FIREBOAT PRACTICES

SAN FRANCISCO FIRE DEPARTMENT

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Fireboat Practices
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FOREWORD

The goal of this manual is to establish standard operating practices as authorized by the Chief of Department and implemented by the Division of Training.

The purpose of this manual is to provide all members with the essential information necessary to fulfill the duties of their positions, and to provide a standard text whereby company officers can:

- Enforce standard drill guidelines authorized as a basis of operation for all companies.
- Align company drills to standards as adopted by the Division of Training.
- Maintain a high degree of proficiency, both personally and among their subordinates.

All manuals shall be kept up to date so that all officers may use the material contained in the various manuals to meet the requirements of their responsibility.

Conditions will develop in fire fighting situations where standard methods of operation will not be applicable. Therefore, nothing contained in these manuals shall be interpreted as an obstacle to the experience, initiative, and ingenuity of officers in overcoming the complexities that exist under actual fire ground conditions.

To maintain the intent of standard guidelines and practices, no correction, modification, expansion, or other revision of this manual shall be made unless authorized by the Chief of Department. Suggestions for correction, modification or expansion of this manual shall be submitted to the Division of Training. Suggestions will be given due consideration, and if adopted, notice of their adoption and copies of the changes made will be made available to all members by the Division of Training.

Joanne Hayes-White
Chief of Department

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SECTION 1. INTRODUCTION

The Port of San Francisco is owned by the City of San Francisco and is administered by the San Francisco Port Commission. The facilities operated by the Port Commission include:

- Numerous deep water docks and general cargo piers
- Foreign free trade zone
- Facilities for fishing boats at the Fisherman's Wharf
- Protected shoal free anchorage.

Private facilities of the Port include:

- Container off/on loading terminal
- Bulk vegetable oil and petroleum oil storage tank yards
- Ship building and ship repair yards
- Lumber yards
- Gas and electric power plants
- Various types of industrial and commercial structures.

In addition, the United States Government maintains US Army, Navy, and Coast Guard facilities within the Port area. The City of San Francisco also maintains a Yacht Harbor and Aquatic Park on the water frontage of the Port.

In most cases, the San Francisco Fire Department is responsible for fire fighting, marine safety, and rescue involving any vessel or waterfront facility within the area of the Port of San Francisco. These types of incidents often develop into difficult operations. Fires may occur on passenger ships, freighters, towboats, oil or gasoline tankers and barges, or on other types of vessels. Ship fires may develop while the vessel is accessible to land fire fighting apparatus or may occur while the vessel is in the bay, anchored or under way, where it can be approached only by a fireboat.

Piers and wharves have special characteristics that present serious fire fighting problems. They are accessible to land fire fighting apparatus from one end only. Pier and wharf functions include:

- Furnishing berthing facilities for vessels of all kinds
- Shelter during loading and unloading operations
- Facilities for assembling and classifying freight
- Facilities for the repair of vessels
- Means for transfer of freight between vessels and trucks or railway freight cars

- Facilities for handling passenger traffic.

The Fire Department provides response of fire apparatus, equipment, and personnel to all land areas within the Port. Additionally, the Fire Department will respond to vessel, marine emergencies and shore structure fires with one or two fireboats. The Phoenix is the front line fireboat, with the Guardian used as a reserve fireboat. The Department is responsible for staffing and maintenance of the fireboats.

Both fireboats are quartered at Station 35 located at Pier 22 1/2 at the foot of Harrison Street.

The San Francisco Port Commission also has established an office of Port Fire Marshal, staffed by San Francisco Fire Department personnel, whose primary duty is to enforce all regulations pertaining to fire safety as they affect the facilities under control of the Port Authority. The Port Fire Marshal also acts as liaison officer between the office of the Chief of Department and the office of the San Francisco Port Commission.

Through mutual fire protection agreement, other marine Bay Area fire fighting assistance is available when requested by the Department. This assistance includes the Oakland Fire Department fireboat, and auxiliary fire fighting equipment maintained on federal, state, and privately owned craft.

The following subjects set forth standard practices for the operation and use of the fireboats Phoenix and Guardian, their equipment, and standard fire fighting procedure concerning ship fires and fire involving marine facilities. The experience, initiative, and ingenuity of the fireboat pilots, engineers, Chief and Company Officers is essential in the extinguishment of fire involving vessels and waterfront facilities.

SECTION 2. SAN FRANCISCO FIREBOATS

SAN FRANCISCO FIREBOAT #1—PHOENIX

Specifications

Builder: Plant Marine Engineering
Where: Alameda, California
Year Built: 1954
Length: 89 feet
Beam: 19 feet six inches
Draft: 7 feet
Displacement: 146 tons
Propulsion: Twin screw

*Reconstructed in 1985 ($1.4 million)

Crew:	1 Fireboat Officer, 1 Pilot, 1 Engineer, 1 Engine Company Officer, 3 Firefighters	
Engines:	#1(Pump Engine only)	Cummins NVHMS-1200 Diesel, Rated 480 BHP @ 2100 RPM
	#2 & #3 (Propulsion Pump)	6 Cylinder Turbocharged Diesels Rated 520 BHP @ 1950 RPM
Generators:	Twin GM-2-71 Diesels each driving a 60 cycle 3 Phase, 30 KW Generator	
Pumps:	Three Delaval two stage centrifugal pumps, each rated @ 3,200 GPM @ 150 PSI	
Fuel:	3,600 gals. Diesel (34 hrs. pump-time or 19.5 million gals. of water)	
Hose:	3,000 feet of 3” line in aft hold; 700 feet of 1 ½” line in fwd hold	
Monitors:	Top of pilot house, 3,000 GPM Bow and Stern, Main Deck, 3,000 GPM Tower, 2,000 GPM – 32 ft. above waterline (Extends to 48 feet) Tip sizes: 1 ½” to 3”	
Under pier Nozzles	One each, Port and starboard, rated @ 1,000 GPM	
Maneuvering Jets:	Fore and Aft each side, 8” above waterline, 1 ½” outlets, controlled from pilot house	

Foam System:	Duplex proportioner system in engine room, controlled from pilot house and aft cabin. One 200' hose reel line in aft cabin; one 50' hose reel line in engine room.
Co2 Sysyem	Eight 100 lbs cylinders at the main deck level, controlled from the pilot house. One 150' hose reel line, main deck, starboard midship.
Hydraulic Applications:	Maneuvering Jets, Under-pier nozzles, Tower System, Steering, and Crane
Air Compressors:	Two Quincey 340, Rated @ 150 PSI. Used to start all engines, gear boxes, throttle control, and ship's whistle.
Crane:	Mounted on aft cabin, 600 lbs. capacity, with 20 foot reach. Auto-Crane brand.
Communications:	SFFD - One SFFD 800 Mhz Motorola Radio One Motorola 1 Ch. VHF (154.28) Marine - Two ICOM M-80, VHF, 74 Ch. P.A./Hailer, Cybernet CTX 1000, 4 station intercom
Depth Sounders:	One Raytheon V 800 Color echo with dual frequency capability One Standard Digital unit with depth alarm
Pilot House:	Pilot's console: engine and throttle controls, radar scope and controls, communications equipment, maneuvering jet controls, under-pier nozzle controls
Engineer's Console:	#1-Pilot house, all pumping controls #2-Engine room, all pumping and engine controls
Specific Equipment:	-One 12' skiff with 30 H.P. outboard motor, center steering -One Divers' monitor (Landy float) -Eight wet suits, various sizes -One portable pump, Honda rated @ 130 GPM @ 150 PSI -Seven 1-hour SCBA's with spare bottles -Resuscitator, defibrillator, first aid equipment -Forcible entry tools, general Firefighting tools, brass fittings -One air-driven jack hammer, heavy duty -One chain saw -One oxy-acetylene cutting assembly
Flood Lights:	Four Halogen flood lights, 500 watts each, two forward and two aft
Search Lights:	Two Perko 10" 1000 watt, mounted on the pilot house

Portable Lighting:	Four 200 watt portable lights Four 100’ extension cords One 1500 watt portable generator
Water Evacuation:	Two eductors, large line One Homelight salvage pump, 200 GPM
Life Raft:	One self-inflating, covered, survival type, 30 person

SAN FRANCISCO FIREBOAT (#2)—GUARDIAN

Specifications

Builder: Milne, Gilmore & German Co.
Where: Vancouver, British Columbia

Year Built:	1951
Length:	88 feet
Beam:	21 feet six inches
Draft:	7 feet
Displacement:	180 tons
Propulsion:	Twin screw

*Reconstructed in 1972 (Diesel engines installed)

Crew:	1 Fireboat Officer, 1 Pilot, 1 Engineer, 1 Engine Company Officer, 3 Firefighters (Fireboats 1 and 2 are not normally staffed simultaneously)
Engines:	Two GM Detroit Diesels Model 16V-71, Rated 535 SHP @ 2100 RPM (Propulsion or Pump Mode) Three GM Detroit Diesels Model 12V-71, Rated @456 BHP @ 2100 RPM (Pump Mode Only)
Generators:	Two GM Detroit Diesels Model 3-71 N, Series, Rated @ 60 BHP@ 2100 RPM. Each drives a 60 cycle, 3 phase, 120/208 Volt 30 KW generator.
Pumps:	Five 2-stage centrifugal pumps, each rated @ 4800 GPM @ 150 psi.
Fuel:	6,500 gals. Diesel in main tanks, 250 in “day” tank
Hose:	3,000 feet of 3” on the main deck 400 feet of 1 ½” on the main deck
Monitors:	9,000 GPM (using 5 ½” tip), bow monitor 9,000 GPM each, port and starboard midship monitors 3,000 GPM Tower (fixed @ 35’ above waterline)
Under-pier Nozzles:	One each, Port and Starboard, rated @ 1,000 GPM
Maneuvering Jets:	Fore and Aft, port and starboard (total of four)
Foam System:	One 2 ½” eductor

	One 1 ½" eductor 1,500 gals. AFFF – 6% ATC in tow aft tanks
CO2 System:	Eight 100 lbs. cylinders at the main deck level, controlled from the pilot house.One 150' hose reel line, main deck, starboard midship.
Hydraulic applications	Steering system only.
Air Compressors:	Two Quincey 340, Rated at 150 psi. Used for throttle controls, all gear box controls, ship's whistle.
Communications:	SFFD -One SFFD 800 Mhz Motorola Radio One Motorola 1 Ch. VHF (154.28) Marine -Two Ray 90 VHF Multi-Ch. P.A./Hailer
Depth Sounders:	One Furuno Mod FCV. – 661 (color)
Radar:	Furuno Model 8050 with 48 mile capability
Pilot House:	Pilot's Console: Engine/Throttle controls (remote control stations on top of Pilot House and on deck, aft of pilot house). Radar scope and controls, Communications equipment, Maneuvering jet controls, under-pier nozzle controls.
Engineer's Console:	#1-Pilot house, all pumping controls #2-Engine room, all pumping and engine controls
Specific Equipment:	-One 12' skiff w/ 30 H.P. outboard motor, center steering -One Divers' monitor (Landy float) -Eight wet suits, various sizes -One portable pump, Honda, rated @ 130 GPM @ 150 psi -Seven 1-hour SCBA w/ spare bottles -Resuscitator, Defibrillator, first aid equipment -Forcible entry tools, general firefighting tools, brass fittings -One chain saw -One oxy-acetylene cutting assembly
Flood Lights:	Nine Halogen, 500 watts each
Search Lights:	Two Perko 10" 1,000 watt, on top of the Pilot house
Water Evacuation:	One eductor, large line One Prosser pump
Life Raft:	One self-inflating, covered, survival-type, 30 person

FOAM EQUIPMENT

Fireboats have two methods of producing foam for the extinguishment of Class B fires:

- Portable foam equipment
- Fixed installation

The forward monitors and the 3” gated outlets are normally supplied from the fixed installation although all outlets can be supplied by the fixed system. Both the monitors and the 3” outlets are charged with foam at the same time.

The 1 1/2 inch inlet foam eductors are identical to those carried on engines. The fireboat also carries large line eductors which operate the same as the 1 1/2" inch eductors. Explanation of their use is contained in the Hose and Hose Appliance Manual.

The fireboats are also equipped with portable foam nozzles with pickup tubes stored in the forward hold. Each fireboat foam nozzle is provided with a 2 1/2 inch swivel female hose connection, a 3-inch tip and a liquid foam pickup tube. Operation of the fireboat foam nozzle consists of connecting the nozzle to a hose line, and placing the pickup tube into a container of liquid foam. Then, water under proper pressure (100 PSI) is supplied to the nozzle. Fifty 5-gallon and two 55-gallon containers of AFFF are carried on the fireboats.

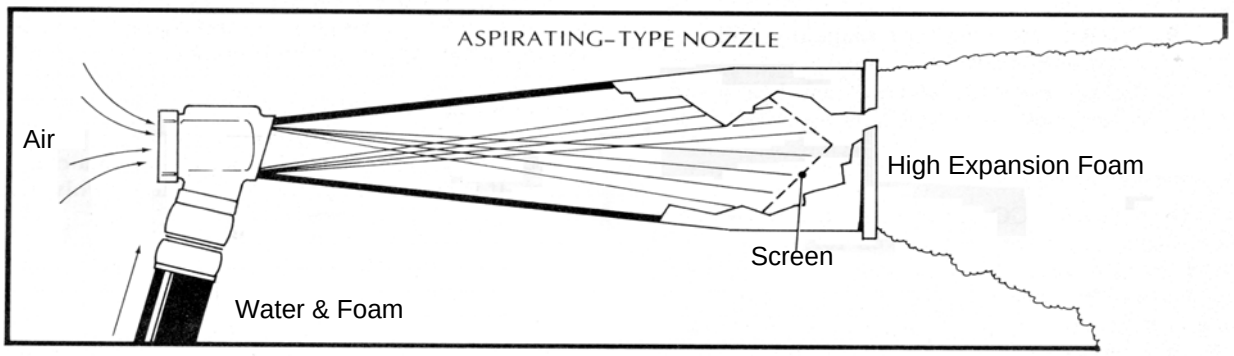
Valves for the control of foam generation by the fixed system are under the supervision of the fireboat engineer. The entire system will be charged unless the forward valve is closed.

Foam produced from this fixed installation is also supplied to the gated outlets at the front of the pilot house for use of hand held foam generating nozzles. It should be remembered that, when foam is requested for any of the four outlets or for the forward monitor, both systems are charged simultaneously with foam. Since it is SFFD policy to backup foam lines with fog streams, it will then be necessary to supply such backup lines from the 3-inch gated outlets located amidships.

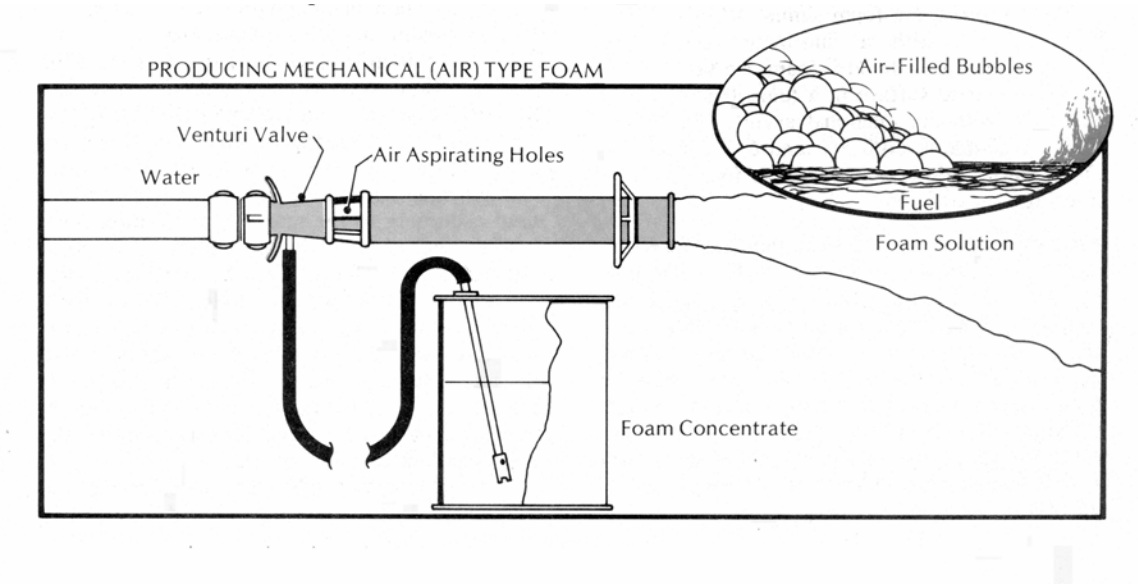
The efficiency of foam application for the control of flammable liquid fires involving vessels or port facilities depends on its proper use. The primary effect of foam is the exclusion of oxygen from the burning surface. It is important that a large smothering blanket of foam be applied to the surface as quickly as possible. Avoid directing the full force of a foam stream directly into a tank or spill area of flammable liquid as this action will create unnecessary turbulence and prevent the formation of a foam blanket. Flow the foam stream gently over the burning surface or deflect the stream off the side of the tank, bulkhead, pier, etc. If the fire involves a room enclosure, it may be necessary to cover its entire surface. If the fire involves open tanks, it is often necessary to cover the area

immediately surrounding the tank with foam to prevent flashback. If the hazard involves a spill, work against the run of the spill, either directly or from the flanks, toward the point of origin.

When using foam, always have hose lines equipped with fog nozzles on hand for protection in the event the foam supply is exhausted before additional supply may be obtained.



Production of high expansion foam. High velocity air strikes the water and foam concentrate solution at the stream, producing the foam.



CARBON DIOXIDE EQUIPMENT

The Fireboats are equipped with CO2 extinguishing systems which provide for Class "B" and "C" fire extinguishment on the Fireboats themselves as well as for extinguishment of such fires on other vessels or at water front facilities. The protective system for the fireboat consists of a piping system with fixed outlets in

the forward and after holds and a hand controlled nozzle connected to a 50 foot hose reel on the port side of the engine room. A hand controlled nozzle connected to a 200 foot hose reel for fire extinguishment on other vessels or on use is installed in the after deck house.

Carbon dioxide is supplied to the fixed nozzles and hand controlled nozzles through a piping system connected to a manifold of 100 lb. CO2 cylinders installed on the boats. The cylinders will allow approximately eight to ten minutes of operation when the hand controlled nozzle is kept continually open and when all the cylinders have been released.

NOTE: Use of the CO2 systems will be under the supervision of the Marine Engineer ONLY.

Safety Precautions and Limitations

Carbon dioxide has several outstanding advantages as an extinguishing agent. It leaves no residue, causes little, if any, damage to the materials to which it is applied, and it is a nonconductor of electricity. Its use for the control of Class "B" and "C" fires is well known. Typical applications include fire extinguishment or protection in enclosures containing stock or cargo through which the CO_2 gas may penetrate and where extinguishment or protection by water or foam may be ineffective or undesirable. Other applications are: machinery spaces, flammable liquid lockers, engineer storerooms and engine compartments of motor craft. The use of CO_2 on ship fires has some limitations:

- Carbon dioxide gas is 1 1/2 times heavier than air at ordinary temperature and atmospheric pressure. It is odorless and colorless. Carbon dioxide, like any other inert gas, may cause suffocation due to oxygen deficiency if high concentrations are breathed for extended periods of time. The use of self-contained breathing apparatus is mandatory for fire fighters when using CO_2 in confined shipboard areas or when entering a confined area in which CO_2 has been discharged.

- CO_2 is ineffective for the extinguishment of cargo that contains enough oxygen to support its own combustion, e.g., celluloid. Cargo fires that contain a certain supply of oxygen, such as air trapped in the spaces between cotton fibers, are often difficult unless sustained total flooding can be maintained. The SFFD has very effectively used CO_2 for total flooding of cargo holds containing such cargo. Large mobile tank trucks of CO_2 are available in the Bay Area for such purposes.

- It is often difficult for CO_2 to penetrate cargo in a ship's hold, such as, to the center of smoldering materials, inside tightly packed bales, or to spaces blocked off by cargo, unless applied from a ships system.

- The use of CO_2 near the top of a ship's hold will not necessarily be an effective extinguishing agent due to its tendency to mix or diffuse with air.

OXY-ACETYLENE CUTTING EQUIPMENT

The Fireboats are provided with a portable oxy-acetylene cutting unit complete with all necessary attachments.

The acetylene cutting unit is a very necessary part of fireboat equipment. At many ship fires it may be necessary to cut holes through metal decks, bulkheads, or through the hull in order to reach the fire with hose streams and circulators. It may be necessary to burn off door hinges or locks as well as to cut holes through decks or bulkheads in order to facilitate rescue operations. Frequently, holes must be cut in hulls to release water in flooded upper deck spaces to prevent the vessel from listing dangerously and capsizing.

All cutting operations require a skilled knowledge by the personnel of the fireboat in the use of the cutting unit. Equally important is a thorough knowledge of ship construction and of the nature of the cargo in the vessel. Before starting any oxy-acetylene cutting operation aboard vessels, the officer in command of the operation must consult with the ship's Master, Mates, Engineers or other responsible personnel who are familiar with the construction of the vessel and the nature of the cargo. Their advice is essential to avoid endangering the watertight integrity of the vessel, to avoid starting or spreading of fire through the ignition of combustible cargo or gases in adjacent compartments, and to avoid damage to equipment, such as, electrical conduit and cable.

Holes for the use of hose streams should always be cut large enough to permit unrestricted use of hose lines or nozzles. Holes for the release of confined water

should be cut slightly above the deck of the flooded compartment. Such holes should be cut in a diamond shape with the cut started at the bottom of the hole to prevent released water from extinguishing the torch flame. Holes to be cut through the hull for the release of water may be positioned properly by using the port holes and rivet rows as a guide. It is seldom advisable to cut holes in the hull below the "tween" decks as any subsequent list of the vessel may cause flooding of the hold and result in capsizing or sinking.

Charged hose lines should always be on hand before starting any oxy-acetylene cutting operation to prevent the ignition of adjacent combustible material by sparks, conduction, or for the extinguishment of any adjacent fire..

PERSONAL FLOTATION DEVICES

All regular and deployed members shall be required to wear approved USCG personal flotation devices while the fireboat is underway and operating. The fireboat officer and pilot shall ensure compliance.

SELF CONTAINED BREATHING APPARATUS (SCBA)

Self contained breathing apparatus are carried in the after deckhouse aboard the Phoenix for use when necessary to enter areas that are deficient in oxygen or are contaminated with smoke or toxic gases.

Breathing apparatus is carried for the officer, pilot, and engineer should the boat be required to moor in a contaminated environment while pumping for a long period of time.

It is SFFD policy at fires not accessible to land apparatus, that a Rescue Squad will be taken on board and assigned to fire fighting or rescue operations.

This policy has been adopted because the fireboat crew is usually fully occupied in mooring operations, raising boarding ladders and providing hose lines and other equipment for use at the fire area. To augment this policy, Department procedure requires that in the event the fireboat is summoned to an offshore fire, Box 900 shall be immediately struck.

A thorough description of self contained breathing apparatus, its proper maintenance and use, is contained in the SCBA Manual.

NOTE: NEITHER TURNOUT CLOTHES NOR TURNOUT BOOTS ARE PROPER EQUIPMENT FOR ON-BOARD FIREBOAT DUTY. Companies required to respond with the fireboat should wear regulation work shoes and station uniforms. However, turnout equipment should be brought on board by the responding Engine Company/Rescue Squad.

OTHER EQUIPMENT

McCulloch Portable Generator

The Fireboat carries a portable generator, rated at 750 watts, complete with 2 portable quartz lights. The Fireboat also has a generator that produces 120/240 vac. There are four outlets for this system on the deck.

Air Compressor

There are 2 air compressors in the engine room: one on the port side and one on the starboard side. An air hose outlet is provided on deck, aft of the forward deck house.

Grapnel & Grappling Hooks

The grapnel hook and chain, and the large grappling hooks carried in the forward hold of the Phoenix, are used as a grab where use of the anchor or the mooring lines is impractical.

The grappling hooks carried in the forepeak of the Phoenix consist of steel hooks, the long shanks of which are welded together and end in an eye to which a rope or chain may be attached. These may be used as a grapnel hook to drag bales or to pull down unsafe walls and partitions. They are also used to drag the bay for submerged large objects. Their use to recover submerged human bodies is not practical due to the fact that they cover only a small drag area and seldom will attach to the body due to the large size of the hooks.

