# LONG BEACH
# FIRE DEPARTMENT

# MARINE FIREFIGHTING
# MANUAL 3.4

**September 1993**

# F O R W A R D

The unique problems that are presented by Marine Firefighting demonstrate the need for an operational manual. The challenges of Navigation Tactics, Equipment and Special Hazards are unique, as compared to the situations encountered by land based companies.

The purpose of this manual is to present an operational guide for Marine Firefighting and Fireboat Operation.


# CHAPTER I

## INTRODUCTION:

The Port of Long Beach provides the most modern facilities for the handling of cargo. In 1992, 75 million metric tons of cargo passed through the port. From Long Beach cargoes are shipped to ports throughout the world. Close to 5500 ships arrive and depart each year, making Long Beach a major port of call. The Long Beach Fire Department also provides fire protection to the Long Beach Naval Shipyard, which is one of the largest on the west coast.

Our harbor has also become famous because of the Queen Mary on our skyline. This famous old lady of the seas is once more receiving admirers from all over the world.

Located in Alamitos Bay is one of the world's finest small boat harbors, with slip space for approximately 2100 permanently based vessels. In addition to the Marina proper, there are numerous privately owned moorings in Alamitos Bay and Naples. Boats from all over the western part of the United States and Mexico make the Marina a stopping place, where guest mooring privileges are offered.

The great responsibility for protecting these very important installations falls to the Long Beach Fire Department and primarily, the Long Beach Fireboats.

There are a number of operations unique to Marine Firefighting. This manual will endeavor to provide a reference form of terms, equipment and operations for the use of the Marine Firefighter.

The difficulty of locating a fire aboard a ship and the subsequent extinguishment of that fire, points out the importance of the Marine Firefighter's understanding of the construction of ships or vessels, which, like buildings, have a shape consisting of many rooms or compartments. Indoctrination in ship construction, vessel types, ships diagrams and pre-planned fires peculiar to Marine Firefighting will prove invaluable to the personnel assigned to the fireboats.

Locating a fire aboard a ship can be further complicated by upsetting the trim of a vessel with large amounts of water; smoky fires below deck with little or no ventilation and light; maneuvering vessels in fast flowing tidal waters; and many other hazards encountered by firefighters in operating a fireboat under various conditions of wind and tide. The fireboat equipment, coupled with the knowledge of each person's specific job, will assist in the extinguishment of shipboard, dock or water front fires.

Familiarity with the physical layout of the various harbors and yacht basins, plus the intimate knowledge of local navigation and Rules of the Road, will make the Marine Firefighter better able to put into effective use the tactics, theories and concepts of Marine Fire Fighting.

Specialized use of fireboats such as manifold, or master stream lines, or perhaps the de-watering of a boat in order to keep it afloat, points to the technical knowledge necessary to the personnel of the Fireboats. There are also the extra duties associated with Marine Firefighting, such as Oil Island response, hazardous chemical spills, proper navigation and good seamanship, that require the most of a person to make the term "Marine Firefighter" a just and proud title.

To these people past, present and in the future, this manual is dedicated.

## CHAPTER II

FIREBOATS AND EQUIPMENT:

The Long Beach Fire Department is equipped with three fireboats responsible for the fire protection of vessels and water frontage properties within the waterways of the Long Beach Harbor and marinas. Fireboat 15 is located at Berth 202, Pier F Avenue, Fireboat 20 is located at 1980 Pier D Street, Berth 37, and Fireboat 21 is located at 225 Marine Drive.

## Section 1

FIREBOAT 15 & 20:

Fireboats 15 and 20 are steel hulled and are approximately 88 feet 6 inches in length with a 21-foot beam and a 6-foot draft. The boats have a displacement in excess of 125 tons.

Each boat is powered by two 12-V92 Detroit diesel, turbocharged, two stroke engines. Each engine is rated to produce 800 horsepower at 2300 rpm using #2 marine diesel oil for fuel. The fireboats have a measured speed in excess of 13 knots. Fuel capacity 1500 gallons. Foam two 500-gallon tanks, 3% AFFF alcohol compatible.

Pumps: Fireboats 15 and 20 are each capable of pumping 10,000 gpm. They are each equipped with a MAIN PUMP which is capable of producing 5000 gpm and two WING PUMPS which are capable of producing 2500 gpm each. The main pump is midships mounted, forward of the drive engines and powered by a third 12-V92 Detroit diesel engine. The two wing pumps are powered by the propulsion engines via a PTO (power take off) unit called the Omega System.

Discharge Capacities:

| | |
|---|---|
| Foredeck Monitor | 2,000 gpm @ 144 psi - water or foam |
| Housetop Monitor | 5,400 gpm @ 142 psi - water only |
| Tower Monitor | 1,500 gpm @ 150 psi - water or foam |
| Aft Monitors | 2,000 gpm each @ 153 psi - water only |
| Bow Monitors | 2,000 gpm each @ 145 psi - water or foam |

Hose Manifolds:

2-side manifolds with 4 2-1/2 outlets - water or foam
1-bow manifold with 3 2-1/2 outlets and a 1-3/4 hose connection - water only
1-aft 1-3/4 hose/foam station - water or foam

Both fireboats are also equipped with bow and stern, port and starboard thrusters that are operated off of the fire main loop

Compartment Locations:

Below Main Deck (Fore to Aft)

- Forepeak or collision bulkhead
- Forward void
- Crew's day room and head
- Engine room
- Aft void and fuel tank 1500 gallons
- Lazerette

Main Deck (Fore to Aft)

- First Aid Room
- Main storage room

Above Main Deck

- Bridge (wheelhouse)

## Section 2

BOAT 21 (located at 225 Marina Drive)

The major characteristics are:

| | |
|---|---|
| • Length on Deck | 32'0" |
| • Length Overall | 35'0" |
| • Beam Overguard | 12'0" |
| • Freeboard Forward | 4'4" |
| • Freeboard Aft | 2'10" |
| • Max Speed | 20 Knots + |
| • Range at Max Speed | 175 Statute Miles Approximate |
| • Crew | 3 Personnel |
| • Cargo Capacity | 2000 pounds |

Two (2) Crusader 350 hp marine engines for power and twin screws for maneuverability.

One (1) Crusader 270 hp marine pumping engine with a 1000 GPM Waterous pump.

500 GPM Stang monitor, with hydraulic controls.

Four (4) 2-1/2" fire hose connections, two (2) each port and starboard.

275' of 1-3/4" hose, 100' of 3" hose.

One (1) water dredge type eductor

One (1) light water applicator with aerating type nozzle.

## CHAPTER III

FIREBOAT OPERATION:

## Section 1

PERSONNEL AND PROCEDURES:

Captain = Capt
Engineer = Eng
Fireboat Operator = FBO
Firefighter/Deckhand = FF/DH

Start Up and Getting Underway - Fireboats 15-20

Capt
1. Turn off shore power
2. Assist FF/DH with dock lines
2. When Capt is certain it is safe to leave dock assume position in pilothouse
4. Direct operations

Eng
1. After shore power has been shut off disconnect and place on holder
2. Assist with dock lines from deck
3. Be prepared to assist FBO with start up procedures

FBO
1. Assume position in pilothouse
2. Start generators and main engines
3. Confirm that shore power is disconnected and dock lines have been cast off
4. Signal FF/DH when ready to cast off bowline

NOTE: Bowline will be last line cast off

FF/DH
1. Assist with docklines
2. Assume position on dock to cast off bowline when signaled by FBO
3. Assume position on deck - secure all deck lines and fenders
4. Report to pilothouse

Underway Procedures

Capt
1. Confirm destination and route with FBO
2. Confirm that all communications and navigational aids are functioning properly
3. Direct operations

Eng
1. Proceed to engine room for visual inspection of area and equipment *See crew training manual
2. Report to pilothouse

FBO
1. Confirm destination and route with Capt
2. Monitor all radio communications
3. Operate the Fireboat in accordance with all maritime rules and regulations

FF/DH
1. Report to pilothouse

Pumping Operations

Capt
1. Direct FBO into position
2. Assist FF/DH with hose lines and monitors
3. Direct operations

FBO
1. Position Fireboat as directed

Eng
1. Bring fire pumps on line
2. Operate pumps and monitors as directed

FF/DH
1. Assist Capt with hose lines and monitors
2. Place fenders and docklines as directed
3. Report to Capt

Docking Procedures

Capt
1. Assist FF/DH and Eng with docklines and fenders

NOTE: Bow line will be secured first

2. Standby shore power switch to turn on after shore power connection has been made by Eng

Eng 1. Assist FF/DH and Capt with docklines and fenders
2. Connect shore power connection to fireboat
3. Signal turn on to Capt when shore power connection is complete

FBO 1. Position fireboat at the dock
2. Secure pilothouse after fireboat is secure to dock

FF/DH 1. Assist Capt and Eng with docklines and fenders
2. Assist in securing fireboat

Pump Down and Fresh Water Flushing of Fire Pumps and Fire Lines

Capt = Assist FF/DH in attaching fresh water line to fireboat manifold

FBO = Assist Eng with fresh water flushing operations *See crew traiing manual
Eng = Flush all systems that have been exposed to salt water

FF/DH 1. Assist Capt in attaching fresh water line to fireboat manifold
2. Standby hydrant to turn on fresh water
3. Assist in securing fireboat

