needed.

3.7.6. Direct Attack

A Class C fire in the Bridge should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining Class A fire directly. (Charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The firefighting hose team should enter the Bridge through watertight door 01-22-1 or 2 depending on the location of the fire with a 1.5" fire hose equipped with a vari-nozzle set to the water fog position. The nozzleman should be dressed out in the FFE if time permits, he should not enter the space without an OBA. The hose tender should wear an OBA but should not enter the Bridge.

3.7.7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.7.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Weather Deck and energized as a backup source of firefighting water. Secure electrical power with the exception of lighting to the Bridge.

3.8. In Port Fires

3.8.1. Scenario

The most likely fire in port is a Class A fire in the Crews Berthing in bedding materials. A Class B fire in the Galley is the next most likely fire in port.

3.8.2. Confining the Fire

The primary fire boundaries are stated above and depend on the involved compartment.

3.8.3. Sizeup

Due to the likelihood of sleeping crewmembers, there is a strong possibility that personnel may need to be rescued. There are no EEBD's in this class of cutter. Class A

combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

3.8.4. First Aid

If the fire is discovered when it is small enough to attempt first aid, the person discovering the fire should use a PKP portable fire extinguisher.

3.8.5. Indirect Attack

An indirect or direct attack can only be attempted in the event additional help arrives on scene. This help can come from another Coast Guard cutter, the Group or Station where the cutter is berthed, or from the local fire department. An indirect attack may be attempted as described in Sections 3.1 through 3.7 above for the particular compartment involved. Preplanning for in port fires and the familiarity of the local fire department with the cutter and this doctrine are considered extremely important.

3.8.6. Direct Attack

A direct attack may be attempted if the scene leader directs in accordance with the procedures described above for the particular compartment involved. The scene leader is the person on watch (in a one man duty section) until properly relieved by the normal scene leader in the crew or by a qualified person in the firefighting team from the local fire department.

3.8.7. Post-fire Activities

Smoldering materials should be jettisoned, with the Commanding Officer's permission, overboard or soaked in a bucket of water on the Weather Deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

3.8.8. Other Actions

During firefighting actions the investigator shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 Mod 1 pump shall be rigged on the Weather Deck and energized as a backup source of firefighting water. Secure electrical power at the shore connection box.