SECTION 3. FIREBOAT OPERATIONS

PERSONNEL

The Fireboats are staffed by:

- One officer
- One pilot
- One engineer

Fireboat personnel are subject to the provisions of all other Rules and Regulations and Department Orders governing their particular classification.

The Captain of the Fireboat is the Commanding Officer and is specifically charged with the proper supervision, discipline, and coordination of the duties of the firefighters, pilots and engineers. In the Captain's absence, the on-duty Lieutenant shall assume the responsibilities of the Captain. Pilots and engineers shall be responsible to the Captain for the strict observance of their duties which are specifically regulated by federal and state maritime law. The pilot and engineer are licensed by the USCG.

The departmental responsibilities of the fireboat pilots and marine engineers are set forth in the Rules and Regulations. The Captain shall assign deck stations to all members of the fire fighting crew and shall designate qualified members to assist the pilot whenever the fireboat is required to tie up to or to get under way from moorings. It is the duty of the Company Officer to see that the orders of the pilot regarding mooring, navigation, and the safe handling of the vessel are promptly and efficiently carried out. When the fireboat is underway, firefighters are assigned to act as lookouts, and to assist the pilot as necessary. Qualified members are also assigned to relieve the pilot at the steering wheel when necessary.

The pilot of the fireboat is solely responsible for the proper and safe navigation of the vessel. When approaching a vessel or shore facility involved with fire or other emergency, the pilot shall comply with the Captain's orders, or those of the Incident Commander as regards to the position at which to place the fireboat in so far as they are consistent with the safety of the vessel.

FIREBOAT COMMUNICATIONS

Both fireboats are equipped with identical communications systems. The Crew communicates with the SFFD 800 Mhz. Motorola radio system. For marine communications there are two ICOM M-80 74 channel VHF radios, and a marine portable. Other parties can be contacted with a Cybernet CTX-1000 hailer. For

remote communications, such as communications between fireboat and skiff, the Department portable radios are used. A cellular phone is also provided.

The fireboat is assigned radio call signal, "Fireboat 1". Whenever the fireboat is ordered to leave quarters for the purpose of an alarm, a drill, an inspection, or a display, the pilot shall turn on and monitor the Department radio until relieved by the Captain or the pilot house watchman.

When responding to shore side fires or emergencies or to a ship moored to a pier or wharf, the Incident Commander will advise the Captain of the fireboat by radio, whether or not the service of the fireboat is required. If the fireboat is not required, the Captain will be ordered to return the fireboat to quarters.

If the service of the fireboat is required, the Incident Commander will advise the Captain of the desired position for the fireboat and the equipment to be used. The Captain shall then make such equipment ready for service and also consult with the pilot as to the safety of the position ordered. If, on nearing the location of shoreside response, the Captain has not received instruction from the Incident Commander, he/she shall make every effort to contact the Incident Commander by radio, for such instruction. This procedure is essential to enable the pilot to consult his charts regarding depth of water, tides, underwater obstructions, etc. Should the pilot consider the position as ordered by the Incident Commander to be unsafe, the Captain shall immediately advise the Incident Commander by radio and request an alternate position. The maintenance of a constant fireboat radio watch is of utmost importance.

When response is to an offshore emergency, the Captain shall maintain constant radio communication with the Communications Center and keep the Communications Center fully informed as to the condition found at the emergency and of the action taken.

It is important that radio communication be maintained between the fireboat and the Incident Commander when using the fireboat deck monitors or water tower streams for proper direction of the streams, as required by the Incident Commander and to prevent endangering land forces by the force of such streams. The Captain may also advise the Incident Commander by radio of conditions which are more clearly visible from the fireboat position. When long hose leads are made from the fireboat for direct use at shoreside fires or for relay purposes, radio communications are essential for control of pump discharge pressures and capacities. Portable Fire Department radios also can be used to supplement the fireboat radio.

SEAMANSHIP & FIREFIGHTING

There are many basic differences in the use of the fireboat and its equipment as compared to that of land fire fighting apparatus and equipment. Basically, the use of the fireboat may be divided into three categories:

Supplying water, hose, and appliances for shipboard or land fires
Fireboat monitors and hose appliances operated from the fireboat itself
Using the fireboat to supplement the High Pressure System or to act as a supply source for relay.

These basic uses involve many problems of seamanship and firefighting that do not occur on land. It is the intent of the Division of Training to detail these problems sufficiently in this manual so that they may be understood by both fireboat and land personnel. It is particularly essential that the Incident Commander should clearly understand the use and limitations of the fireboat. Land personnel required to work with the fireboat should understand the way in which problems such as navigation, mooring, and the leading of hose lines affect the use of the fireboat.

Getting Under Way From Quarters

At the beginning of each shift, the Captain shall assign each firefighter to a station on the fireboat as deckhands and/or lookouts. The stations of deckhands are particularly essential for the handling of mooring lines which consist of the bow line, the spring line, and the stern line.

The station of the Captain when getting under way or mooring shall be at the spring line where he or she can see all deckhands and be in position to give to or receive signals from the pilot.The pilot shall then turn on the department radio, the marine band radio, and the steering gear hydraulic equipment, and shall monitor the radio until relieved.

The electric cable used to supply electric current to the fireboat, when moored at quarters, shall be disconnected by the engineer. The engineer shall start the diesel engines and, when ready to respond, shall notify the pilot and transfer engine controls to the pilot house.

When engine controls have been transferred to the pilot and the Captain has given the go ahead signal, the pilot will use the P.A. system to advise Firefighters stationed on all lines to cast them off in the order and manner prescribed by the pilot.

A firefighter shall be stationed at the bow to act as lookout, and be particularly vigilant as the fireboat approaches open water at the pierhead and immediately warn the pilot of the position of any approaching vessel.

The fireboat will leave the dock slowly to avoid collisions and to permit sufficient warm up of the diesel engines. As the fireboat approaches the pierhead, the pilot will sound one long blast on the fireboat whistle to warn passing traffic of his approach.

Getting Under Way From Pier or Ship Side

Getting under way from the scene of an emergency at which the fireboat is moored differs from the procedure of leaving quarters and will vary with wind, tide, and clearance.

Under no condition shall any mooring line be cast off without orders from the pilot. The Pilot will designate which lines to cast off and which to hold fast. The signal to cast off lines will be given over the P.A. system. Lines must be kept out of the water to avoid fouling the propellers and shall be secured immediately to prevent their being washed overboard.

Whenever getting under way from or coming alongside any mooring, fireboat members should standby with fenders for placement between the hull of the fireboat and that of any other vessel or shoreside structure. Their use prevents strain and damage to the fireboat. In no case should a member attempt to fend off the fireboat or another vessel with his hand or foot, or lean back against another vessel in order to force them apart. Such action may lead to serious injury.

Coming Alongside and Mooring

When coming alongside the scene of any fire or other emergency, the pilot shall consult with the Captain regarding the most practical position for the fireboat. Every effort shall be made to position the fireboat for most effective use, consistent with the safety of the vessel.

When the desired position of the fireboat is determined, the Captain shall station his crew, ready with fenders, heaving lines, mooring lines, boarding ladders, boathooks, etc. The position of mooring lines may vary. They shall be made fast only on order of the pilot. Heaving lines are attached to the "eyes" of mooring lines after they have been led through the fireboat chocks from inboard to outboard.

The procedure for making fast to a pier, wharf, or other shore structure is best accomplished by having a firefighter on shore make the mooring lines fast. Frequently, however, there may be no one on the pier or structure where it is desired to make the mooring lines fast. If this is the case, it may be possible to come alongside and let a firefighter off the fireboat to handle the mooring lines.

When it is not feasible to get a firefighter on shore, it may be possible to use a slip line (a mooring line with an "eye" at one end) in the following manner: Two firefighters working from the fireboat are used in this procedure.

- The first firefighter passes the eye of the slip line through the chock from the inboard to the outboard side of the fireboat allowing ample slack at the outboard side, then weaves, whips or passes the eye around a bit, piling or other sound mooring.

- The second firefighter pulls in the eye with a boathook, passes it through the chock and makes the eye fast to a fireboat cleat.

- The first firefighter then pulls in the slack and, at the bitter end, makes a bight fast to the same cleat on which the eye has been made fast.

This procedure will hold the fireboat until mooring lines can be made fast. All shoreside mooring lines should be made fast, above the high water mark, otherwise the ends of the lines will be underwater at high tide.

Shoreside mooring lines must also be taken in or slacked off from time to time according to the rise and fall of the tide, except where it is possible to allow enough slack line to permit the fireboat to rise and fall with the tide.

The fireboat, approaching a vessel involved with fire (with the exception of a tanker fire), should moor as close to the seat of the fire as possible in order to provide short hose leads and easier communication between the vessel and the fireboat. In case of doubt, the Captain or pilot should seek the advice of the involved ship's officer before the fireboat is secured alongside.

When coming alongside a ship, bow and stern thrusters will be used to hold the fireboat in position. If the thrusters fail, the captain or pilot should communicate with the ship via the marine radio and request that a line be provided to haul the mooring line up from the Fireboat. Willing hands are usually available on board the involved vessel to make the mooring lines fast.

As soon as the fireboat is made fast, a rope ladder should be lowered from the involved ship or the fireboat boarding ladder placed so that the hook of the ladder engages on the ship's railing. Careful watch should be maintained on board the fireboat for any sign of the involved ship listing or, if anchored, for any sign of dragging anchor.

Before discharging water from any of the fireboat monitors, every effort should be made to make at least one mooring line fast. It is extremely difficult for the pilot to control the fireboat and hold a position due to the force of nozzle reaction from the operating monitors. When all mooring operations have been completed the

engineer should be stationed in the pilot house to operate the water tower and pump controls.

Anchoring

The anchor equipment on the Phoenix is located as follows. The anchor is lashed in an upright position to the forward starboard bulkhead of the pilot house. The anchor bit is on the deck forward of the pilot house. The anchor line and chain, anchor davit, and snatch blocks are in the forepeak.

FIREBOAT SKIFF

Each fireboat carries a 12 foot fiberglass skiff powered by an outboard motor. The skiff is used to gain access to the substructure of piers and wharves, for rescue, and as a tender for the fireboat. The skiff can be equipped with a portable pump that will supply one small line.

Access to the areas under a pier seldom is possible along its length due to the spacing of fender piling. However, an opening approximately 10 feet long is usually available near the shore on either side of the pier.

Never maneuver a skiff between the fireboat and another vessel or between pier fenders and a vessel as the movement of the vessel may easily crush the skiff. In rescuing a person from the bay always lift the victim over the stern or bow, never over the side of the skiff. Such action at the side of the skiff may cause it to capsize. When going ashore, leave the skiff securely moored. If the skiff cannot be moored, leave a firefighter in attendance.

The skiff is carried on decks. The launching gear for the skiff consists of a model 6006h Auto Crane mounted on the after deckhouse. The launching or retrieval of the skiff is usually done by the engineer but may also be done by trained fire fighting personnel. See Appendix for crane operating instructions.

KNOTS & HITCHES

The standard rope practices as described in the Rope Manual include all those commonly used on fireboats with the exception that a round turn and two half hitches are commonly used to secure a mooring line to the following:

- Bit or post.
- Ringbolt.

NOTE: These particular hitches will not slip or jam when there is a strain on the line.

A line secured to a cleat should not be tied with a knot as a strain on the line may cause the rope to jam and it may be difficult to free. Proper procedure is as follows: with the bitter end, make a round turn around both horns of the cleat and leave the end free. Secure the line to both horns of the cleat with figure eight hitches.

NAVIGATION

The primary responsibility for the safe navigation of the fireboat is that of the pilot. The following factors, however, all have an important bearing on fireboat navigational and fire fighting maneuvers and therefore are briefly described.

Electronic Depth Sounders

The fireboats are equipped with two (2) depth sounders, one is a video display unit that displays the actual contour and make up of the bottom in color. The other is a simple digital display unit. Only one unit may be used at a time.

Radar

The Phoenix is equipped with radar to facilitate safe navigation, response, and maneuvering during poor visibility.

Steering

The rudder steers a vessel by presenting a surface to the water passing along the hull. When a vessel is moving ahead, pressure upon the rudder forces the stern away from the side of the rudder on which the pressure is being applied and turns the bow to that side. The helm (steering wheel) of a vessel is so arranged that when the wheel is turned to one side, the rudder turns toward that side and causes the bow to turn towards that side.

When a vessel is moored by the bow in moving water, the rudder may also be used to hold away from the position the vessel would normally assume, a procedure commonly termed "sheering." For example: the fireboat, moored by the bow alongside a ship which is underway, can be held out from the side of the ship by giving the fireboat sufficient rudder away from the ship. A fireboat with hose lines running ashore and exerting a shoreward drag can often be held away from the shore by running a mooring line to shore from the beam of the boat and then pointing the bow away from the shore into the run of the tide. The pressure of the tide will keep the mooring line taut and the bow away from the shore. Frequently, the fireboat can be moved in a cramped area across the tide by keeping the engines running and the bow to the tide but at an angle to the direction of the current. The water striking the inclined side of the boat tends to force it sideways and with the current, the sideways movement being checked by bringing the bow head on again to the current.

The direction and force of the wind have considerable influence upon the steering and movement of fireboats and skiffs. Difficulties due to wind are often encountered when coming out of docks, making turns, or passing ships or high shore buildings.

Normally, the fireboat is brought alongside a ship or wharf, bow to the tide, since a slow approach can be made and steerage way held to the last moment. However, when the tide is running to windward and the wind has more effect on the fireboat than the tide, the boat may be brought alongside bow to the wind.

Depth of Water

The pilot is responsible for seeing that the fireboat does not go aground, whether the boat is moored or underway. When moored, if there is any doubt about the depth of water on an ebb tide, the pilot will take soundings at intervals and will warn the officer when a move farther out into the bay is necessary. Constant study of the bay at all stages of the tide is required of the pilot in order to know what moorings are safe at all tides and where the deep water channels run.

Aircraft On the Water

Should it be necessary to maneuver the fireboat alongside an aircraft in the bay, the approach usually should be made from the windward side and with extreme caution to avoid damaging the aircraft. It is generally a safer procedure, when practicable, to make the final approach by skiff if rescue is involved.

Rules of the Road

The Rules of the Road to prevent collision of vessels while navigating upon certain inland waters, such as the San Francisco Bay, are set forth in law enacted by the United States Congress. The United States Coast Guard is responsible for the enforcement of these rules. The pilot of the fireboat is responsible for conforming with them. It is also the responsibility of the pilot to determine that firefighters assigned to act as lookouts or to assist the pilot, are thoroughly informed on all such rules which are pertinent to their particular assignment.

HOSE LEADS

> While approaching the fire location, and as soon as sizeup is feasible, as many lines of such size and length as the officer considers necessary shall be made ready.

Equipment to be used at the incident should be made ready while underway to the fire. Monitor nozzles should never be opened unless ordered by the Incident Commander, and only when the use of such monitor nozzles would not create a situation adversely affecting the steering and maneuvering of the fireboat.

Utility Rope

When it is impractical to pass a hose line by hand from the fireboat to the vessel or shore facility involved, the hose should be hauled to the deck with a utility rope rather than to attempt carrying the hose up a ship's ladder or Fire Department ladder. Ample slack should always be maintained in such hose leads on the fireboat deck to compensate for the rise and fall of the tide. Should the lead be a considerable distance, as from fireboat to shore, the strain at the manifold connection should be taken up by a utility rope. Large hose lines, when required, should be wyed into 1 1/2 inch hose lines on the deck of the vessel or shore facility involved, and not on the deck of the fireboat.

Leading Hose Ashore

Every attempt should be made to moor the fireboat to a pier or wharf before leading hose lines ashore. Shallow water, etc. may make it necessary to lead hose lines to shore with the fireboat lying offshore at anchor. This type of lead is made by using the skiff to stretch a rope to shore.

Ample hose, with all lengths and nozzle connected, should be flaked out on the shoreside deck of the fireboat opposite the manifold. The length of hose should be sufficient to allow at least two lengths more than the estimated distance to shore to provide for the rise and fall of the tide, and for the curve the hose will take as it is carried by the current.

Hose connected to the manifold should be secured with a rope to relieve the strain at the coupling. The connection to the manifold should be made through a Trojan valve for pressure control in the case of simultaneous monitor operations.

Land companies should have hose at hand on shore ready to lead to the point of discharge. Ample personnel must be available to assist the fireboat crew when they arrive on shore. The hauling rope is made fast to the hose lines as outlined in the Rope Manual. Normally the hose will stay afloat until charged. Under no conditions shall the hose line be charged until the proper signal is given from shore.

Great care should be exercised when operating hose lines from the skiff. The nozzle reaction may capsize the skiff. Safe practice requires that only 1 1/2 inch hose lines be operated from the skiff.

MONITORS

The officer in charge of the fireboat should consult with the pilot before ordering the opening of any of the monitors aboard the fireboat. If a situation presents itself where the opening of a monitor nozzle would affect the steering or

maneuvering of the fireboat, the officer in charge of the boat should immediately notify the Incident Commander of that fact.

Operations of the fireboat deck and water tower monitors are described under section 4 of this manual. When approaching a fire ashore, at which monitors are to be used, every effort should be made to contact the Incident Commander by radio and receive instructions as to how and where they should be used.

Monitor streams should never be used when hand held hose lines are adequate. This precaution is important when fighting fires in vessels, particularly small craft and barges. The volume of water discharged from the monitors is such that small craft may be quickly swamped or caused to list dangerously.

The effect of nozzle reaction when using the monitors is sufficiently powerful to push the fireboat away from its position. Therefore, every effort should be made to make at least one mooring line fast to shore before operating any monitor. Upon occasion it may be necessary to cool down an area with a hand held hose line or with a monitor so that mooring lines can be made fast. It is also quite possible to direct a stream from another monitor nozzle opposite to that being used on the fire to hold the boat in position.

When it is impossible to make mooring lines fast or hold the fireboat in position with thrusters, the bow of the boat should be headed toward the fire with only the forward monitor being operated. This procedure will enable the pilot to use the two aft engines for propulsion to maintain the boat's position. However, as soon as conditions warrant, mooring lines should be made fast in order to permit all pumps to be used for fire fighting service. The operations of the Fireboat Guardian are much the same as with the Phoenix. The Guardian is 88' long, has a 21' beam with a 7' draft. The Guardian has 5 diesel engines and an approximate pumping capacity of 24,000 GPM

SECTION 4. SHIP CONSTRUCTION

One of the most important principles of fire fighting, whether the fire is in a land structure or in a ship, is that every effort must be made to locate the seat of the fire quickly and confine the fire to its place of origin. This principle is of particular importance in a ship fire because the ship is usually constructed of steel which will readily conduct heat from the fire to surrounding combustible materials.

It is of utmost importance that firefighters have a general knowledge of ship construction in order that they may readily find their way about a ship, particularly when visibility is obscured by smoke. For this reason, the following general descriptions of the construction of a typical freighter, passenger ship, tanker, and refrigerator ship are included in this manual. However, all ships carry a ship's plan which will show the general construction of the ship, the location of passenger, crew, and other accommodations, the holds, the position of bulkheads and their openings, and the exposures to which fire may spread. Usually a cargo stowage plan is also available which will specify the location and type of cargo carried.

The ship's plan is most often found in the chartroom and the cargo stowage plan is usually held by the Chief Mate (First Officer). The Incident Commander of any ship fire should always consult these two plans, if available, so that the IC may take full advantage of the ship's construction in relation to cargo, life hazard, and the fire risk involved.

CARGO SHIPS OR FREIGHTERS

The construction of two typical freighters is shown in Figures 8 and 9. It is noted that although the design of these two ships varies, there are two features which are common to all ships. They are the provision of watertight bulkheads, and the fore and after peaks. The peaks are compartments in the bow and stern, separated by watertight bulkheads, which generally extend from the keel to the main deck. They are used for various purposes but usually for the storage of ship stores or as water ballast tanks to adjust the trim of the ship.

Holds & Decks

The holds of a ship are the spaces in which the cargo is stored. They are always numbered from bow to stern. There may be as many as eight holds in large freighters, but the most common number is five. Watertight steel bulkheads commonly separate the various holds from adjoining spaces. Openings in the bulkheads are fitted with watertight doors; however, such openings are seldom found below the level of the second deck.

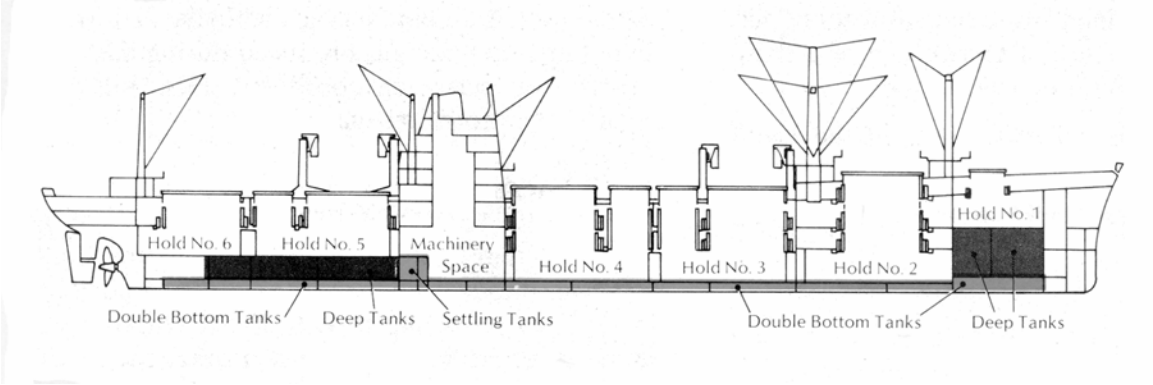


Figure 8

Each cargo space of a freighter may be a single compartment extending from the inner bottom of the vessel to the main deck, or the space may be divided by decks. In some freighters it will be found that the first deck below the main deck is undivided fore and aft or divided only by removable wood bulkheads. This type deck is commonly termed a "shelter deck."

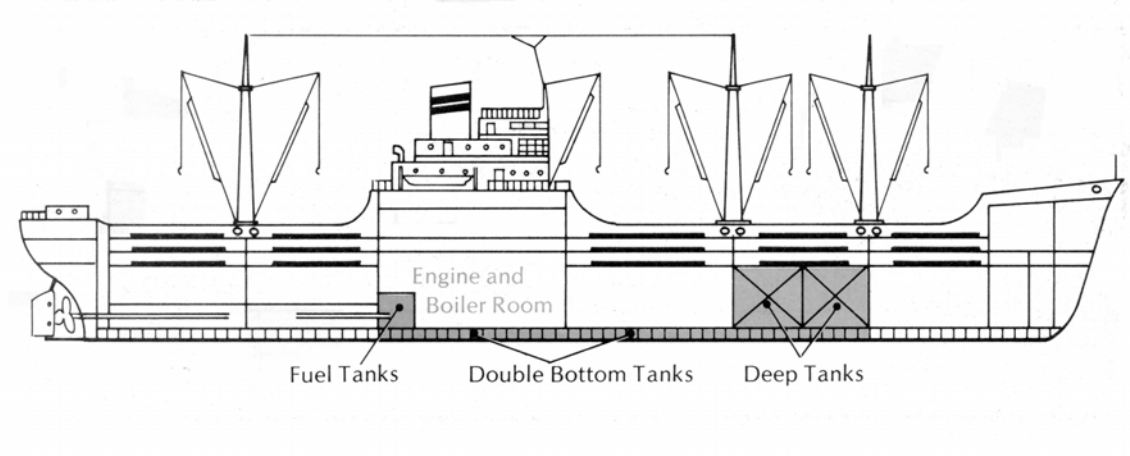


Figure 9

The lower decks, separated by watertight bulkheads between holds, are termed the "'tween decks". The space below the lowest deck is termed the "lower hold". It is obvious that a fire may spread more easily through a shelter deck than through the 'tween' decks separated by watertight bulkheads.

The opening in the main deck over each hold is termed the "hatchway" or "hatch". It provides access to the hold through which cargo may be loaded or unloaded. Some vessels are provided with two hatches opening into the same hold. Shelter and 'tween decks usually will have hatches similar to and directly below those in the main deck.

The hatch at the main deck is surrounded by a raised side or coaming and is provided with portable supports usually constructed of steel and commonly termed "strongbacks." They support the hatch covers. Hatch covers may be of

timber or of welded construction. At sea they are covered by tarpaulins. The strongbacks are usually constructed of steel.