Fireboat 21 - Start Up - Leaving Dock

Capt 1. Disconnect shore power
2. Assist FF/DH with docklines
3. Direct operations

FBO 1. Assume position at helm
2. Start main engines
3. Make certain dock lines and shore power have been disconnected prior to leaving dock

FF/DH 1. Assist Capt with docklines
2. Assume position on deck
3. Secure all deck lines and fenders

Underway

Capt
1. Confirm destination and route with FBO
2. Confirm that all communications and navigational aids are functioning properly
3. Direct operations

FBO
1. Confirm destination and route with Capt
2. Monitor all radio communications
3. Operate the fireboat in accordance with all maritime rules and regulations

FF/DH
1. Report to Capt

Pumping Operations

Capt
1. Direct FBO into position
2. Assist FF/DH with hose lines and monitor
3. Direct operations

FBO
1. Start pump engine
2. Position fireboat as directed

FF/DH
1. Assist Capt with hoselines and monitor
2. Place lines and fenders as needed
3. Report to Capt

Docking Procedures

Capt
1. Assist FF/DH with docklines and fenders
2. Connect shore power

FBO
1. Position fireboat at dock
2. Secure helm and pilothouse

FF/DH
1. Assist Capt with docklines and fenders
2. Assist in securing the fireboat

**PHASE I**

**Initial Fireboat Introduction and Training**

The initial training will consist of eight (8) three (3) hour training sessions, four (4) consecutive sessions and one fireboat then repeat the same training sessions at the other fireboat.

This training will encompass all phases of fireboat operations and the Captains will receive extra training on the administrative duties and responsibilities.

**PHASE I TRAINING SCHEDULE**

Day 1 OVERVIEW

The trainee will be taken on a complete tour of the fireboat. He/she will have each compartment and it=s contents identified and their uses explained. The Fireboat Maintenance Program, the Maintenance Work Orders and Sub-Requisition forms will also be located and explained.

Day 2 PUMP AND FOAM SYSTEMS

The trainee will have the fire main and foam systems identified and explained. The trainee will then participate in a pump and flush down exercise.

Day 3 ELECTRICAL SYSTEMS

The trainee will have the entire electrical systems identified and explained. The trainee will then participate in the procedure used to start and put on line one of the generators and the electrical panel.

Day 4 REVIEW

The trainee will tour the fireboat and identify and explain the systems on the fireboat. The trainee will also learn the record keeping procedures in the station computer.

At the conclusion of these eight (8) training session, the trainees will be considered fireboat qualified and eligible to work at the fireboats, IF both of the assigned Captains sign off on their abilities.

It will be the responsibility of the Battalion Chief/Harbor Liaison to keep the Callback roster at Station 19 current on which personnel are qualified to be assigned at the fireboats.

The trainee will then be responsible for and required to attend the on-going Recurrent Fireboat Training to maintain their qualified status.

## PHASE II

### Recurrent Fireboat Training

The Recurrent Fireboat Training will require a minimum of four (4) hours of training per month/per person, to be scheduled (when possible) with the on-duty assigned person at that position. The training will alternate between the two fireboats.

When possible the qualified relief personnel will work a four (4) shift cycle of the position he/she is trained in during a vacation or holiday period.

This schedule should give each qualified relief person approximately 48 hours of refresher training and 96 hours of scheduled hands-on experience.

It is the responsibility of each trainee to attend each training session and make sure that it is documented in the Response, Activities Menu (7) of the Fireboat Main Maintenance Menu program at each of the fireboat stations.

Both fireboat stations on all shifts will use an identical recording procedure to document the Recurrent Fireboat Training Record each month and include it with the Month End Reports. This report will be submitted through channels to the Deputy Chief of Operations with comments from the shift Battalion Chiefs.

Those members not having the required number of training hours will be notified by their respective Battalion Chief and be given until the next reporting period to become current. These members NOT complying will be dropped from the Qualified Relief List.

Any member on the Qualified Relief List who is promoted will no longer be automatically considered as qualified at the new rank and may not be eligible to work at the higher capacity at the fireboats.

## CHAPTER IV

SHIP AND SMALL CRAFT CONSTRUCTION:

## Section 1

SHIP CONSTRUCTION:

The port of Long Beach is known as "America's Most Modern Port" and is a major link in the exchange of world goods. Cargoes include bulk petroleum, newsprint, grain, minerals, lumber, copra, tallow, automobiles and steel. All within the guardianship of the Long Beach Fireboats and responding companies. Types of ships found entering and leaving Long Beach Harbor include freighters, tankers, super-tankers, containerized cargo ships and ore carriers.

Diagrams of various types are included on the next pages, again with the intent of providing a foreknowledge of ships enabling the Marine Firefighter to be better equipped.

### Ship Construction - Decks

1. Main deck - highest complete deck extending from stem to stern.
2. Second deck - the first complete deck below the main deck. Also called the between deck.
3. Third deck, fourth deck, etc., - the lowest complete deck on a ship.
4. Platform deck - a partial deck below the lowest complete deck.
5. Superstructure deck - any partial deck above the main deck, which does not extend to the sides.
6. Upper deck - partial deck amidships above main deck extending to the sides of the ship.
7. Forecastle deck - partial deck above the main deck on forward part of the ship.
8. Half deck - partial deck above the lowest complete deck.
9. Poop deck - partial deck at the very stern above the main deck.

### Military Ships - Compartment Numbering System

Ship is divided into Sections A, B and C. Each section is divided into six (6) sections. Odd numbered sections on starboard and even numbers on port. The last letter in the compartment designation indicates the use of the compartment as follows.

| | |
|---|---|
| A - Supply and storage | EXAMPLE: Compartment B-213-M |
| B - Batteries | B - Amidships section |
| C - Control | 213 - Section 2 (port side), Compartment 13 |
| E - Machinery | M - Ammunition storage |

F - Fuel
L - Living quarters
M - Ammunition
T - Trunk
V - Voids
W - Water
900 - Bilges

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 (see figs #7 and #9). 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."

The lower decks, separated by water-tight bulkheads between holds, are termed the "tween decks," and the space below the lowest deck is termed the "lower hold," (see figs #7 and #9). It is obvious that a fire may more easily and quickly spread through a shelter deck than through the 'tween decks separated by water-tight bulkheads.

The opening in the main deck over each hold is termed the "hatchway" or "hatch" and 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 with a raised side or coaming and is provided with portable supports usually constructed of steel and commonly termed "strongbacks." They support the hatch covers. The hatch covers may be of timber or steel construction. At sea they are covered by tarpaulins. The strongbacks are usually covered by tarpaulins. The strongbacks are usually constructed of steel (see fig #9). Both the hatch cover and strongbacks are extremely heavy and, 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 crew member or dock worker to operate the ship's carbo 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 and are normally covered with wood planks. Often heavy bulk cargo such as trucks, tractors, launches, etc., are carried on top of the main deck hatch covers.

In some freighters, in addition to the athwartships bulkheads, there may be a bulkhead running lengthwise with the center line of the ship from the hatch to the athwartships bulkhead to prevent lateral movement of cargo.

This type construction is most common in ships carrying loose cargoes such as grain.

In 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 fig #7). The cover to such tanks is dogged down and 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 only that part of the hatch cover directly over the ladder. However, 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 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/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 (see fig #10).

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 when 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 (see fig #10). 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 bilges. 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 bilges is pumped out through pipelines connected to bilge pumps in the engine room. If a large

accumulation of oil or other flammable liquid should occur in the bilges, a serious fire could result and dangerously expose the holds and engine room. In this event, water, steam or C02 could be discharged to the bilges 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 usually is 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. In steam vessels there usually are 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, and 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. Owing to the steep incline of these ladders and to the fact that they are usually somewhat greasy, firefighters descending them, particularly under smoky 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 fig #7). 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 and sometimes also 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 #7, #11 and #13). 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 and 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 "fo'c'sle") at the bow, the bridge amidships and the poop at the stern. The interior of these structures is used primarily for crew accommodations, galley and messroom, but may also be used for cargo and ship stores. Steel deckhouses 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. Some of the large transpacific or transatlantic passenger ships which ply a definite trade route are built for maximum speed and luxury and carry a relatively small amount of cargo. They may have up to twelve 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. The cabins, palatial suites, stores and place of assembly, together with the ship's refrigeration, heating and power plants, and the enormous fuel storage possess every fire hazard found in an average city. However, the average passenger ship, whether intended for trans-oceanic or coastal trade, is designed to carry a lesser number of passengers and will have considerable cargo capacity (see fig #11). 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. These bulkhead doors may be operated manually from either side of the bulkhead and often can also 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 upon exposure to fire and they also may be remotely controlled from the bridge. A feature in some modern ships in 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 also is the presence of 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 better-class cabins. This creates a hidden space between the inside of the paneling and the ship's side or the deck overhead through which fires can spread horizontally and vertically (see fig #12). 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 of 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, but occasionally they may carry other liquid cargoes such as molasses, syrup, cottonseed oil, etc. A typical oil tanker is shown in figure #13. 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 crew accommodation; 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. In older type tankers the crew's quarters may be located in the fo'c'sle. The peaks, fore and aft, usually contain ship's stores, boatswain's stores, paint lockers and fresh water tanks, etc. 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. Also the gangway may carry water, steam pipes and electric cables.