Both the hatch cover and strongbacks are extremely heavy. When opening a hatch to fight or investigate a fire in a ship's hold, every effort should be made to obtain the assistance of an experienced ship's crewman or dock worker to operate the ship's cargo winch and tackle to remove the cover and strongbacks. Before removal of the covers, charged hose lines should always be in position to combat any sudden flare-up of fire due to admission of air. The coamings of the tween and shelter deck hatches project very little above the level of the deck. They are normally covered with wood planks. Often, heavy bulk cargo, such as trucks, tractors, launches, etc. is carried on top of the main deck hatch covers. Hydraulically operated hatch covers may be found on large modern cargo ships. These are generally all steel welded construction, watertight and designed to take a full deck load. There is generally an emergency method of operating these hatches if the hydraulic system fails.

In some freighters, there may be a bulkhead running lengthwise along the center line of the ship to prevent lateral movement of cargo. This type construction is most common in ships carrying loose cargoes such as grain.

In many freighters the lower hold of the cargo space forward of the engine or boiler room may be occupied by deep tank or cargo tanks. These tanks are commonly used for water ballast but may carry liquid cargo such as fuel oil, vegetable oil, or fish oil, and in exceptional cases, general cargo (See Figs. 8 and 9). The cover to such tanks is dogged down but can be removed if necessary. Deep tanks may also be located aft of the engine room or in both positions.

Access To Holds and Decks

Permanent means of access to the holds and lower decks of freighters is usually provided by a stationary vertical ladder placed on the side or end of the hatch. These ladders generally extend from the main deck to the lower hold, though often they may be staggered at different deck levels. There may be two such ladders for each hold, usually placed, one fore and one aft of the hatchway. These ladders are generally reached by removing all or part of the hatch cover directly over the ladder. Small hatch covers placed over the head of the ladder, designed primarily to facilitate inspection of the cargo while at sea, are often available.

A firefighter using a ship's vertical ladder to enter a hold should always step off the side of the ladder and forward, making certain that he or she has firm footing before releasing his grip from the ladder. Often the lower deck hatch covers are off and if the firefighter should step backward, it is probable that he or she would fall into the lower hold. This precaution is particularly important when severe smoke conditions obscure clear vision and when the ship is in port for repair.

Often the floor plates, platforms, gratings, hatch covers, etc. are removed to facilitate repair or movement of cargo.

Emergency means of access to a ship's hold may be provided by vertical shafts extending from a mast house to the hold. These vertical shafts, in addition to acting as ventilators, usually have ladders which will give access through doors to the tween decks, lower hold, and through manholes to the double bottom.

Ventilators, which are always plainly visible on the deck of a ship, are used to ventilate the lower deck and hold spaces of the vessel. In an emergency, the vent shaft which extends from the deck cowls can be used as a means to discharge water into the holds if direct access is impossible. It must be made certain, however, that the ventilator shaft leads to the place at which it is desired to discharge the water because the ventilator may supply only a single space or may lead to the 'tween deck space and continue to the lower hold. Ventilators are usually provided with screens to prevent pilfering of the cargo. Some ventilator shafts have ladders for access to lower decks and holds. If it should be necessary to prevent entry of air to the holds, the deck cowl can be removed and the top of the vent shaft can be plugged or sealed with a canvas cover lashed over the opening.

Situated at the outer sides of the double bottom tanks are the ship's bilge. These bilges are used to collect any drainage of water at the bottom of the hold. They are usually protected by wood coverings termed "limber boards". Water collecting in the bilge is pumped out through pipe lines connected to bilge pumps in the engine room. If a large accumulation of oil or other flammable liquid should occur in the bilge, a serious fire could result and dangerously expose the holds and engine room. In this event, water, steam or CO2 could be discharged to the bilge through the bilge sounding pipes which extend to the upper deck near the side of the ship on each side of each hold. These pipes also may be used to assist in locating a ship fire through thermometer readings of the interior temperature of the ship.

Engine and Boiler Rooms

The machinery space of the average freighter is usually located amidships and is usually separated from the adjoining holds by watertight bulkheads with no openings. However, there are exceptions where the engine and boiler rooms are at the stern of the ship. On steam vessels there are usually two such spaces, the engine room and the boiler room, separated by a bulkhead with openings or doors between both spaces. On motor ships (diesel) there is normally only one machinery space.

The propellers of some ships are driven by electric motors supplied with current from generators driven by steam turbines. The engine room of such a vessel will closely resemble an electric power station installed in an extremely confined space. Any fire involving live electrical apparatus therein should be handled with

class "C" extinguishing agents. Each engine room and boiler room is normally ventilated through overhead ventilators, skylights, or gratings.

Steel ladders provide the principal means of access to engine and boiler rooms. They usually lead from the upper decks and from the engineer's quarters. Because of the steep incline of these ladders and the fact that they are usually somewhat greasy, firefighters descending them, particularly under smoke conditions, should use extreme care. They should always descend facing the ladder and not as if walking down a stairway.

When direct access to the engine room is not possible, emergency access may be available through the escape hatch and propeller shaft tunnel. (See Figs. 8 and 9). The shaft tunnel is a narrow, watertight compartment which houses the propeller shaft, and extends from the after engine room bulkhead to the stern. An escape hatch to the main deck is located at the after end of the tunnel or immediately aft of the engine room bulkhead. Usually a watertight door in the after engine room bulkhead gives access to the shaft tunnel.

FUEL OIL TANKS: Fuel oil for oil fired vessels may be stored in the double bottom tanks, in bunker tanks, and in deep tanks (See Figs. 8, 9). Double bottom tanks are at the extreme bottom of the ship and run nearly the whole length of the vessel. They vary in depth from approximately 2 1/2 feet to 6 feet. The tanks may be subdivided into watertight compartments used to carry ballast, fresh water, boiler feed water, as well as fuel oil. Access to double bottoms is provided through manholes covered with bolted steel plates. If oil should escape from any of the piping or equipment used to carry fuel oil from the storage tanks to the oil burners, it will normally collect in the space between the double bottom tanks and the engine or boiler room floor plates and create a potentially dangerous fire hazard.

Superstructures

The superstructure above the main deck of the average freighter is commonly divided into three areas:

- The forecastle (often abbreviated "focsle") at the bow,
- The bridge amidships,
- The poop at the stern.

The interior of these structures is used primarily for crew accommodations, galley, and mess room, but may also be used for cargo and ship stores. Steel deck houses built upon these structures are usually for the accommodation of the ship's officers and passengers. They also provide housing for the chartroom, radio room, offices and navigational equipment.

PASSENGER SHIPS

Passenger ships are of many types. Most of the large transatlantic passenger ships are built for maximum speed and luxury and carry a relatively small amount of cargo. They may have up to twelve or more decks and vary in length up to 1000 feet or over. Their accommodations will often house as many people as may be found in a fair sized town.

These ships have every fire hazard found in the average city: cabins, suites, stores, places of assembly, ship's refrigeration, heating and power plants, and enormous fuel storage. However, the average passenger ship, whether intended for transoceanic or coastal trade, is designed to carry a lesser number of passengers and will have considerable cargo capacity. Freighters may also have accommodations for passengers, but are not generally considered to be passenger ships.

The tween decks and deck superstructure in which passenger accommodations are located are usually lettered "A", "B", "C", etc. from the top downwards. Above "A" deck there may be one or more decks such as the sun deck, game deck, promenade deck, boat deck, etc. Below the lettered decks there are usually two or three decks for the accommodation of the crew, galley, stores, etc. Decks at and below the water line are usually divided into a series of spaces by watertight bulkheads so that, in the event of damage to the ship, any damaged area can be isolated by closing watertight doors in the bulkheads.

Bulkhead doors may be operated manually from either side of the bulkhead and can often be opened or closed mechanically from a master control on the bridge. Fire resistive bulkheads usually divide the decks above the water line and are normally provided with fire resistive doors that can be operated manually from either side. In modern ships such doors close automatically when exposed to fire. They may also be remotely controlled from the bridge. In some modern ships there is a small opening in such doors at deck level through which hose may be led or through which water may be drained without keeping the door in an open position.

Access to passenger accommodations is usually provided by a corridor on each side of each passenger deck from which passages lead to the cabins. The corridors generally end in halls which give access to large public rooms and to stairs and elevators leading to the other decks.

In addition to the fire hazards common to both passenger ships and freighters due to the similarity of construction design of cargo and machinery spaces, there are multiple concealed spaces in passenger accommodations through which fire may readily spread undetected. It is common practice to cover the frames of the ship and the deck beams with decorative paneling, particularly in the passageways, halls, public rooms, and cabins. This creates a hidden space

between the inside of the paneling and the ship's side or the deck overhead through which fire can spread horizontally and vertically. This hazard is particularly serious in any continuous hidden space above the passageways which may also contain electric cables, piping, vent ducts and flues. In modern ships the decorative paneling is usually a fire resistive material, but it is seldom that adequate fire stops are provided in such concealed spaces.

Compounding these fire fighting factors is the maze of passageways on the multiple decks of a passenger ship and the extensiveness of the passenger accommodations. It also must be remembered that the decks above and below any deck involved with fire are usually of steel construction and, upon being heated, may readily spread the fire by conduction or radiation.

TANKERS

Tankers are designed to carry all types of liquid petroleum products. They may also carry other liquid cargoes such as molasses, syrup, cottonseed oil, etc. In this type tanker, the engine room is located aft. The superstructure at the stern and above the engine room contains the engineer's and the crew's accommodations. Amidships are the deck officers' quarters and the navigating bridge. The fo'c'sle usually will contain a small cargo hold with a deep tank below. The peaks, fore and aft, usually contain ship's stores, boatswain's stores, paint lockers and fresh water tanks, etc.

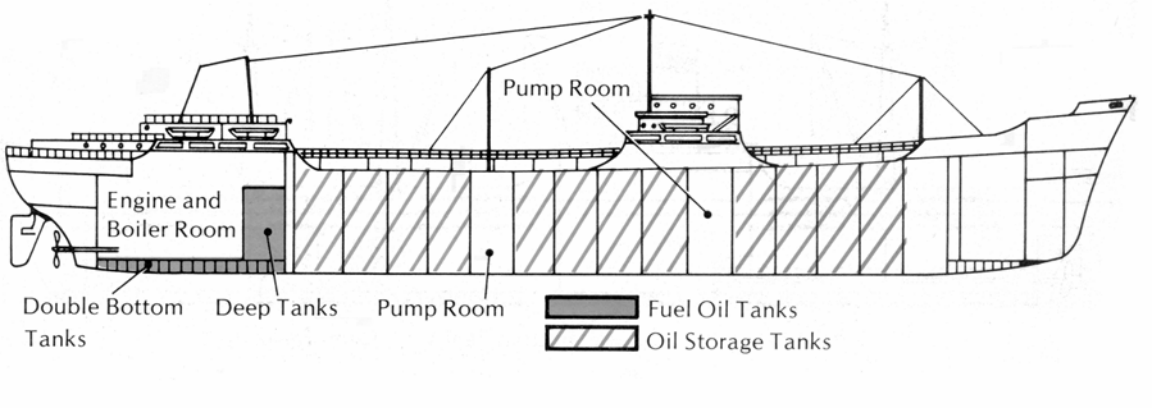


Figure 10

The oil storage tanks are located between the fo'c'sle and engine room. A raised fore and aft gangway or catwalk located above the cargo tanks gives access to the aft quarter, engine room, navigating bridge, fo'c'sle and pump houses. The gangway may carry water and steam pipes and electric cables. The cargo pumps are usually housed in watertight, floodable compartments which extend the full width and depth of the hull. Cofferdams separate the engine room aft and the cargo space forward, from the oil cargo tanks. They normally consist of two watertight bulkheads three to six feet apart and can be flooded with water to form a fire break. Fuel oil for the engines is stored in tanks abaft the aft cofferdam or

in tanks beneath the engine room in the double bottom. Note that the double bottoms in tankers generally do not extend the full length of the ship as is common in other vessels.

Cargo tanks are designed to restrict the movement of the oil surfaces when the tanks are loaded in order to maintain the stability of the ship when underway. The more common type of construction will subdivide the tank into a number of individual tanks by transverse and longitudinal bulkheads. Access to each subdivision is provided through a manhole in the deck. The tanks generally extend to the bottom of the ship. Extreme care should be exercised if it is necessary to use tank inspection ladders as in the case of a rescue. They may be in poor condition due to the corrosive action of the oils carried. The tanks are filled or emptied by means of pipelines located at the bottom of each tank.

The position of tank bulkheads can be determined by the continuous row of rivets running from side to side or fore and aft on the deck. Unlike the holds of a freighter, oil cargo tanks may be numbered from bow or stern according to the practice of the ship's owner. With the exception of the vents, the tanks are sealed and are designed to present minimum fire risk.

REFRIGERATOR SHIPS

Refrigerator ships are designed to carry perishable foods such as meats, fruits, etc. in the holds of the ship where the temperature is low enough to prevent spoilage of the cargo. All such holds are insulated to prevent absorption of heat from outside the hold. The sides, bulkheads, decks, and bottom of the hold are packed with an insulating material placed between the ship's structure and a covering of wood or metal. An insulated hatch cover designed to fit below the main deck hatch cover, completes the insulation.The insulating material may be non combustible, such as glass wool or rock wool, but, more often, it is of granulated cork, or cork slab material, which burn easily and with considerable smoke. Most newer ships have fire resistive insulation. The insulation is continuous in any one cargo compartment. All steel or iron supports are usually encased in a wood covering. It is obvious that a fire in cork insulation could easily travel and involve an entire cargo hold. Frequently combustible and non combustible types of insulation may be used together in the same hold. For example, glass wool may be used only against bulkheads subject to heat. The remaining insulation may consist of cork material. It should not be assumed that the ship is lined throughout with a non combustible insulation simply because a sample of the material has been found to be a non combustible type.

Holds in which the cargo must be maintained in a frozen state or at an extremely low temperature are usually refrigerated either by a direct refrigerating system in which the refrigerant is piped directly into the hold, or by the indirect system in which a liquid, such as brine, cooled by the refrigerant, is circulated throughout the hold. In either system the refrigerating pipes run over and around the hold.

When the hold is loaded, the refrigerant piping grids below the hatch openings are plugged with an insulated cover and then covered with wooden hatch covers. The main deck cover is battened down.

Holds in which the cargo only needs to be chilled are kept at the required temperature by cooled air. The air, cooled by a refrigeration system, is circulated throughout the holds by means of air ducts. These ducts are provided with baffles where they pass through divisional cargo hold bulkheads and with watertight doors where they pass through watertight bulkheads. If a fire should involve any such duct, these doors and baffles should be closed and the ventilating fans shutdown. It is not uncommon for each cargo hold to have its own system of ducts, refrigeration machinery, and ventilating fans. Ducts may be constructed of wood or metal. A fire in a wooden duct obviously presents a serious fire fighting problem.

The refrigerant commonly used on modern refrigerator ships is Freon 12. It is non combustible and of low toxic classification. Other ships may use ammonia, methyl chloride, carbon dioxide, etc. and, in case of fire, toxic gases may be present in the spaces surrounding the refrigeration machinery.

Refrigerated holds may be fitted with thermometer tubes, by means of which the temperature in the holds can be determined. If necessary, these tubes may also be used to discharge water, CO_2, or steam into the hold. In some cases, the ship will be provided with adapters for this purpose. In ordinary freighters and passenger ships, there is at least one refrigerating hold or compartment.

SECTION 5. SHIPBOARD FIRE FIGHTING EQUIPMENT

All ships 1000 tons and over are required to have a fire control plan. This plan will locate and identify the fire fighting systems on the ship. It should be clearly marked and found near the top of the gangway. Passenger ships and freighters are provided with considerable fire fighting equipment for the control of fires at sea. This equipment will consist of a fire main system similar to a wet standpipe system found in buildings. Standpipe outlets, hose, nozzles, portable extinguishers and related minor equipment will be spaced throughout each deck. An automatic sprinkler system may be available, particularly for the protection of passenger accommodations. A fire alarm and/or automatic fire detecting system may also be installed. Fixed CO_2 and/or steam extinguishing systems are usually provided to protect holds and machinery spaces. The engine room may be provided with a fixed foam system for oil fires.

Shipboard fire fighting equipment is provided primarily for fire control when the ship is at sea. It can prove invaluable to the Fire Department in controlling a fire when the ship is in port. The standpipe system can be used to prevent fire spread during the time Fire Department hose is being led aboard. If Fire Department personnel use the ship's standpipe system and the water pressure seems to be low, pump pressure can be increased for fire fighting purposes. Vessels designed for specific purposes, such as refrigeration ships, tankers, etc. are also provided with extinguishing equipment designed for control of their particular fire hazard.

FIRE MAINS (STANDPIPES)

A ship's fire pumps, fire mains, and related equipment should be capable of supplying at least two strong hose streams. They are fitted with outlets from which hose lines may be led to the holds, machinery spaces, decks, and all other parts of the ship. Ships provided with such equipment usually have one or more inlets to which the fireboat or engine companies can lead should the fire pumps be inoperative. Special adapters will, in all probability, be necessary to connect to fire main inlets of foreign ships. Under present worldwide safety practices, adapters to US. National Standard Thread is available on board most ships of U.S. registry. The adapter should be found in all ships of 1000 tons or more. A variation of this type adapter should be found on ships of foreign registry.

AUTOMATIC SPRINKLERS

Some ships, in addition to carrying a standpipe system, are provided with an automatic sprinkler system. Installation of sprinkler systems is generally limited to passenger ships. The area protected is usually restricted to the spaces normally used by the passengers and crew, although it may extend to other parts

of the ship. The primary water supply for such a system is one or more pressure tanks charged with fresh water. The secondary supply is an automatic pump drawing sea water. In addition, sprinkler inlets are usually provided fore and aft to which the fireboat or land companies may connect hose lines to augment the system's water supply. Such systems are supervised and are provided with a flow indicator panel and an annunciator located in the chart room or on the bridge. A plan of the ship will be mounted alongside the indicator, from which the location of the sprinkler heads in operation can be determined.

FIRE ALARMS AND AUTOMATIC FIRE DETECTORS

Fire detection systems on board a ship are so arranged that in case of fire, both a visible and audible alarm is received in the pilothouse or fire control station (normally on the bridge). For vessels over 150 feet in length there should be an audible alarm in the engine room. The receiving equipment or console indicates both occurrences of a fire and its location aboard ship. Consoles are located on the bridge and in the CO_2 room. The CO_2 room is the space that contains the fire extinguishing mechanisms. Only a bell is required in the engine room to alert the engineer to an emergency outside the machinery space.

Upon hearing a fire alarm, the watch officer on the bridge sounds the general alarm to call the crew to their fire and emergency stations, as listed on the station bill. However, in all cases the master must be alerted immediately and the cause of the alarm must be investigated.

The types of fire detection systems approved for use aboard ship include the following.

- Automatic fire detection systems
- Manual fire alarm systems
- Smoke detection systems
- Watchmen's supervisory systems
- Combinations of above

Coast Guard regulations (title 46 CFR) require that certain types of detecting equipment be used in specific spaces aboard certain ships. The USCG permits other types of systems where the equivalent protection is demonstrated. They may also allow the installation of systems that are not actually required by law or regulation. Approved types of fire protective systems are carried in the Coast Guard Equipment List (CG-190).

STEAM SMOTHERING SYSTEMS

Steam smothering systems for fire fighting are not installed on US ships contracted on or after January 1, 1962. Vessels equipped with these systems

may continue to use them. The systems may be repaired or altered, provided that the original standards are maintained.

Steam for a smothering system may be generated by the main or auxiliary boilers. The steam pressure should be at least 100 PSI. The boilers should be capable of supplying at least 1 LB of steam per hour per 12 ft^3 of the largest cargo compartment.

The steam supply line to each manifold must be fitted with a master valve at the manifold. The branch line to each compartment must be fitted with a shut-off valve. The valve must be clearly marked to indicate the protected space. On tank vessels, the valves leading to cargo tanks must be open at all times. Thus, in case of fire, it is only necessary to open the master valve to ensure a flow of steam into each tank. The valves leading to the tanks not involved in the fire may then be closed. On cargo vessels, the master valve is always open, and the valves leading to individual compartments are closed.

In pump rooms, the steam outlets must be located just above the floor plates. In cargo holds, the outlets must be placed in the lower portion of each cargo hold or 'tween deck.

When using steam to extinguish a fire in a ship's hold, several considerations must be observed:

- Steam must be available in large amounts. At the start of the injection, the steam will immediately condense into water until the hold warms up. If the steam supply is not maintained, air will be sucked into the hold and accelerate the fire.

- The use of steam on cargo in which water should not be used is seldom advisable. A large part of the effect of steam is gained by its moisture content.

- The application of steam is most effective on fires near the top of the hold where it's smothering and saturating effect will act quickly and may prevent the fire from involving the vital hatch covers. On the other hand, fires near the bottom of the hold may be better controlled with CO_2 than with steam.

CARBON DIOXIDE (CO_2)

Carbon dioxide (CO_2) extinguishing systems are used to protect cargo spaces, pump rooms, generator rooms, storage spaces such as paint lockers, galley ranges and duct systems. They are also used in engine rooms to protect individual generators.

Two fixed CO_2 system types are used for vessel protection: The total-flooding system for machinery space and the cargo system. A total flooding system for machinery space is activated only as a last resort; after all other extinguisher methods have been tried and have failed to control the fire. This system for a machinery space expels 85% of its total capacity within 2 minutes to achieve rapid saturation of the air with CO_2 and quick extinguishment. This rapid release of the CO_2 is necessary in spaces as engine rooms, where fast-burning flammable liquids must be extinguished quickly. Smaller versions of the total-flooding system are used in generator rooms, pump rooms and paint lockers. The systems designed for these spaces may be supplied by the main system, or may be complete, independent systems.

The cargo system is not activated immediately upon discovery of the fire. The involved space (usually a cargo hold) is first sealed. Then the agent is introduced into the space at a preset rate, to reduce and maintain the oxygen content at a level that will not support combustion. The cargo tanks aboard cargo and passenger vessels may be protected by a type of CO_2 system. Tank vessels contracted prior to January 1, 1962, may have CO_2 systems in their cargo tank. Tank vessels contracted on or after January 1, 1970, must be equipped with a deck foam system and may have an approved inert-gas or water spray system for cargo tank protection.

All CO_2 systems consist basically of piping, discharge nozzles of a special configuration, valves and CO_2 cylinders. The cylinders are arranged to discharge their contents into the system through a manifold. The CO_2 is also used to activate alarm devices and pressure switches that shut-down ventilation systems. Total flooding systems and cargo hold systems are activated manually. Smaller systems (those using less than 136 kg ((300 lb.)) of CO_2) for paint lockers and other smaller spaces may be automatically activated by heat sensitive devices or may be operated manually.

Limiting factors in the use of CO_2 on shipboard fires are:

1. If the type of cargo is such that it contains enough oxygen to support its own combustion, such as celluloid, or contains a supply of air such as may be trapped in tightly baled fibers, the efficiency of CO_2 may be greatly reduced.
2. CO_2 may not easily penetrate all parts of a tightly packed hold or to spaces blocked off by the cargo.

If the fire ship is coming from sea, the U.S. Coast Guard Captain of the Port at Coast Guard Island will be alerted and, in turn, alert the Fire Department. Normally, this will provide time to gain necessary information and to plan accordingly.

Whether the fire originates while at sea or while at berth, the following procedures should be observed if CO_2 is going to be used. Extreme care should be exercised to determine that the product on fire does not produce oxygen when burning. CO_2 cannot control such fire.

1. Notify the Communication Center to order tank truck of bulk CO_2 to the desired location.
2. Request the Communication Center to call a marine chemist. Have the chemist report directly to the Incident Commander.
3. Request the ship's master to call a conference which should include the ship's captain, chief engineer, chief mate, stevedoring foreman, insurance surveyor, US. Coast Guard Captain of the Port, Incident Commander, San Francisco Fire Department, Port Fire Marshal and marine chemist.

This joint conference should resolve the following:

1. Estimate of extent of fire and the type of product burning.
2. Determine near as possible exact location of fire.
3. Determine if adjoining bulkheads, including the shaft alley, are showing signs of unusual heat transfer.
4. Determine if there is danger of possible acceleration of the fire from exposure of reactive cargo.
5. Determine the exposure danger of cargo in adjoining holds.
6. Determine the most effective method of applying bulk CO_2. The systems outlined may require special adapters, most of which are carried aboard the fireboat.
7. Establish a command for clearance of any action which may cause loss of CO_2 gas or which may cause CO_2 to be routed through ducts to prohibited areas of the ship.
8. Before CO_2 is applied to the hold the hatch should be securely closed and covered with tarpaulins. Should the fire be located in the lower hold or lower tweendeck area, and such area is accessible by stair ladder, covers may be carried to this level and spread.
9. When CO_2 is applied, the Incident Commander should be certain that the system of application is routing the gas to the fire hold and, if possible, directly to the area on fire.

Upon initial CO_2 application, try to reduce the temperature of the fire as quickly as possible by rapidly inserting large quantities of gas (3 or 4 cylinders from the

ship's system, or 1000 to 1500 lb. from a tank truck). This application will exhaust a considerable amount of live smoke which is to be expected.

Additional applications should be applied at time intervals of approximately 15 minutes. As the temperature drops and CO_2 concentration increases, applications may be spaced to about one an hour. When the gas concentration reaches the desired level, the CO_2 application may be stopped or modified by the Incident Commander or the marine chemist. Normally, 80% or greater concentration is ideal. This concentration must be maintained for at least 48 hours. Our case histories have proven conclusively that the 48 hour saturation is most effective in total extinguishment.

When the cargo hold is opened, the rescue squad, with self contained breathing equipment, should probe the hold for the location of the seat of the fire and note any possible areas of heat confinement. The marine chemist should supervise the ventilation of the hold and check carefully for persistent pockets of gas which tend to accumulate in the lower areas of the hold.

The marine chemist will provide a copy of his log to the Incident Commander. The log details the time of CO_2 insertion, the amount, and the temperature before each gas application.

MARINE HALON 1301 SYSTEM

A halogenated extinguishing agent, Halon 1301, has been accepted by the Coast Guard for limited used in fixed fire fighting systems aboard U. S. ships. Halon 1301 is a very efficient extinguishing agent for fires involving flammable liquids and gases and live electrical equipment. It is a clean agent; its residue does not contaminate electrical contacts or circuits. It is a nonconductor of electricity.

Halon 1301 is a colorless odorless gas. It may be toxic when exposed to flames. When flames are extinguished quickly, a minimal amount of toxic material is produced. Slow extinguishment allows increased production of toxic materials at levels that could be dangerous to personnel.

To be acceptable for use on US ships, a Halon 1301 system must be as reliable and effective as the system it replaces. Most of the Halon 1301 systems approved by the US Coast Guard protect machinery spaces, turbine enclosures and pump rooms, where the usual petroleum products may be found. Halon 1301 systems are not yet approved for installation in the holds of ships carrying general cargo (usually class A materials).

The spaces for which Halon 1301 systems have been approved are those normally protected by CO_2 systems thus, Halon 1301 systems must meet all the design requirements for CO_2 total flooding systems.

A Halon 1301 remote release (pull-box) station is required for each protected space.
It should be located close to one exit from the protected space. Posted instructions at the release station should describe how to activate the system from the station. They should also describe an alternate means of activating the system in case the remote release fails. The instructions should be in large print and easily understood.

A warning device, actuated by pressure from the Halon 1301 system, must sound an alarm when the agent is about to be discharged into the protected space. The discharge must be delayed to give personnel sufficient time to evacuate the space before the Halon 1301 is released. In addition, a sign must be posted at each entrance to each protected space. The sign must warn personnel not to enter the space without breathing apparatus after the system has been activated.

If a protected space is ventilated mechanically, the ventilation system must be automatically shut down by the release of the Halon 1301. Time must be allowed for fans and motors to stop rotating before the agent is released into the space.

If a diesel or gasoline engine draws air from the protected space, the engine must be shut down before the extinguish agent is released. Otherwise, the Halon 1301 would be decomposed by the high pressure and temperature within the engine. An automatic shutoff, activated by the extinguishing system is required.

FOAM SYSTEMS

Foam is used mainly in fighting class B fires, although low-expansion foam (with a high-water content) can be used to fight class A fires. Foam extinguishes mainly by smothering, with some cooling action. Foam may be generated chemically or mechanically.

Foam systems are found in boiler rooms, machinery spaces and pump rooms on all large vessels. Mechanical foam systems may be installed in these spaces instead of other approved systems such as CO_2. Deck foam systems must be installed on tankers constructed after January 1, 1970, as fire protection for flammable-liquid cargo. Some older vessels may have foam systems protecting flammable liquid cargo holds; foam systems are no longer employed for this purpose.

Fixed foam systems are designed to protect the inaccessible parts of the machinery space, such as under boilers and floor plates, and the bilges of fire rooms and motor rooms. The system must be activated manually when fire is discovered in the protected area. First the water and foam-concentrated supply pumps are started. Then the proper control valves are opened to allow the water

and foam concentrate to flow to the proportioner. If central foam-producing equipment furnishes foam solution to more than one piping system, then the control valve to the proper system must be opened. In most fixed systems, the nozzles are aimed at a bulkhead or metal deflector, so the foam flows gently onto the surface of the burning liquid. All spray nozzles discharge at the same time, to cover the area rapidly with a blanket of foam.

Deck Foam Systems

Deck foam systems are required on all tank vessels by the 1970 Tank Vessel Regulation. The foam system replaces the fixed pipe, inert gas smothering system, for improved fire protection. With a fixed-pipe, inert gas system, the rupture of a key inert-gas line would make it impossible to get inert gas to the fire. The rupture of the tank would make it impossible to maintain an inert-gas concentration.

The deck foam system is intended to protect any deck area with foam applied from monitors or hose stations located aft of the area. At least 50% of the required rate of application must come from mounted devices (monitors) due to the fact they have greater range, require fewer personnel, and can be put into operation in a much shorter time than handheld devices.

The deck foam system is activated manually. The first step is to activate the foam pumps and open the proper valves in the foam supply room. This starts the flow of foam solution to the fire station through the main piping. The monitor is put into operation by opening a valve that is usually located in the supply pipe at the base of the turret. The handlines at the foam station also must be put into service manually. When the foam solution passes into the foam turret or hand nozzle, air is drawn in; and mixed with the foam solution to produce low-expansion mechanical foam.

Inert Gas Systems for Tank Vessels

Although the inert gas system is not a fire extinguisher system, it is designed to prevent fires and explosions. With few exceptions, every tank ship 100,000 or more dead weight tonnage and with a keel-laying date of January 1, 1975, or later, must have an inert gas system. The system must be capable of supplying to the cargo tanks a gas mixture with an oxygen content of 5% or less by volume.

The inert gas system is composed of a gas generator, a scrubber, blowers, distribution lines, valves, instrumentation, alarms and controls.

Dry Chemical Deck Systems

Ships carrying liquefied gases in bulk are now being fitted with a dry chemical fire extinguishing system to conform with IMCO (Inter-Governmental Maritime Consultive Organization) and the US. Coast Guard recommendations and

regulations. The system is used to protect the cargo deck area and all loading-station manifolds on the ship. Each deck system is actually made up of several independent skid-mounted units. The units are placed on deck so that they protect overlapping areas. The units are self-contained fire fighting systems that use dry chemical.

Each unit consists of a large capacity storage tank holding up to 3000 lb. of dry chemical, 6 to 8-400 cubic foot nitrogen cylinders, and 100-150 feet of rubber hose on reels. The unit can be fitted with a turret nozzle and several handlines. In some systems, handlines are used exclusively; in this case, up to six handline stations can be supplied by each unit. However, in some installations, remote handlines are connected to the unit in piping. The hose lines are equipped with special ON-OFF control nozzles.

Monitor Maximum Capacity (lb./sec)	Maximum Reach (ft)
22	33
55.4	99
99	132

A handline is considered to have a range equal to its length. The actual coverage is affected when the target is above the nozzle. Wind conditions also affect coverage.

When fire is discovered, each skid-mounted unit is activated manually. The nitrogen cylinder valve is opened to release nitrogen propellant. The nitrogen flows into the dry chemical storage through a perforated aerating tube. The holes in the tube are covered with rubber, so that nitrogen can flow into the tank but dry chemical cannot enter the tube. The action is similar to a check valve. The nitrogen cylinder valve is calibrated to release dry chemical to the nozzle at the proper rate. They should always be stowed with the nozzle in the closed position, since the dry chemical flows as soon as the nitrogen is released.

If handlines are used, its entire length should be pulled from the reel. This ensures a smooth flow of dry chemical and provides enough hose for maneuvering at the fire. The handline-nozzle lever has two positions: Lever forward (CLOSED); lever back (OPEN). The flow of dry chemical into turret nozzles is controlled by a turret control valve. The valve must be opened by the turret nozzle person when he/she is in position. Some turrets can be activated and controlled from a remote station.

Streams from both handlines and turrets should be directed onto fires in the same manner.

To fight a spill fire, the stream should be aimed at the base of the fire and moved back and forth in a sweeping action. When the turret and handlines are used

together, the turret stream should be used to quickly knock down the bulk of the flame. The handlines should be directed at the flanks of the fire.

Hose lines from the fire-main system should be run out and charged with water. However, water streams should not be directed into the fire unless it's absolutely necessary. Initially, they should be used to protect personnel from radiant heat, which can be very intense. If possible, the flames should be extinguished or confined to a small area by the use of dry chemical only. Then, water streams can be directed into the area to cool hot surfaces.

SECTION 6. SHIP FIRES

Ship fires are among the most difficult to control. The variety of fuels aboard and the ways in which their combustion products can hamper fire fighting operations are obvious to firefighters. In addition, the ship's configuration complicates extinguishment. If the fire is located in a below decks compartment, it will be surrounded by steel decks and bulkheads; the space will be difficult, if not impossible to ventilate. Materials burning in a lower cargo hold may be impossible to reach, since everything stowed above the fire would have to be removed. This is very important, especially if the ship is at sea. Fires located on weather decks may be easier to reach, but fire fighting operations could be complicated by adverse wind conditions.

What is actually burning determines the appropriate type extinguishing agent, but the location of the fire dictates the method of attack. In some instances, the fire location determines both the extinguishing method and the attack method. Cargo hold fires are an obvious example: they are fought with CO_2 rather than water, even when class "A" fuels are involved. The method of attack is an indirect one that is somewhat unique to cargo hold fires.

TRAINING

The fireboats are one of the most completely equipped units of the Department because of the obvious reason that they may be the only units operating at a location inaccessible to land apparatus. However, the best and most complete equipment is of little value unless the personnel assigned to its use are thoroughly trained. It is the responsibility of the Captain to train his crew by frequent drilling. Drills should cover every phase of fire fighting and seamanship that may be required by the fireboat crew. When possible, drills should be held under simulated conditions of actual operation to instill confidence and to develop skill in the use of equipment. Equally important are frequent inspections of ships and waterfront facilities where the Captain, pilot, and crew may gain knowledge of their construction and use, their fire hazards, and their probable life hazard potential in a fire. Land companies which respond to waterfront alarms must participate in such drills and inspections since they are subject to respond to fires in ships moored at piers and wharves and to fires involving other waterfront facilities. These companies may be assigned to staff the fireboat or to augment the firefighting crew of the fireboat during the course of a fire.

ASSISTANCE AVAILABLE TO INCIDENT COMMANDER

Every Incident Commander should have a comprehensive knowledge of the resources and assistance available to the Department for fighting ship fires. By federal law, the primary responsibility for the protection and security of vessels within the territorial waters of the United States rests with the masters, owners, operators, and agents of such vessels. The Captain of the Port, US Coast Guard, has the authority to take full or partial possession or control of any vessel within the territorial waters of the United States under his jurisdiction, whenever it appears to the Captain that such action is necessary in order to secure such vessel from damage or injury, or to prevent damage or injury to any vessel or waterfront facility. The Captain of the Port also has the authority to enlist the aid and cooperation of Federal, State, County, Municipal, and private agencies to assist in the enforcement of the above regulation.

It is the experience of the Department that the master, the deck officers and the engineering officers of any vessel have always extended their fullest cooperation to the Department during a fire in the vessel. These officers will have a thorough knowledge of the construction of the ship, its hazards and its degree of stability. They will have the most immediate knowledge of the location, nature and extent of the fire, and of the availability of the ship's fire extinguishing aids.

Should the ship's officers not be on board, as when the ship is in port and moored to a pier or wharf, the ship will be in the charge of a Port Officer. Often shipping companies employ marine superintendents at ports from which their company's ships operate. These port superintendents usually will be present at a fire in a vessel belonging to their company and will render assistance to the Incident Commander

Representatives of the Maritime Insurance Underwriters are also available for assistance to the fire department. Through their cooperation with the ship's Captain and the representative of the ship's owners, they may make available tugs, barges, stevedores, specialized fire fighting equipment and other extinguishing aids. The Port Authority harbor tugs and many of the Navy, Coast Guard, and Army Transport tugs and other small craft are equipped with fire pumps, deck outlets and monitors and are capable of assisting as auxiliary fireboats when required. The fireboat of the Oakland Fire Department also is available through mutual aid provisions. The Port Fire Marshal, or his representative, responds to all waterfront fires, and also renders every assistance to the Department which can be provided through the offices of the Port Authority.

FIRE FIGHTING STANDARDS

It is no more practical to set forth rigid rules and regulations for fighting ship fires than it is for fighting building fires. Experience, however, has developed certain

standards which, under most conditions, will prove helpful in extinguishing ship fires.

Policy

The Incident Commander should not order a ship moved from its mooring or anchorage. The IC may recommend to the ship's senior officer that such action be taken, or obtain the authority and approval of the Captain of the Port (United States Coast Guard) and of the Port Authority to enforce such action.

The IC should always enlist the aid and direction of the ship's senior officer and/or the aid and direction of the Captain of the Port for correction of a list which a ship has taken due to accumulation of water in the ship during the course of fire fighting. The Incident Commander should not undertake any action to scuttle or flood a ship without the approval and direction of the Captain of the Port. Department personnel are not qualified to undertake responsibility for this type action.

Cutting of any watertight bulkhead, hull plating, or cutting into engine room areas or other areas where machinery, electric cables, etc. may be damaged should not be attempted by Fire Department personnel without the approval of the ship's senior officer. In the event such approval cannot be obtained, then the direction of the Captain of the Port should be secured, particularly if the cutting action would endanger the watertight integrity of the ship.

Accessibility

The position at which a ship on fire is most accessible to Fire Department personnel and equipment is when the ship is berthed at a pier or wharf. Such a position makes possible the use of both land fire fighting equipment and fireboat equipment. It also facilitates overhauling the cargo. It provides for accessibility to or from the ship by use of the ship's accommodation ladder or gangplank, and by use of Fire Department ladders.

A problem may develop where it will be necessary to move a ship on fire to a fire resistive mooring, such as the off-shore end of Pier 50. There the danger of the fire extending to combustible shore structures is minimal and the location provides access to land apparatus. It may be necessary to move the ship to a position remote from shore structures, ship channels, bridges, etc. because of an explosion hazard or other hazard. The extent of the fire and/or the nature of the cargo may be such that, as a last resort, the ship will have to be flooded. It will then have to be moved to a position where it will present the least navigational hazard and where the bottom will not severely damage the hull of the ship or cause it to capsize.

If the fire involves the superstructure of the ship to such an extent that hose lines cannot immediately be led on board, control of the fire may be obtained from the

pier and/or fireboat through use of land based master streams and fireboat monitors. Every effort should be made to get hose lines on board at the earliest possible moment. Extreme care and judicious control of the heavy stream discharge must be maintained to prevent large accumulations of water in the ship which may cause it to list dangerously or to capsize.

Should it be necessary to transport personnel or equipment to or from the fireboat while fighting a ship fire off-shore, the Communications Center shall be so notified. They have a record of various government and private agencies that will provide such transportation.

Life Hazard

As in any fire, the first consideration of the Incident Commander is the hazard to life. Life hazard at a ship fire usually will be most severe on a ship which is underway, coming in or leaving port, when the passenger and/or crew complement of the vessel is at or near its maximum and the holds are full of cargo. Fire on board a vessel moored to a pier does not present as severe a life hazard because most of the passengers and a large percentage of the ship's crew will be ashore. It must be emphasized that the spread of fire in a ship can be extremely rapid due to the presence of strong drafts created by multiple horizontal and vertical openings.

Size-Up

On arriving to take charge of a ship fire, the Incident Commander should immediately contact the senior ship's officer. The IC should obtain from this officer information concerning the exact location and extent of the fire, the materials involved, the hazard to life, the danger of the fire extending to adjoining holds or compartments, to shore structures, or to other craft. The IC must determine if cargo doors and port holes at the sides of the ship are closed, if watertight doors in bulkheads and fire doors are closed, and if power is available to move the ship. The IC should require that the ship's plan and cargo stowage plan be made available. The IC and his subordinate officers may refer to these plans during the progress of the fire. These plans are particularly important because verbal information given under the stress of a fire may not be reliable. The ship's cargo stowage plan on outgoing or incoming ships will be complete; but on a ship in the process of loading, the cargo stowage plan may not be fully made up. The Incident Commander will have to rely on the ship's cargo manifest and verbal information obtained from the ship's officer and cargo handlers.

Other important points on which the Incident Commander should be informed, relative to the extent and hazard of the fire, are:

1. What steps have already been taken by the crew to extinguish the fire? If CO_2 or steam has been used or is in use, and whether such gas or vapor is still confined to the fire area. What fire

extinguishing equipment is aboard, i.e., pumps, fire mains, hose, sprinklers, CO_2, Halon 1301, foam and steam systems and is it available for use?

2. What are the means of access to the fire area and to adjacent holds, compartments and bulkheads?
3. How can the access of air to the fire area be controlled?
4. Can water introduced in the course of fire fighting be pumped out? The ship's engineer will be best qualified to give this information, and will be able to determine whether eductors and portable pumps can assist and where they should be positioned.
5. Which compartments or holds adjacent to the fire area may be affected by radiated or conducted heat or by direct spread of fire? Where can hose lines be led to keep exposed bulkheads cool? Whether arrangements can be made to provide the assistance of dock workers, if necessary, to work out and move cargo?
6. It should be determined whether the ballast tanks, fuel oil and fresh water tanks are full or empty and if fuel oil is contained in the double bottom tanks below the fire. In the case of empty tanks, it may be necessary to consider whether they should be filled with water to counteract the effect hose streams may have upon the stability of the ship.
7. In all ship fires, it is particularly important that an avenue of escape be maintained for the fire fighting force. The type of cargo and its effect on the stability of the ship should be kept in mind. Large units such as locomotives, buses, trucks, tractors, and launches are often stowed on deck and over hatch covers, as well as in holds, in shelter or 'tween decks. While they may not be dangerously combustible, the burning or loosening of lashings, flattening of tires, buckling of decks, or listing of the ship, may cause these units to shift and endanger personnel and/or the stability of the ship.
8. The Incident Commander of a fire on board a ship moored to a pier should be cognizant of the relatively slow response of the fireboat. A fireboat cannot be maneuvered as easily as a road apparatus. It is continually affected by wind, tide and navigational obstructions. It is very important that instructions given to the fireboat by radio be correct, otherwise considerable time will be lost in unnecessary maneuvering.

Hazardous Materials

Hazardous materials will be found included in the cargo of many ships. The dangers and methods of fire extinguishment of such materials are identical to those on land with the possible exception that a ship can be moved to a safe location remote from exposures.

At ship fires, high concentrations of toxic or suffocating gases often accumulate in holds, tanks, bunkers and other ship spaces. There are cases on record which show that the percentage of oxygen in ship tanks or voids which have been sealed for long periods was as low as 4%. Depletion of oxygen and generation of carbon monoxide will occur in holds where a fire has been burning with the hatches covered.

Cargoes of organic origin such as linseed oil cakes, rosin, tobacco, potatoes, oranges and similar products, aided by moisture, can produce dangerous gases. Carbon dioxide used by the ship's crew to control a fire may be present in high concentrations in holds, compartments and other spaces. In port, a ship may be in the process of fumigation, using fumigants such as hydrocyanic acid or methyl bromide. However, port regulations require that NOTICE OF FUMIGATION signs be posted conspicuously and that the Fire Department be notified regarding the location, time, duration and nature of the fumigant before the fumigation begins.

Firefighters must always be protected with self contained breathing apparatus at any stage of a ship fire. Extra breathing apparatus and spare cylinders should always be available on deck. Fireboat personnel should don breathing apparatus on deck of the ship involved, and not on the fireboat due to the danger of losing balance and falling overboard while climbing a boarding ladder. In every case where breathing apparatus is used at a ship fire, life lines and/or signal lines should be utilized as instructed in the San Francisco Fire Department Rope Manual. This is a prerequisite for safety when operating in holds or passageways. The maze of passageways is confusing and the means of egress from holds is difficult to locate under smoke conditions.

When a hazardous cargo, such as explosives, is aboard a ship and is exposed to fire, every safeguard should be taken to prevent a catastrophe involving loss of life and extensive property damage. Flooding the holds or scuttling the vessel, however, should only be considered as a last resort. Experience has demonstrated that with the exercise of sound judgment, close supervision, and extreme care, the majority of such fires can be extinguished with hand held hose lines taken to the seat of the fire.

Handling and storage of explosives within the port area of San Francisco is permitted only under strict regulations adopted jointly by the Captain of the Port, US. Coast Guard; the Chief of the Division of Fire Prevention, San Francisco Fire Department; the Fire Marshal; and the Chief Warfinger of the San Francisco Port Authority. These regulations prohibit loading of dangerous explosives (Class "A") in other than remote off-shore areas in the bay known as "High Explosive Anchorage's". Lighters are required for ship to shore transport.

All ships engaged in loading or discharging explosives and flammable volatile liquids, or taking on fuel, are required to display a red flag from their signal halyards in the daytime and a red light at night. These signals warn approaching vessels of the danger of open lights, smoking, collision, etc.

Handling Class "C" explosives and fireworks from ship to pier to receiver or storing limited quantities of such materials on piers is permitted when in compliance with port regulations. Transporting small quantities of "dangerous cargo", such as Class "A" explosives or ammonium nitrates, across a pier to a ship may be permitted under port regulations, but storage of such materials on the pier is prohibited.

Spread of Fire

Fires in ships can extend through radiation, conduction, or by direct contact. Steel used in construction of ships, will readily conduct heat and ignite combustible material in contact with it. Fire may spread through horizontal and vertical openings common on ships, or through pipe ducts or hidden spaces covered with paneling. The ship's ventilating system should be shut down immediately at ship fires of any magnitude to prevent fire extending via vent ducts. Many vessels maintain a master control of the ship's ventilating system on the bridge by which the system may be shut-down quickly in case of fire. On other vessels, reliance will have to be placed on the ship's officers for control of the system.

The Incident Commander of a ship fire must check all sides of the fire area as well as above and below the fire frequently. Particular watch must be maintained to prevent embers from dropping down holds and companion ways and starting additional fires in such spaces. A close watch for possible spread of fire outside the ship should be kept during all stages of a ship fire. Fire may spread to adjacent shore structures or to stacks of materials on an adjacent pier or wharf without being noticed. The mooring lines may burn away and allow the ship to break adrift.

Fire fighters should be prepared for heavy smoke to issue from unexpected places as a result of the construction of passageways, corridors, and air ducts. They should not be misled into directing hose streams down openings, such as ventilator shafts, from which smoke is rising, unless heat is also present and it is known that the water will reach the fire area. The smoke extractor and portable electric exhaust fans are very useful in clearing smoke from holds. Plugging or covering deck ventilators with canvas is also useful in controlling flow of air that may be accelerating the fire.

It is standard practice to maintain a fire watch aboard the vessel after the fire has been extinguished, especially if cargo is being unloaded from a hold in which there has been a fire. Unless unavoidable, overhauling of cargo should not be done on the deck of a pier or wharf. It would be better to overhaul on the deck of

the ship on which the fire occurred, or on a barge brought alongside for salvage purposes. If there is no alternative to stacking and overhauling burnt material on a pier or wharf, the area selected should be wet down frequently and a fire watch, equipped with charged hose lines, should be maintained until it is certain that there is no possibility of fire breaking out in the salvaged material.

Cargo Hold Fires

The intensity of a cargo hold fire will depend primarily on whether or not the hold is covered; if the cover has withstood the fire; and whether CO_2, steam or any other extinguishing accent has been used to hold the fire in check pending the arrival of the Fire Department. As previously stated, hold hatches are surrounded by a coaming or raised side provided with sockets into which the supports for the hatch cover are placed. The covers are usually strong timbers cut in sizes to fit the opening. When the hold is full, they will be covered with a tarpaulin secured in place by batten bars and wedges. Some ships may be provided with metal hatch covers weighing several tons. A boom or derrick will be required to raise such metal covers from the hatch. If power is not available on the ship to operate the ship's winches, arrangements must be made to provide a floating crane or land crane.