The cargo pumps usually are housed in watertight floodable compartments, which extend the full width and depth of the hull as shown in figure #13. Cofferdams (fig #13) separate the engine room aft and the cargo space forward, from the oil cargo tanks. They usually consist of two watertight bulkheads three to six feet apart and can be flood with water to form a firebreak. Fuel oil for the propelling engines is stored in tanks abaft the aft cofferdam and often in tanks beneath the engine room in the double bottom (see fig #13). It is noted that the double bottoms in tankers generally do not extend the full length of the ship as is common in other vessels.

Cargo tank construction is designed to restrict the movement of the free oil surfaces when the tanks are loaded so as to maintain the stability of the tanker underway. The more common type of construction will sub-divide the tank into a number of individual tanks by transverse and longitudinal bulkheads with access to each subdivision provided through a manhole in the deck. The tanks generally extend to the bottom of the ship and, in them; the frame of the ship's hull is usually exposed. Extreme care should be exercised if it should be necessary to use tank inspection ladders as in the case of a rescue. They maybe 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 usually 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 either from forward or aft according to the practice of the ship's owner. With the exception of the tank vents normally carried up the ship's masts, the tanks are sealed and are designed to present minimum fire risk.

LIQUEFIED NATURAL GAS CARRIERS: At the present time, ships are being constructed for the express purpose of carrying LNG from foreign ports to the United States. These ships will be in effect giant "Thermos" bottles. They will present the double hazard of natural gas and the natural gas being in a cryogenic state. When information becomes available, it will be included in this manual.

REFRIGERATOR SHIPS: Refrigerator ships are designed to carry perishable foods such as meats, fruits, etc., in the holds of the ship wherein the temperature is sufficiently depressed 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 plug hatch cover designed to fit below the main deck hatch cover after the cargo hold is loaded, completes the insulation (see fig #14).

The insulating material may be a non-combustible, such as glass wool or rock wool, but more often it is of granulated cork or cork slab material, either of which burns easily and with considerable smoke. The insulation is continuous in any one cargo compartment and all steel or iron work 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. For example, glass wool may be used only against bulkheads subject to heat; the remaining insulation may consist of cork material. Therefore, 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 of 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 whether 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 refrigerating piping grids below the hatch openings are plugged with an insulated cover and then usually covered with wooden hatch covers, the main deck cover being battened down.

Holds in which the cargo need only be maintained at a chilling temperature usually are kept at the required temperature by cooled air. The air, cooled by a refrigerating system, is circulated throughout the holds by means of air ducts (fig #15). These ducts are usually 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 shut down.

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 either wood or metal. A fire in a wooden duct obviously presents a serious firefighting problem.

The refrigerant commonly used on modern refrigerator ships is Freon #12 which 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 refrigerating machinery. Refrigerated holds may be fitted with thermometer tubes as shown in figure #15, by means of which the temperature in the holds can be determined. If necessary, these tubes may also be used to discharge water, C02 or steam into the hold. In some cases, the ship will be provided with adapters for this specific purpose. In ordinary freighters and passenger ships, usually there is at least one refrigerating hold or compartment.

## SHIPBOARD FIREFIGHTING EQUIPMENT

Passenger ships, freighters and tankers are provided with considerable firefighting equipment for the control of shipboard fires while at sea. This equipment will consist of a fire main system not unlike a wet standpipe system found in buildings ashore. 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 C02 and/or steam extinguishing systems are usually provided for the protection of holds and machinery spaces. The engine room may also be provided with a fixed foam system for extinguishment of oil fires.

Shipboard firefighting equipment, although provided primarily for fire control when the ship is at sea, 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, it should be determined if the pump pressure has been increased for firefighting 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 will be capable of furnishing 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 make connections should the fire pumps be inoperative. Special adapters will, in all probability, be necessary to connect to fire main inlets of foreign

ships, but under present world-wide safety practices adapters to U.S. National Standard Thread will be available on board most of such ships. When a vessel equipped with a standpipe system and/or an automatic sprinkler system is moored at a pier or is at anchorage in the bay with insufficient or no steam or power to operate her fire pumps at full capacity, or when under repair, it is common practice in the Port of Long Beach to require that hose lines connected to the system inlets be connected to the City water main, or to auxiliary pumps if the main is not accessible.

Space for Connection picture

The International Convention for the Safety of Life at Sea, 1960, requires a universal coupling for connecting the fire mains of a merchant vessel either ship to ship, or ship to shore. The arrangement specified is a pair of flanged and threaded fittings, one "International Shore Connection (Ship)" provided on each vessel with female threads corresponding to the vessel's hydrants and fire hose, the other "International Shore Connection (Shore)" provided by the local shoreside firefighting forces with female threads to match the local threads. The flanged faces can be gasketed and bolted together quickly, and thus enable emergency water for firefighting to be pumped aboard. It was agreed that all merchant vessels of 1,000 gross tons and over, on an international voyage would be required to carry at least one International Shore Connection (Ship). It was further recommended that the signatory governments request port or other appropriate local authorities to provide the shoreside counterpart, International Shore Connection (Shore).

Shore connections for connecting to fire mains of vessels, as described above, have been issued to the following companies:

Fireboats #15, #20, #21
Engine Companies #1, #6, #13

These connections shall be carried on the apparatus in a protected and convenient location.

Automatic Sprinklers: Some ships, in addition to carrying a standpipe system, also may be provided with an automatic sprinkler system. Installation of sprinkler systems is generally limited to passenger ships and the area protected is usually restricted to the spaces normally used by the passengers and crew, although it may well extend to other parts of the ship. The primary water supply for such systems is usually one or more pressure tanks

charged with fresh water, the secondary supply being an automatic pump or pumps drawing seawater. 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. Usually such systems are supervised and are provided with a flow indicator panel and annunciator normally 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 quickly be determined.

Fire Alarms and Automatic Fire Detectors: Some ships are equipped with automatic fire detecting systems, which operate at a fixed temperature setting or on the principle of rate of temperature increase. Usually these systems also provide for an annunciator and indicator board located in the chart room or on the bridge, and are identical to such systems found in buildings ashore. Fire alarm boxes usually are installed in passenger accommodations and are coded to notify the bridge as to the location of the alarm.

Large vessels often will be equipped with a pneumatic smoke detector system in which a continuous suction will be maintained in pipes leading from holds to an indicator panel on the ship's bridge or in the chart room. It is claimed that this type of detector will give immediate notification of smoke from a fire in a hold even though the outbreak of fire may be very small. Notification of the detection of smoke will be apparent at the indicator panel, and will give the location of the hold affected. This type detector system is usually so designed that the same piping which carries smoke to the indicator panel can also be used to discharge C02 gas into the hold involved to extinguish the fire. The design of the control valves for this use is such that it is impossible for the C02 gas to reach the indicator panel.

Steam: A fixed steam of C02 fire extinguishing system will usually be found installed in all ship's holds except vessels used exclusively for the transport of coal or gain in bulk.

In vessels provided with a fixed steam system, the injection nozzles usually will be placed at varying heights in the hold. In order to prevent accidental injection of stem into a hold, it usually will be necessary to connect a deck steam pipe to a hold steam-injection-fitting before steam can be discharged into the hold.

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

1. Steam must be available in continuous large amounts because 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.

2. The use of steam on a cargo in which water could not also be used is seldom advisable because a large part of the effect of steam is gained by its moisture content.

3. The application of steam is perhaps most effective on fires near the top of the hold where its smothering and saturating effect will not only act quickly but may also prevent the fire from involving the vital hatch covers. On the other hand, fires near the bottom of the hold may often be better controlled with C02 than with steam.

Carbon Dioxide (C02): Fixed installations of C02 extinguishing systems on ships usually are provided to protect cargo spaces, machinery spaces, engineer's storerooms, flammable liquid lockers, and similar spaces. They have also largely supplanted steam smothering systems for cargo hold protection.

United States Coast Guard Regulations require that the number of pounds of C02 required for the protection of each cargo space shall be equal to the gross volume of the space of cubic feet divided by 30. A separate supply of C02 need not be provided for each space protected. However, the total available C02 supply shall be at least sufficient for the space requiring the greatest amount. The C02 is injected into the cargo space through fixed nozzles installed under the deck so as not to interfere with the storing of cargo. It is discharged through high pressure piping from a battery of C02 cylinders stored outside the spaces protected in a location where they will not be inaccessible in the event of fire in any of the protected cargo spaces.

Limiting factors in the use of C02 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 oxygen such as may be carried in the interstices of tightly baled fibers, the efficiency of C02 may be greatly reduced.

2. C02 may not easily penetrate to all parts of a tightly packed hold or to spaces blocked off by the cargo.

3. The tendency of C02 gas to diffuse or mix with air when heated and stimulated by air currents usually will cause it to be unsatisfactory for use on fire near the top of the hold. If the fire is immediately below the hatch covers, C02 will seldom provide adequate protection.

Foam: Fixed foam systems are usually found in the machinery and boiler room spaces of oil burning and motor ships. They 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 operating controls of such systems are usually manual and are located outside the spaces, which they are designed to protect.