Access to the ship is provided by the ship's accommodation ladders, by pier gangways, and by placement of Fire Department ladders. Ladders placed to the side of a ship should never be strapped to the ship. The movement of the vessel, due to swells, tide or any subsequent list, may displace the ladders, break the strap or break the ladder. Access to holds is provided by permanent vertical hold ladders at the side and/or end of the hatch, by a vertical ladder leading from an inspection hatch opening, or by ladders in mast houses having trunks with watertight doors to the 'tween decks and lower hold. If Department ladders are used to provide access into holds, be certain that their footing is secure. If it is suspected that they are not resting on a solid surface, secure the top of the ladder at the hatch opening. When stepping off any ladder into a hold, step forward, never backwards, to avoid falling into a lower section of the hold.

As in any fire, the first extinguishing operation of the Fire Department at a cargo hold fire is to lead hose lines to the seat of the fire and to exposures to which the fire may extend. If the hatch covers have not been removed, all necessary hose lines should be led into position and charged before any attempt is made to open the hatch. Circulators, fog nozzles, and straight stream nozzles should be provided. Firefighters equipped with self-contained breathing apparatus should be assigned to stand-by, ready to descend into the hold.

The Incident Commander should endeavor to determine the location and intensity of the fire before removing the cover by removing either the small inspection cover or a small portion of the hatch cover near a hold ladder. If the cover is battened down with a tarpaulin, it should be rolled back partly so that the hatch can be secured again quickly.

Whenever possible, firefighters, equipped with self contained breathing apparatus and life lines, should enter the hold with small hose lines and attempt to extinguish or control the fire until the hold can be thoroughly ventilated and the cargo worked out in order to reach the seat of the fire. Cargo hold fires are similar to basement or sub-basement fires and working conditions are often not as bad in the hold as they may appear from above. Only firefighters equipped with breathing apparatus should be allowed to enter the hold until it has been thoroughly ventilated.

If it is impossible to enter the hold, heavy streams and circulators can be operated from the deck level through the hatch and sometimes through ventilators. As soon as possible, hand held hose lines should be led into the hold to lessen water damage and to prevent a large accumulation of water in the hold.

When reasonable control of the fire cannot be quickly affected by the above method, holes may be cut in the deck or bulkheads with an oxy-acetylene torch. The holes should be large enough for hose lines or circulators and should be cut at points where the plates are hottest. Before the holes are cut through, charged hose lines should be made ready for immediate attack. Should it be necessary to cut a hole through the ship's side, the hole should never be cut below the bettween deck. Any subsequent listing of the ship might bring the hole under water and dangerously flood the vessel. If it is necessary to cut through the ship's side or through a bulkhead to release accumulated water, a diamond shaped hole should be made starting at the lowest point and working upwards. This will keep the cutting flame at a point above any escaping water. Improvised plugs should also be at hand if holes are cut in a bulkhead or ship's side to plug the hole.

The bulkheads of the holds or compartments adjoining those involved in the fire should be examined for heat as soon as possible. If such adjoining spaces are likely to be affected by heat radiated from or conducted through the bulkheads, the bulkhead should be cooled with spray streams. Exposed cargo or other combustibles should be moved away from contact with the bulkhead or removed from the area. No more water than is absolutely necessary should be used to cool the bulkhead to avoid unnecessary water damage. Close portholes, side loading doors and other openings in the ship's side to reduce the amount of air reaching the fire and the possibility of water entering the hull through these openings should a list of the ship occur. The plates of the ship's side should be checked frequently. If there is any indication of their heating, they should be cooled immediately with hose streams. This action is essential to prevent bulging or warping of the plates, especially, just above the water line where opening of a seam or fracture of a plate could produce flooding.

In practically all hold fires it eventually will be necessary to work out the cargo in order to reach the seat of the fire and to extinguish it completely. This is

especially true where the fire is in the lower hold and is inaccessible due to stowage of cargo above. If the amount of the cargo necessary to be unloaded is large, the Fire Department should request from the ship's master, owners, representatives, or underwriters, experienced stevedores to assist in unloading the cargo.

If large quantities of water have accumulated or threaten to accumulate in the 'tween deck spaces, the stability of the ship may be endangered. Arrangements should be made to remove the water with eductors and/or portable pumps, if the ship's pumps are inoperative or of insufficient capacity.

If it is considered necessary to attempt to control or extinguish the fire with CO_2 or steam, the hatches should be battened down. All hold ventilators and bulkhead openings should be closed. A small exhaust ventilator, a small hatch opening, or a bilge sounding pipe may be used to inject CO_2 or steam, if no fixed system is provided. After the hold is flooded with CO_2 or steam, these remaining openings must be closed. The hold should not be opened until it is believed that the fire is out or until all arrangements for fighting the fire with Department equipment have been completed. Control of the fire can usually be judged by the temperature of exposed hull and bulkhead plates, thermometer reading of the interior temperature, and by the temperature, quantity and density of smoke finding its way out of the hold.

Flooding of a hold should be attempted only as a last resort. A proper attack on the fire, combined with working out the cargo will usually yield satisfactory results.

Fires in Machinery & Storage Spaces

Fires which occur in engine and boiler rooms are commonly caused by a rupture of the oil supply lines. The most common causes of such failure are cracks or faults in the oil line or a collision. Other causes are defects in the burner, fuel tanks or settling tanks overflowing, oil accumulation in the bilge, electrical defects, and punctured fuel or settling tanks. The primary source of ignition is contact of leaking oil with hot surfaces such as hot pipes, boiler fronts, etc.

Most oil burning ships are provided with remote controls to shut off the flow of oil to the boiler room. These remote controls are located on deck near the engine or boiler room ladder or on the bridge. On some ships there may be two remote shut-offs, one to shut off power to the oil pump and one to shut off oil supply. Machinery spaces are provided with fixed foam, CO_2, steam or water spray systems and with suitable portable extinguishers. One of the first duties of the Incident Commander of a fuel oil fire in a ship's engine or boiler room should be to consult with the ship's chief engineer and, when necessary, request that the oil supply be shut off. The engineer's cooperation should also be sought regarding the use of any fixed extinguishing system. In his absence, reliance will have to

be placed on available information supplied by other ship officers or crew members and by such information as may be included in the ship's plan.

Access to machinery room spaces is normally available by means of the engine room or boiler room ladders. Access also may be possible from the shaft tunnel, where the tunnel is provided with a watertight bulkhead door. Access to the tunnel is gained through the aft escape hatch. In many machinery room fires, the updraft may be so great that it will be impossible to reach the room from above. Access to the space then may be gained through an uninvolved engine room, boiler room, or shaft tunnel bulkhead door. Access may also be gained through holes cut in the bulkhead between the boiler room and the adjoining hold.

In all machinery room fires, firefighters going below decks must be protected with self-contained breathing apparatus and provided with charged hose lines equipped with fog or spray nozzles and charged foam lines. When foam hose lines are ready for advancement, as much ventilation as possible must be provided for the area being worked into. When advancing through bulkhead doors, the door must be opened with extreme caution because oil may be above the door coaming. Holes through bulkheads must be cut sufficiently high above the machinery room floor for the same reason. The proper use and operation of fog or spray nozzles is extremely important to cool the atmosphere, to permit a close approach to and subsequent extinguishment of the fire, and for the protection of the firefighters working into the fire area. An escape route must be kept available. Additional hose lines must be made ready and charged for protection of the firefighting crew.

A small fire in a machinery space resulting from an accidental release of a limited quantity of oil can usually be extinguished with a Class "B" portable extinguisher, with spray streams or with fog streams. A fire caused by oil leaking from a supply pipe can quickly develop into an intense fire and drive the ship's crew out of the machinery space. Heat of the fire may cause the leaking oil to heat and flow more freely. Attack on such a fire will first require that the flow of oil be shut off by remote control if possible, followed by use of the ship's fixed extinguishing system and advancement of Department fog or spray streams and foam streams. Use of fixed CO_2 or steam systems in this type of fire may not be practical when the intense updraft prevents sufficient concentration at the seat of the fire. Foam, water spray or fog systems usually will be more efficient. The use of several spray or fog streams in the access way above the machinery space will provide considerable cooling effect and will reduce the updraft and vaporization rate of the leaking oil so as to permit a safer advance to the seat of the fire. This procedure can also be used when the fire is being fed by oil escaping onto the floor of the machinery space or onto the fuel tank tops. Fixed CO_2 or steam systems provided for an oil fire occurring above the tank tops and under the floor of the machinery space have proven very satisfactory. It may be necessary in this type fire to pump water into the bilge to float the oil above the floor level where foam may be applied more efficiently.

Occasionally fires may occur in shaft tunnels as a result of overheated bearings. There seldom is any flammable material in such spaces, apart from the oil or grease in the shaft bearings. Such fires usually are easily extinguished with approved portable extinguishers or fog streams. If it is impossible to reach the tunnel and extinguish the fire because of intense heat, smoke or other reasons, it may be possible to shut all watertight doors and flood the area.

Fuel oil fires in bilges can be extinguished by fog, steam, CO_2, or foam. They are comparatively easy to control in their incipiency by use of the ship's extinguishing equipment located in the engine or boiler room. However, if the fire has gained much headway, hose lines must be led in. The use of the bilge sounding pipes for the discharge of CO_2 or steam, flooding or draining the area, and the application of foam or fog streams should be considered. Fuel oil, contained in double bottoms below a hold involved with fire, is seldom a problem. The water under the ship and the water collecting on the tank top from the hose streams discharged on the fire will keep the oil sufficiently cool to prevent a serious hazard.

In any extensive fire involving fuel oil in a machinery room, precautions must always be taken against the possibility of flashback or re-ignition of oil due to the large number of hot surfaces with which the oil may come in contact. Fog streams should be provided to protect firefighters advancing hose lines and to keep these firefighters cool and shielded. The application of solid water streams in such type fires is seldom advisable. If used, they should never be allowed to play on hot pipes or on boiler fronts. They may cause the pipes or glass gauges to break and release high temperature steam or water. Foam streams should be applied to flow the foam gently over the fire to avoid undue agitation of the oil. Very little overhauling will be necessary in machinery room fires. Standby lines should be maintained until it is absolutely certain that no re-ignition of oil will occur.

Oil fires in the machinery spaces of small craft such as tugs, fishing boats and pleasure craft may be successfully extinguished with the fireboat CO_2 or foam equipment. However, the precaution of protecting firefighters operating such equipment with charged fog or spray hose lines should always be observed.

Modern ships make use of electricity to operate various kinds of equipment such as winches, ventilating fans, steering engines, propulsion motors, etc. This equipment will be located throughout the ship. The engine room, equipped with steam or diesel engine driven generators and large electrical equipment, will often resemble an electric power station on land with similar fire fighting hazards and problems. Fires in a ship's electrical machinery usually are controlled by the ship's crew using Class "C" fixed or portable extinguishing equipment. If the Fire Department is called, no attempt should be made to extinguish such a fire unless a qualified ship's engineering officer is present to direct safe procedure or unless

the Fire Department Incident Commander is certain that all electric power is shut-off.

Use only Class "C" extinguishing agents. These include the ship's CO_2 extinguishers, Halon 1301, either portable or fixed, the fireboat's 200-ft. CO2 hose reel, or dry chemical portable extinguishers. Protect operating firefighters with self-contained breathing apparatus.

Ventilation is critical to effective fire fighting in engine room fires. As the attack is made, doors and hatches in the upper parts of the engine room, preferably those opening directly to weather decks, are opened to vent the products of combustion. Once the fire is completely out, and surrounding structural members have been cooled, mechanical venting is used to remove the combustion gases and draw in cool air. This is permissible, since the duct is vented directly to the outside. In most cases, operation of the exhaust fan at the top of the engine room on low speed would accomplish the necessary venting.

Container Fire

A fire involving ordinary combustibles in a modern, well-built container will frequently extinguish itself by consuming all of the oxygen in the container. In the following examples we will assume that this did happen.

Example-Container Fire on Deck: The container is in the center of a three stack and is surrounded on three sides by other containers. It was packed at a stuffing shed at the terminal and can be expected to contain a variety of materials, none reported hazardous.

The Fire Department responds and along with a vessel representative checks the container labels and the cargo manifest to determine the contents of the involved container and adjacent containers. At the same time, a houseline is advanced to the involved container and is immediately used to cool down the container. A second backup line is lead to the container.

The cargo manifest indicates that water is the proper extinguishing agent. Crewmen chisel or punch a hole about 1 inch in diameter near the top of one side of the container, close to the hottest area. A piercing applicator or pike end of a fire axe could be used. A short applicator is attached to a combination nozzle, and the low-velocity head is removed (vessel or fireboat equipment). The applicator is inserted into the hole, and the nozzle is opened. The nozzleman floods the entire container, even though this may not always be necessary.

If the cargo in the container is very valuable and can be damaged by water, CO_2 or Halon can be introduced into the container through the opening. Six or more portable 15 lb. CO_2 extinguishers should be used for the initial discharge. The opening should then be plugged, and additional CO_2 discharged hourly, until the fire is extinguished.

Protecting Exposures: A house line is used to protect the adjacent containers and to cool the deck. If the fire were intense and a container located right on the deck were involved, it would be advisable, as a precautionary measure, to inspect the compartment immediately below the main deck for extension by conduction.

Overhaul: The container is opened and its contents removed and examined. Any fire that is discovered is extinguished. This step may be delayed until the container has been unloaded in port.

Container Fire in a Hold: This is an example of a container fire in a ships hold. The smoke detection system indicates smoke in number 4 hold, lower section, starboard side. The ship is at sea, ten miles outside of the Golden Gate. The number 4 hold is fully loaded with containers, and there are two tiers of containers on top of the hatch cover.

The fireboat is dispatch, responds and the firefighters board the vessel. Firefighters and the ships fire party open the emergency escape hatch and note a minimum of smoke and no heat. Visibility within the hold is 50 ft. The on-scene leader declares that the hold can be entered. Two crew members, familiar with the stowage of containers on the ship and firefighters, all equipped with breathing apparatus, lifelines and portable lights, ente the area. When they reach the lower level, they still encounter light smoke and no heat so they decide to proceed. A houseline is lowered to them, and crewmen on deck are standing-by to pay out additional hose line.

The fire party locates the burning container. They first cool the outside of the container with water fog. Then they make an opening into the container, insert the applicator and discharge water into the container. The applicator is held in place until sufficient water has entered the container. Then the team examines the involved and adjacent containers for hot spots. When additional examination indicates the fire is out, the hose lines are withdrawn, the hold secured and the detection system restored.

If initial examination had disclosed a considerable amount of smoke and heat, with less than 50 ft of visibility, the hold would have been sealed. It then would have been flooded with CO_2.

The confinement, exposure protection and overhaul would be the similar to a container fire on deck.

Store room and Locker Fires

Storeroom and locker are practically synonymous in shipboard terminology. They are spaces or compartments in which ship materials such as linen, paint, food, boatswain's and engineer's supplies are stored. The space referred to in a

ship as a "locker" bears no resemblance to what is known as a locker ashore. Usually it is of considerable size and is filled with various combustibles and presents a serious fire hazard. Locker fires smolder for long periods of time before being noticed. They are often difficult to reach with hand lines due to the generation of intense heat, smoke, carbon monoxide, and other gases of combustion. The doors to locker rooms are often locked making forcible entry necessary. The effectiveness of operating with at least two fog or spray steams should be apparent, one line protecting the other and both aiding in the absorption of heat, smoke, and other combustion gases.

If smoke and heat conditions are extremely severe, it may be possible to stretch hose lines down a remote hatchway and then lead through a passageway to the area involved, taking care that hose lines are not operated against each other preventing the advancement of either. If the locker room on fire cannot be reached within a reasonable period of time because of intense heat and smoke, the hottest spot on the deck above the fire or in the adjoining bulkhead should be located immediately and cut open with an oxyacetylene torch to operate circulators. In this operation, the hose line, with shut-off control and circulator, must be stretched and charged so as to be ready for operation as soon as the hole is cut. Charged hand held hose lines should also be ready to work down into the locker on fire. Operation of the circulator for a short period of time usually will extinguish the main body of fire and permit advancement of hand held hose lines to the seat of fire.

Firefighters operating below decks must be protected with self-contained breathing apparatus. Provision of adequate ventilation is required at any locker fire. It is very important to examine spaces on all sides of locker fires frequently. Such fires often extend outside the locker in two or more directions by heat conducted through or radiated from bulkheads and decks. Careful overhauling of materials stored in lockers is essential after the fire is extinguished.

The lockers in which fires are most common are those in which the boatswain's and engineer's stores are kept. Paint and linen lockers are frequently protected with fixed extinguishing systems. The boatswain's locker is usually located in the forepeak with access from the fo'c'sle passage. A boatswain's locker may be on more than one deck with a common hatchway to each deck. Materials stored in this space will include oakum, rope, canvas, mops, brooms, hemp, etc. The engineer's locker usually is located at an intermediate level in a wing or half deck off the engine room. It may contain a workshop as well as combustible stores such as machine waste rags, oil, grease, etc. Fires in engineer's lockers, if not quickly controlled, have been known to severely damage the machinery and the engineer's quarters.

Passenger Stateroom or Cabin Fires.

Fires in the passenger accommodations of ships are like those which occur in large hotels. Spread of such fires is usually due to delayed alarms or to structural defects.

Fire fighting procedure in passenger accommodations should always include utilization of the ship's sprinkler system in the same manner as would be the case with a building fire. The use of the ship's fire main and hose equipment should not be overlooked, particularly for immediate attack while Department hose leads are being made. The fire main system should be augmented by charged Department hose lines led into inlets, if provided and if necessary.

On large passenger ships, professional firefighters or ship's crew trained in fire fighting are often available. Their help and guidance should be requested by the Incident Commander.

The danger of fire spreading by means of the ventilating system in passenger accommodations is always a severe hazard. The system should be shut down immediately by means of a master control on the bridge or by other controls operated by the ship's engineer.

Fire doors are provided at intervals in the long corridors of passenger areas. Fire doors and watertight bulkhead doors, in the involved area, should be closed as soon as possible to prevent fire spread and to confine the heat and smoke to the fire area.

Generally speaking, a watertight bulkhead is similar to a non-watertight bulkhead except for the fact that the watertight bulkhead has been sealed to prevent the passage of water. A watertight bulkhead will prevent the passage of smoke and flame. It will, however, transfer heat by radiation and conduction the same as a non-watertight bulkhead. Therefore, if it is necessary to depend on a watertight bulkhead for a fire stop, it should be inspected frequently. Charged hose lines should be provided at the side opposite the fire to cool it if necessary.

Usually, fire in passenger accommodations can be controlled and extinguished by advancing hose lines to the seat of fire and to exposures on all sides. Firefighters must be protected with breathing apparatus and fog or spray streams. Fire in concealed spaces covered with paneling may travel quickly and be difficult to locate. It is always advisable to remove sections of such paneling in adjacent cabins, passages and corridors to make certain that fire has not spread through these voids. Ventilation of cabin areas can usually be provided by opening portholes from the inside. If it should be impossible to open portholes from the inside, ventilation often can be achieved by lowering a firefighter over the side in a rope sling, or by raising a firefighter with an aerial ladder spotted on the pier apron, to break the glass of a porthole with an ax. In some cases it may

be possible to get at the fire more quickly and easily with a hose line operated through the porthole if protection against fire spread is provided inside the ship.

Always exercise caution discharging large streams and fireboat monitor streams into the upper deck compartments. A large accumulation of water in these spaces may adversely affect the stability of the ship. If it is necessary to cut holes in the ship's side to release water from these areas, the line of portholes will usually give an indication of the position of the decks. Portholes are set 5 to 6 feet above each deck level.

Oil Tanker Fires

Any tanker carrying liquid petroleum products must be considered a possible conflagration. The typical modern tanker has a capacity of approximately 250,000 barrels. The cargo may be any one or several liquid petroleum products, varying from crude oil to low flash point gasoline.

Cargoes of gasoline and oil having a low flash point present the greatest danger. The danger of cargoes of heavy oil is relatively less. The danger of fire or explosion, other than that caused by collision, is less when the tanks are full, properly sealed and vented. When the tanks are empty and contain flammable vapors, fire or explosion may occur from a single spark or from static electricity.

Some of the most serious tanker fires have resulted from collisions. The flow of burning oil from ruptured tanks has spread the fire to the ship's other tanks and to the ship's superstructure. Burning oil, floating on the water's surface, has spread fire to piers and other ships in the vicinity.

There is always a fire or explosion hazard during loading or unloading of tanker cargo. This hazard is due primarily to overflow of tanks or rupture of oil supply lines. Oil flows on the surface of the water and spreads around vessels and piers. The spillage may be ignited by sparks or flames. It is most prevalent when oil barges are brought alongside vessels and between piers during fueling operations. Explosions and fires have occurred on tankers undergoing repairs or when exposed to fires in the vicinity of the tanker.

In general, fire fighting principles applicable to oil tank fires on shore should be followed in the case of oil tanker fires. Concentrate all available foam lines on the burning oil in such a manner that the foam will take effect as quickly and efficiently as possible. Cool the external plates of the ship to avoid tank rupture. Exercise extreme care to prevent water from entering the tanks and causing the oil to overflow.

At any extensive tanker oil fire, the Incident Commander should determine whether there is sufficient foam compound and foam making equipment to deal with the fire before beginning the attack. Required additional supplies should be ordered immediately. Successful attack on oil fires can be made only if the

supply of foam is continuous. A break in the continuous application of foam will allow the fire to gain headway.

Approach to tanker fires must be made as quickly as possible, with adequate leads of foam lines, fog or spray lines and solid streams. Wherever possible, approach and hose leads should be made from the windward side. The tanker should be boarded at a position as remote as possible from the fire area, usually the forward or after deck. The boarding ladders must always be accessible and protected with fog or spray streams in case they are needed for an emergency retreat.

At times, the intensity of a tanker fire may be so great that hose lines cannot be led immediately. It may be necessary to first sweep the vessel with the monitors, tower, or heavy hand streams to cool down the sides and deck of the ship or to control the fire involving the vessel's superstructure. It may be necessary to move the vessel to a position remote from exposures or to remove exposed vessels. The fire may be so intense that the ship's crew has abandoned the vessel. If a collision or explosion has occurred, burning oil may be floating on the water around the tanker. Operation of the fireboat monitors and of heavy hand held streams may be required to break up floating oil fires in order to affect rescue of victims in the water or to make possible the approach of the fireboat to the tanker. Operation of the fireboat forward monitor, as a foam stream, as well as hand held foam streams, may be required to control the fire and to permit boarding of the tanker.

After boarding the tanker, all available foam streams should be concentrated on one tank at a time to provide for maximum coverage of the available foam. When possible, the foam streams should be directed against a tank wall or an obstruction at a point above the oil. This procedure will absorb the velocity of the foam streams, allowing the foam blanket to form without undue agitation of the oil surface. The most effective application of the foam streams can be made from the windward side of the fire. This position will provide protection for firefighters from exposure to flammable vapors. Fog or spray streams should always be provided to protect firefighters advancing foam lines and kept at hand for use if the foam supply should be interrupted or become exhausted. After an oil tank fire has been extinguished, the layer of foam upon the oil should be maintained until it is certain that the tank plates and cover have cooled and there is no danger of re-ignition.

If oil is burning in a tank which has been torn, ruptured or perforated, updraft from the burning oil may prevent quick and efficient foam application. The Incident Commander may be required to use a combination of methods if a foam blanket is to be obtained. Foam may be applied through the manhole of the tanks if they are intact and the heat of the fire does not prevent their being opened. Vent pipes broken off near the tanks may provide an opening to insert a foam nozzle.

However, this procedure is seldom practicable because the relatively small area of the vent pipe will prevent free flow of the foam discharge.

Oil flowing from a broken pipe or punctured tank, and spreading over a considerable area may be extinguished by applying foam to the pool being fed from the break or puncture. This procedure will extinguish or control fire in the large pool area after which the spill may be extinguished with foam, CO_2 or fog. The foam blanket must be maintained until it is certain the flow has been stopped and there is no danger of re-ignition.

Water is just as indispensable in fighting tanker oil fires as is foam. Its use for the external cooling of deck plates, tank covers and the sides of the vessel is vital to prevent heat transfer or tank rupture. Water streams are also required for the protection of exposures and for the extinguishment of fire which has extended to the ship's superstructure, to land facilities, or to exposed vessels. When boarding a tanker to advance foam lines to a burning tank, oil found on deck should be washed overboard with hose streams first before attacking the burning tank. Additional hose lines must be kept operating to drive oil floating on the surface of water away from exposed piles and vessels. Caution must be exercised in the use of water streams to prevent water falling on and breaking up any foam blanket formed at a lower level or from entering an oil tank whether on fire or not. The use of water streams is essential if flooding of the tanker cofferdams or voids is required in order to provide a fire break.

Fog and spray streams are of great value for the protection of firefighters from radiant heat, for cooling purposes, and for the extinguishment of high flash point oil fires such as motor or fuel oils. These oils will seldom mix with water and the spray from the fog nozzle will form an emulsion covering the oil surface and shut off air supply to the fuel. The emulsifying action may be temporary but it usually will last long enough to extinguish the fire.

Fog or spray streams can be used against fires in low flash point volatile liquids only in relatively confined areas or on surfaces where the streams can completely cover the burning oil and dilute the vapor-air mixture to a point at which it will not support combustion. Severe hazard exists in this application. If the area involved is considerable and the streams do not cover it completely movement of the spray may permit a flash back to an area previously extinguished.

Cargo tanks of oil tankers or compartments of such vessels which have been closed for a considerable period of time should not be entered for rescue or any other purpose by anyone not provided with, and experienced in the use of, approved closed circuit breathing apparatus carried on the Rescue Squads. Firefighters carrying out such assignment must always be protected by charged fog or spray hose lines held by firefighters from a deck above. Life lines should always be used and tended by firefighters from above.

Burning oil on the surface of the bay will be best handled by the fireboat using monitor and hand held streams to break it up into patches and to cool and extinguish it. Oil floating on the bay waters, but not afire, also may be broken up into patches in the same manner and separated so as to prevent possible ignition from one patch to another. The cooling effect of the water on which the oil is floating will reduce the danger of the oil catching fire. In either case, the primary effort should be to drive the oil from combustible materials, piers, crafts, etc. Foam applied over the surface of floating oil will reduce the danger of ignition and flashover, making it possible to disperse the oil safely.

LNG VESSELS

Liquefied Natural Gas is a hydrocarbon fuel composed mostly of methane. It burns cleanly, with little or no visible smoke. The flame height is greater than that of other hydrocarbon fuels, and the radiant heat produced is much more intense. In the liquid state, LNG weighs about half as much as water; its liquefication temperature is approximately -162^{o} C (-260^{o}F). Its volume increases 600 times as it changes from a liquid at its boiling temperature to a gas at atmospheric pressure at 60^{0}F. When the temperature of the vapor rises to approximately -112^{o}C (-170^{o}F), it weighs the same as air. It is transported in a liquid state for economic reasons.

LNG is colorless, odorless and severely damaging to eyes and throat. The liquid causes frostbite on contact with the skin. It causes embrittlement fractures in ordinary steel but may be safely handled in stainless steel, certain copper alloy and aluminum containers. The ambient vapor is not irritating to the eyes or throat.

Many safeguards are built into ships that transport LNG to combat spills and fires. These vessels are equipped with deck water spray systems to control spills, prevent brittle fracture of the deck plating and facilitate fast warm-up of the vapors to minimize the fire hazard from cloud drift. The spray system is also used to help prevent ignition. If ignition does occur, the spray system will provide a water curtain to protect vital areas, such as the bridge and gas control room from intense radiant heat of the fire. It also will cover most piping and tanks with a cooling barrier of water. The radiant heat could build up enough pressure in uncooled tanks and piping to cause them to rupture.

Every LNG ship is equipped with enough large dry chemical skid units to protect the entire weather deck area in case a fire occurs and extinguishment is desired. The dry chemical would be used to extinguish a small spill fire where the LNG spill could be controlled. If a large spill were to occur, as from a high energy impact, fire would be almost a certainty. The spread of fire would be controlled with dry chemical, while the fire was allowed to burn itself out. The water spray system would be used to prevent other tanks from being involved.

LNG Spill due to High Energy Impact (Collision)

As of this writing, there has not been a reported high energy impact involving an LNG ship, however it is conceivable that such collisions could occur.

A fire attack on an involved LNG vessel requires that efforts be directed towards controlling the spread of the fire, while the LNG from the involved tank is consumed. This is accomplished by 1) effecting a position for rescue of crew, and maneuvering to change the relative wind more towards the beam (to decrease the heat intensity on the uninvolved tanks; and 2) continuing to cool adjacent structures. Additional cooling is provided by fire-main hose lines and deluge water flow from fire-main monitors. No attempt is made to extinguish the fire.

At least several hours will be required for all the LNG in the involved tank to burn up. During this time, there is no relaxation of efforts to control the fire and keep it from spreading. Eventually, the spill rate begins to decrease. When this becomes evident, the firefighters advance as many water fog applicators as possible to the fire. The fog streams are directed at the breach in the hull, so that flames, will not flash into the double hull as the liquid flow diminishes. Further, the vessels inert gas system should be used to make the breached void inert, as well as the LNG tank as it is draining. This minimizes the danger of explosion when all the liquid has drained and only gas is left. Continue this cooling after the flames have been extinguished, and until all metal structures are cooled to avoid reflash.

It is highly unlikely such an impact could occur without a fire. Since it is conceivable, we must consider the effect of the vapor cloud drifting toward an inhabited area. All present predictions are based on instantaneous release of the total contents of the tank. This in itself is unrealistic, as the breach in the hull would not normally release all the LNG at once. If it did happen, a drifting vapor cloud of such magnitude could present a fire hazard to large inhabited areas. However, it is more likely that a small cloud would form and would dissipate within a few hundred yards of the vessel.

REFRIGERATOR SHIP FIRES

Fires in refrigerated holds may occur in the cargo, in the insulation, or in the wood sheathing retaining the insulation. Fire in the cargo may spread to the insulating material and sheathing, and may extend to other parts of the ship by direct travel through air ducts or by radiated or conducted heat. Considerable quantities of heat, fumes, and smoke are produced by such fires. They will require maximum use of natural ventilation and portable exhaust fans. The seat of a fire located in insulated holds is usually difficult to locate. If a fire is burning

in the insulating material or in the air ducts, the use of CO_2, steam, or water directed through a hatchway will be of little value. Smoke issuing from thermometer tubes may indicate the deck where the fire is burning.

When taking charge of such fires, every effort must be made to consult with the ship's senior officer and the chief engineer or his assistants. The engineering officers are best qualified to give information regarding the refrigerating and air duct facilities and the availability and application of ship extinguishing systems. Whenever possible, shut-off of the refrigerating and ventilating systems should be confined to the area affected by the fire. Total shut-off of the system may cause the entire cargo to deteriorate.

Spread of the fire to other parts of the ship can be prevented by closing air duct baffles and watertight doors where they pass through watertight bulkheads. Immediate inspection should be made of hold bulkheads outside of the fire and of ducts extending outside of the affected hold. Charged hose lines should be assigned to any area where it is possible for fire to travel through air ducts or where heat may be radiated from or conducted through bulkheads.

If the fire cannot be found in the cargo, look for involvement of the insulation by feeling for evidence of heating. Look for signs of fire in the wooden boards retaining the insulation or on the sheathing of the air ducts. Fire involving insulation will require opening the sheathing. Power saws are particularly useful in this operation. Caution must be exercised not to rupture any refrigerating coils which may be located behind the sheathing. The sheathing should first be opened by cutting a hole above the point where there are indications of heat. The hole must be large enough to insert a nozzle to cool down the involved area. When the fire in the suspected area has been controlled, the sheathing below and to each side of the first hole should be stripped down to the deck. This will permit the insulation to run out or to be pulled out bringing the fire with it. Charged hose lines must be at hand to extinguish any fire in the insulation as it comes out. Usually fire will travel fast in cork insulation. It is essential that enough insulation and sheathing be removed to be certain that all fire has been extinguished. If the fire has involved the air ducts, woodwork encasing the ducts must be stripped from an area sufficiently large to determine that no hidden fire has escaped detection.

In order to gain access or to ventilate a refrigerated hold through the hatchway, it may be necessary to remove a large insulated plug below the hatchway opening. This plug may be in one piece and require the use of a cargo boom to remove it, or the plug may consist of individual slabs capable of being handled easily. It may be necessary to disconnect and remove refrigerant pipes below the plug. If the insulation of the hold is non-combustible and the air ducts can be completely shut off, it may be possible to make the hold airtight. The fire can then be controlled with the ship's fixed steam or CO_2 extinguishing system.

If the fire involves the refrigeration plant or damages the refrigeration machinery, release of toxic and irritant fumes must be anticipated. Even if the refrigerant is of a non-toxic type, release of such fumes in a confined area will require the protection of breathing apparatus. Whenever possible, control of such a situation should not be attempted until a ship's engineer has been consulted. Firefighters assigned to effect control must be protected with self-contained breathing apparatus, life lines and fog or spray streams. Operation of the fog or spray streams in the contaminated atmosphere will tend to absorb the fumes. If the fumes are irritating, protective clothing must be provided and the exposed soft membrane tissues of the body must be covered with Vaseline. Identical protection should be provided for firefighters attempting to rescue persons trapped in holds or refrigeration plant compartments containing released refrigerants. Whenever possible, refrigerant cylinders exposed to fire should be removed immediately or kept cool with water streams. Overheating will cause rupture of the cylinders or the blow-off of safety plugs and subsequent release of refrigerant fumes.

EXCURSION BOAT FIRES

The first consideration of an Incident Commander at an excursion boat fire will be life hazard. If the superstructure of the vessel is wood it will be extremely vulnerable to fire.

In this type of fire, fireboat monitor and tower nozzles should be used to protect passengers and at the same time control the fire. Every effort must be made to work the fireboat in closely in order to board the vessel quickly and operate hand held hose lines at close range. This procedure is very important to prevent panic and to control the fire.

The Communications Center must be kept advised of the emergency. Adequate Coast Guard and harbor craft must be summoned if passengers are in the water or threatening to abandon the vessel. Life rings and other buoyant material must be thrown over the side to support persons in the water. The fireboat Phoenix is provided with equipment that allows one or two lengths of 3 inch hose, coupled together to form a closed circle, to be inflated with air and thrown overboard for the support of persons afloat. It has been determined by tests that approximately 50 PSI in the hose gives the best buoyancy. An air pressure gauge is carried in the pilot house to determine this pressure. Whenever possible, available Coast Guard and harbor craft should devote their attention to the rescue of persons in the water to permit maximum use of the fireboat for extinguishment of the fire. While enroute to the emergency, if it is evident by the color of smoke from the fire that oil is burning, the forward monitor and hose lines should be made ready for the application of foam.

Danger of capsizing excursion boats exists if a large number of persons are on board and are endangered by fire or panic. This may occur as the fireboat is

approaching, if the passengers rush to one side of the vessel. It is advisable to approach the vessel from the bow or stern, using the monitor and tower nozzles to drive the fire away from the passengers. This action will minimize their excitement and prevent panic while at the same time helping to control the fire.

TUGBOATS AND TOWBOATS

Tugboats and towboats are both used to move barges in the bay in addition to harbor duties and tanker escort duties. Because of their construction, tugboats are better adapted to the towing of barges in open sea, where they are subject to heavy wind and waves. Ocean going tugs range in size up to 356 metric tons. Their lengths range from 100-150 ft, and their engines from 1120-6710 kilowatts (1500-9000 hp). Ships that are being towed are normally pulled, but in the newer integrated tug-barge configurations, the barge is pushed.

Towboats are power units that propel single barges or multiple-barge tows made up of 40 or more barges. These vessels are designed to work in protected waters or rivers and canals. They are not used extensively on San Francisco Bay. Special rudder arrangements and one to four propellers in a Kort nozzle provide the control necessary to navigate the restricted channels of rivers and canals. A tow of about 10 tank barges representing about 3,000,000 gallons of petroleum products, is a common towing assignment for such vessels.

Modern tugboats and towboats are powered by diesel engines. They are both outfitted the with same basic types of fire protection equipment.

Automatic fire detection systems used on tugboats and towboats are almost always set to activate an alarm rather than a fire extinguishing system. There are two reasons for not installing automatic systems in engine rooms. 1) A system that automatically floods the engine room with an extinguishing agent can jeopardize the lives of personnel in the space and; 2) The flooding of an engine room would cause the loss of propulsion. During a critical navigating maneuver, this could result in a serious accident.

Detectors are sometimes used to trigger fire fighting systems in spaces such as paint lockers, lamp lockers and small storage spaces, as these spaces are not normally occupied. Wherever an automatic system is used, a warning system should be installed with proper warning signs posted.

On tugboats and towboats, automatic fire detection systems are used primarily in engine rooms. The detectors most often employed are pneumatic detectors and combination heat and smoke detectors.

The fire-main system is the basic fire fighting system for tugboats and towboats. In most systems, 2 1/2 or 3 inch piping carries water from the pumps to the fire stations. The water pumps have capabilities ranging from 150-500 gallon per

minute. Generally two pumps are installed; one in-service and another as a backup pump.

The fire stations are usually located at the main deck level, on exterior bulkheads. A wide variety of hose lengths and nozzles are used since some tug/tow vessels are not required to carry specific nozzles.

Some older tugboats and towboats do not have a fire-main system. Their only fire fighting water supply is a pipe outlet with a connection for a deck wash down hose. While this setup is very ineffective, it can be used to extinguish a small incipient fire.

Fixed CO_2 or Halon 1301 total flooding systems are installed in engine rooms of some tugboats and towboats. The systems are activated from outside the space by pulling two release cables in the proper sequence. The cable pulls are usually located just outside the doorway(s) leading from the engine room to the main deck or passageway. Before the CO_2 is released into the engine room, a warning horn sounds. The engine room must be evacuated at that time. Small tugs or towboats have small engine rooms. The rapid discharge of several CO_2 cylinders into a confined space could lower the oxygen level to a dangerous level.

Small CO_2 or Halon 1301 flooding systems are often used to protect paint and lamp lockers and deck gear storage spaces. These small systems may or may not be activated by fire detectors. Normally they are activated manually. However, if a system can be operated automatically, a discharge warning horn or bell must be part of the system.

CAUTION: Carbon dioxide extinguishers must not be used to purge fuel tanks. During a purging operation, an explosion occurred due to static electricity when a CO_2 extinguisher was used to purge a small fuel tank. Usually this is not considered to be dangerous during fire fighting; operations, however, during purging the discharge horn was close enough to the fuel tank rim to permit a static spark to jump from the horn to the tank, ignite the vaporized fuel and cause the explosion.

Tugboats and towboats are required to carry portable fire extinguishers capable of extinguishing class A, B, and C fires.

BARGES

At one time or another, barges carry almost every conceivable type of flammable cargo. A tow may consist of similar barges that are all carrying the commodity, or a variety of different types of barges carrying different cargoes. In the latter case, the diversity of cargoes and storage methods can complicate fire fighting operations.

The hulls of most inland waterway barges are similar in length, width and draft because the must be able to navigate the same waterways. The final configuration of a barge is, however, determined by the cargo it will carry and the size of the locking system.

The types of barges include: Open-Hopper barge, used to move sand, gravel rock, coal, logs lumber and fertilizer; Covered Dry-Cargo barge, similar to open-hopper barge, but is equipped with watertight covers for the entire cargo hold; Deck barge, which is generally a hull box, with a heavily plated, well supported deck. Deck barges usually carry machinery, vehicles, and heavy equipment; and Tank barges.Three basic types of tank barges are used for the transportation of liquids. On single-skin tank barges, the bow and stern compartments are separated from the midship by transverse collision bulkheads. The entire midship shell of the vessel constitutes the cargo tank. For strength and stability, this huge tank is divided by bulkheads. The structural framing for the hull is inside the cargo tank. Double-skin tank barges have, as the name implies, an inner and outer shell. The inner shell forms the cargo tanks; the tanks are free of internal structural members and thus are easy to clean and to line. Double-skin barges are used to transport poisons and other hazardous liquids that require the protection of a void space between the inner and outer shells.

Barges with independent cylindrical tanks are used to transport liquids under pressure or liquids that are offloaded by pressure. In some cases, cylindrical tank barges are used to carry cargoes at or near atmospheric pressure when special tank lining or insulation is required. The barge itself is generally of the open-hopper type, with tanks nested in the hopper. The tanks are then free to expand or contract, independently of the hull. For this reason, cylindrical tank barges are preferred for high temperature cargoes such as liquid sulfur and refrigerated cargoes such as anhydrous ammonia.

The fire protection equipment carried aboard barges is very limited. In almost every case, it consists of two portable fire extinguishers. Barge owners try to conform to the Coast Guard regulation requiring that these extinguishers be provided and maintained. However, the barges are often left unattended at dockside, where they are subject to vandalism and theft. As a result, portable fire extinguishers are often missing, and the barge is left without fire protection.

On some large fuel barges, the small pump room is protected by a CO_2 flooding system. The system usually consists of two 50 lb. cylinders, piping and discharge horns. The cylinders are secured to the outside pump room bulkhead. When fire is discovered, the system is activated manually.

Early discovery of a barge fire is another problem, since barges are unmanned and do not have fire detection systems. A fire that starts after a barge is loaded will probably not be discovered until it has reached an advanced stage.

Deck fires on barges seldom involve serious problems of extinguishment. If the barge is adrift it must be secured so as not to expose piers or provide a bridge for extension of the fire to adjoining piers and vessels.

Holds in barges often will extend continuously fore and aft under the cargo platforms. Small access hatches may be provided on the port and starboard side of each end, through which ventilation may be effected or circulators operated. When an entire hold below the cargo deck is involved with fire, it will be necessary to open holes in the center deck area and to operate circulators between the ends of the barge.

If the barge is loaded with cargo, caution must be exercised in the use of water for fire fighting so as not to cause sinking or capsizing of the craft. This precaution is particularly important at fires involving barges used to float railroad cars. This type of craft is likely to be top heavy. Injury to the fire fighting force could result from possible overturning of cars.

FIRES IN US NAVY AND NAVAL SEALIFT COMMAND SHIPS

The Fire Department is seldom called to fires in US. Naval vessels primarily because such fires are usually controlled by an efficient and thoroughly trained shipboard fire fighting force. Most naval vessels carry an extensive range of fire fighting equipment, including fire mains supplied by fire pumps, hose, nozzles of various types, fixed steam, CO_2, foam, Halon 1301, sprinkler systems, and a wide range of appropriate type portable extinguishers. Quantities of flammable material comparable to those which may be found in the hold of a merchant ship are seldom encountered in naval combat vessels, with the exception of flammables in the ship's store room or explosives in magazines. However, the Navy operates many auxiliary and support ships which present the same hazards as do other cargo or passenger ships. They have identical hull construction to their counterparts in the Merchant Marine.

Naval combat vessels are also more extensively divided into watertight compartments than are merchant ships. These divisions will be longitudinal as well as transverse. The decks below the water line are fitted with watertight doors and hatches which can be closed in order to isolate each deck. If it is necessary to discharge large quantities of water into a naval combat ship, these watertight sub-divisions can be used to confine excess water to relatively small compartments and prevent endangering the stability of the ship. Their use is also of great value if counter-flooding is necessary to reduce a list.

The Damage Control Officer will probably be most expert source if information concerning the effect of water accumulating in the ship. The Damage Control Officer will have various diagrams, charts, and tables giving the location of watertight compartments as well as the weight or amount of water necessary to

flood each compartment and the amount of list such flooding will produce or overcome. The numerous bulkheads required for the sub-divisions are also useful in minimizing the risk of fire spread.

On arrival at any Navy ship fire, the first action of the Incident Commander will be to seek the advice and cooperation of the ship's senior officer. The Damage Control Officer will usually be assigned to cooperate with the Fire Department. His advice or suggestions should be complied with whenever possible. Normally the first step will be the immediate isolation of the fire by closing all possible bulkhead openings, fire screen doors and watertight doors and hatches. Hose lines will then be led to the seat of fire, with additional hose lines cooling the opposite sides of all bulkheads adjacent to the fire area. The operation of hose lines should be carried out with spray or fog nozzles whenever possible, using a minimum of water. Most ship's magazines are equipped for flooding, and are provided with a fixed deluge or sprinkler system. The hanger decks of aircraft carriers are fitted with a complete sprinkler system and fire doors. The bulk fuel (JP) supply for the aircraft is stowed in permanent flooded tanks to prevent accumulation of flammable vapors.

In some cases, when the amount of combustible material involved is small, the Incident Commander, with the approval of the ship's officer may consider it advisable to seal the compartment involved and flood it with CO_2. Every precaution must be taken to see that the heat radiated or conducted from the bulkheads does not spread fire to adjacent compartments.

FIRES IN VESSELS UNDERGOING REPAIR

Port facilities in San Francisco include piers and dry-docks where repair may be made of the external hull area as well as the internal compartments and the superstructure.

Fires in ships undergoing extensive repairs at a pier or in a dry dock will present special problems to the Incident Commander that are not commonly encountered elsewhere. Generally they will include the following:

1. Usually the ship's officers and crew will be ashore. There may be no one on board sufficiently familiar with the ship to give directions to the location of the fire, to operate the ship's fixed extinguishing equipment, or to guide firefighters about the vessel.
2. The ship may be "dead" with no steam or electrical power on board other than electricity supplied from shore connection or steam in the donkey boiler.
3. The ship's fire mains may be inoperative.
4. Watertight bulkhead doors and fire doors probably will be open.
5. Bulkhead or deck plates may have been removed.

6. The hull plates of a ship in dry-dock may be removed rendering the hull non-watertight. This could permit fire from the outside to enter the vessel.

7. Normally there is no cargo aboard a ship under repair in a dry-dock or at a pier. Fire in such ships usually involves combustible materials in storage and locker rooms, or rubbish in holds. Such fires are often the result of careless control of sparks from welding or cutting equipment or careless use or disposal of smoking materials.

A ship in dry-dock is supported along the length of the keel by wooden blocks and held upright by wooden or steel shores and by wooden blocks placed against the bilge on each outboard side of the ship. Fire involving these blocks and supports can result in breaking the back of the vessel or causing it to capsize.

In addition, the ends of shores are often held in position against the ship's hull by lines from the deck. If these lines burn, the shoring may fall out. Sufficient heat from an internal fire may be conducted through the hull plates to the ends of shores and cause displacement of the shores. Care in the use of water is more essential at fires in ships that are dry-docked than in ships afloat. The additional weight of water discharged from hose lines may be sufficient to slacken or break the shoring, damage the bottom plating, or collapse the keel blocks.

Fires in ships undergoing repair will usually require the use of Fire Department lighting equipment if the ship's lighting is inoperative. The ship's winches and other power equipment also may be out of service and will require that provision be made for use of shipyard cranes, etc. The fireboat, approaching a ship on fire in a dry-dock, should tie-up as close to the vessel as possible. Long and difficult hose leads usually will be required.

SHIP STABILITY

In the event of a fire involving a ship or other craft there is a basic problem of ship stability. Failure or neglect to consider this factor and to observe the precautions necessary to maintain a ship's stability may result in loss of life, injury to persons, and, in some instances, the total loss of the vessel, or damage far exceeding the fire loss.

1. The Incident Commander must keep all factors in mind which might affect the stability of the ship. Some of these factors include the following:

2. The location of any flooded space, whether it is forward or aft, port or starboard, high or low on the ship.

3. Whether the ship is light or loaded, a condition quickly determined from the freeboard of the vessel and its draft. When a ship is light

and the water used in extinguishing the fire settles in the upper portions of the ship, the tendency to capsize will be increased. Water settling to the bottom of the ship has a stabilizing effect . Dangerous lists may originate from water accumulating on or above main decks. There must be no delay in relieving such accumulation of water.

4. The depth of the water where the vessel is floating. This factor affects the possibility of grounding, especially where the vessel is alongside a pier or wharf.

5. Whether there are direct openings to the sea, such as portholes or cargo loading doors in the side of the ship which may allow water to pour aboard in the event a list does occur.

6. The possibility of serious injury to personnel on a ship listing away from a pier if the hawsers snap due to the severe strain.

SECTION 7. PIER FIRES

Piers and wharves are constructed with extensive open areas conducive to rapid horizontal spread of fire. It is this open horizontal construction that has caused extensive fires capable of destroying the entire pier and its contents. Piers are accessible to land apparatus only at the shore end. Land apparatus alone cannot control an extensive pier fire. Efficient fireboat operation is necessary to have an effective fire fighting force.

Fireboat and waterfront companies must possess a thorough understanding of pier and other waterfront construction and be able to anticipate conditions which may occur at fires in these structures. Officers of such companies should conduct regular practical drills covering equipment to be used, methods for extinguishing pier fires, and problems that may be anticipated. Frequent inspection of piers should be made in order to acquire knowledge of superstructure construction. These inspections will enable the companies involved to anticipate difficulties at pier fires, and to determine what fire fighting equipment is available on the pier structure itself.