These foam installations are similar in operating principle to those used on land. Usually they are of the chemical type supplied from a single tank containing the two foam solutions in separate compartments, although they may be of the foam-powder generator type

connected to a fire main, or a mechanical foam system. Distribution of the foam is usually by means of fixed perforated pipes or spreaders designed to give even distribution of foam to the areas protected. On some ships, distributors may also be found about 10 feet above the floor plates and arranged to discharge foam to the boiler fronts.

## Section 2

SMALL CRAFT:

Long Beach is the home of many small boat anchorages, both public and private, as well as the large City owned marina in Los Alamitos Bay. These small boats are varied in size from the small sailing sabot to the 100' or larger vessels moored in the marinas. There are over 5000 small boats within Long Beach City limits. This number is represented by more than 150 types of boats. It is obvious that not all can be shown, therefore two types have been chosen as being typical of the majority of small boats.

The following diagrams presented for the purpose of familiarizing the Marine Firefighter with the general layout of these pleasure boats. It is important that the Firefighter be alert to the best ingress and egress to a boat and the possible location of lockers, bulkheads, etc.

As most small boat fires are below deck, usually in the engine compartment, the following diagrams show engine access and typical interior layout. Fuel tanks are usually port and starboard, outboard of the engine with vents in the deck over the tanks.
As stated above with over 150 types of boats in the area, it would be impractical to document the construction of small boats. With the exception of a bulkhead immediately forward of the engine/fuel compartment, all other bulkheads, through-hull fittings, cabin layouts, interior access, storage, etc., would change with each type of craft.

## CHAPTER V

MARINE FIREFIGHTING TACTICS:

## Section 1

SHIP FIRES:

Ship fires frequently cause extremely serious and difficult firefighting problems. Fire may occur in a ship while it is moored to a pier or wharf where it is accessible to land firefighting apparatus or it may occur while the vessel is underway or at anchor and can be approached only by water.

The fireboat is one of the more completely equipped units of the Department because of the obvious reason that it may be the only unit operating at a location inaccessible to land apparatus. However, the best and most complete equipment is of little value unless the personnel assigned are thoroughly trained in its use. Therefore it is the responsibility of the Captain to train his personnel by frequent drilling. Drills should cover every phase of firemanship and seamanship necessary to use the equipment and appliances of the fireboat efficiently. When possible, drills should be held under simulated conditions of actual operation to instill confidence and to develop skill in the use of such equipment. An equally important requisite to training is frequent inspections of ships and waterfront facilities whereby the Captain, Fireboat Operator and crewmembers may gain knowledge of their construction and use, their fire hazards, and the probable life hazard if fire should involve such ships or structures. Land companies which respond to waterfront alarms should also 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. Frequently they are assigned to augment the firefighting crew of the fireboat during the course of a fire.

Assistance Available to the Officer-in-Command at Ship Fires: Every officer of the Fire Department in command of a ship should have a comprehensive knowledge of the resources and assistance available to the Department for fighting ship fires. By Federal law (1), the primary responsibility for the protection and security of vessels within the territorial waters of the United States rests with the master, owners, operators and agents of such vessels. The Captain of the Port, U.S. Coast Guard, by Federal law (1), the authority to take full or partial possession or control of any vessel or any part thereof, within the territorial waters of the United States under his jurisdiction, whenever it appears to him 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 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.

1. U.S. Coast Guard Regulation - CG-239 - Security of Vessels and Waterfront

Facilities

It is the experience of the Department that the master, the deck and engineering officers of any vessel have always extended their fullest cooperation to the Department in the control of a fire involving their ship. These people will have a thorough knowledge of the construction of the ship, its hazards and 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 who is responsible for the duties of the ship's officers, during their absence, in relation to firefighting. Often shipping companies employ marine superintendents in ports from which their company's ships operate. These port superintendents will usually be present at a fire in a vessel belonging to their company and will render valuable assistance to the Officer-in-Command of the fire.

Representatives of the Maritime Insurance Underwriters also are available for assistance to the Fire Department. Through their cooperation with the ship's captain and representative of the ship's owners, they may make available tugs, barges, stevedores, specialized firefighting equipment and other extinguishing aids. Navy tugs and Coast Guard boats are equipped with fire pumps, deck outlets and monitors, and are capable of assisting as auxiliary fireboats when required. The fireboats of Los Angeles are available through mutual aid provisions.

Firefighting 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.

1. Policy: The Officer-in-Command should not order a ship moved from its mooring or anchorage. He may recommend to the ship's senior officer that such action be taken, or he may obtain the authority and approval of the Captain of the Port and of the Chief Wharfinger to enforce such action.

   The Officer-in-Command 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 firefighting. The Officer-in-Command should not undertake any action to scuttle or flood a ship without the approval and direction of the Captain of the Port and/or the Chief Wharfinger, Department personnel are not qualified to undertake responsibility for this type of action.

   The cutting of any watertight bulkhead or hull plating, or the 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

approval of the Captain of the Port should be secured particularly if the cutting action would endanger the watertight integrity of the ship.

2. 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 firefighting equipment and fireboat equipment. It also facilitates the working out and overhauling of cargo, and provides for adequate accessibility to or from the ship by use of the ship's accommodation ladder or gangplank, and placement of Fire Department ladders.

   A problem may develop wherein will be necessary to move a ship involved with fire to a mooring, where the danger of the fire extending to combustible shore structures is at a minimum but still 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 the explosion hazard of the ship's cargo or because of other hazards. The extent of the fire and/or the nature of cargo may be such that, as a last resort, the ship will have to be flooded. She will then undoubtedly have to be moved to a position where it will present the least navigational hazard and where the bottom is of such nature that it will not severely damage the hull of the ship or cause her 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 aerial ladder nozzles and fireboat monitors; but every effort should be made to get on board at the earliest possible moment. In such an event, 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 her to list dangerously or even to capsize.

3. Life Hazard: As in any shoreside fire, the first consideration of the Department Officer-in-Charge of a ship fire is that of 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 usually does not present as severe a life hazard because most of the passengers will be ashore and a large percentage of the ship's crew will be ashore on leave. It cannot be too strongly 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.

4. Size-Up: On arriving to take charge of a ship fire, the Officer-in-Command should immediately contact the senior ship's officer aboard. He should obtain as much information as possible as to the exact location and extent of the fire, the materials involved, the hazard to life, the danger of the fire extending not only to adjoining holds or compartments but also to exposed piers, to other shore structures, or to

other craft. He must determine whether cargo doors and portholes in the sides of the ship are closed, if watertight doors in bulkheads and fire doors are closed, and whether power is available should the ship have to be moved. He should also require that the ship's plan and cargo stowage plan be made available so that he and his subordinate officers may refer to these plans at any time during the progress of the fire. This latter provision is particularly important because verbal information given under the stress of a fire often is not reliable. In this connection it is noted that 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 and reliance will have to be placed on the ship's cargo manifest and verbal information obtained from the ship's officer and cargo handlers.

Other important points, on which the Officer-in-Command should be informed, relative to the extent and hazard of the fire, are:

A. What steps have already been taken by the crew to extinguish the fire? If C02 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, C02, foam and steam systems and if they are available for use?

B. All means of access to the fire areas and to adjacent holds, compartments and bulkheads.

C. How the access of air to the fire area can be controlled.

D. The extent to which water introduced in the course of firefighting can be pumped out. The ship's engineer will be best qualified to give this information. He will be able to determine whether eductors and portable pumps can assist and where they should be positioned.

E. The extent to which compartments or holds adjacent to the fire area may be affected by radiated or conducted heat or by direct spread of fire. The access by which hose lines can be led to keep exposed bulkheads cool. Whether arrangements can be made to provide the assistance of dockworkers, if necessary to work out and move cargo.

F. It should also 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-involved part of the ship. In the case of empty tanks, it may be necessary to consider whether they should be filled with water to counteract the adverse effect water discharged from hose streams may have upon the stability of the ship.

G. In all ship fires, it is particularly important that an avenue of escape always be maintained for the firefighting force. The type of cargo and its effect on the

stability of the ship should also 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, listing of ship, may cause these units to shift and thus endanger personnel as well as the stability of the ship.

H. The Officer-in-Command of a fire on board a ship moored to a pier should be cognizant of the relatively slow response of a fireboat. A fireboat cannot be maneuvered as easily as a road apparatus and is continually affected by wind and tide as well as by navigational obstructions and the heat and smoke of the fire itself. It is very important that instructions given to the fireboat by radio be correct, otherwise considerable time will be lost in unnecessary maneuvering.

5. Hazardous Cargos and Ship Fire Gases: As at shoreside fires, 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 the ship involved often can be removed 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 fire has been burning with the hatches covered. Dangerous gases may be found in bilge areas. Cargoes of organic origin such as linseed oil cakes, rosin, tobacco, potatoes, oranges and similar products aided by moisture, may 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, the ship may be under the process of fumigation, using such fumigants as hydrocyanic acid or methyl bromide. However in this instance, Port regulations require that signs giving notice of the fumigation be posted conspicuously and that the Fire Department be notified before the fumigation regarding the location, time, duration and nature of the fumigant.