PIER CONSTRUCTION

In general, piers and wharves in the Port of San Francisco are of pile and deck construction. Some piers are covered with a superstructure, others are of flat open deck construction. Wharves are generally the same type of construction as piers except that they are constructed parallel with the shoreline and are more accessible to land apparatus. The average width of San Francisco piers varies from 150 to 200 feet. Their length varies from 600 to 1,000 feet or over. They are provided with aprons on the water sides and water end. The aprons vary in width from 15 to 25 feet. Most aprons are flat and accessible to pumpers for drafting. Others are constructed with depressed railroad tracks to provide easy access to and from railroad freight cars. These are not accessible to engines for drafting. The docking area between piers will vary from 100 to 300 feet. This space provides a fairly good firebreak between piers. Bulkheads at the land end between piers vary in depth from 25 to 60 feet. They may be covered with a superstructure connecting adjoining piers or they may be open.

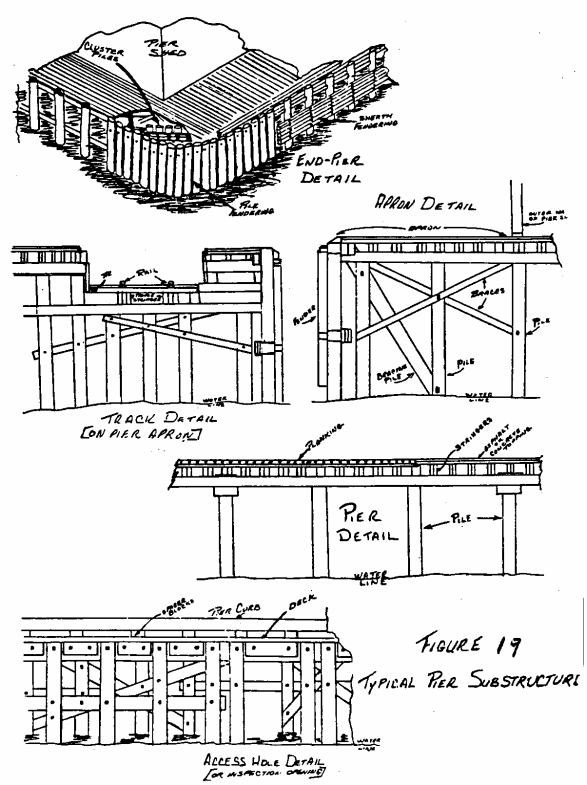


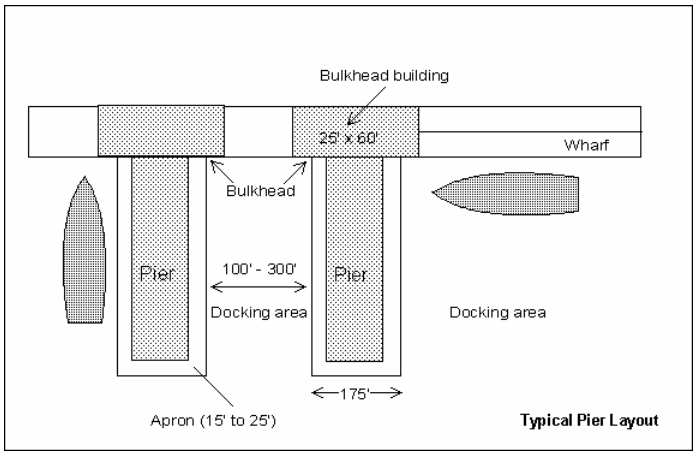
FIGURE 19
TYPICAL PIER SUBSTRUCTURE

Open bulkheads are accessible to pumpers for drafting. Most of them are marked with fire lanes for the exclusive use of fire apparatus. These lanes are kept clear by the San Francisco Port Commission Police and Port Fire Marshal. The average height of a pier superstructure is 20 feet to the eaves and 30 feet to the peak of the roof. The average depth of water alongside the piers is 30 feet at low tide and 40 feet at high tide.

The substructure of most older piers consists of wood piling with extensive heavy timber bracing and reinforcing.

Most of the newer piers are built on concrete pilings. A few piers, such as portions of Pier 50, are built on solid fill. Heavy fendering is provided around the periphery of the pier extending from the level of the apron to the mean low water line. Fenders are constructed of closely spaced pilings or heavy timber sheathing. Inspection openings through fenders are usually provided on both sides of the pier near the shore or water end. The fireboat skiff may gain access to the substructure of the pier through these inspection openings.

The decks and aprons of the older piers are 4-inch wood planks covered with asphalt or concrete. Newer piers have reinforced concrete decks. Practically all piers have two or more suction holes in their deck at which pumpers can position for drafting. Suction holes are covered with iron covers painted red and surrounded by a white colored square. An overhead red reflector also marks their location in covered piers. One pumper can position for drafting at each suction hole. Each suction hole cover is provided with a handle for help in removing the cover. A number, drawn in white chalk on the underside of each cover, designates the vertical distance from the deck line of the pier to the mud line of the Bay. This distance may be used to prevent placing the suction hose strainer in the mud. A few piers are provided with pipe casing holes placed in the deck or apron.



The shed construction of covered piers varies widely. The sides and water end of most older piers are wood construction supported by wood or steel frames. Some are covered with corrugated steel. The newer piers have side and end construction of reinforced concrete. There are also piers in which such construction may be a combination of any or all of these materials. Roofs may be heavy plank construction, covered with tar and gravel, supported by steel or timber trusses and columns. Some of the newer piers have concrete roofs covered with tar and gravel.

Cargo openings provided with sliding or rolling doors are spaced on all sides of the pier. They are large enough to drive Department apparatus through. Some piers are provided with sidewall windows. Most piers are equipped with roof skylights. Some pier sheds are provided with draft curtains in the roof area to retard the horizontal draft common at pier fires. The extreme open horizontal length of pier structures seldom is fire-stopped by partitions or walls. The shore end of most piers is often sub-divided into offices by wood frame construction.

FIRE FIGHTING EQUIPMENT

Wheeled and hand portable fire extinguishers are the principal fire fighting equipment provided on San Francisco piers. Fire alarm boxes are located directly in front of each pier.

Auxiliary and automatic alarms are available on some piers. These systems may be equipped with alarm indicator panels.

Piers 24 annex and 26 have standpipe or sprinkler systems. The bulkhead building between these piers and the piers themselves are equipped with an automatic sprinkler system, wet standpipes, and hose reels. This fire protection has been provided because these three structures are a direct exposure hazard to the San Francisco-Oakland Bay Bridge. But systems are owned and maintained by the Bay Bridge Authority. Pier 24 annex and the bulk-head building between Pier 24 annex and Pier 26 are of wood frame construction supported on wood piling. They are completely sprinklered throughout the substructure and superstructure areas.

Because Pier 26 has reinforced concrete deck and pilings, it is sprinklered only throughout the superstructure area. The exterior walls of each pier and the

bulkhead building, adjacent to ship-berths, are protected by automatic heat detectors which can activate a deluge system of open sprinklers to protect these areas. Each system is supplied with water by connection to a domestic main. Two Fire Department Siamese connections are provided on the shore and water ends of each pier. One Fire Department connection is provided on the shore and water end of the bulk-head between buildings.

The main sectional control valve of each structure is located below deck at the shoreside entrance. Some sectional control valves of Pier 24 annex and the bulkhead building are below the decking; others are at the base of risers. Sectional control valves of Pier 26 are in the upper section of the superstructure near the roof. Below-deck shutoff valves are covered by a square metal manhole cover.

There are several other piers equipped with sprinkler and/or standpipe systems. The best way to locate them is by pre-inspection.

There are few hydrants on the pier side of streets bordering the waterfront primarily because of infirm ground conditions and the corrosive effects of salt water on water mains. Water for Fire Department use when fighting water front fires is generally supplied by the fireboat; by engines drafting from pier aprons, suction manholes, and bulkheads between piers; or by hose leads from hydrants across waterfront streets.

FIRE FIGHTING STANDARDS

There are several unique factors encountered at pier fires that effect fire fighting problems. The extensive length and open construction of pier structures provide ideal means for rapid fire spread. The structures act as an enormous horizontal flu where a small fire fanned by strong drafts through unbroken areas can quickly develop into one of serious extent.

The timbers and piles below the level of pier decks are treated with creosote and may be coated with waste oil deposited by the rise and fall of the tide so that fires in this area produce intense heat and dense clouds of smoke. This condition is aggravated by closely spaced piles or fenders, hindering access to substructure areas. At high tide, access by skiff may be imposing even through the inspection openings.

Merchandise from all parts of the world may be on the pier deck awaiting shipment. They may be non-hazardous or they may react violently when subjected to excessive temperature or when struck by hose streams. They may give off toxic gases when decomposed by fire.

Piers are subject to two general types of fire, either one of which may be disastrous. The first type is a fire that originates in the substructure which may

burn piling and wood members to such an extent that it threatens the collapse of the structure. The second type fire is one that originates above the pier deck. It involves the superstructure and/or merchandise on the pier, and can quickly spread throughout the pier shed. Fire fighting operations at such fires will include many of the following standard procedures.

Size Up

Quick and accurate size up is more important at a pier fire than at other fires. A smoldering pier fire may quickly turn into one of major proportion.

Additional Alarms

No delay can be permitted in calling for special equipment or in ordering a greater alarm if the fire is threatening to extend. Even when the extent of the fire is not immediately apparent, the Incident Commander should consider an additional alarm because of the possibility of the fire breaking out and spreading rapidly. If the fire is of any extent, additional firefighters will be required to supplement the fireboat crew. The service of the Utility Unit's jackhammers will be required if it is necessary to break through the asphalt or concrete deck covering.

Assistance may be required from stevedores and their lift machinery to remove exposed cargo. Coast Guard and harbor tugs may be needed to move vessels exposed to the fire or to secure vessels which have gone adrift. It is essential that radio communication be maintained between the fireboat and the Incident Commander, particularly when fireboat monitor streams may endanger firefighters operating on the pier. The fireboat officer should keep the Incident Commander advised of any different perspectives of the fire.

Fire Causes

Fires under piers frequently result from heating equipment which has been placed directly on concrete slabs laid on timber planking. Many pier fires are caused by sparks or cigarettes which have lodged in cracks in the decking or in spaces in wooden pier fendering. These materials smolder until fanned into fire by air currents. These probable locations of fire should always be carefully checked where smoke odor is apparent and the seat of the fire is not immediately known.

Fire Fighting Equipment

Utilize fully the fire fighting equipment provided on the piers. On those piers equipped with sprinkler systems, the Incident Commander should immediately order at least one hose line to be connected to sprinkler inlets. The system shall not be charged unless so ordered by the Incident Commander.

Exposures

Covering exposures to prevent the spread of fire will include removing small craft. This is particularly important if they are exposed to substructure pier fires. Extreme care must be exercised when protecting small craft with hose streams to prevent their being flooded or capsized. Every effort should be made to prevent mooring lines from being burned. Immediate protection of ships can often be effected by firefighters detailed to operate the ship's hose lines or monitors until the ship can be moved or until Fire Department hose lines can cover the exposure.

Exposed openings such as side cargo doors and portholes should be closed. The possible extension of fire to neighboring piers and to bulkhead structures must be carefully watched. Wind conditions, heat radiation, flying and floating embers are the prime contributors to fire spread. Close exposed pier windows and doors. Position hose lines on the exposed sides and roof of the pier. A special watch may be required in substructure areas to guard against burning embers floating with the tide. Roofing ladders placed over the side or through suction manholes of the exposed structures will permit examination of hidden areas. Fires involving the superstructures of vessels or fires venting through the hatches of vessels seriously expose piers.

Protecting exposures from pier fires requires the coordination of fireboat monitor streams and master streams positioned on the shore side and on adjacent piers. The water curtain which the fireboat is capable of producing has proven of tremendous value when operated on the leeward side of such fires. Maintenance of radio communication between the Captain of the fireboat and the Incident Commander is vital to proper coordination of fireboat and shoreside streams. Hose lines should not be led ashore from the fireboat when a pier is heavily involved with fire since such leads would immobilize the fireboat.

Positioning Apparatus

The position which a fireboat should assume at pier fires is the responsibility of the Incident Commander. Again the importance of radio communication is apparent. Conditions at the off-shore end of the pier may be visible only from the vantage point of the fireboat. Communication will be vital to proper coordination of land and fireboat forces. Usually the fireboat will be positioned on the lee side of the pier between the fire and the land end and as close to the fire as conditions will permit. At this position, the fireboat is able to operate directly on the fire and to prevent spread of fire toward the land end. It must be remembered that the fire fighting crew of the fireboat normally consists of one officer and three firefighters.

Full and efficient use of fire boat equipment often will require the assistance of land companies. In order to avoid injury to personnel by fireboat heavy streams, land companies must anticipate the use of such streams and be prepared to

protect themselves from the effects. Hose lines led from the fireboat will usually consist of large lines with either nozzles, circulators or 1 1/2 inch wyes connected to them. Positioning the fireboat at bulkheads between piers may be required when it is necessary to connect to High Pressure System Inlet Manifolds or when it is necessary to supply hose lines for operation on fires involving waterfront structures other than piers, or to set up a water curtain to protect piers exposed to other waterfront fires.

It is important to keep in mind that the speed with which pier fires are capable of spreading may require the quick withdrawal of firefighters and apparatus. Apparatus should never be positioned on the water end of a pier which is on fire. Apparatus not essential for fire fighting operations should be kept off the pier. Access-ways are often congested on piers which are heavily laden with merchandise. Where this condition exists, drivers should be careful not to obstruct other apparatus maneuvering for position. It is good practice not to drive apparatus onto any pier where the fire has a good start unless there is plenty of room to turn around and drive off quickly. If the access-way is sufficiently clear, back in. Park apparatus on piers with the front of the apparatus facing the pier entrance in order that the apparatus may be moved quickly.

ALL FIRST ALARM ENGINES ARRIVING AT A PIER FIRE SHOULD IMMEDIATELY POSITION FOR DRAFTING UNLESS OTHERWISE ORDERED BY THE INCIDENT COMMANDER. THE FIRST ENGINE TO ARRIVE SHOULD COMMENCE DRAFTING OPERATIONS IN ORDER TO HAVE WATER AVAILABLE AT ITS OUTLETS.

This procedure is essential in order to overcome the delay in supplying water by drafting. Engines unable to draft should be replaced immediately.

Ventilation

Ventilate pier superstructures by opening skylights, doors, and windows on both sides of the pier. Start first at the outer end and work toward the land end of the pier. The side openings, and the draft curtains, if provided, will tend to slow the fires spread toward the land end. Side openings should not be made if they expose vessels moored to the pier, nor should they be made until hose streams are in position to prevent extension of fire.

Substructure—Deck & Fender Fires

At pier fires, as at all fires, the first objective is to confine the fire to the point of origin. This is difficult to accomplish at substructure pier fires because of heavy deck construction and because of obstructions such as pilings, girders and beams under the deck. Creosote treated pilings present a highly flammable surface. Additionally, wave action causes oil and other flammable debris which has been floating on the surface of the water to be tossed up and left clinging to the piling in layers. This contributes to the flammability of the substructure and

will accelerate fire spread. A fire burning in the underside of a pier deck will require quick action to prevent extensive fire spread.

The fireboat's under-pier nozzles are effective in controlling a fire of this type. If the tide is sufficiently low, initial control may be affected by use of fireboat monitors and/or hose lines operated from the fireboat deck. If the tide is extremely high, neither of these operations may be possible or effective. Control of the fire will depend primarily on above deck operations. Conditions as observed from the vantage point of the fireboat shall be reported frequently, by radio, to the Incident Commander.

Operations by land companies will include venting the superstructure and stretching sufficient hose lines to control fire spread. Cargo on the deck over the fire or which obstructs fire fighting operations should be removed. Sufficient hose leads must be made for operation of circulators through pipe casing holes, and/or through holes cut in the deck over the fire. It is often practical in this type fire to place roofing ladders over a pier side or through holes cut in the pier deck for operation of hose lines by firefighters positioned on the ladders and secured with a life line.

Fire fighting operations may require cutting open a section of the pier deck the entire width of the pier ahead of the fire. Circulators can then be placed across the entire width of the opening. This will break the draft and provide a water curtain, both of which will tend to prevent spread of the fire beyond the opened section. If possible, prior to this operation any cargo on the deck over the fire or on the fire side of the opened section should be moved out. Additional holes must be cut through the deck over the fire for use of circulators and hand held hose lines. A small portable pump can be placed in the skiff, when staffed by two firefighters, to control incipient fires under pier structures, tide conditions permitting.

It is obvious that at this type of fire, the fire fighting force will be exposed to the hazard of rapid fire spread, to intense heat and dense smoke, and to the possibility of structural collapse. It cannot be too strongly emphasized that these factors alone are sufficient to warrant the immediate ordering of greater alarms or special calls for equipment such as the Utility Unit, Rescue Squads, or the Light Unit. Utility companies and city departments can provide additional pavement breakers and cutting tools. Requests for stevedores, the Coast Guard, the Navy or the San Francisco Port Commission to supply additional services may be necessary.

Superstructure & Cargo Fires

At any extensive fire involving the superstructure and/or cargo on a pier, a quick examination must be made to determine whether the fire has spread to the underside of the pier deck. If it has, immediate action must be taken to prevent further spread under the pier. Land units must be very careful not to place

themselves and their apparatus in a position where the fire could spread and cut them off from the land side of the pier. Pumpers will usually be positioned at bulkheads between piers and at available hydrants until it is certain that it is safe to position them on the pier.

Unless otherwise ordered, the fireboat will take position on the leeward side of the pier between the fire and the land end of the pier. Operations will include inspecting the substructure area from a skiff, leading hose lines to this area if necessary, supplying hand held hose lines for operation on the pier deck, and operating monitor nozzles as necessary.

Overhauling

Thoroughness when overhauling pier fires is especially important. Fire may remain in cracks in the piling and in deck floors as well as in spaces between deck planks, timbers, and fendering. Water damage usually will not be extensive at pier structure fires. There is little danger of increasing such damage through use of excess water streams in overhauling operations. The final operation of the fireboat before leaving the pier should be inspection of the substructure space. Fire details equipped with charged hose lines may be required to remain at these fires until it is certain that there is no danger of rekindle. Baled cargo which has been involved with fire should be thoroughly wet down and removed to an open area remote from the pier. The bales should be opened and overhauled. All overhauled cargo should be removed from the pier as soon as possible.

Fires On Shore

The fireboat can often render valuable assistance at fires involving structures within reasonable distance of shore bulkheads. This assistance may include the use of the fireboat monitor and tower nozzles, for direct operation on the fire or to cover exposures. If hydrants are widely spaced in the fire area, hose lines supplied by the fireboat pumps will be of great assistance in the control of such fires.

SECTION 8. APPENDICES

APPENDIX A—FOAM SYSTEMS

Portable Foam Generating Nozzles Supplied from 5 Gallon Liquid Foam Containers.

1. Secure sufficient 3 inch hose to reach seat of fire. From after hold.
2. Secure portable foam generating nozzle or nozzles with pickup tubes attached and sufficient 5-gallon containers of liquid foam. From forward hold and after hold.
3. Secure sufficient Gorter nozzle shutoffs. From After Deck House or after hold.
4. Connect Gorter shutoff and foam nozzle to discharge end of hose. Do not remove pickup tube.
5. Connect hose to forward gated 3” outlets. Foam from the fixed system cannot be supplied to the manifold amidships. It is therefore preferred that hose leads for use with the 5 gallon foam containers be taken from the pump outlets at the forward end of the Pilot House to insure foam supply in the event that the supply of 5 gallon foam containers becomes exhausted. Care must be observed when using 5 gallon foam containers with hose led from Pilot House outlets. These outlets must be discharging water, not foam, for this particular use.
6. Lead hose to and provide foam containers at point of operation.
7. Order hose lines charged to at least 100 PSI. Make certain Gorter control is shut off after air confined in hose is released.
8. Remove the cap from the foam container to be used.
9. On order of officer-in-charge, open Gorter shut-off and operate foam stream as directed.
10. Insert the pick-up tube in a foam container.
11. Provide additional foam containers at the nozzle. To maintain uninterrupted foam supply.
12. Provide back-up fog streams from 10 outlet manifold.

The Fire Boat Fixed Foam System

1. Proceed as in 1, 2, 3, 4, and 5 above with the exception that the 5-gallon foam container and pick-up tubes are not required.
2. Connect hose to forward 3” outlets.
3. Lead hose to point of operation.

4. Notify fireboat engineer to supply foam liquid.
   a. Open system control valve.
   b. Open Gorter shut-off.
   c. Operate foam stream as directed.
5. When required to change foam supply from 5-gallon containers to fixed system proceed as follows:
   a. Shut off Gorter control.
   b. Remove pick-up tube.
   c. If hose lead is connected to manifold amidships, change connection to forward gated 3” outlets.
   d. Notify fireboat engineer to supply foam liquid to forward gated 3” outlets.
   e. Open forward gated 3” outlets and Gorter control. Operate foam stream as directed.
6. The forward monitors on both Fireboats have high capacity foam nozzles in place as standard practice.

APPENDIX B—ANCHORING

Preparation

1. Bring out the anchor line and chain from the forepeak leaving one end of line with shackle attached to the ringbolt in the forepeak bulkhead.
2. When anchor line is on deck, remove straps holding coil.
3. Make the end of the anchor line fast to anchor chain, and free end of anchor chain fast to anchor (shackles hand -tight).
4. Take bight in anchor line about 15 feet from anchor chain; pass bight over top of chain rail at bow, then through the forward chock, at bow, from the outboard side. Make bight fast to anchor bit with three round turns.

How to Drop Anchor

1. Heave all free line between anchor and bit over the side at which anchor is to be dropped. This precaution eliminates the danger of someone's feet getting caught in the anchor line as it becomes taut. Make certain that the anchor line does not become entangled with the bow fender.
2. Firefighters lift the anchor to the side.
3. On the command "Let Go" the anchor is heaved over the side.
4. Pay out anchor line around the bit, and make it fast to the anchor bit as directed by the Pilot.

The anchor is raised by the crane under the direction of the pilot.

APPENDIX C—THE SKIFF

Launching

NOTE: The skiff is to be launched under the direct supervision of the Marine Engineer ONLY.

Each fireboat is equipped with a 12 foot fiberglass skiff mounted on deck.

NOTE: The heavy steel lifting hook on the end of the crane's cable presents the possibility of a safety hazard. Therefore, it must be kept under control by being tethered to a rope attended by a crew member whenever it is not attached to the skiff's lifting harness. The hook must not be allowed to swing freely at any time.

To launch the skiff:

1. Remove canvas cover and lashings.
2. Choke (push in key) start and run engine to warm-up. Shut off engine.
3. Secure boarding ladder over the side of the fireboat at the position the skiff is to be launched.
4. Direct firefighters assigned to the skiff to don life jackets. MANDATORY
5. Inform the Marine Engineer that the crane is to be used
6. Close the breaker switch to the hydraulic system.
7. Start the hydraulic pump system, switch is located by door on way down to engine room.
8. Using remote control, lower hoist and remove securing rope.
9. Raise and guide boom out from boom support.
10. As the boom is extended, lower the hoist at the same time or the hoist will raise and strike the limit switch stopping operation of the unit.
11. Turn the boom to the desired location, if the boom is to be used to launch the skiff, extend the boom to the marks located on the boom.
12. Lower boom and attach hook to eye on boat hauling straps, raise hoist and boat to clear the rail on the fireboat, swing the crane to a

position over the water and lower the skiff down to the water. As this operation is being done remember to have a member hold on to the line attached to the front of the skiff. **DURING THIS OPERATION DO NOT ALLOW PERSONNEL TO STAND UNDER THE SKIFF AS IT IS ROTATED.**

13. **NEVER RAISE OR LOWER THE SKIFF WITH PERSONNEL IN THE SKIFF**.
14. To secure the skiff back in place on the boat, reverse the above procedures.

Retrieve the Skiff

1. Bring the skiff alongside of the fireboat to the position from which it was launched.
2. Station deck hands on bow and stern lines to guide and position the skiff.
3. Secure lift tackle bridle hooks at each end of skiff.
4. Reverse lift tackle secured to winches:
5. Secure topping lift rope with three round turns (clockwise) on power winch.
6. Secure lift tackle with two round turns (clockwise) on hand-operated winch and secure to top cleat.
7. Operate boom with power winch to lift skiff out of water to position inboard over fireboat deck.
8. Release lift tackle from cleat and with hand inch lower skiff to storage chocks.
9. Release lift tackle bridle and secure hooks.
10. Check all equipment for damage and secure.
11. Upon return to quarters, wash down skiff, gear, and launching tackle with fresh water.
12. When skiff and gear are dry, replace canvas cover and secure with lashings.