It is evident that firefighters should always be protected with an approved Department self-contained breathing apparatus at any stage of a ship fire if there is any question as to the safety of the personnel entering the interior of the ship. Even if breathing apparatus is not immediately required it should always be available on deck in case a subsequent change in the fire situation makes its use necessary. Fireboat personnel should don breathing apparatus on the 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, lifelines should be utilized as instructed in the Long Beach Training

Manual. This is a prime requisite for safety when operating in holds or passageways, as the maze of passageways is confusing and the means of egress from holds is difficult to locate under smoke condition.

When 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 damage. The flooding of the holds or scuttling of 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.

The handling and storage of explosives within the port area of Long Beach is permitted only under strict regulations adopted jointly by the Captain of the Port, (U.S. Coast Guard); the Fire Marshal and the Chief Wharfinger of the City of Long Beach. These regulations prohibit the loading of dangerous explosives (Class "A") in other than remote offshore areas in the harbor known as "Explosive Anchorages." 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 from their signal halyards a red flat in the daytime and a red light at night to warn approaching vessels of the danger of open lights, smoking, collision, etc. The handling of Class "C" explosives and fireworks from ship to pier to receiver or vice versa and the storing of limited quantities of such materials on piers is permitted when in compliance with port regulations.

6. Spread of Fire: Fires in ships, as previously stated, can extend through heat radiation, conduction, or by direct contact with fire. The material used in construction of ships, being mainly steel, will readily conduct heat and ignite combustible material in contact therewith. Fire also may spread through the many 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 on alarm of fire. On other vessels, reliance will have to be placed on the ship's officers for control of the system.

The Officer-in-Command of a ship fire must cause frequent and thorough checks to be made on all sides of the fire area as well as above and below the fire. Particular watch must be maintained to prevent embers from dropping down holds and companionways and thereby starting additional fires in such spaces. The precaution of keeping a close watch for possible spread of fire outside the ship should not be forgotten in the early 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, or the mooring lines may burn away and allow the ship to break adrift.

Firefighters 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 especially known that the water will reach the fire area. The smoke ejector 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. Long Beach is fortunate in having all pier and wharf surfaces constructed of noncombustible materials. Cargo involved in a fire aboard ship can be off loaded and overhauled on the dock without fear of communicating to the pier or wharf itself. If the ship is at anchor and cannot be brought dockside, the cargo can be off loaded to and overhauled on a barge moored alongside.

7. 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 C02, steam or any other extinguishing agent 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 are placed the supports for the hatch cover. Most ships are provided with metal hatch covers weighing several tons. The hatch covers are in turn covered with heavy tarpaulins, which in turn are secured with metal battens and wooden wedges. If the ship has lost power and her winches and cargo booms are inoperative, then a land or floating crane must be provided to remove the hatch covers.

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 as the movement of the vessel, due to swells, tide or any subsequent list, may displace the ladders or break the strap or ladder. Access to holds is provided by permanent vertical hold ladders at the side and/or end of the hatch, and sometimes by a vertical ladder leading from an inspection hatch opening, or by ladders in mast houses having trucks 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. In stepping off a ladder into a hold do so in a forward direction and never backwards to avoid falling into lower sections of the hold.

As in any fire, the first extinguishing operation of the 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. Distributor and fog nozzles as well as straight stream nozzles should also be provided. Personnel equipped with self-contained breathing apparatus should be assigned to stand-by, ready to descend into the hold.

The Officer-in-Command should endeavor to determine the location and intensity of the fire before removing the cover by either removing 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 only be rolled back partly so that the hatch can, if necessary be secured again quickly.

Whenever possible, firefighters equipped with self-contained breathing apparatus and life lines, should enter the hold with 1 3/4 inch hose lines and attempt to extinguish the fire, or to control it until the hold can be thoroughly ventilated and the cargo worked out in order to reach the seat of the fire. In this connection, it is noted that 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. In no case should personnel who are not equipped with breathing apparatus be allowed to enter the hold until it has been thoroughly ventilated.

If it is impossible to enter the hold, heavy streams and distributors 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 it is apparent that reasonable control of the fire cannot be quickly affected by the above method, then by the use of an oxy-acetylene cutter, holes may be cut in the deck or bulkheads. The holes should be large enough to allow the working of hose lines or distributors 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 through the ship's side because any subsequent listing of the ship may 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, behind which water accumulation is suspected, a diamond-shape cut should be made starting at the lowest point and working upwards so as always to position 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, should it be necessary. (Note: See subtitle "Policy" regarding cutting of ship's bulkheads,platesandhull.)
As soon as possible in the initial stage of controlling the fire, the bulkheads of the holds or compartments adjoining that involved should be examined for heat. 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, and 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. Arrangements should also be made to close portholes, side loading doors and other openings in the ship's side to help reduce the amount of air reaching the fire and 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, and 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 discharged is large, the Fire Department should, in the early operations of the fire, request assistance form the ship's master, owners, representatives or underwriters for the provision of 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 by the use of eductors and/or portable pumps, if the ship's pumps are inoperative or of insufficient capacity.

Should it be considered necessary to attempt to control or extinguish the fire by smothering it with C02 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, a bilge sounding pipe, or holes drilled in deck plates may be used to inject C02 or steam, if no fixed system is provided. After the hold is flooded with C02 or steam, these remaining openings must be closed. The hold should not be opened until it is believed 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.

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

8. Fires in Machinery and Fuel Storage Spaces: Fires which occur in engine and boiler rooms of modern oil-fired ships usually are 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 collision. Other causes are defects in the burner, overflowing of the fuel tanks or settling tanks, oil accumulations in the bilges, electrical defects and punctured fuel or

settling tanks. The contact of such leaking oil with hot surfaces such as hot pipes, boiler fronts, etc., is the primary source of ignition.

Most oil burning ships are provided with remote controls whereby the flow of oil to the boiler room can be shut off. These remote controls are usually located on deck, near the engine or boiler room ladder and, in some cases, on the bridge. On some ships there may be two such controls, one to shut off power to the oil pump and one to shut off oil supply. Machinery spaces usually are provided with fixed foam, C02, steam or water spray systems and with suitable portable extinguishers. One of the first duties of a Fire Department Officer-in-Command 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's officers or crew members and by such information as may be included in the ship's plan.

Access to machinery room spaces normally is available by means of the engine room or boiler room ladders. Access also may be possible from the shaft tunnel, where it 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 where there is an intense oil fire, personnel 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 advancement through bulkhead doors is required, 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 nozzle is extremely important not only for the purpose of cooling the atmosphere so as to permit a close approach to and subsequent extinguishment of the fire area. Safe means of egress must be maintained at all times should an emergency withdrawal be required. Additional hose lines must be made ready and charged for protection of the operating force.

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, or with spray or 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. The heat of the fire may also 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 this is 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 C02 or steam systems in this type of fire may not be practicable when the intense updraft prevents sufficient concentration at the seat of the fire. Foam or high-pressure 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. The above procedure also is applicable when the fire is being fed by oil escaping on to the floor of the machinery space or on to the fuel tank tops. Fixed C02 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 bilges to float the oil above the floor level where foam may be more efficiently applied.

Occasionally fires may occur in shaft tunnels as a result of overheated bearings, but since 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. Should it be impossible to reach the tunnel and extinguish the fire because of intense heat, smoke or other reasons, it may be practicable to shut all watertight doors and flood the area.

Fuel oil fires in bilges can be extinguished by fog, steam, C02 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 C02 or steam, the practicability of flooding or draining the area, and the proper application of foam and fog streams should be considered. Fuel oil contained in double bottoms and below a hold involved with fire is seldom a problem because the water under the ship and the water collecting on the tank top from the hose streams discharged on the fire usually will keep the oil sufficiently cool to prevent serious hazard.

In any extensive fire involving fuel oil in a machinery room, precaution must always be observed against the possibility of flashback or re-ignition of oil due to the large number of hot surfaces with which oil may come in contact. Fog streams should be provided to protect the rear of advancing hose lines and to keep the personnel ahead cool and shielded. The application of solid water streams in such type fires is seldom advisable, but if used they never should be allowed to play on hot pipes or on boiler fronts where they may cause the pipe or glass gauges to break and release high temperature steam or water. Whenever possible, foam streams should not be directed into burning oil, but rather be allowed to flow gently over the fire so as to avoid undue agitation of the oil. Very little overhauling will be necessary in machinery room fires; however, stand-by lines should be maintained until it is absolutely certain that no re-ignition of oil will occur.

Oil fires in the machinery space of small craft such as tugs, fishing boats and pleasure craft usually may be successfully extinguished with C02 or foam equipment. However, the precaution of protecting the personnel 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, motors to operate propellers, etc. This equipment will be located throughout the ship, but 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 firefighting hazards and problems. Fires in ship's electrical machinery are usually controlled by the ship's crew using C02 fixed or Class "C" portable extinguishing equipment. Should the Fire Department be called, no attempt should be made to extinguish such fire unless a qualified ship's engineering officer is present to direct safe procedure, or unless the Fire Department Officer-in-Command is certain that all electrical power is shut off. Use only Class "C" extinguishing agents. These include the ship's C02 extinguishers, either the portable type or a fixed installation, the fireboats C02, or dry chemical portable extinguishers. Protect operating firefighters with self-contained breathing apparatus if C02 is to be applied in a confined space.