Supplying the 5 Inch Hose

The fireboat does not directly supply the five inch hose. Tests have shown that the preferred method is to pump into 3 inch lines siamesed on shore into the 5 inch hose or portable hydrant system. However, Incident Commanders should mandate the use of the minimum amount of 3 inch hose necessary to reach the 3 to 5 inch Siamese on shore, from which point 5 inch hose leads are made to the fire or other point of discharge. This practice minimizes friction loss.

Incident Commanders should be aware that while the Phoenix can supply up to 3000 psi pressure by the use of two pumps in series, albeit at a reduction in overall volume, the Guardian does not have this capability. The Guardian's maximum pressure is 150 psi, although it can provide the far greater volume of 24,000 GPM.

Supplying the Portable Water System

1. If it is not possible for the fireboat to come close enough to shore to use a heaving line the skiff may be used.
    a. The pilot should select the best position to anchor. Drop the anchor and make sure it is holding.
    b. Lower the skiff over the side of the fireboat. Put two firefighters in the skiff with life jackets. Proceed to shore.
    c. The firefighters in the skiff will pick up the hauling line from firefighters on shore and take it to the fireboat.
    d. The land-based crews will pull multiple 3" hose lines from the fireboat to shore using hauling line(s). These will then be connected to 3" to 5" Siamese appliances as necessary.
    e. For obvious reasons of space limitations, it is not practical, under any circumstances, for a 3" to 5" Siamese to be employed on the deck of a fireboat.

APPENDIX D—US COAST GUARD - SHIP FIRE FIREFIGHTING PLAN

Initial Command Functions

1. Announce Arrival
2. Take Command
3. Size-Up
   a. Type of Incident
   b. Name of Ship
   c. Location of Ship
   d. Type of Ship
   e. Access Route
   f. Condition of Piers
   g. Water Supply
   h. Observable Conditions
   i. Resources Immediately Available
   j. Pre-Planned Resources
   k. Tide, Wind and Current
4. Make Situation Report
5. Establish Command Post
6. Request Additional Alarms If Needed
7. Establish Staging Area
8. Notify US. Coast Guard
   a. Phone: 437-3073
   b. Request: "On Scene Coordinator"
9. Establish Security Zones
   a. Ashore: Local Law Enforcement
   b. Waterway: USCG.
10. Request SCBA Compressor Unit Or Cascade
11. Notify Local Port Authority
    a. Rescue
    b. Fire Attack
    c. Property and Environmental Conservation
12. Make Division Assignments From First Alarm Units And Give Strategic Assignments
13. Assign A Logistics Officer To Provide Supplies To Operational Divisions

Priority 1 - Rescue

1. Contact Ship's Officers And Terminal Manager
2. Determine Number Of Casualties
   a. Number of People Involved
   b. Location of all People Involved
   c. Dead/Injured
   d. Trapped
   e. Not Accounted For
3. Determine Your Rescue Objectives
   a. Evacuate Civilians
   b. Search For Victims
   c. Extricate Victims
   d. Triage
   e. Provide Emergency Medical Care
   f. Transport Victims
   g. Crew Welfare
   h. Firefighter Safety
4. Request Resources To Support Rescue Operations
   a. Activate Multi Casualty Or Disaster Plan
   b. Ambulances
   c. Heavy Rescue Equipment
   d. Notify Receiving Hospital/s
   e. Notify OES
   f. Request Marine Chemist
   g. Notify US. Immigration
   h. Notify Red Cross
   i. Notify Coroner
5. Designate A Fire Attack Division
   a. Strategic Assignment - Support Rescue Operations
   b. Tactics:
      1) Lay And Position Hose Lines To Protect Rescue Operations
      2) Position Aerial Apparatus For Access and/or For Use As A Standpipe
6. Designate A Rescue Division
7. Rescue Division Officers Responsibilities
   a. Assign Rescue Team
   b. Assign Triage Team
   c. Assign Treatment Team
   d. Assign Transportation Team
   e. Coordinate All Medical Activities

Continue developing your staff as needed.

1. Assign Operations Officer To Direct And Coordinate All Tactical Operations.
2. Assign Safety Officer To Identify Hazardous And Unsafe Conditions To Insure Protection Of Personnel.
3. Assign Information Officer To Release Information To The Press.
4. Assign Planning Officer To Forecast Probable Course of Events And Project Alternative Courses Of Action.
5. Assign Liaison Officer As A Contact For Responding Agency Representatives.

THINK OF THESE ASSIGNMENTS AS JOBS AND NOT AS PEOPLE. IF YOU CAN'T FIND SOMEONE TO DO THEM, THEN YOU WILL HAVE TO DO THEM YOURSELF.

Priority 2 - Fire Attack

1. 1. Contact Ship's Officers
   a. Captain
   b. Chief Mate
   c. Chief Engineer
   d. Other Officers
   e. Ship's Owner Or Local Agent
   f. Interpreter
2. Determine Status Of Fire
   a. Request Ship's Fire Plan
   b. Request Cargo Stowage Plan And General Arrangement Plan
   c. Request Dangerous Cargo Manifest
   d. Location Of Fire
   e. Type Of Area Involved
   f. Type And Quantity Of Material Burning
   g. Primary Cargo
   h. Location, Type and Quantity Of Hazardous Material Aboard
   i. When And How Did Fire Start
   j. What Has Crew Done To Fight Fire
   k. Fire Protection System's On board
   l. Areas Protected By Systems
   m. Have Systems Been Used To Fight Fire
   n. Access To Fire Area
   o. Access To Exposed Spaces
   p. International Shore connection
   q. Status Of Ventilation System

r. Location And Status Of Fire Resistant Bulkheads, Fire Zones And W/T Doors.
s. Status Of Ship's Pumps And Fire Main System
t. Flooding Or Instability U. Projected Progression Of The Fire

3. Communicate Updated Status Report

4. Strike Greater Alarms Or Activate Mutual Aid Plans If Needed

5. Fire Attack Objectives
   a. Protect External Exposures
      1) Warehouse
      2) Piers
      3) Waterfront Facilities
   b. Remove Endangered Shipping
   c. Cool The Exterior House And Hull
   d. Secure Ventilation Air And Fire Dampers
   e. Effect Natural and/or Mechanical ventilation
   f. Secure W/T Doors And Hatches
   g. Set Fire Boundaries
   h. Activate Ship's Fire Systems
   i. Augment Ship's Fire Main System Through International Shore Connection
   j. Position Hose Lines At Fire Boundaries
   k. Apply Foam To Involved Area
   l. Coordinate Interior Attack
   m. Off Load Cargo
   n. Break Burning Fuel On Surface Of Water Into Patches And Drive Away From Ships And Piers With Fireboat Monitors
   o. Flood, Scuttle, Ground Or Beach

6. If You Intend To Put Water On The Ship, Request The Coast Guard Strike Team With Dewatering Equipment At The Earliest Possible Time. Don't Wait Until The Ship Begins To List.

7. Request Resources To Support Fire Attack Objectives
   a. Mutual Aid
   b. Greater Alarms
   c. Fire Boats
   d. Coast Guard Vessels
   e. Helicopters
   f. Tug Boats
   g. Cranes
   h. Bulk Foam
   i. Bulk CO_2
   j. Divers
   k. Oxy-Acetylene Cutting Torches
   l. Welders/Cutters

m. Lighting Equipment
n. Foam Nozzles And Eductors
o. Longshoremen
p. Cats and Loaders
q. Switch Engine
r. Shipboard Fire Fighting specialists
s. Fuel
t. Food
u. Marine Inspectors, US. Coast Guard

Priority 3 - Property and Environmental Conservation

1. Determine Property Conservation Objectives
   a. Pollution Control
   b. Salvage
2. Request Resources To Support Property Conservation Objectives
   a. Commercial Salvage Master
   b. Oil Skimmers
   c. Oil Containment Booms
   d. USCG. Pacific Strike Team
   e. Marine Environmental Protection Specialists

APPENDIX E—EQUIPMENT INVENTORY

EQUIPMENT INVENTORY—PHOENIX

After Deck House

- ☐ Radiological survey meters
- ☐ Fire axes
- ☐ Crowbars
- ☐ Cutting out chisel
- ☐ Double female fittings
- ☐ Double male fittings
- ☐ increases
- ☐ Decreases
- ☐ Maul
- ☐ 2 1/2 inch combination nozzles
- ☐ 1 1/2 inch combination nozzles
- ☐ Gorter nozzle
- ☐ Circulators (Federal & Gorter)
- ☐ Flanged fitting (universal ship connector)
- ☐ 4 to 5 inch adapter
- ☐ Sledge hammer
- ☐ 3-way for portable hydrant with 3 inch hose
- ☐ Gasoline chain saw
- ☐ Electric chain saw

Foreward Hold

- ☐ 140 gpm Honda Portable pump
- ☐ Air hose
- ☐ Basket stretchers
- ☐ Gasoline can
- ☐ Canvas stretchers
- ☐ Eductor Block and tackle
- ☐ Air gun (pavement breakers)
- ☐ Line gun Sounding line
- ☐ SCBAs - 4.5s
- ☐ Inside Wood snatch blocks
- ☐ Spanners (all sizes)
- ☐ Wyes - 2 1/2 to 1 1/2 inch
- ☐ Standie
- ☐ Trojan valves
- ☐ Grappling hook and chain
- ☐ 3-way
- ☐ Shovels
- ☐ 800 ft. of 1 1/2 inch hose
- ☐ Landi floats

After Hold

- ☐ Hose and ladder straps
- ☐ 3000 ft. of 3 inch hose
- ☐ Washers
- ☐ Gorter nozzles complete
- ☐ CO_2 nozzle with 200 ft. hose
- ☐ Monitor nozzle tips
- ☐ 30 lb. dry chemical extinguisher
- ☐ 50 - 5 gal. AFFF 3%-6% foam
- ☐ Eductor hose (hard) 25 ft.
- ☐ Hose & ladder straps

Fore-Peak

- ☐ Flotation coats
- ☐ Fire helmets
- ☐ Portable flood lights
- ☐ Foam adapters & nozzles
- ☐ Extension cords

On Deck

- ☐ Portable generator
- ☐ Homelite portable pump
- ☐ Oxy-acetylene cutting unit
- ☐ 2-25 ft lengths of 5 inch hose

Pilot House And Chart Room

- ☐ 2 - Portable radios
- ☐ Flashlights & lanterns

- ☐ Binoculars
- ☐ 14 Adult life jackets
- ☐ 8 Child life jackets
- ☐ Various marine publications
- ☐ 2 - SCBA's
- ☐ Ansul fire extinguisher
- ☐ Trauma kit
- ☐ 1 set of Bay area charts
- ☐ Hazardous Materials book

Monitor Tip Sizes

- ☐ Forward Monitor - FOAM
- ☐ Pilot house monitor - 3 inch
- ☐ After deck monitor - 1 ½ inch

EQUIPMENT INVENTORY-GUARDIAN

Galley Area (Below Pilot House)

- ☐ Forcible Entry Tools
- ☐ 3” nozzles, adaptors, fittings
- ☐ 24 Adult life jackets
- ☐ 12 Youth life jackets
- ☐ Prosser Pump
- ☐ Medical Equipment, including O2 and defibrillator

On Deck

- ☐ 2 Alternate Steering Stations (1 amidships on upper deck; 1 on flying bridge, above Pilot House)
- ☐ 24 of 3” gated outlets
- ☐ 12 foot skiff with 30 HP outboard motor
- ☐ Hydraulic crane
- ☐ 30 person self-inflating life raft
- ☐ 1 Foam monitor, forward position, on bow
- ☐ 2-6” barrel monitors, amidships, 10 feet above main deck
- ☐ 1-3” barrel monitor (28 feet above main deck)
- ☐ Range of nozzles, from 2 ½” diameter to 6” diameter
- ☐ 3,000 feet of 3” hose
- ☐ 400 feet of 1 ½” hose
- ☐ Eductors
- ☐ Foam eductor equipment, amidships, in wooden chest adjacent to 3” hose
- ☐ 7 SCBA, 1 hour, with spare bottles
- ☐ chain saw
- ☐ 2 trash pumps

AUTO CRANE MODEL 6006H SPECIFICATIONS (FOUND ON EACH FIREBOAT) *

- ☐ Crane rating of 36,000 lbs.; maximum lifting capacity of 6,000 when extended 6 feet horizontally
- ☐ Power boom extends from 10 to 16 feet, with manual extension to 20 feet
- ☐ 360 degree rotation with positive locking
- ☐ Hydraulic winch with 20 feet/minute takeup, single line speed
- ☐ 95 feet of 3/8 inch diameter aircraft quality cable
- ☐ Automatic overload protection system
- ☐ “Opti-flow” hydraulic control system, with manual override
- ☐ Swivel block with hook and safety latch
- ☐ Remote control with 24 foot cord

*This is clearly marked as to operation.
*Should normally be operated by the Marine Engineer, or under the Engineer’s immediate and direct supervision.

APPENDIX F—DEPARTMENT OPERATIONS: PROPERTY UNDER FOREIGN CONTROLINTRODUCTION; FOREIGN FLAG VESSELS

File Code 78 A-141
December 5, 1978

From: Chief of Department
To: Distribution List "A"
Subject: Department Operations: Property Under Foreign Control; Foreign Flag Vessels.
Reference: Section 502, Rules and Regulations
Enclosure: None

Officer Endorsement:
Sec. 1107 - R. & R. .

1. Due to recent occurrences in foreign consulates in San Francisco, and aboard foreign flag vessels in the port, the following information shall be used in dealing with these emergencies.

2. After a series of meeting with the Federal Bureau of Investigation, the United States Department of State, the San Francisco Police Department, and the United States Coast Guard, the following guidelines shall be adhered to by departmental personnel when responding to any emergency in subject properties or locations. The senior fire department officer on the scene shall be in complete charge of the incident and be responsible for adhering to guidelines and procedures in accordance with policies of the above mentioned agencies.

3. The International Consular Corps, at the Vienna consular Convention, provided that entry consent may be assumed in the event of fire and other disasters, requiring department action. In these cases departmental standard operating procedures shall be adhered to and automatic entry consent will be granted.

4. A major exception to the automatic entry consent is that it does not apply to Soviet Union block countries. If any incident occurs at Soviet block countries, requiring prompt emergency action, entry to said properties must be obtained from the Consul General or a staff member in command. It should be strongly stated here that any exterior operations required in adjacent properties, i.e., covering exposures, placement of apparatus, rescue and extinguishment, life safety, etc., standard operating procedures shall be strictly adhered to while awaiting permission to enter any Soviet block property. When consent is given for entry extreme care must be exercised by departmental personnel, and all emergency actions shall be limited and restricted only to those extraordinary purposes for which consent is given

or implied. Official files, diplomatic communications, private facilities, official papers, etc., should not be touched or intruded upon without the consent of the Consul General or authorized staff members. To the extent practicable, and giving due regard for personal safety and security, a designated consulate staff member should be permitted to observe the conduct of departmental personnel within said premises. When possible, the designated staff member should be allowed to attend to the protection of any files, communication facilities a d official papers requested by said staff member.

5. With respect to our department gaining access to foreign flag merchant ships, according to the US. Department of State, in an emergency situation such as fire, appropriate action consistent with standard operating procedures for shipboard fires would be similar to that taken if the vessel carried the United States flag. However, as a matter of courtesy and protocol, it would be appropriate to seek consent of the master or other reliable authority before boarding a foreign flag vessel. This is particularly applicable to Soviet Union block vessels. In the absence of such consent, and when emergency actions are obviously needed, department personnel shall take action to board vessels and perform standard operating procedures for shipboard fire fighting, and if the situation is of a serious nature or poses a threat to the safety of the Port.

6. The situation regarding a war vessel of another nation within the Port is entirely different. In this case there is no right to board and the only action that may be taken is that to require such a war vessel to leave the Port.

7. If a language barrier exists in any of the forgoing circumstances, the Federal Bureau of Investigation should be notified so that they may provide an interpreter. The contact number for the Federal Bureau of Investigation is on file at the Communications Center. No matter what the situation may be however, the Federal Bureau of Investigation will always be notified by the Communications Center personnel.

8. This General Order will stay in effect until International Law covering these situations is changed, or until the US. State Department and the Federal Bureau of Investigation notifies this department of needed changes or modifications.

APPENDIX G—GLOSSARY OF TERMS

ACCOMMODATION LADDER. A portable, light ladder or stairway hung over the side of a ship for use in boarding or leaving a vessel.

ABAFT. A term used to describe the relative position of an object which is farther aft than another. For example, the mainmast is "abaft" the formast.

AFT. Toward, or near the stern or rear of a vessel .

AFTERPART. Ship's hull, aft of amidships section.

AFTERMOST. Nearest the stern.

AFTERPEAK. The compartment in the narrow part of the stern, aft of the last watertight bulkhead .

AHEAD. The direction forward of the bow.

ALONGSIDE. Beside a pier or vessel.

AMIDSHIPS. At or near the amidships section of the ship.

ASTERN. The direction abaft the stern.

ATHWARTSHIPS. Across the ship at right angle to the center line.

BALLAST. Any weight or weights (usually sea water) used to control the draft of a vessel or to improve the stability of a vessel. (Water ballast is let into the double bottoms, water ballast tanks or trim tanks).

BATTEN DOWN. Cover up and fasten down (Usually said of hatches when they are covered up with tarpaulins which are fastened down with battens).

BEAM. The extreme width of a ship at its widest part.

BELOW. Below a deck or decks.

BETWEEN ('TWEEN) DECKS. Cargo space between the lower hold and main deck, divided by bulkheads which are usually watertight and fire resistant

BILGE. Generally any space in the lower part of a ship's hold where waste water collects and in which bilge suctions are placed for pumping out.

BITT. A vertical post of heavy timber or metal (usually in pairs) around which mooring or towing lines or cables and other lines may be made fast.

BOAT. Small open craft propelled by oars, sails, or some form of engine. (Also applies to larger vessels built to navigate rivers and inland waters).

BOAT DECK. A deck on which lifeboats and auxiliary boats are kept.

BOLLARD. A single or double cast steel post secured to a wharf or pier and used for mooring vessels .

BOOM. A general name given to a projecting spar or pole that provides an outreach for extending foot of sails, mooring boats, handling cargo, etc.

BOW. The forward or front end of a boat or vessel.

BRIDGE, NAVIGATING. A deck from which the ship is navigated .

BULKHEAD (SHIP). A vertical partition corresponding to the wall of a room extending athwartships or fore and aft with the length of the ship.

BULKHEAD WALL. A retaining wall of timber, stone, concrete, steel or other material built along, or parallel to, navigable waters.

BULWARK. Raised woodwork or plating running along each side of the vessel above the weather deck.

CAPTAIN. Whenever the title Captain is used in this manual, it shall mean the Commanding Officer of the fireboat or the officer who is acting as the Commanding Officer of the fireboat.

CARGO PORT. A large opening in the side of a ship used for the passage of cargo.

CENTER LINE. The imaginary middle line of a ship extending from stem to stern.

CHAIN LOCKER. A compartment in the forward portion of a ship in which anchor chain is stowed .

CHARTROOM. A small room adjacent to the pilot house in which charts and navigating instruments are located .

CHOCK. A heavy saddle or seat of wood or metal through which ropes or hawsers may be led

COAMING. The raised framework above deck openings used to prevent the entry of water.

COWL. The hood shaped top of a ventilator pipe.

DAVIT. A crane arm used in handling small boats, stores, gear, anchor, etc.

DECK. The part of a ship corresponding to the floors of a building. (Tween, shelter, main decks, etc.).

DECKHOUSE. A shelter built on a deck.

DOCK. A natural or artificial open or closed basin in which vessels may remain afloat when berthed at a pier or wharf.

DOUBLE BOTTOM. Compartments at the bottom of a ship between the inner and outer bottoms and used for ballast, tanks, water, fuel, oil, etc.

DRAFT. The vertical distance between the lowest point of a ship, when afloat, and the surface of the water.

EBB TIDE. The period in the tidal current when the water is flowing away from the land.

FAKE. To prepare a rope or hose by coiling it in layers so that each fake overlaps the one underneath in such a way as to run out rapidly without the chance of becoming entangled.

FATHOM. Six feet.

FLOOD TIDE. The period of the tidal current when the water is flowing toward the land.

FORE AND AFT. In line with the length of a ship.

FOREPART. The hull of a ship forward of the amidships section.

FORECASTLE (FO'C'SLE) The upper deck forward of the foremast and included in the bow area.

FOREMAST. The first mast of a ship abaft the bow.

FOREPEAK. A compartment or tank at the bow of a ship.

FORWARD. Near, at, or toward the bow of a ship.

FREEBOARD. The vertical distance between water line and main deck.

FREEING PORT. An opening through a ships bulwark which provides ready drainage of water from the ship's deck.

GUNWALE. The upper edge or rail of a side of a vessel or boat.

HATCH. Hatch or Hatchway is an opening in a ship's deck providing for passage of cargo or personnel from one deck to another (Figure 8 & 9).

HOLD. The cargo space of a ship's hull.

HAWSER. A heavy line, 5 inches or more in circumference used for towing or mooring.

HULL. The body of a vessel exclusive of masts, yards, rigging, machinery and equipment.

INBOARD. Toward the centerline in relation to the sides of the vessel.

INCIDENT COMMANDER. The senior fire department officer in charge of operations at a fire or other incident.

INNER BOTTOM. The plating forming the top of the double bottom.

KEEL. The principal fore and aft foundational structure of a ship.

KING POST. A mast, outboard from the center line, used to carry cargo booms.

KNOT. A measure of speed, not distance, equal to one nautical mile (6,076 feet) per hour.

LADDER. A metal, wooden or rope stairway. (A "Jacob's ladder" is a ship's ladder with rope or chain sides and wood or metal rungs).

LEE SIDE. The side of ship away from the wind

LENGTH OVERALL. The length of a ship from the extreme front of the bow to the aftermost point of the stern.

LIGHTER. A small vessel used for discharging or loading vessels anchored in harbors.

LINE. A common seaman term for rope.

LOCKER. A small stowage compartment usually in the form of a chest or a closet.

MAIN DECK. The uppermost deck extending continuously throughout the length of the vessel.

MANHOLE. A round or oval hole cut in tanks or decks to provide access.

MIDSHIP. Near the middle point of a ship's length.

NAUTICAL MILE. 6076 feet or approximately 1-1/8 miles.

PASSAGEWAYS. Corridors or hallways used to facilitate horizontal movement between compartments on board ship.

PEAK TANKS. Ballast tanks located in the bow and stern of a ship.

PIER. A structure, usually of greater length than width, a projecting from the shore into navigable waters so that vessels may be moored alongside. A pier may be either an open deck or covered by a shed.

POOP. The after, upper portion of a ship's hull which often contains the steering gear.

POOP DECK. First deck above the main deck at the after end of a vessel.

PORT SIDE. The left hand side of a ship, looking towards the bow.

PUNT. Flat bottomed narrow boat with square ends.

SCUTTLE. To sink a vessel by opening the seacocks.

SEACOCK. A valve connecting with the outside sea water in the lower part of a vessel and used in flooding various parts of the vessel.

SHAFT ALLEY. Shaft Alley or Tunnel is a narrow water tight compartment through which the propeller shaft passes from the after engineroom bulkhead to the stern tube.

SHELTER DECK. Usually the first deck below the main deck. In some ships, the shelter deck may be divided by moveable bulkheads.

STARBOARD. The right hand side of a ship, looking forward.

STEM. An upright at the bow of a ship into which the side timbers or plates are joined, made of cast iron, steel, or wood.

STERN. The aft end of a vessel.

SUBSTRUCTURE, PIER OR WHARF. That portion of the construction below and including the pier or wharf deck.

SUPERSTRUCTURE, PIER OR WHARF. That portion of the construction above the pier or wharf deck.

SUPERSTRUCTURE, SHIP. That portion of a ship located above the main deck.

TRIM. The manner in which a vessel floats on the water, whether on an even keel or down by the bow or stern.

WHARF. A structure having a platform built along and parallel to navigable waters so that vessels may be moored alongside. A wharf may be either open deck or covered by a shed.

WINCH. A hoisting engine which operates a horizontal shaft fitted with drums by which lines are hauled in.

WINDLASS. A machine for hauling or hoisting, having a cylinder upon which is wound the hoisting rope, cable or chain.

WINDWARD, WEATHER SIDE. The side of a ship toward the wind

END