9. Storeroom or 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 frequently smolder for long periods before being noticed and on arrival of the Fire Department they are often difficult to reach with hand lines due to the generation of intense heat, smoke, carbon monoxide and other gases of combustion. Often the doors to locker rooms are locked necessitating a close approach and forcible entry before water can be applied to the seat of the fire. In this case, the effectiveness of operating with at least two fog or spray streams 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 so as to hamper or prevent the advancement of either. Should it be apparent that 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 oxy-acetylene cutter for operation of distributors. In this operation, the hose line, with shut-off control and distributor, must be laid 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 distributor 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. (Note: See subtitle "Policy" regarding cutting of ship's bulkheads, plates and hull.)

Protection of personnel operating below decks with self-contained breathing apparatus, and provision of adequate ventilation are required at any extensive locker fire, because of intense heat, smoke and generation of toxic combustion gases. It is also very important to frequently examine spaces on all sides of locker fires. 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 under control or 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 found protected with fixed extinguishing systems. The boatswain's locker is usually located in the forepeak with access from the fo'c'sle passage. Frequently a boatswain's locker may be on more than one deck with a common hatchway to each deck. Storage of materials in such space will include oakum, rope, canvas, mops, brooms, hemp, etc. The engineer's locker is usually located at an intermediate level in a wing or half deck off the engine room and often will contain a workshop as well as combustible stores such as machinery, waste rags, oil, grease, etc. Fires in engineer's lockers, if not quickly controlled, have been known to damage the machinery and the engineer's quarters severely.

10. Passenger Stateroom or Cabin Fires: Fires in the passenger accommodations of ships are not unlike those which occur in large hotels. Spread of such fires is usually due to delayed alarms or to structural defects.

Firefighting procedures in passenger accommodations should always include the full utilization of the ship's sprinkler system, if provided, 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 the purpose of 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 crewmembers trained in firefighting are often available. Their help with the ship's fire extinguishing installations and in guidance about the ship should be requested by the Fire Department Officer-in-Command.

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 through the cooperation

of the ship's engineer, if this has not been done.

Fire doors, commonly referred to on shipboard as "fire screen doors," are often provided at intervals in the long corridors of passenger areas. These doors, as well as watertight bulkhead doors in the involved area, should be closed as soon as possible to prevent fire spread and to continue 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 at all joints and openings to prevent the passage of water. A watertight bulkhead will prevent the passage of hot gases and flame that may be transferred by convection. It does, however, have the same characteristics of heat transfer by radiation and conduction as that of a non-watertight bulkhead. Therefore, if it is necessary to depend on a watertight bulkhead for a fire stop, it should be inspected frequently and charged hose lines should be provided at the side opposite the fire to cool them if necessary.

Usually fire in passenger accommodations can be controlled and extinguished by the advancement of hose lines to the seat of fire and to exposures on all sides as well as above and below the fire. In heavy smoke and heat conditions, the operating force 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. Opening portholes from the inside usually can provide ventilation of cabin areas. If it should be impossible to open portholes from the inside, ventilation often can be achieved by lowering someone over the side in a rope sling, or by raising someone with an aerial ladder spotted on the pier apron, to break the glass of a porthole with an axe. In some cases it may be possible to get at the fire more quickly and easily with a hose line operated through the porthole when protection against fire spread is also provided inside the ship.

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

11. Oil Tanker Fires: Any tanker carrying liquid petroleum products must be considered a conflagration hazard particularly when it is realized that the typical modern tanker has a capacity of approximately 250,000 to 1,000,000 barrels and that the cargo may be any one or several of the liquid petroleum products varying from crude oil to the low flash point gasoline’s.

Cargoes of gasoline and oils having a low flash point present the greatest danger

whereas the dangers of cargoes of heavy oils are relatively less. The danger of fire or explosion, other than that caused by collision, is also less when the tanks are full and properly sealed and vented than when the tanks are empty of petroleum products yet contain flammable vapors. Under the latter circumstance, 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 not only to the ship's other tanks but also to the ship's superstructure. Burning oil floating on the water's surface has spread these fires 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 thereby permitting oil to flow on the surface of the water and to spread around vessels and piers where 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, the principles applicable to fighting oil tank fires on shore should be followed in the case of oil tanker fires. They primarily involve the concentration of all available foam lines on the burning oil in such a manner that the foam will take effect as quickly and efficiently as possible. They also include the external cooling of plates to avoid tank rupture, and the exercise of extreme care to prevent water from entering and overflowing oil from the tanks.

Whenever possible, the Department Officer-in-Command should immediately consult with the ship's senior officer. His cooperation will prove of immeasurable value in determining the extent and hazard of the fire, the nature of the material involved, and the use and availability of the ship's fire extinguishing systems. At any extensive tanker oil fire, the Officer-in-Command should at once determine whether he has sufficient foam compound and foam making equipment to deal with the fire. Required additional supplies should be ordered immediately. Successful attack on oil fires can be made only if the supply of foam is continuous. It is far better to have on hand too much foam compound rather than to allow the fire to gain headway because of a break in the continuous application of foam.

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 maximum 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 then may be necessary to first sweep the vessel with the monitors, 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 exposure to other vessels and to the land or bridge structures, or to remove exposed vessels. The fire may be so intense as to cause all or part of the ship's crew to abandon the vessel. In the case of a collision or explosion, burning oil may be floating on the water around the tanker. Operation of the fireboat monitors and of heavy hand-held streams may then be required to break up floating oil first in order to effect rescue of personnel in the water or to make possible the approach of the fireboat to the tanker. Operation of the fireboat monitors, as a foam stream, as well as hand-held foam streams may also be required in order to control the fire sufficiently to permit boarding of the tanker.

On boarding the tanker, all available foam streams should be concentrated on one tank at a time so as to provide for maximum use of the available foam as quickly and efficiently as possible. Application of the foam should be as gentle as possible in order to permit it to flow evenly and quickly over the oil surface and to form a continuous foam blanket without undue agitation of the oil. Whenever possible, the foam streams should be directed against an obstruction at a point above the oil on which it is desired to lay the foam blanket. This procedure will absorb the velocity of the foam streams in such a manner that it will continually advance the edge of the foam blanket 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 also will provide protection for personnel from exposure to flammable vapors. The protection of fog or spray streams should always be provided for the personnel 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 at the hole may be so great as to prevent quick and efficient foam application. The Officer-in-Command must then utilize his own resourcefulness and may be required to use a combination of methods if a foam blanket is to be obtained. In this event, 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 means through which 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.

When burning oil is flowing from a broken pipe or punctured tank and spreading over a considerable area, it may be found most practicable to first apply foam on the pool being fed from the break or puncture. This procedure will usually provide

extinguishment or control of the large pool area after which the spill may be extinguished with C02 or fog. The foam blanket must be maintained until it is certain the flow has been stopped and that there is no danger of re-ignition.

It will be found that 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. If, when boarding a tanker to advance foam lines to a burning tank, oil is found on deck, the oil on deck, whether it has flashed or not, should be washed overboard with hose streams before attacking the burning tank. Additional hose lines must be kept operating to drive oil floating on the surface of water from exposed piles and vessels. Caution must always 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, of course, essential if flooding of the tanker cofferdams or voids is required in order to provide a firebreak.

Fog and spray streams are of great value not only for the protection of firefighters from radiant heat and for cooling purposes, but also for the extinguishment of high flash point oil fires such as motor or fuel oils. These oils are seldom miscible with water and the spray from the fog nozzle will form an emulsion covering the oil surface and shut off air supply to the combustion area. This emulsion often can be formed over a considerable area and while the emulsifying action may be transient, it is usually of sufficient duration to extinguish the fire.

The use of fog or spray streams against fires in low flash point volatile liquids can be employed only in relatively confined areas or surfaces where the streams can completely cover the burning oil surface 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 because any moving of the spray may then permit a flash back to an area previously extinguished.

Burning oil on the surface of the bay probably will be best handled by the fireboat using powerful 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; but in either case the primary efforts should be to drive the oil from combustible materials, piers, crafts, etc. A blanket of foam applied over the surface of floating oil will reduce the danger of ignition and flashover, thereby preventing a fire and making it possible to disperse the hazardous material with safety.

12. Refrigerator Ship Fires: Fires involving the insulated holds and refrigeration machinery of refrigerator ships (reefers) are included under this section.

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 usually are given off from such fires. They generally will require maximum natural ventilation and the use of mechanical aids such as portable exhaust fans and the smoke eductor as well as protection of the operating force with self-contained breathing apparatus. The seat of a fire located in insulated holds is usually difficult to locate. If located in the insulating material or in the air ducts the use of C02, steam, or water directed through the hatchway will be of little value. Smoke issuing from thermometer tubes may designate the deck where the fire is burning (consult ship's plan).

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 usually 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 hold, or deck of the hold affected by the fire, because total shut-off of the system may cause the entire cargo to deteriorate.

The spread of fire to other parts of the ship must be prevented whenever possible by closing air duct baffles and watertight doors where they pass through watertight bulkheads. Also, immediate inspection should be made of ducts extending outside of the affected hold and of the opposite side of the hold bulkheads. Charged hose lines should be assigned to any area where it is suspected that fire may travel through air ducts or that 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; also look for signs of burning on the wooden boards retaining the insulation or of burning on the sheathing of the air ducts. Fire involving insulation will require opening of the sheathing. Power saws are particularly useful in this operation but 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 for insertion of a nozzle to cool down the involved area. When it is determined that the heat in the suspected area has been sufficiently controlled, the sheathing below and to a reasonable distance on each side of the first hole, should then 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, of course, 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 such insulation and its sheathing be removed until it is certain that all fire has been extinguished. Should opening of sheathing require the removal of refrigeration coils, standing by and assistance of the ship's engineering officer will be essential to proper procedures. If the fire has involved the air ducts it is essential that any woodwork encasing the ducts be stripped from an area sufficiently large to determine that no hidden fire has escaped detection.

In order to gain access to or to ventilate a refrigerated hold through the hatchway, it is usually 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 or derrick to remove it, or the plug may consist of individual slabs capable of being handled easily. Also it is usually necessary to disconnect and remove refrigerant pipes below the plug.

If insulation of the hold is entirely of a noncombustible type such as rock wool or glass wool and the air ducts can be completely shut off and guarded, it may be possible to make the hold airtight and to control the hold fire with the ship's fixed steam or C02 extinguishing system.

Should the fire involve the refrigeration plant or should an accident occur damaging 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 ship 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 as to proper procedure. Personnel assigned to effect control must be protected with self-contained breathing apparatus, lifelines 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 irritant, protective clothing must be provided and the exposed soft membrane tissues of the body must be covered with Vaseline. Identical protection also should be provided to personnel effecting rescue of persons trapped in holds or refrigeration plant compartments containing released refrigerants. Whenever possible, refrigerant cylinders exposed to fire should be removed immediately or be kept cool with water streams in order to prevent their rupture or the blow-off of safety plugs and subsequent release of refrigerant fumes.

13. Excursion Boat Fires: The first consideration of an Officer-in-Command of a fire occurring on an excursion boat will be that of the life hazard. If the superstructure of the vessel is of wood construction it will be extremely vulnerable to fire. Fire occurring on this type vessel often will necessitate operation of the fireboat monitor in such a manner that they will 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 for allaying the danger of panic and at the same time for

controlling the fire.

The dispatcher must be kept advised of the emergency and adequate Coast Guard, harbor craft and Lifeguard, 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. Whenever possible, available Coast Guard, harbor craft and Lifeguard should devote their attention to the rescue of persons in the water in order to permit maximum use of the fireboat for extinguishment of the fire. While enroot to the emergency, if it is evident by the color of smoke from the fire that oil is burning, the forward turret and hose lines should be made ready for the application of foam so that there will be no delay in getting to work promptly on arrival.

A 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. Therefore it is often advisable to approach the vessel from bow or stern, utilizing the monitor and tower nozzles to drive fire away from the passengers so as to minimize excitement and prevent panic while at the same time endeavoring to control the fire.

14. Barge Fires: This type craft is often of heavy plank and timber construction with heavy crisscross timbers in the hold. Ventilation of a hold fire in a barge is difficult and will require the protection of breathing apparatus for personnel working down into these spaces. Deck fires on barges seldom involve serious problems of extinguishment; however, if the barge is adrift it must be secured so as not to expose piers or provide a bridge for extension of 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 some means of ventilation may be affected and through which smoke ejectors may be operated. When an entire hold below the cargo deck is involved with the fire, it usually will be necessary to open holes in the center deck area and to operate distributors from one or more points between the ends of the barge.

If the barge is loaded with cargo, caution must be exercised in the use of water for firefighting so as not to cause sinking or capsizing of the craft. This precaution is particularly important at fires involving barges used to float heavy cargos, such as rock, trucks, etc. This type of craft is likely to be top heavy, and should it assume a severe list, injury to the firefighting force could result from possible shifting of cargo.

15. Fires in U.S. Navy Ships: The Fire Department is often called upon to assist at fires in the Naval Shipyard. The fires are usually controlled by shipboard firefighting personnel and the Naval Shipyard Fire Department. Usually the fireboats' duties are more of a standby nature, for emergency water supply. Most naval vessels carry an

extensive range of firefighting equipment, including fire mains supplied by fire pumps, hose, nozzles of various types, fixed steam, C02, foam and 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 storeroom or explosives in magazines. However, the Navy operates many cargo and troop ships, which present the same hazards, as do other cargo or passenger ships. They have hull construction identical to their counterpart in the Merchant Marine.

Naval combat vessels are also more extensively divided into watertight compartments than are merchant ships. These divisions will usually be longitudinal as well as transverse and, in addition, the decks below the waterline are fitted with watertight doors and hatches, which can be closed in order to isolate each deck. If, during fire fighting operations, it is necessary to discharge large quantities of water into a naval combat ship, these watertight sub-divisions will provide means by which excess water can be confined to relatively small compartments and thus prevent endangering the stability of the ship. Their use is also of great value should counter-flooding be necessary to reduce a list. Either of these operations should, of course, be conducted only under supervision of the ship's senior officer, or an officer designated by him. The officer on board who probably will be most expert concerning the effect of water accumulating in the ship is the Damage Control Officer. He will have available various diagrams, charts and tables whereby the location of watertight compartments can be quickly determined as well as the weight or amount of water necessary to flood each compartment completely 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 Fire Department Officer-in-Command will be to seek the advice and cooperation of the ship's senior officer. The Damage Control Officer usually will be assigned to cooperate with the Fire Department and 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, followed by direct hose leads to the seat of fire, with additional hose lines cooling the opposite sides of all bulkheads adjacent to the fire area. The operation of those 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 usually are provided with a fixed deluge or sprinkler system. The hanger decks of aircraft carriers are fitted with a very complete sprinkler system and the bulk gasoline fuel supply for the aircraft usually 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 Fire Department Officer-in-Command, with the ship's officer approval, may consider it

advisable to seal the compartment involved and flood it with C02. Every precaution must be taken to see that the heat radiated or conducted from the bulkheads does not spread fire to adjacent compartments. The personnel who are first to enter any compartment which has been sealed for over-hauling and final extinguishment must be protected with self-contained breathing apparatus, because the atmosphere will be dangerously deficient in oxygen.

16. Ship Stability: In the event of a fire involving a ship or other craft in the waters of the Port of Long Beach, there is, in addition to the basic problems previously discussed, the factor 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.

It is not the intent of this section of the manual to infer that it is the responsibility of Department personnel to undertake the direction of operations necessary to correct a ship's list or to direct the operation of counter-flooding, sinking or scuttling. These operations are extremely technical and require an intimate knowledge of seamanship, ship construction and mathematics. Their direction must be under the supervision of qualified marine personnel such as the Master or Chief Engineer of the ship. (Note: See subtitle "Policy.") The subject of stability is covered in this section only from the firefighting viewpoint of the precautions and measures necessary to prevent endangering the stability of a ship.

Should water be used in large quantities to extinguish a fire involving a vessel, careful attention must be given to the fact that additional weight is being taken aboard. This added weight increases the displacement and draft of the vessel and may adversely affect the ship's stability. The degree to which the stability is affected depends upon several factors, such as the design of the ship, whether the ship is light or loaded, and the amount and location of the additional weight.

To obtain a clear concept of ship stability and the means available for its maintenance it is necessary that some of the basic factors contributing to a stable condition be considered.

A ship afloat in calm water has only two forces working on it--namely, buoyancy and gravity. A ship displaces a volume of water equal to its own weight. Once the vessel settles in the water it is supported by the buoyant forces of the water itself. These forces may be considered as being concentrated at a point termed the "center of buoyancy." Figure "A" illustrates the center of buoyancy in a ship in an upright position. Figure "B" illustrates the shift in the center of buoyancy after the ship heels to starboard.
The point at which the mass of the ship and its cargo is concentrated is termed the

"center of gravity." This point will not always be in the same spot on a ship--a fact that is best understood by reference to Figures "C" and "D" which illustrate how the center of gravity may be raised or lowered, depending on whether the vessel has a heavy cargo at the base of the hold or in the 'tween deck spaces.

The "heel" of a ship refers to the inclination of a ship from the vertical position either to starboard or port, and is used where the inclination is more or less temporary. Where the inclination from the vertical is somewhat permanent, the condition is classified as a "list." Figures "E", "F", and "G" show varying amounts of water in the upper part of a ship as follows: "E" on an even keel where a small quantity of water has not affected stability; "F" a greater quantity of water collected on one side causes the ship to list resulting in reduced stability; "G" a larger quantity of water increases the list resulting in the ship becoming unstable and in danger of capsizing.

Figures "F" and "G" also show the changes occurring in the location of the center of gravity and the center of buoyancy as a ship takes on a list. When the center of buoyancy passes inboard of the center of gravity the stability approaches dangerously to the point of capsizing.

Built into vessels are facilities to prevent and correct a list, which may cause the vessel to capsize. These facilities include the transferring of fuel oil from tanks on the low side of the vessel to tanks on the light side, shifting of cargo and other weights, counter-flooding one or more compartments or holds, and pumping out one or more compartments or holds. As previously stated, the operation of these facilities must be under the direction of the ship's officers, preferably the ship's engineering officer, who, because of his duties, will know his ship thoroughly, including the location of the various valves controlling the transfer of fuel, flooding and pumping out of holds. This officer or his junior officers will be able to advise and direct methods of correcting a list and render other valuable assistance.

The Officer-in-Command of a ship fire must keep all factors in mind, which might favorably or adversely affect the stability of the ship. Some of these factors include the following:

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

B. 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; whereas, water settling to the bottom of the ship has a stabilizing effect unless buoyancy has been dangerously reduced. Dangerous lists may originate from water discharged from hose streams and large size nozzles accumulating on or above main decks. There must be no delay in relieving such accumulation of water.

C. 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.

D. 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.

E. The possibility of serious injury to personnel should the hawsers snap due to severe strain where the ship is taking a list away from the pier or wharf.

Should it be necessary to flood a hold or a compartment of the ship in order to extinguish the fire, the full cooperation and direction of the ship's officers must be obtained to arrange for any necessary counter-flooding of other parts of the ship in order to preserve stability. Flooding a lower hold is almost always practicable, but seldom is it practicable to flood in the 'tween decks, and never in the shelter deck.

In all flooding operations the depth of water beneath the keel must be sufficient to maintain stability and to keep the fore and aft trim within safe limits. It is essential to make certain that no water can leave the flooded area and that no water can enter through cargo ports, portholes, or other side openings. If it is not possible or desirable to flood the hold from below with bilge lines or sea valves, then flooding should be done by use of the largest possible number of open hose butts. The objective of the Fire Department should be to flood as quickly as is possible consistent with preserving the ship's stability.

If the fire is too extensive to be extinguished by flooding individual holds, the only alternative may be to sink or scuttle the vessel. Under these circumstances, arrangements must be made through the Port and Coast Guard authorities to have the ship towed to a suitable beaching ground where she may be sunk awash without damage to the hull from a rocky bottom and where the vessel will not create an obstruction to normal shipping.

## Section 2

FIGHTING FIRES ON YACHTS AND SMALL CRAFT:

The yachts and small craft berthed in the Long Beach marinas range from 16 to 1150 feet in length. In general, fires involving these craft involve a combination of structure fires and fires involving fuels, all in confined areas with all the hazards of fires of both types. Where

the hulls and structural members are made of steel, we have the added hazard of heat traveling by conduction in all directions from the seat of the fire. After the reception of an alarm involving a vessel, while under way to the location of the alarm, the following equipment is usually made ready.

A. Bow turret with mystery nozzle
B. 50 feet of 1 3/4 inch pre-connected hose line with mystery nozzle (security line)
C. Grappling hook or grapnel, and/or boat hooks determined by the size and type of the vessel involved
D. 5 gallon foam cans and nozzle for use with pre-connected foam proportioner
E. De-watering siphons and supply and discharge lines
F. Dry chemical extinguishers

Upon arrival at the fire scene begin size-up procedure by ascertaining if there is any life hazard involved.

Caution! Electrical Hazard: On boat fires or pump outs where the boat is docked in a marina area, there is probably a shore connection to 115 volts. It is probably energized and its disconnection should be of prime consideration by all hands.

It is desirous to approach a working fire from the windward side, which allows us to take advantage of a more protected environment and to attain a closer proximity before applying extinguishing agents. If necessary, the fire would be "knocked down" with the turret stream prior to securing and boarding.

When the involved vessel is unsecured (drifting), anchored, or under way, it is essential to secure the vessel to our boat, using grappling hooks, boat hooks, chains, lines or whatever method possible. A hose stream would have a tendency to push an unsecured vessel away from our ship, negating boarding, removal of life hazard and extinguishment operations aboard the involved craft.

Once the vessel is secured, surface flames would be extinguished, using bow turret stream and/or hand line streams. An engine room fire which could be confined to that area would be attacked with dry chemical, C02 or foam. Extreme caution must be exercised when opening any hatches, as explosive conditions can be created by this action.

Care should be exercised in the use of hose streams around superheated fuel tanks as quick cooling of the metal could result in metal shrinkage and warpage, ruptures of seams, et cetera, possibly increasing the existing hazard.

When the fire is aboard a vessel secured to a dock or in a slip it is not always possible to approach from a favorable direction or is it necessary to secure the fireboat to the burning vessel before beginning operations. The burning vessel should be left tied up in the slip and the boats in the adjacent slips should be protected or removed. It is desirable that all

fire operations and work be done over the bow, where the turret is located, so that the boat operator is in a better position to see the operations. Whenever possible, the turret should be kept in a straight ahead position for ease of boat operation. Stream pattern is controlled by firefighter operator on deck but turret should not be directed off center under any circumstances, unless instructions are given to do so by the Fireboat Operator (pilot). Turret may be elevated or depressed by firefighter. The turret should be charged by the time the turn is made into the slip where the burning vessel is located.

When a vessel is completely involved with fire, consideration should be first given to adjacent exposure vessels (adjacent slips). Where space does not permit the "bow on" approach, where the lengthwise centerline of the fireboat is 90 degrees opposed to that of the involved craft, i.e., a 90-degree approach, the fireboat should be secured to the involved vessel or convenient floats, pilings, or adjacent vessels, before water can be delivered from the bow turret, as the water back pressure or torque will tend to make the bow of the fireboat uncontrollable. After exposures have been protected and the fire is controlled, or as soon as manpower and conditions permit, procedures for de-watering and final extinguishment will be instituted in the same manner as for vessels which are anchored, drifting, or under way.

**De-watering**

It is an important step to start de-watering operations as soon as possible, to prevent the possible sinking or capsizing of the involved vessel, especially where fuel is involved. Fireboat #21 carries for this purpose:

1. Custom made suction (Gold Dredge) 1 1/2" inlet.

Occasionally de-watering must be begun before fire is completely extinguished, to prevent sinking or capsizing. It is important to note that on small fires, water damage can exceed fire loss when machinery aboard is immersed in water.

## CHAPTER VI

SPECIAL HAZARDS:

### Section 1

Emergencies in Harbor Area:

For any emergency in the Harbor area involving ship fires, oil spills, pipelines breaks, etc., the procedure to follow will be to notify the following agencies:

1. Health Department
2. Chief Wharfinger
3. Captain of the Port (Coast Guard)
4. Department of Fish and Game

The above agencies have the authority and the responsibility for dealing with these emergencies.

The Chief Wharfinger is responsible for the waterfront areas of Long Beach. He/she enforces Municipal Laws on the water and is in charge of Port Security. He/she acts for the General Manager of the Port.

The Coast Guard can enforce the Federal Laws and has the authority to fine violators.

The Department of Fish and Game can enforce State Laws and has the authority to fine violators.

## Section 2

Emergencies in Marina Areas:

For emergencies in the marina areas involving boat fires, oil spills, pipeline breaks, etc., the procedures to follow will be to notify the following agencies:

1. Health Department
2. Director of the Marine Department
3. Captain of the Port (Coast Guard)
4. Department of Fish and Game

The Director of the Marine Department has the authority and responsibility to enforce Municipal Laws in the marina areas and is in charge of the Marina Security Officers.

The Marine Department has a limited first aid firefighting capability, and may respond to boat fires and pump outs. When they are on the scene at the time our fireboat arrives, it is understood that the Fire Department will be in charge of the emergency, and the Marine Department will assist in any way possible.

## Section 3

Oil Spills:

When called upon to assist at a flammable liquid spill on the surface of the water, the purpose of the fireboat would be to confine the liquid to a particular area until the area can be boomed or cleanup is effected. The confinement technique is particularly effective with heavy oils, such as bunker fuels or crude oil. This is accomplished by pointing the forward turret at an angle over the bow and leaving it in that position. The fireboat is then maneuvered in sweeps by the fireboat operator, pushing the oil into an ever smaller area.

If the material spilled is of a more volatile nature, such as gasoline or JP-4, in addition to confining the liquid to a specific area, the liquid is broken up with hose streams to allow it to evaporate. The forward turret and the 1 1/2" security lines are used for this purpose. The wash of the fireboat when sweeping back and forth, aids in dissipating the spill.

## Section 4

Oil Islands:

Each oil island is provided with a 1000 GPM electrically driven drafting pump capable of supplying the four standard hydrants at 140 psi with which each oil island is equipped. There is an emergency generator if power is lost. Also if something happened to the salt water drafting operation, the system could be changed to use the water injection water for firefighting.

In the event of a power failure or pump failure, a fireboat will be expected to supply the oil island with water. This is accomplished by a fireboat tying up to an oil island dock and pumping four 3" lines into the inlets provided at each dock. Because of the surge, at all oil islands, great care must be taken in tying up the fireboat. This should be undertaken at the direction of the Fireboat Operator. Unless safe tie up procedures are followed, severe damage to the fireboat and great danger to Fire Department personnel could result. In addition to proper tie ups, chafing gear should be provided for 3" hose lines. The fireboats are also used to transport personnel and to provide equipment and hose ashore.

Personnel ferried to the oil islands by the THUMS boat must be expected to fight any fire with the water supply available and any first aid equipment on the oil islands. Some of the first aid equipment is: 100 gallons of AFFF , 150# wheeled fire extinguishers with pre-connected hard hose on reels and sand. The islands have anywhere from fire to nine hydrants depending on the island. The reason for the above statement is that under ideal conditions the fireboat cannot be expected to arrive at any oil island in less than 22 to 26 minutes.

## CHAPTER VII

SPECIAL INFORMATION:

### Section 1

BOAT #15

## Section 2

BOAT #20:

## Section 3

BOAT #21: