

CHAPTER 8

SHIP/AIRCRAFT CHARACTERISTICS

This ship is built to fight. You'd better know how.

—Admiral Arleigh Burke

The air fleet of an enemy will never get within striking distance of our coast as long as our aircraft carriers are able to carry the preponderance of air power to the sea.

—Rear Admiral W. A. Moffett

The U.S. Navy has thousands of vessels and aircraft in its inventory. They range from small harbor patrol boats to huge super carriers and from helicopters to giant transport planes. You won't be expected to know the characteristics of each one, but you should be able to recognize the type of ship or aircraft you see. You should also be able to identify its mission and armament and have an idea about its size. In this chapter, you'll learn about the major classes and the major types of ships and aircraft the Navy operates and what their characteristics and missions are. You will also learn some of the more common terms used to identify structural features and the terminology used to express direction and locations aboard ship.

Before you learn about the types and classes of ships, you need some background information about ships in general. To take advantage of scientific advances, the fleet is making changes. Cruise missiles, close-in defense systems, and multirole radar units are replacing conventional electronic and weapons systems. The Navy's new submarines and aircraft carriers are nuclear-powered. Therefore, steaming endurance is limited only by the replenishment of necessary supplies and food.

Many ships have been modernized to perform a wide variety of missions and to accomplish old missions more efficiently. During overhaul, older ships are outfitted with new radar, fire control, and communications systems. The hulls are strengthened and power plants reworked to extend the lives of these ships. However, it's not economically sound to convert all ships to nuclear power.

SHIP TERMS

Learning Objectives: When you finish this chapter, you will be able to—

- Identify terms used aboard ship.
- Recall the names used for superstructures and components of ship's hulls to include decks and doors and hatches.
- Identify structural terms.

In civilian life you used terms such as *upstairs*, *downstairs*, *windows*, *floors*, *ceilings*, *walls*, and *hallways*. In the Navy, you must learn to use Navy language. To use civilian terminology aboard ships marks you as a *landlubber*—a scornful term used to describe those who know nothing of the sea.

GENERAL TERMS

Lengthwise direction on a ship is *fore* and *aft*; **crosswise** is *athwartships*. The front of the ship is the *bow*; the rearmost is the *stern*. To move forward toward the bow is to go *forward*; to move toward the stern is to go *aft*. Anything that is more toward the bow than another object is *forward* of it, and anything that is more toward the stern is *abaft* (behind) the other object.

A ship is divided in half lengthwise by a *centerline*. When you face forward along the centerline, everything to your right is to *starboard*; everything to your left is to *port*. Fixtures and equipment take the name of the side on which they are located, such as the *starboard gangway* and the *port anchor*.

When you go toward the centerline, you go *inboard*. An object nearer the centerline is *inboard* of another object and that object is *outboard* of the first. The section around the midpoint area is called *amidships* (also called the *waist*). The extreme width of a ship, usually in the midship area, is its *beam*.

You never go downstairs in a ship; you always go *below*. To go up is to go *topside*. However, if you climb the mast, stacks, rigging, or any other area above the highest solid structure, you go *aloft*. The *bridge* is topside and usually forward. It contains control and visual communication stations. Human beings live *in* a ship or *on board* a ship. Inanimate objects, stores, and equipment are *aboard* a ship. Similarly, you *board* a ship or *go on board*. Stores, ammunition, and so on are *taken aboard* and *struck below*.

An object hanging against the side, bow, or stern is *over* the side, bow, or stern. An object in the water but not touching the ship is *outboard* of or *off* the ship (off the starboard side, off the port bow, and so on). An object in front of a ship is *ahead* of it. An object to the rear is *astern*, never in back. Cooking is done in the *galley*, not in the kitchen.

The fore-and-aft inclination of a ship is the ship's *trim*—down by the head or down by the stern. To trim a submarine is to adjust water in the *variable ballast tanks*, or *trim tanks*. A ship is said to *list* if it has a permanent or semipermanent inclination to one side or the other. This is a less than optimum condition.

STRUCTURAL TERMS

In this section, you will learn some of the terms related to ship construction. These terms won't tell you "how to" build a ship; however, by learning the terms, you will understand the major structural characteristics of the hull, decks, and superstructure of a ship.

Hull

Figure 8-1 shows the hull structure of a cruiser. You should refer to this figure as you read this section. The *hull* is the supporting body of a ship. Think of the *hull* as an envelope. Inside the hull are *strengthening members* that prevent the envelope from collapsing. The hull also contains partitions that form machinery, berthing, messing, and other spaces.

The *keel* is the backbone of the ship. The keel of most steel ships does not extend below the ship's bottom; hence, it is known as a *flat keel*. Its usual shape is that of an I-beam. All other parts used in constructing the hull are attached, either directly or indirectly, to the keel.

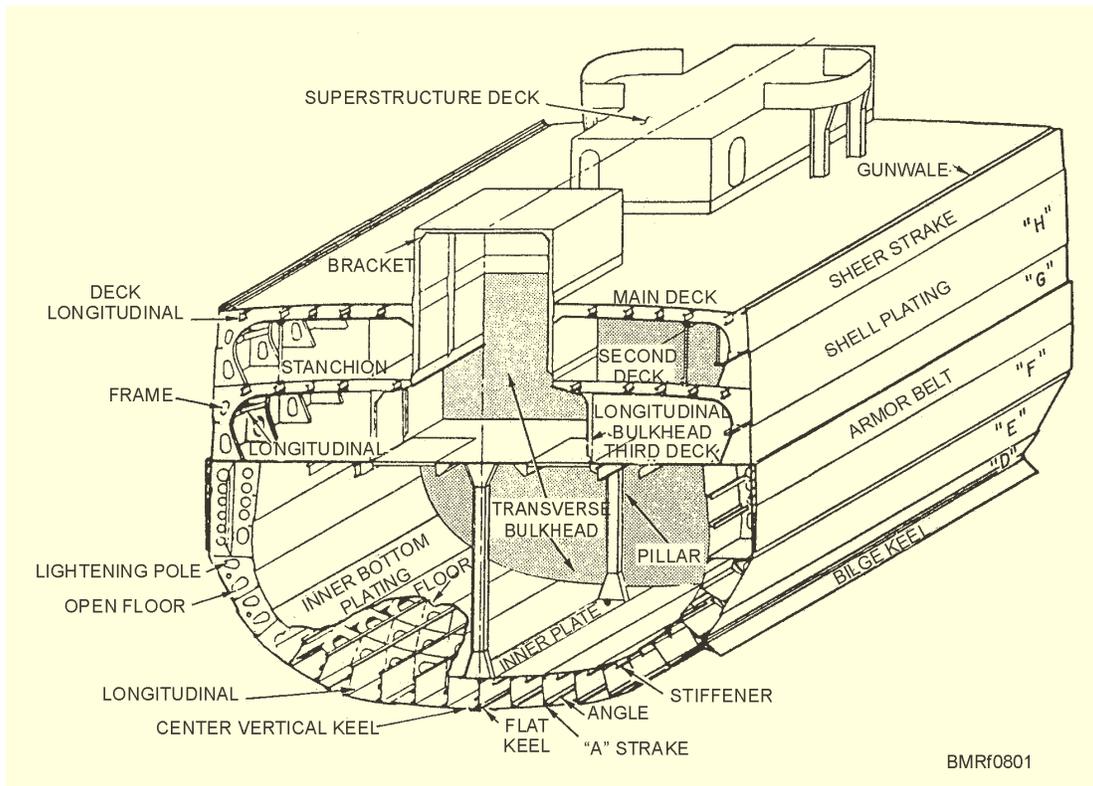


Figure 8-1.—Hull structure of a cruiser.

Student Notes:

The athwartships structure consists of *transverse frames* and *decks*. The decks run outboard from the keel to the turn of the bilge (where the bottom turns upward). Here, they are attached to the transverse frames, which then extend upward to the main deck.

Frames running parallel with the keel are called *longitudinals*. From the turn of the bilge up the sides they are also called *stringers*. The network of floors and longitudinals resembles a honeycomb (known as *cellular construction*), which greatly strengthens the bottom of the ship. When plating covers the honeycomb, double bottoms are formed. The space between the inner and outer bottoms (known as *tanks*) is used for liquid stowage. Planks laid upon the tank tops are called *ceilings*. The forward end of the keel, which is extended upward, is called the *stem*. The after end of the keel has a similar extension called the *sternpost*. The part of the stem above water is the *proW*; the forward edge of the stem is the *cutwater*.

The interior of a ship is divided into compartments by vertical walls, called *bulkheads*. Bulkheads run both transversely and longitudinally. Most bulkheads are merely partitions; but spaced at appropriate intervals, they are transverse watertight bulkheads. These bulkheads extend from the keel to the main deck and from side to side to provide extra stiffening and to partition the hull into independent watertight sections. Large ships have a series of longitudinal side bulkheads and tanks that provide protection against torpedoes. Usually, the outer tanks are filled with oil or water, and the inner tanks (called *voids*) are empty. The innermost bulkhead is called the *holding bulkhead*. If a torpedo were to hit the ship, the outer tanks, although ruptured, would absorb enough energy from the explosion that the holding bulkhead would remain intact, thus preventing flooding of vital spaces.

The plates that form the ship's hull are called *strakes*. Strakes are fastened to the framework in longitudinal rows. The keel forms the center strake. Strakes are lettered, beginning with the A strake on either side of the keel and extending up to the main deck. Some of the strakes also have names. The A strake is called the *starboard strake*; the strake along the turn of the bilge is the *bilge strake*; the uppermost strake is the *sheer strake*. A protecting keel running along the bottom near the turn of the bilge is called a *bilge keel*. Its

purpose is to reduce rolling of the ship. (A ship *rolls* from side to side; it *itches* when it goes up and down fore and aft; it *yaws* when the bow swings to port and starboard because of wave action.)

The upper edges of the sides, where the sheer strakes join the main deck, are called the *gunwales* (rhymes with funnels). The foremost part of the ship, where the gunwales join the stem, is known as the *eyes* of the ship. The port and starboard quarters are located where the gunwales curve inward to the sternpost.

The water level along the hull of a ship afloat is the *waterline*. The vertical distance from the bottom of the keel to the waterline is the ship's *draft*. *Freeboard* is the distance from the waterline to the main deck. Figures 8-2 and 8-3 show various parts of the hull and deck.

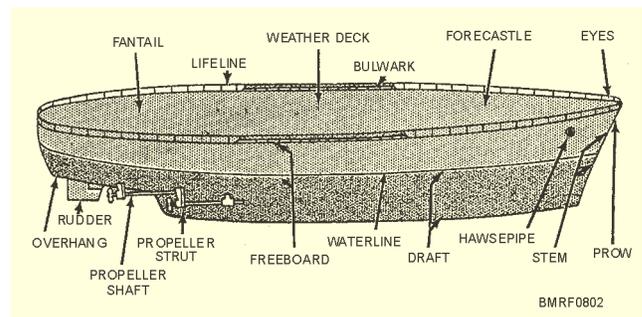


Figure 8-2.—The hull.

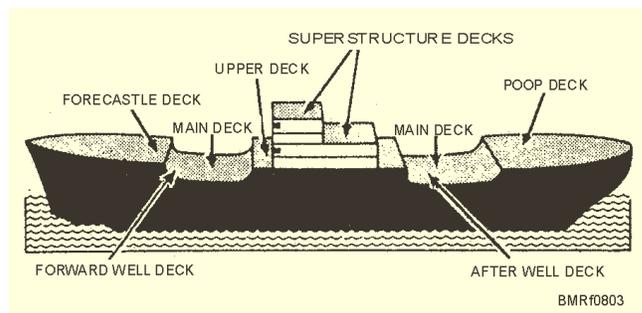


Figure 8-3.—The weather deck.

Decks

The floors of a ship are called *decks*. They divide the ship into layers and provide additional hull strength and protection for internal spaces. The undersurface of each deck forms the *overhead* (never the ceiling) of the compartment below. *Compartments* are the rooms of a ship. Some compartments are referred to as rooms, such as the wardroom, stateroom, and engine room.

Student Notes:

Generally speaking, you do not use the word *room*. For instance, you never refer to the space where you sleep as the bedroom or where you eat as the dining room. These spaces are called the *berthing compartment* or *space* and the *messdeck*.

A steel deck is made of steel plating (strakes) running fore and aft. The outboard strake in the deck plating is composed of stringer plates that are welded or riveted to the side plates of the ship adding additional strength to the ship's sides. Decks are supported by athwartships deck beams and by fore-and-aft deck girders. Further deck support is provided throughout the ship by vertical steel pillars called *stanchions*. Stanchions are mounted one above the other or one above a strength bulkhead. (The short posts used as lifeline supports also are called *stanchions*.) Look at figure 8-2. Decks are usually slightly bowed from the gunwale to the centerline to provide for water drainage and to strengthen the deck. The arch so formed is called *camber*.

A deck or part of a deck exposed to the weather is called a *weather deck* (fig. 8-3). *Bulwarks* are a sort of solid fence along the gunwale of the main (weather) deck. The bulwarks are fitted with *freeing ports* (scuppers) to permit water to run off during heavy weather.

A deck that extends from side to side and stem to stern is a *complete deck*. On an aircraft carrier, the uppermost complete deck is the *flight deck* from which aircraft take off and land. In all ships but aircraft carriers, the uppermost complete deck is the *main deck*. On an aircraft carrier, the *hangar deck* is the main deck. The hangar deck is the deck on which aircraft are stowed and serviced when not on the flight deck.

The first complete deck below the main deck is the *second deck*; the next, the *third deck*; the next, the *fourth deck*; and so on. *Half decks* or *'tween decks* take the number of the deck above and have the fraction 1/2 added to them.

A *strength deck* is just what the name implies. It is a complete deck (usually the main deck) designed to carry not only deck loads on it but also to withstand the hull stresses. A damage control deck (on most ships the second or third deck) is the lowest deck having access through the main transverse bulkheads, from forward to aft. This deck usually contains damage control main

repair equipment in addition to the facilities for the control of flooding, sprinkling, and pumping if the ship is damaged.

The following are definitions that relate to decks in modern ships (the location of each deck is also given):

Companionways (ladders). Companionways, or ladders, lead from one deck level to another. They may or may not be covered by hatches.

Flats. Flats are plating or gratings installed only to provide working or walking surfaces above bilges.

Forecastle (pronounced folk' sel) *deck*. The forecastle deck is the deck above the main deck at the bow. Ships that don't have raised forecastles are called *flush-deckers*. In them, the part of the deck from the stem to just abaft the anchor windlass is the forecastle.

Gallery deck. The gallery deck is the first half deck or partial deck below the flight deck.

Half deck. The half deck is any partial deck between complete decks.

Levels. A level is a general term used to designate deck heights above the main deck. The first level above the main deck is the 01 (pronounced oh-one) level, the second the 02 level, and so on. Different decks at a particular level, however, carry different names. For example, both a poop deck and a boat deck (usually) are on the 01 level.

Platforms. Platforms are partial decks below the lowest complete deck. They are usually broken to admit machinery and are called *platform decks* or just *platforms*. They are numbered downward, as first platform, second platform, and so on.

Poop deck. The poop deck is a partial deck above the main deck located all the way aft. A flush-decker does not have a poop deck, so the stern area of the main deck on a flush-decker is called the main deck aft, or the *fantail*.

Quarterdeck. The quarterdeck is not an actual deck, but an area designated by the CO for the conduct of official functions. It is the station of the officer of the deck in port, and its location depends on how the ship is moored or which side of the ship is tied up to the pier.

Student Notes:

Superstructure deck. The superstructure deck is a partial deck above the main, upper, or forecastle deck that might not extend to the sides of the ship; or if it does, it does not have side plating carried up to it.

Upper deck. The upper deck is a partial deck extending from side to side above the main deck amidships. It is part of the superstructure, which is the part of a ship's structure above the deck. The superstructure does not include masts, yards, stacks, and related parts. The side plating extends upward to the upper deck.

Well deck. The well deck is the forward part of the main deck between upper deck and forecastle and aft between the upper deck and the poop deck.

Doors and Hatches

Access through bulkheads is provided by *doors* and through decks by *hatches*. *Watertight (WT) doors*, as the term implies, form a watertight seal when properly closed. All doors leading to weather decks are of the watertight variety, as are those in structural (watertight) bulkheads. (See fig. 8-4.) The doors are held closed by fittings called *dogs*, which bear up tight on wedges. A rubber gasket around the edge of the door presses against a knife-edge around the doorframe forming a watertight seal when all dogs are properly seated (*dogged down*). Some doors have individually operated dogs, as shown in figure 8-5. Other doors are quick acting types, for which a handwheel or lever operates all the dogs at once, as shown in figure 8-6. Some WT doors have openings, called *passing scuttles*, through which ammunition is passed. These scuttles (small tubelike openings) are flashproof as well as watertight.

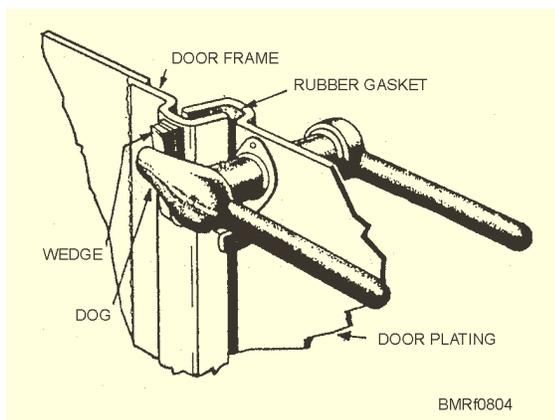


Figure 8-4.—Dogs and gasket for watertight door.

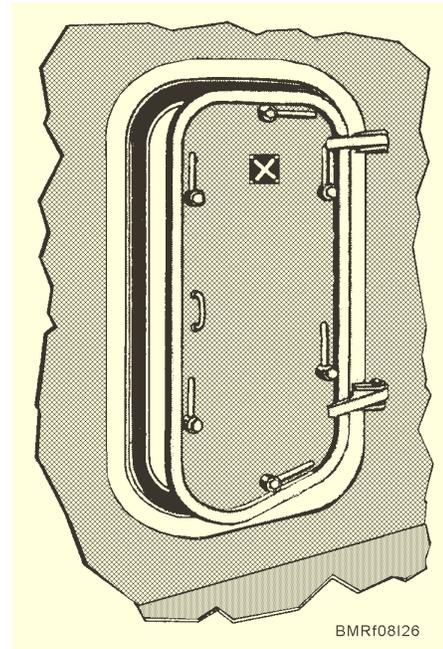


Figure 8-5.—Watertight door with individually operated dogs.

Nonwatertight (NWT) doors are used in NWT bulkheads and are of various types. Some slide, some fold, and others are similar to the regular house door (but made of metal). Some NWT doors have dogs, but fewer than those used on WT doors.

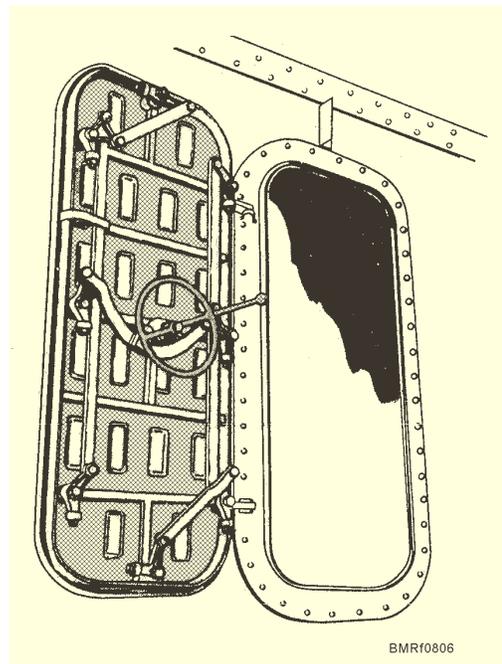


Figure 8-6.—Quick-acting watertight door.

Student Notes:

Hatches are horizontal openings for access through decks. A hatch is set with its top surface either flush with the deck or on a *coaming* (frame) raised above the deck. Hatches don't operate with quick-acting devices. They must be secured with individually operated dogs or drop bolts.

Figure 8-7 shows a typical hatch with an *escape scuttle*, which is a round opening with a quick-acting closure. An escape scuttle may also be found in the deck (or overhead) of a compartment that otherwise has only one means of access.

Manholes of the hinged type are miniature hatches provided in decks for occasional access to water, fuel tanks, and voids. Bolted manholes are sections of steel plate that are gasketed and bolted over deck access openings. Manholes are also found in bulkheads but are not as common as deck manholes.

A cargo hatch and hold are shown in figure 8-8. The hatch is a large opening in the deck that permits loading and unloading of equipment and materials. It is covered

by hatch boards or a mechanical/hydraulic hatch cover. A cargo hatch is protected from the weather by a canvas tarpaulin (tarp for short). The tarp is pulled over the hatch boards and down the sides of the coaming around the hatch and then battened down. To batten down is to secure the tarp by wedging battens (slats of wood or steel) that hold it against the side of the coaming.

Superstructure

The solid part of a ship above the main deck is called the *superstructure* (fig. 8-9). The masts, stacks, and related gear above the superstructure are referred to as the ship's *top hamper* (fig. 8-10). Masts are of three general designs—pole, tripod, and cage. On a single-masted ship, the mast is called simply the *mast*. A two-masted ship has a *foremast* and *mainmast*. A three-masted ship has a *foremast*, *mainmast*, and *mizzenmast*, in that order from forward. *Stacks* (never chimneys or funnels) are the large pipes that carry off smoke and gases from the boilers. The wider lower section of a stack is an *uptake*.

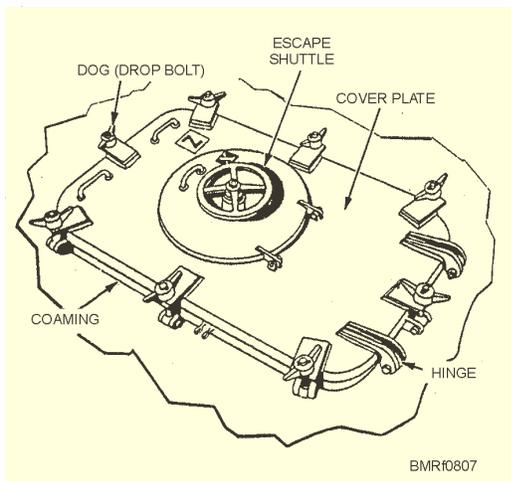


Figure 8-7.—Bolted hatch with escape scuttle.

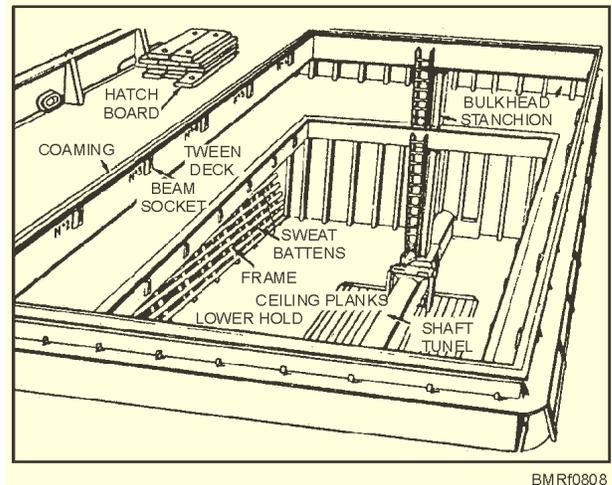


Figure 8-8.—Cargo hatch and hold.

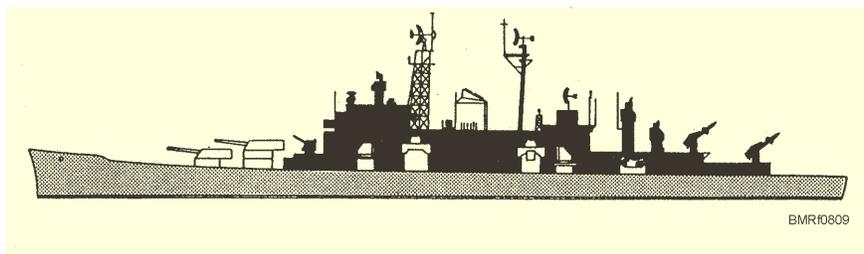


Figure 8-9.—Superstructure.

Student Notes:

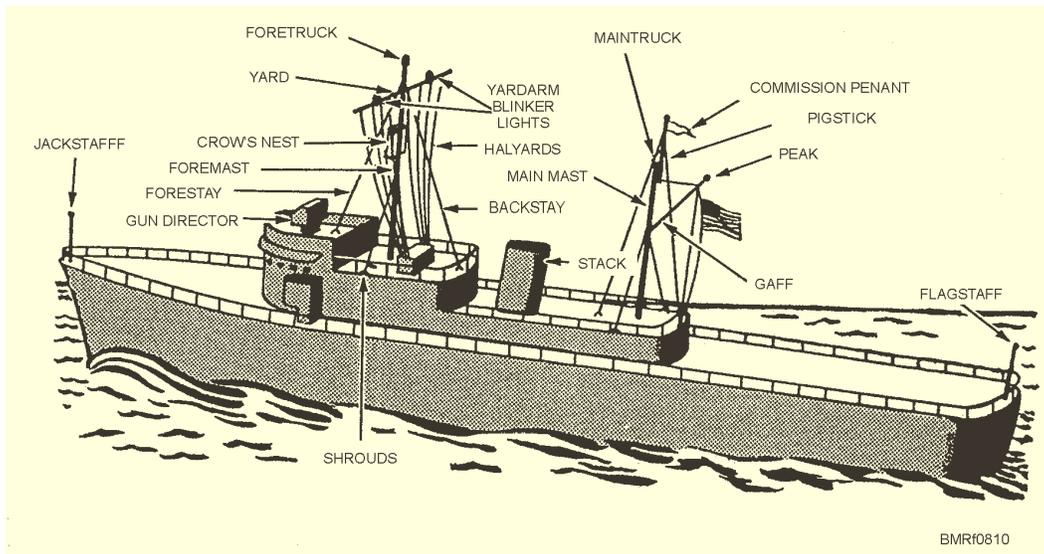


Figure 8-10.—Top hamper.

Masts are used to support radio and radar antennas, signal halyards (lines used for hoisting signal flags, signal lights, and booms). Stays and shrouds, together with other wires used for similar purposes on stacks, masts, and so on, are known as the ship's *standing rigging*. Lines or wires used for hoisting, lowering, or controlling booms, boats, and so on, are known as *running rigging*.

Look at figure 8-10. The top of a mast is called the *truck*. A small sheave (a pulley, pronounced *shiv*) at the truck is used to run halyard lines for hoisting. The top of the foremast is the *foretruck*, and the top of the mainmast is the *main truck*. Commissioned ships of the U.S. Navy fly a commission pennant secured to a pigstick and hoisted to the truck. Ships that have radar antennas at the top of their masts fly the commission pennant from a sheave fixed in the highest convenient location.

Most foremasts have a light spar, called a *yard*, and mounted horizontally athwartships on their upper part. The port and starboard halves of a yard are the port and starboard *yardarms*. The yardarms carry a number of sheaves for signal halyards. Also, yardarms usually carry a set (two) of blinker lights, used (by means of a telegraph key) for signaling. The *gaff* is a light spar suspended at an angle abaft the upper part of the mainmast. The upper end of the gaff is the *peak*. The

national ensign is flown at the peak while a ship is under way. When a ship is anchored or moored, the national ensign flies from the *flagstaff* at the stern, and the union jack flies from the *jackstaff* at the bow.

The *bridge*, from which the ship is controlled while under way, is located in the superstructure. The bridge contains the primary equipment used by the bridge watch personnel to control (*conn*) the movement of the ship: *helm* (steering control), *lee helm* (speed control), and *radar repeaters*. Ships also have a secondary conning station from which control can be maintained if the bridge is put out of commission. Some larger classes of ships have, in addition to the navigation bridge (*conn*), a *flag bridge* for the use of the squadron commander or admiral and staff.

The *signal bridge* (where Signalmen operate the signal lights, flags, and pennants) is normally located atop the bridge. On aircraft carriers, the signal bridge is abaft and usually one deck above the navigation bridge. Outboard, open ends of a bridge are called *bridge wings*. Located near the bridge is the *chart house*, where charts (maps) are stowed and worked on by the Quartermaster. Also nearby (on some ships) is the *combat information center* (CIC) manned by operations and combat systems department personnel.

Student Notes:

Main control is the station where the engineer officer controls the engineering functions of a ship. Main control is normally located below the main deck in boiler or machinery spaces.

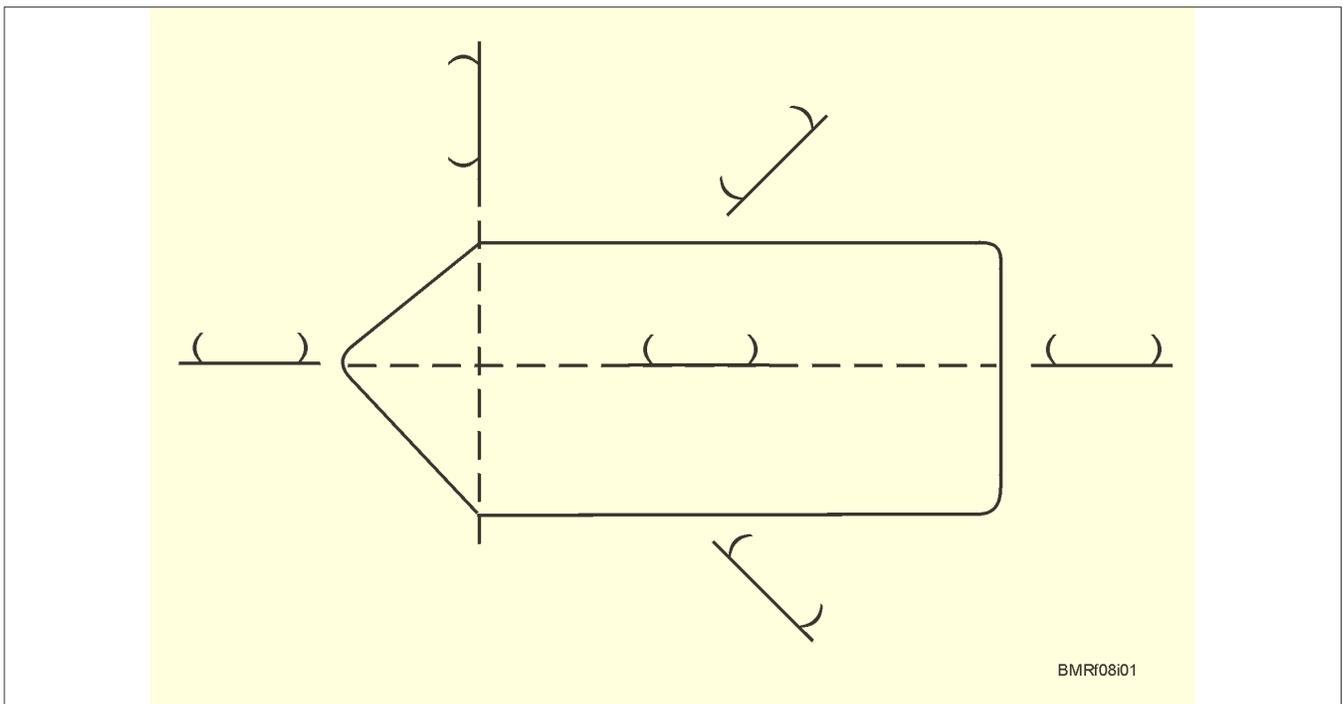
Each type of ship uses its superstructure spaces differently; hence, only generalities can be made to

describe them. Some of the spaces that may be found in the superstructures, in addition to the bridges, include administration and personnel offices, officers staterooms (berthing spaces), CPO quarters, a helicopter hangar, and radar and other electronic equipment rooms.

REVIEW 1 QUESTIONS

Q1. Label the following ship's parts.

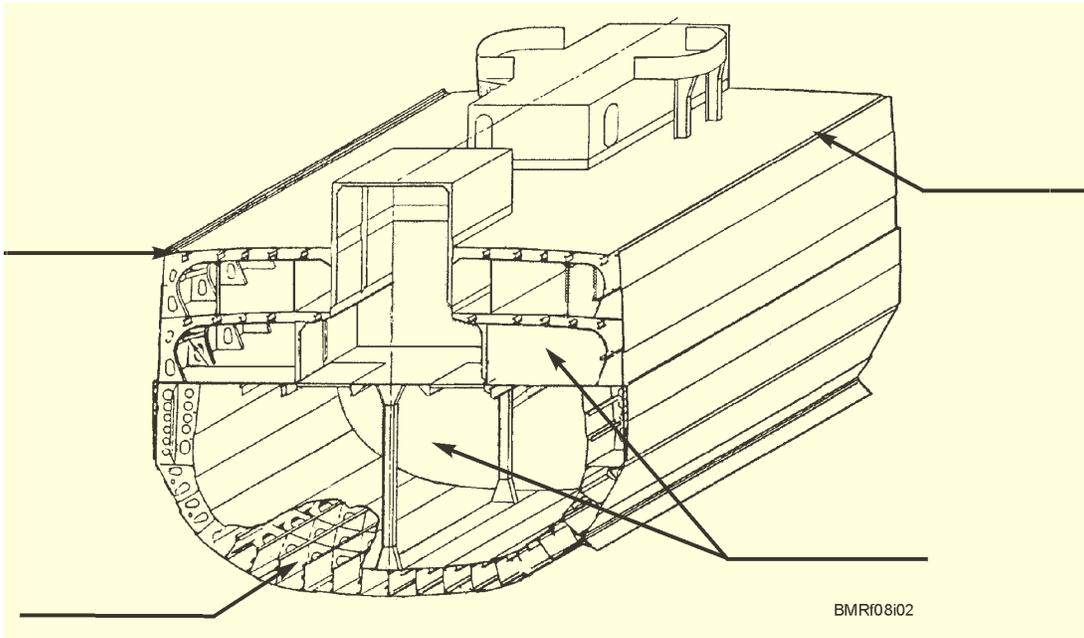
- a. Bow
- b. Beam
- c. Stern
- d. Centerline
- e. Port
- f. Starboard



Student Notes:

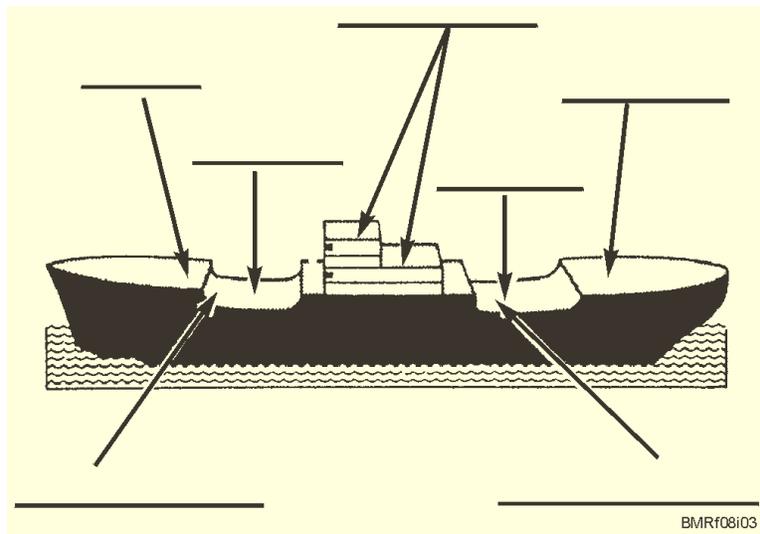
Q2. Label the following areas of a ship.

- a. Bulkheads
- b. Gunwale
- d. Longitudinals
- e. Stanchion



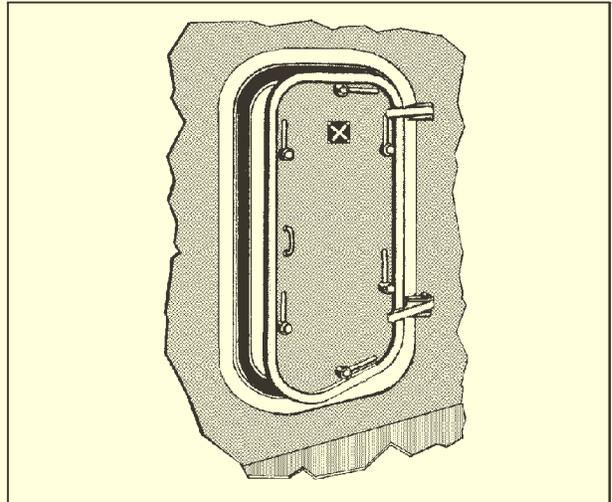
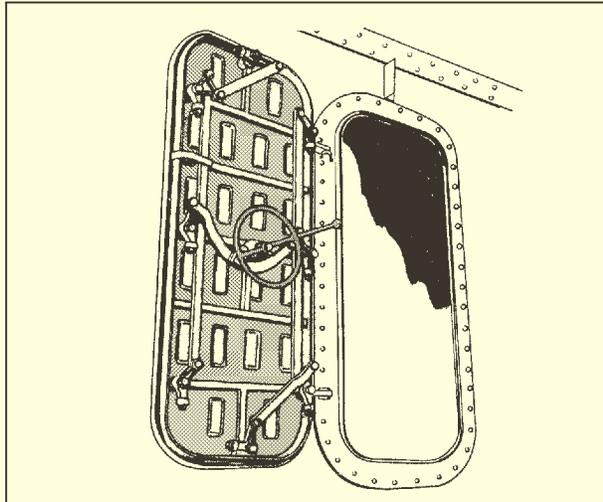
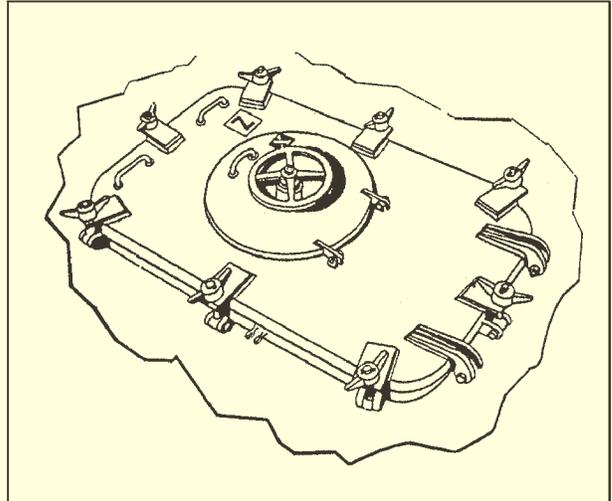
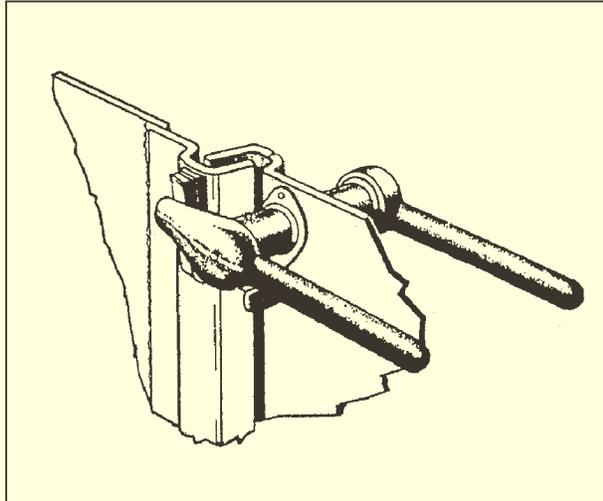
Q3. Label the following areas of a ship.

- a. Forecastle
- b. Poop deck
- c. Main deck
- d. Well decks
- e. Superstructure decks
- f. Upper deck



Student Notes:

Q4. Label the following doors/hatches.



BMR0860

Student Notes:

COMPARTMENT DESIGNATION/DECK NUMBERING SYSTEM

Learning Objectives: When you finish this chapter, you will be able to—

- Recall compartment designations.
- Recall deck lettering and numbering systems.

Every space in a ship (except minor spaces, such as pea coat lockers, linen lockers, and cleaning gear lockers) is assigned an identifying letter and number symbol. This symbol is marked on a label plate secured to the door, hatch, or bulkhead of the compartment. Compartments on the port side end in an even number and those on the starboard side end in an odd number (fig. 8-11). A zero precedes the deck number for all levels above the main deck. Figure 8-12 shows the system of numbering decks.

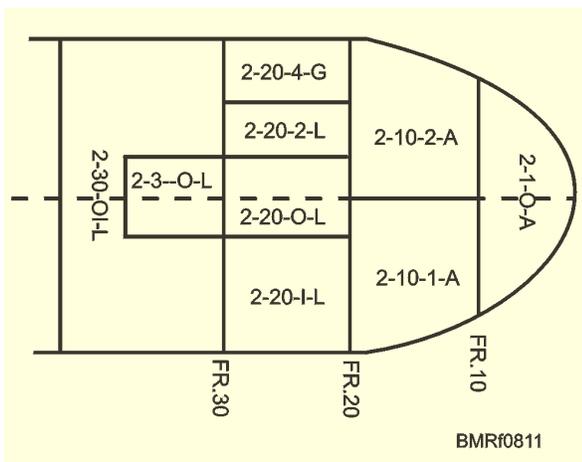


Figure 8-11.—Compartment designations.

Ship's compartment designations consist of a deck number, a frame number, the relationship of the compartment to the centerline, and a letter showing the use of the space. Where a compartment extends through two or more decks, the number of the lower deck is used. The frame number indicates the foremost bulkhead of the compartment. If the forward boundary is between frames, the frame number farthest forward within the compartment is used.

Compartments located on the centerline carry the number 0. Compartments to starboard are given odd numbers, and compartments to port are given even numbers. Where two or more compartments have the same deck and frame number, they have consecutively higher odd or even numbers, as applicable, numbering from the centerline outboard. For example, the first compartment to starboard is 1, the second is 3, and so on. To port of the centerline, they are numbered 2, 4, and so on. When the centerline passes through more than one compartment with the same frame number, the compartment having the forward bulkhead through which the centerline passes carries the number 0. Compartments above the main deck are numbered 01, 02, 03, as applicable, shown in figure 8-12.

The last part of the compartment number is the letter that identifies the primary use of the compartment. On dry and liquid cargo ships, a double letter is used for cargo holds to differentiate them from spaces containing the same commodity for use by the ship (for example, fuel oil). Compartment usage in the present system is shown in table 8-1.

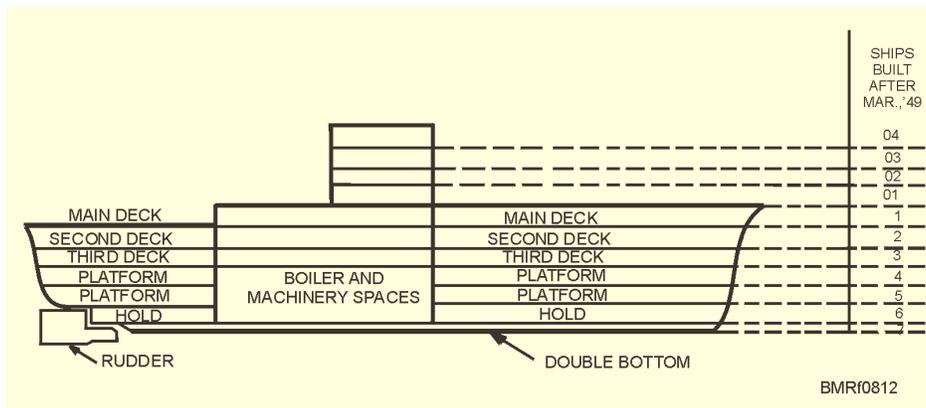


Figure 8-12.—Deck numbering system.

Student Notes:

Table 8-1.—Compartment Letters for Ships

Letter	Type of Compartment	Examples
A	Stowage spaces	Store and issue rooms; refrigerated compartments
AA	Cargo holds	Cargo holds and cargo refrigerated compartments
C	Control centers for ship and fire-control operations (normally manned)	CIC; plotting rooms; communications centers; pilothouse; electronic equipment operating spaces; IC rooms
E	Engineering control centers (normally manned)	Main machinery spaces; evaporator rooms; steering gear rooms; pump rooms; auxiliary machinery spaces; emergency generator rooms
F	Oil stowage compartments (for ship use)	Fuel- , diesel- , and lubricating-oil compartments
FF	Oil stowage compartments (cargo)	Compartments carrying various types of oil as cargo
G	Gasoline stowage compartments (ship use)	Gasoline tanks, cofferdams, trunks, and pump rooms
GG	Gasoline stowage compartments (cargo)	Spaces for carrying gasoline as cargo
J	JP-5 fuel (ship use)	Jet fuel stowage spaces
JJ	JP-5 fuel (cargo)	Spaces for carrying JP-5 fuel as cargo
K	Chemicals and dangerous materials (other than oil and gasoline)	Chemicals, semisafe materials, and dangerous materials carried as cargo or for ship's use
L	Living spaces	Berthing and messing spaces; staterooms; washrooms; heads; brig; sick bay; and passageways
M	Ammunition spaces	Magazines; handling rooms; turrets; gun mounts; shell rooms; ready service rooms
Q	Miscellaneous spaces not covered by other letters	Laundry; galley; pantries; wiring trunks; unmanned engineering; electrical and electronic spaces; shops; offices
T	Vertical access trunks	Escape trunks
V	Voids	Cofferdam spaces (other than gasoline); void wing compartments
W	Water stowage spaces	Drainage tanks; freshwater tanks; reserve feedwater tanks

Student Notes:

The following is an example of compartment designation for a ship:

Number 2-175-7-A

Second deck.....2
Frame Number.....175
Fourth compartment to starboard
from the centerline.....7
Compartment usage (stowage).....A

Access closures are numbered in the same manner as compartments, except that the letter designating usage is omitted.

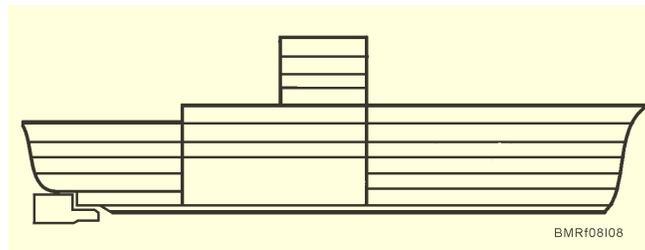
REVIEW 2 QUESTIONS

Q1. Identify the following compartment designation number:

01-56-2-Q

Q2. Label the following areas on the ship.

- a. 04
- b. Main deck
- c. Third deck
- d. Platform
- e. Machinery space



SHIP IDENTIFICATION

Learning Objectives: When you finish this chapter, you will be able to—

- Identify major types of ships to include their size, armament, armor, speed, class, and category.
- Identify types of warships to include aircraft carriers, surface combatants, submarines, and other types of combatants.
- Identify auxiliary types of ships to include replenishment-at-sea ships, material support ships, and fleet support ships.
- Identify the purpose and use of combatant craft.
- Identify the purpose and use of support craft.

Name and designation identify each Navy ship. In the name USS *Kitty Hawk* (CV-63), for example, USS means United States ship; CV is the designation—it

indicates this type of ship is a multipurpose aircraft carrier. The ship's identifying or hull number is a general indication of the number of ships of the same type that have been built. (There are gaps in the sequence of numbers of most types because of the cancellation of shipbuilding orders, particularly at the end of World War II.) A ship's hull number never changes unless its designation also changes and not always then.

NOTE

Official designations for various types of ships are contained in appendix III, titled Ship's Classification.

TERMS USED IN SHIP IDENTIFICATION

The terms you will learn in this chapter will help you identify ships. Some of the terms you will learn are ship's size, armament, speed, class, and categories.

Student Notes:

REVIEW 3 QUESTIONS

- Q1. How is the size of a ship usually given?
- Q2. What is meant by a ship's armor?
- Q3. What term is used to indicate the speed of a ship?

Ship size. The size of a ship usually is given in terms of its displacement in long tons. Displacement means the weight of the volume of water that the ship displaces when afloat; in other words, the weight of a ship by itself. The Navy uses standard displacement, which is the weight of a ship when ready for sea. All weights given in this chapter are standard displacements, except where otherwise noted. Cargo ships usually are measured in light displacement (no cargo aboard) because of the wide difference in the weights of cargo carried.

Ship armament. Armament describes the offensive weapons a ship carries—guns, rockets, guided missiles, and planes.

Ship armor. Armor means protective armor—special steel installed along the sides of the ship, on a deck, and on some gun mounts and turrets.

Ship speed. The speed of a ship is stated in knots. A knot is 1 nautical mile per hour (mph) or about 1 1/8 statute miles per hour. When a ship goes 20 nautical miles an hour, its speed is said to be 20 knots (but never 20 knots per hour). A land (or statute) mile is 5,280 feet. A nautical mile is about 6,080 feet, or roughly 2,000 yards. A ship traveling at 20 knots is, therefore, traveling at the rate of about 23 mph.

Ship class. Ships are said to be of a particular class. Do not confuse this characteristic with type, which is shown by a ship's designation. The *Forrestal*, for example, was the first of several aircraft carriers of the same general advanced type and configuration to be completed. The next three carriers completed after the *Forrestal* are of the *Forrestal* class; however, later CVs or CVNs (nuclear-powered carriers) of other types are different classes (such as the *Kitty Hawk* class, *Nimitz* class, and so forth).

Ship categories. Ships of the U.S. Navy are divided into four categories that include combatant ships, auxiliary ships, combatant craft, and support craft.

SHIPS CATEGORIES

Ships of the U.S. Navy are divided into four categories:

- Combatant ships
- Auxiliary ships
- Combatant craft
- Support craft.

Combatant Ships

Depending on size and type, combatant ships may have missions other than simply “slugging it out” with an enemy ship. Combatant ships are of two types—warships and other combatants.

WARSHIPS.—Most warships are built primarily to attack an enemy with gunfire, missiles, or other weapons. There are exceptions, however, that you will see as we go along. The following types of ships are included in the warship category:

- Aircraft carriers
- Battleships
- Cruisers
- Destroyers
- Frigates
- Submarines

Student Notes:

Aircraft Carriers.—There are three types of aircraft carriers—

1. Multipurpose aircraft carriers (CVs)
2. Multipurpose aircraft carriers (nuclear propulsion) (CVNs)
3. Training carriers

The job of the CV or CVN is to carry, launch, retrieve, and handle combat aircraft quickly and effectively. The aircraft carrier can approach the enemy at high speed, launch planes for the attack, and recover them. The attack carrier is an excellent long-range offensive weapon and is the center of the modern naval task force or task group. Figure 8-13 shows the USS Nimitz, and figure 8-14 shows aircraft flying over the USS Enterprise.

The displacement and aircraft capacity of the older CVs is less than the newer nuclear-powered CVNs. The older Forrestal class CVs displace about 79,000 tons

and embark about 75 aircraft. The larger Nimitz class displaces about 96,000 tons and embarks about 85 aircraft. There is also a big difference in ships company and air wing complement (personnel assigned). The Forrestal class has about 5,400 personnel assigned, while the Nimitz class has about 5,700. Most carriers have the following equipment/capabilities:

- Angled flight decks
- Steam catapults
- Ability to launch and recover planes simultaneously
- Large hangar deck for plane stowage
- Deck-edge elevators to move aircraft rapidly between the hangars and flight decks
- Extensive repair shops and storerooms
- Fast-fueling equipment



Figure 8-13.—USS *Nimitz* (CVN 68).

Student Notes:



Photograph courtesy of LT Brian Douglas

Figure 8-14.—Various aircraft from Carrier Wing Three fly over the USS *Enterprise* (CVN 65).

The emphasis is on speed (all carriers can do over 30 knots), endurance, and sea-keeping ability (ability to stay at sea for long periods under all conditions), plane-carrying capacity, and maintenance capability.

Battleships.—The battleships have been decommissioned. However, they could be reactivated. Battleships participated in few surface engagements in World War II, but with their large number of antiaircraft guns, they proved to be excellent support ships in carrier task forces. Another major role was that of providing gunfire support of amphibious landings in both the Pacific and European theaters. Only their large-caliber guns could knock out heavily reinforced gun emplacements. They also provided gunfire support in the Korean conflict.

Several battleships (BBs) were modernized to include additional armament such as Tomahawk and Harpoon missile systems or the Phalanx close-in weapons system (CIWS). Battleships were given state

names. However, since there is little likelihood of our building any more battleships, state names are being given to cruisers like the USS *South Carolina* (CGN 37) and to submarines (SSBNs) like the USS *Ohio* (SSBN 726) and USS *Michigan* (SSBN 727).

Cruisers.—Cruisers are medium-sized, general-utility ships. They have a large cruising range and are capable of high speeds (over 30 knots). They serve as protective screens against surface and air attacks and also provide gunfire support for land operations. The two basic types of cruisers are the guided-missile cruiser (CG) and guided-missile cruiser (nuclear propulsion) (CGN). Cruisers displace about 10,000 tons. The CGs include cruisers with missiles, but some of these also have guns that are 5"/54 caliber. CGNs are the same as the CGs except that their main engines are nuclear-powered. Figures 8-15 and 8-16 show two cruisers.

Student Notes:



Photograph courtesy of PH3 Jason D. Malcom

Figure 8-15.—USS *Philippine Sea* (CG 58) comes alongside USS *Enterprise* during an underway replenishment.



Photograph courtesy of PH3 Christopher Mobley

Figure 8-16.—USS *Port Royal* (CG-73).

The *Ticonderoga* (CG 47) class cruisers are built on the *Spruance* (DD 963) hull. Modern U.S. Navy guided-missile cruisers perform primarily a battle force role. These ships (fig. 8-16) are multimission surface combatants capable of supporting carrier battle groups, amphibious forces, operating independently, and as flagships of surface action groups. Because of their extensive combat capability, these ships have been designated as battle force capable.

Destroyers.—Destroyers (DDs) and guided-missile destroyers (DDGs) are multipurpose ships that are useful in almost any kind of naval operation. They are fast ships with a variety of armaments, but little or no armor. For protection, they depend on their speed and mobility. Their displacement varies from 2,425 tons to 7,800 tons.

The principal mission of destroyers is to operate offensively and defensively against submarines and surface ships and to take defensive action against air attacks. They also provide gunfire support for amphibious assaults and perform patrol, search, and rescue missions.

The destroyers armament consists of 5-inch guns and a variety of antisubmarine weapons, such as torpedoes, ASROCs, and surface-to-air missiles.

Traditionally, destroyers have been named after Secretaries of the Navy and officers and enlisted personnel of the Navy and Marine Corps.

Destroyers make up the Navy's largest group of similar types of ships. Only a few are mentioned so you will have some idea of the several types and classes.

Spruance class destroyers. The *Spruance* (fig. 8-17) class destroyers displace 7,800 tons fully loaded. Each of these ships has two 5"/54-caliber guns, one Seasparrow missile launcher, one ASROC launcher, and two Mk 32 triple-torpedo tubes. They also have full helicopter facilities to accommodate the SH-2H or SH-60B helicopter, and the larger Sea King SH-3 helicopter. The *Spruance* class destroyers are the first large U.S. warships to use gas-turbine propulsion. This propulsion system was selected because of its smaller space requirements, rapid replacement capability, and cold start capability. (The engines can go from "cold iron" to full power in 12 minutes.)

Kidd class guided-missile destroyers. The Kidd class guided-missile destroyers are designed around the *Spruance* hull and engineering plant. Armament includes two Mk 26 Tartar/ASROC launchers; two Quad Harpoon canisters; two Mk 45, 5"/54-caliber gun mounts; and two Vulcan/Phalanx CIWSs. There are facilities for two SH-2 LAMPS or one LAMPS III. Displacement of these ships is 8,500 tons and propulsion is gas turbine.

Arleigh Burke class destroyers. The DDGs of the Arleigh Burke class (fig. 8-18 and fig. 8-19) are the most



Photograph courtesy of PH1 James Slaughenhaupt

Figure 8-17.—Spruance class destroyer, USS *Moosebrugger* (DD 980).

Student Notes:



Figure 8-18.—Guided-missile destroyer USS *The Sullivans* (DDG 68).



Figure 8-19.—USS *Hopper* (DDG 70).

powerful and survivable class of destroyers ever put to sea. They possess the following capabilities:

- AEGIS weapons system with the AN/SPY-1D multi-function radar, capable of detecting and tracking over one hundred targets simultaneously, while conducting multiple engagements
- The vertical launching system, capable of storing and rapidly firing 90 missiles
- The SQQ-89 antisubmarine warfare system with its SQR-19 towed array sonar and the SQS-53C digital hull-mounted sonar
- The Harpoon antiship cruise missile system
- The Tomahawk antiship and land attack cruise missile system, capable of hitting targets hundreds of miles away
- Improved versions of the 5-inch gun and the Phalanx close-in weapons system.

The Arleigh Burke class represents a return to all-steel construction and incorporates electromagnetic pulse hardening, enhanced firefighting features, and a collective protection system to provide protection against nuclear, chemical, or biological contamination. This vital equipment is distributed through the ship, giving the ship improved blast and fragmentation protection, which lets them to survive a hit and continue to fight.

Frigates.—The classification “frigate” designates ships used for open-ocean escort and patrol. Frigates resemble destroyers in appearance, but they are slower, have only a single screw, and carry less armament. Frigates are slowly being replaced by DDGs. The Oliver Hazard Perry class is the only class of guided-missile frigates still commissioned. The USS *Ingraham* (FFG 61) (fig. 8-20) carries the following armament:

- A single 76-mm, .62-caliber
- Dual-purpose gun
- A 20-mm Vulcan/Phalanx rapid-fire gun
- A single launcher for Harpoon missiles
- Two SH-60 LAMPS III helicopters

- Two Mk 46 triple-torpedo tubes

Submarines.—The Navy deploys two classes of submarines attack submarines (SSNs) and ballistic missile submarines (SSBNs). The mission of nuclear attack submarines (SSNs) is to locate and destroy enemy ships and submarines. They also act as scouts, deliver supplies and personnel to locations in enemy territory, and perform rescue missions.

Fleet ballistic missile submarines (SSBNs) deliver ballistic missile attacks against assigned targets from either a submerged or surfaced condition. Most of the SSBNs are being converted to carry Trident missiles, which have greater range and multiple warheads.

A new class of submarine, the Ohio class (fig. 8-21), has been developed for the Trident missile. The Ohio class is the largest undersea craft developed by the Navy. It displaces 16,600 to 18,700 tons. The size of the Trident submarine is dictated by the larger size missile required for ranges of 4,000 to 6,000 miles and by the larger reactor plant required to drive the ship. The submarine has 24 tubes for the Trident missile and 4 torpedo tubes located in the bow.

A nuclear-powered attack submarine, like that of the Sturgeon class, displaces 3,800 to 4,700 tons, can do more than 20 knots, and has four torpedo tubes. The newer Seawolf class fast-attack submarine displaces about 9,137 tons, has four torpedo tubes, and can attain speeds of over 35 knots (fig. 8-22). The Seawolf performs a variety of crucial assignments, from underneath the Arctic icepack to all regions anywhere in the world. Its missions include surveillance, intelligence collection, special warfare, covert cruise-missile strike, mine warfare, and anti-submarine and anti-surface ship warfare. The Seawolf’s stealth characteristics make it the world’s quietest submarine.

Early submarines were named after marine life. The first SSBNs, however, were given names of persons well known in American history, like USS *George Washington*, USS *Patrick Henry*, and USS *Lafayette*. The new fast-attack submarines (SSNs) are named after American cities, like the USS *Los Angeles*, USS *Albuquerque*, and USS *Memphis*. The Tridents (SSBNs) are being named after American states, like the USS *Ohio* and USS *Michigan*.

Student Notes:



Figure 8-20.—USS *Ingraham* (FFG 61).



Photograph courtesy of PH3 Erik Kenny

Figure 8-21.—USS *Maryland* (SSBN 773).



Figure 8-22.—USS *Seawolf* (SSN 21).

OTHER COMBATANTS.—Other ships classified as combatants are amphibious warfare ships and mine warfare ships.

Amphibious warfare ships.—An amphibious assault operation is the fastest means of landing large numbers of personnel, equipment, and supplies on enemy-held territory. The lessons learned during World War II, Korea, and Vietnam have resulted in the U.S. Navy having the largest and most capable amphibious force in the world. With the introduction of new classes of ships and new types of landing craft and helicopters, the U.S. Navy can conduct an amphibious operation almost anywhere in the world.

Amphibious assault ships. Tarawa-class amphibious assault ships (LHAs) are able to embark, deploy, and land a marine battalion landing team by helicopter, landing craft, amphibious vehicle, or by a combination of these methods. The Tarawa-class ships have 9 *Sea Stallions* and 12 *Sea Knight* helicopters plus 6 *Harrier* attack planes. It also carries 2 RAM launchers, two 5"/54 caliber Mk-45 lightweight guns, two *Phalanx* 20mm CTWS mounts and six 25mm Mk 38 machine guns. The USS *Belleau Wood* (LHA 3) (fig 8-23) and the USS *Peleliu* (LHA 45) (fig. 8-24) are examples of amphibious assault ships.

The Wasp-class LHDs are designed to embark, transport, and land 2,000 troops and their equipment using transport helicopters in conjunction with a beach assault. The Wasp-class ships are the largest amphibious ships in the world (fig. 8-25). Their vertical envelopment is more effective than older methods of amphibious landings. One feature of this class of ships is the ability to commit the landing force in an assault without being limited to favorable beaches. These ships allow establishment of beachheads in enemy territory more quickly than older methods. When not in used for amphibious assaults, LHDs have the capability to assist in antisubmarine warfare.

Amphibious transport dock. Amphibious transport docks (LPDs) are versatile ships. They perform the mission of amphibious transports, amphibious cargo ships, and older LSDs. The Navy's newest class of ships are scheduled to replace the Navy's amphibious fleet. The LPD (fig. 8-26) is a highly reliable, warfare-capable ship, as well as the most survivable amphibious ship ever put to sea. The LPD incorporates the latest quality of life standards for the embarked Marines and Sailors—they accommodate women as part of the crew and embarked troops.

Student Notes:



Photograph courtesy of PHC Justin A. Kahkosko

Figure 8-23.—USS Belleau Wood (LHA-3) refuels USS Vincennes (CG 49) during an underway replenishment.



Photograph courtesy of PHC Larry Nixon

Figure 8-24.—Landing craft, utility (LCU-1663) back loads equipment and personnel to USS Peleliu (LHA 45).



Photograph courtesy of JO2(SW/AW) Tyler A. Swartz

Figure 8-25.—USS Bonhomme Richard (LHD 6).



Photograph courtesy of PH2 Felix Garza

Figure 8-26.—USS Duluth (LPD 6).

Dock landing ships. Dock landing ships (LSDs) (fig. 8-27) were designed to transport and launch a variety of amphibious craft and vehicles with embarked crews and troops. All landing craft operate from a well deck that is over 300 feet long and 50 feet wide. The types of amphibious craft vary from the newer LCAC (landing craft air cushion) (fig. 8-28) to the



Photograph courtesy of PH2 Todd R. Cromer.

Figure 8-27.—USS Comstock (LSD 45).

conventional LCU (landing craft utility) or LCM (landing craft mechanized). The number of amphibious craft embarked will vary, depending on the type of craft and class of ship.

The newer class of LSD is capable of transporting and operating four LCACs while the older classes may embark only three. A newer variant of the LSD will be designed to handle only two LCACs but will have a

Student Notes:



Photograph courtesy of SGT Don L. Mayes

Figure 8-28.—Landing craft air cushion (LCAC).

larger cargo capacity. These ships also have a helicopter platform over the well deck that allows them to conduct limited helicopter operations.

Tank landing ships. Tank landing ships (LSTs) (fig. 8-29) were developed during World War II. The Navy required a ship capable of transporting troops, tanks, ammunition, and all sorts of supplies. The LSTs of today's fleet are fitted with bow doors and a bow ramp that give access to the tank deck. Another ramp and turntable in the tank deck enable vehicles to turn around and reach the main deck under their own power. They also have a stern gate that permits off-loading of amphibious vehicles directly into the water. In addition to transporting and landing equipment in amphibious assaults, these ships can transport and launch a pontoon causeway section in support of amphibious operations. With booms and winches mounted on the main deck forward, this class of ship is capable of numerous missions. They carry one 20mm *Phalanx* and two 25mm Mk3 machine guns.

Amphibious command ships. Amphibious command ships (LCCs) (fig. 8-30) provide amphibious command and control for major amphibious operations.



Figure 8-29.—USS LA Moure County (LST 1194).



Photograph courtesy of PH2 John Sokolowski

Figure 8-30.—USS Mount Whitney (LCC-20).

With the latest command and control facilities available, these ships have become fleet flagships. They are capable of supporting a naval amphibious task force, a landing force, and an air force simultaneously.

Mine Warfare Ships.—Mine countermeasures ships (MCM) are ships designed to clear mines from vital waterways. In the early 1980s, the U.S. Navy began development of a new mine countermeasures (MCM) force, which included two new classes of ships and minesweeping helicopters. The Iran-Iraq war and Operation Desert Shield/Desert Storm showed the importance of a state-of-the-art mine countermeasures force when the *Avenger* (MCM 1) and *Guardian* (MCM 5) ships conducted MCM operations.

Avenger class ships are designed as mine hunter-killers capable of finding, classifying, and destroying moored and bottom mines. These ships use sonar and video systems, cable cutters, and a mine-detonating device that can be released and detonated by remote control. They are also capable of conventional sweeping measures. The ships are of fiberglass sheathed, wooden hull construction. They are the first large mine countermeasures ships built in the United States in nearly 27 years. (See fig. 8-31.)



Figure 8-31.—USS Chief.

Student Notes:

Osprey (MHC 51) class ships are also designed as mine hunter-killers. The MHC 51 has a 15-day endurance and depends on a support ship or shore-based facilities for resupply. Ships under this class are named after birds.

REVIEW 4 QUESTIONS

Q1. List the four categories of ships.

- a.
- b.
- c.
- d.

Q2. List the six classes of warships.

- a.
- b.
- c.
- d.
- e.
- f.

Q3. What are battleships names after?

Q4. Name the two basic classes of cruisers.

- a.
- b.

Q5. For protection, the destroyer depends on their

_____ and _____.

Q6. What class of ship was developed for the purpose of open ocean escort and patrol?

Q7. Name the two classes of submarines.

- a.
- b.

Q8. What class of ship is used to land large numbers of personnel, equipment, and supplies on enemy held territory?

Auxiliary Ships

Today's fleet is highly mobile and can respond to an area of conflict quickly. However, its ships cannot remain on station indefinitely. There must be a means of resupply and repair. The auxiliary ships of today's fleet are the lifeline to the combatant force. These ships keep the fleet operating by furnishing vital supplies and repair facilities. They can deliver such items as fuel, food, ammunition, and repair parts.

The types of ships in the auxiliary force range from fast combat support ships (AOEs) to rescue and salvage ships (ARSS). The type of service an auxiliary provides determines its classification. The initial letter in each designation is the letter *A*. The second and subsequent letter indicates the service it performs. An *AE* indicates an ammunition (explosives) supply ship, while an *AO* is an oiler. These types of ships do not always receive the level of publicity a carrier or cruiser might receive, but they fight and work just as hard in times of emergency. Certain classes of auxiliaries have the capability to function in many roles. An AOE is capable of supplying not only fuel and ammunition but can supply dry stores and refrigerated stores.

Student Notes:

REPLENISHMENT-AT-SEA SHIPS.—

Replenishment at sea is the term applied to the transfer of fuel, munitions, supplies, and personnel from one vessel to another while ships are under way. During World War II, replenishment at sea (fig. 8-32) was

developed to a fine art of seamanship, which is taken as a matter of course today.

Replenishment at sea is accomplished with both the replenishment ship and the ship(s) being replenished steaming side by side on parallel courses at a

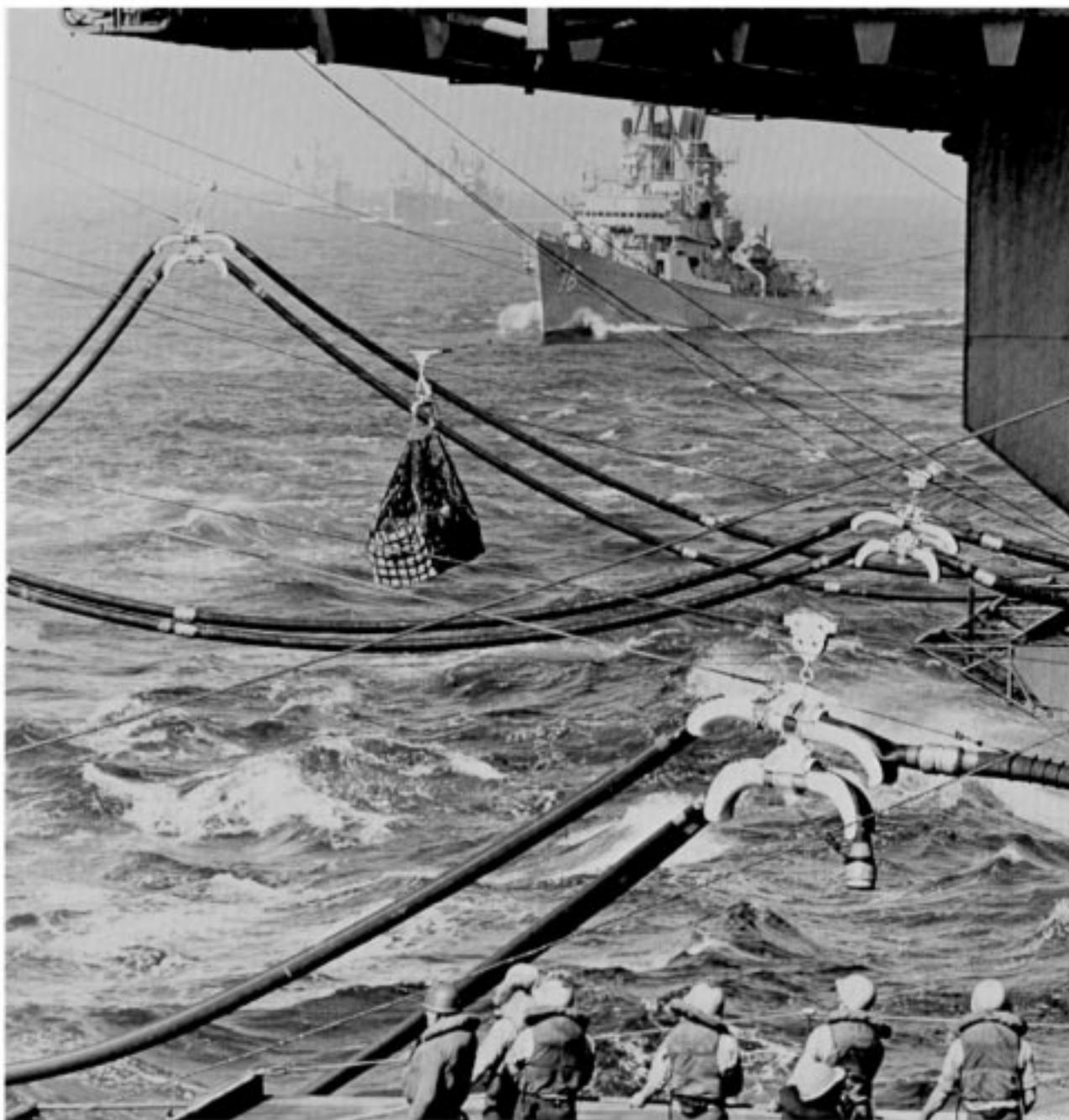


Figure 8-32.—Replenishment at sea enables the fleet to remain at sea and make successive strikes without returning to base for fuel, ammunition, and supplies.

Student Notes:

predetermined speed. In most cases, the replenishment ship maintains its course and speed while the other ship(s) maneuver(s) into position alongside. A separation of about 100 feet is maintained between ships, with the replenishing ship frequently serving ships both to port and starboard. Messenger lines are passed to the receiving ships, which send back telephone and distance measuring lines and then haul over cargo-handling gear or fuel hoses by means of the messengers.

Ships designed for that purpose do most of the replenishment, but major combatant ships are capable of refueling smaller ships. Even the smallest ships can, and do, transfer light freight, mail, and personnel by means of highlines.

In addition to the standard replenishment capabilities, all recently constructed, as well as many of the older auxiliary, ships have helicopter platforms for the transfer of munitions, personnel, cargo, and stores by vertical replenishment. Vertical replenishment permits a receiving ship to remain on station in combat formation, eliminating the necessity of temporarily immobilizing itself by going alongside another ship for replenishment.

Ammunition Ships.—Ammunition ships (AEs) (fig. 8-33) operate with replenishment groups to deliver ammunition and missiles to the fleet at sea. Their design

incorporates a mechanical handling system for more rapid loading and off-loading of ammunition. The mechanical handling system includes such equipment as dual-cantilevered elevators in the holds; forklift trucks; and low-lift, power-operated transporters on the main deck for handling palletized ammunition from the elevators to the transfer stations. Universal portable metal dunnage provides maximum stowage with ready access to all types of ammunition. A tension highline system is built into the design along with new, improved electro-hydraulic cargo winches for replenishment at sea. These improvements provide for much more rapid and reliable transfers and conservation of deck space. These ships are capable of handling all types of missiles (fig. 8-34).

Oilers and Tankers.—Oilers (AOs), carrying Navy fuel oil, jet fuel, and other petroleum products, operate with replenishment groups and deliver their cargo to ships at sea. Oilers, as well as ammunition ships (fig. 8-35), can service ships on both sides simultaneously.

The AO (Jumbo) is a conversion of the AO that includes the installation of a new midsection in the hull. This midsection increases the payload and provides for an improved balance of cargo fuel products to meet the more recent demands placed upon the AO by the increase in fleet requirements for jet aircraft fuel.



BMR10833

Figure 8-33.—USS *John C. Stennis* (CVN 74) off-loads ammunition onto ammunition ship USS *Mount Hood* (AE 29).

Student Notes:



BMR10834

Figure 8-34.—An AE highlines a missile to a guided-missile ship during replenishment at sea.

Fast Combat Support Ships.—The fast combat support ship (AOE) is the largest and most powerful auxiliary ship in the Navy. Unlike other replenishment ships, the AOE is designed to operate as an integral force rather than as a unit of an underway replenishment group.

The AOE (fig. 8-36) is a multiple-product ship (missiles, fuel, ammunition, and general cargo) that has a cargo-fuel capacity greater than that of our largest fleet oilers plus a hold capacity equal to the largest ammunition ship. In addition, the ship carries a large

load of both general supplies, materials, and refrigerated cargo.

Other than speed and capacity, this ship has two major areas of improvement over other replenishment vessels—material handling and replenishment at sea. Materials, other than missiles and special weapons, are moved vertically by elevators or conveyors. Horizontal movement of general cargo and ammunition is mechanized through the use of pallet transporters and forklift trucks. Cargo helicopters are available to

Student Notes:



Figure 8-35.—AOE conducting an evolution.



Figure 8-36.—A multiple-product AOE conducting underway replenishment.

replenish outlying units of the force with dry cargo and ammunition.

The missile and special weapons-handling system is separate from the cargo-handling system. This arrangement permits a continuous flow of missiles from the cargo holds to the missile-transfer system, port or starboard.

The fuel hoses on the AOE are designed to permit an average ship separation of 200 feet during replenishment instead of the normal 100 feet. The greater distance reduces the possibility of collision and makes increased replenishment speeds feasible. There are nine replenishment stations to port and six to starboard.

FLEET SUPPORT SHIPS.—While certain types of naval auxiliary ships are designed and equipped specifically for towing, for salvage, or for rescue operations, most of these types may, in an emergency and to a limited extent, perform all these operations. Among ships as versatile and as adaptable as the auxiliaries, there is bound to be an occasional overlapping of functions to meet an unexpected situation.

Rescue and Salvage Ships.—The mission of the rescue and salvage ship (ARS) has four parts—debeaching stranded vessels, heavy lift capability from ocean depths, towing other vessels, and manned diving operations. For rescue missions, these ships are equipped with fire monitors forward and amidships, which can deliver either fire-fighting foam or seawater. The salvage holds of these ships are outfitted with portable equipment to provide assistance to other vessels in dewatering, patching, and supplying of electrical power and other essential services required to return a disabled ship to an operating condition.

The Navy employs ARSs (fig. 8-37) to salvage U.S. government-owned ships and, when it is in the best interests of the United States, privately owned vessels. The rugged construction of these steel-hulled ships, combined with speed and endurance, make rescue and salvage ships well suited for rescue/salvage operations of Navy and commercial shipping throughout the world. The versatility of this class of ship adds to the capabilities of the U.S. Navy with regard to assisting those in need on the high seas.



Photograph courtesy of PHI Todd P. Cichonowicz

Figure 8-37.—USS *Grapple* (ARS-53).

Oceangoing Tugs.—There is one major type of oceangoing tug—the ATF (fleet ocean tug) (fig. 8-38). It has a large cruising range and limited salvage capabilities. ATFs are equipped with firefighting equipment, including fire monitors. (A fire monitor is similar in appearance to a gun and permits water to be discharged through a horizontal arc of 360°.) They also are fitted with automatic towing machines and booms. In addition to hauling and towing, fleet tugs may be called on to patrol certain areas, lay smoke screens, and pull landing craft off beaches. They are often used in search and rescue (SAR) operations. Military Sealift Command (MSC) personnel now operate most fleet tugs.



Photograph courtesy of Robert J. Sitar

Figure 8-38.—USNS *Powhatan* (T-ATF-166).

Student Notes:

Combatant Craft

Combatant craft include patrol craft, amphibious warfare craft, and mine warfare craft.

Patrol craft. Surface patrol craft are intended for use relatively near the coast or in sheltered waters or rivers. These craft may be transported aboard larger units.

Amphibious warfare craft. All amphibious craft that have the organic capacity for amphibious assault, principally in coastal waters. They may be transported aboard larger units.

Mine warfare craft. All craft with the primary function of mine warfare that operate in coastal waters. They may be transported aboard larger units.

Support Craft

Among the hardest working ships of the Navy are the support craft. Not primarily fighting ships, they are for the most part unarmed. These are ships that serve a variety of purposes in continental and overseas harbors, sea frontiers, convoys, amphibious forces, and task forces. Many are small, but of incalculable use to the Navy.

With a few exceptions, support craft designations start with the letter *Y*. A few of the class names identify the many duties they perform:

- Auxiliary floating dry dock—large (AFDB) and small (AFDL)
- Floating crane (YD)
- Diving tender (YDT)
- Ferryboat or launch (YFB)
- Fuel oil barge (YO)
- Gasoline barge (YOG)
- Oil storage barge (YOS)
- Floating workshop (YR)
- Tug (YTL, YTM, or YTB)
- Water barge (YW)

Student Notes:

REVIEW 5 QUESTIONS

- Q1. What is the term used to describe the transfer of fuel and supplies between ships while underway?
- Q2. Ships usually maintain a distance of _____ feet while taking on supplies at sea.
- Q3. What type of replenishment allows a receiving ship to stay on station in combat formation?
- Q4. What class of ship is the largest and most powerful auxiliary ship?
- Q5. The mission of the rescue, salvage, and towing ships is to—
- Q6. Support craft designators usually start with what letter?

NAVAL AIRCRAFT

Learning Objective: When you finish this chapter, you will be able to—

- Recognize fixed-wing and rotary-wing aircraft, to include aircraft nomenclature and characteristics.

The history of naval aviation goes back to 1911 when the Navy acquired its first aircraft, a pusher-type biplane with no cockpit. The only covered surfaces were the wings and tail, and flight speed was less than

50 mph. By contrast, today's high-performance planes have speeds in excess of 2,000 mph.

AIRCRAFT NOMENCLATURE

In this section, you will learn the basic parts of aircraft and how the Navy identifies aircraft.

Fixed-Wing Aircraft Nomenclature

A fixed-wing aircraft (fig. 8-39) may be divided into three basic parts—fuselage, wings, and empennage (tail).

FUSELAGE.—The fuselage is the main body of the aircraft, containing the cockpit and, if there is one, the cabin. On virtually all naval fighter and attack aircraft operational today, the engines and some of the fuel tanks are mounted within the fuselage.

WINGS.—Wings are the primary lifting devices of an aircraft, although some lift is derived from the fuselage and tail. Located on the trailing (rear) edge of the wings are flaps that may be used to give extra lift on takeoff or to slow the aircraft in flight or landings; ailerons that control the roll or bank of the aircraft; and trim tabs used to aerodynamically unload the control surfaces to relieve some of the pilot's work. On the leading (front) edge of the wing may be found auxiliary lifting devices, resembling flaps, which are used to increase camber (curvature) of the wing for added lift on takeoff. Most Navy jet aircraft carry their

bomb loads on pylons (called *stations*) under the wings and, in some cases, under the fuselage. Some jets have missile stations on the sides of the fuselage. Fuel cells are located in the wings; additional external tanks can be fitted for extra range. Larger jets may have their engines slung beneath the wings in pods. Some low-wing aircraft have their main landing gear retract into the wings, while the nose wheel retracts into the fuselage. On most high-wing aircraft all gear retracts into the fuselage.

EMPENNAGE.—The empennage consists of the stabilizing fins mounted on the tail section of the fuselage. These include the vertical stabilizer on which is generally mounted the rudder that is used to control yaw, or direction of the nose about the vertical axis; and the horizontal stabilizer, on the trailing edge of which are the elevators that determine the pitch (climb or dive). Some supersonic aircraft may have a full delta wing. In that case, there is no horizontal stabilizer and the elevators and ailerons are combined into control surfaces called *elevons*.

In aircraft with internally mounted jet engines, exhausts normally are in the tail. High-performance jets have afterburners that give additional thrust at the cost of greatly increased fuel consumption.

Rudder, ailerons, and elevators are collectively grouped as control surfaces. The "stick" or a similar device in the cockpit controls these surfaces, while foot pedals control the rudder. On high-performance aircraft, aerodynamic pressures on these surfaces become too great for a pilot to overcome manually; hence, all high-speed models today have power-assisted controls.

Rotary-Wing Aircraft Nomenclature

The aerodynamics of rotary-wing aircraft (fig. 8-40) are considerably more complex than those of fixed-wing aircraft. A helicopter essentially consists of a fuselage, main rotor or rotors, and often a tail rotor.

FUSELAGE.—As in fixed-wing aircraft, the fuselage contains the cockpit and cabin.

MAIN ROTOR.—The main rotor is the approximate equivalent of the wing of a fixed-wing aircraft. Each rotor blade is an airfoil, like a wing, and

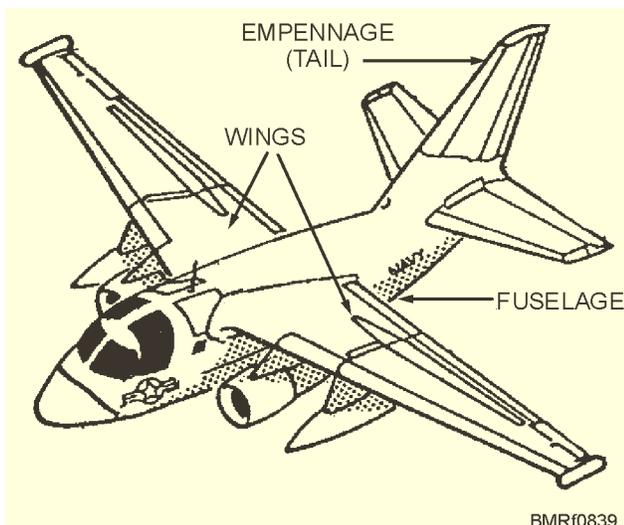


Figure 8-39. Fixed-wing aircraft.

Student Notes:

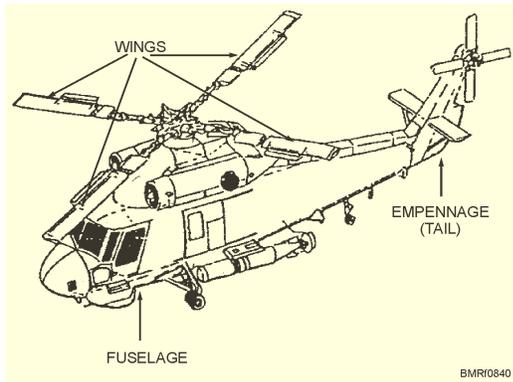


Figure 8-40.—Rotary-wing aircraft.

the lift is generated by the rotation of the assembly, which creates a flow of air over the blades.

A helicopter is lifted into the air by the aerodynamic forces on the rotor and not pushed up by the downwash. Some helicopters have twin rotors in tandem at either end of the fuselage; but most have a single, main rotor with a tail rotor mounted at right angles. A few have tandem intermeshing rotors.

TAIL ROTOR.—The tail rotor is used for directional control and stability. It is mounted at right angles to the main rotor to counteract the torque of that system. By varying the pitch of the tail rotor blades, the pilot controls yaw.

Helicopter engines are connected to the rotor shaft(s) by a transmission, which may be disengaged. That permits the engine(s) to be operated on the ground without engaging the rotor system and also permits a mode of flight known as *autorotation*. If the engines should stop while in flight, they can be disengaged; the freewheeling action of the rotor will allow a slower descent.

AIRCRAFT MODEL DESIGNATIONS

All aircraft have tri-service designations; that is, a given aircraft has the same alphanumeric identification symbol, regardless of which service uses the aircraft. Look at table 8-2. Here, you can find the four basic parts of an aircraft model designation.

Table 8-2.—Aircraft Model Designations

Mission/type modification symbol		Basic mission/type symbol		Aircraft series number	Model series letter
A	Attack	A	Attack	These numbers are assigned sequentially within each basic mission category. The number is separated from the basic mission symbol by a dash.	This letter, added to the series number, indicates an improvement or alteration of the basic mode. These are assigned in sequence; for example: F-4A, F-4B, F-4C, and so forth.
C	Cargo/transport	B	Bomber		
D	Drone control	C	Cargo/transport		
E	Special electronics	E	Special electronics		
H	Search and rescue	F	Fighter		
K	Tanker	H	Helicopter		
L	Cold weather operations	K	Tanker		
M	Missile capability	O	Observation		
O	Observation	P	Patrol		
Q	Drone	S	Antisubmarine		
R	Reconnaissance	T	Trainer		
S	Antisubmarine	U	Utility		
T	Trainer	V	Vertical takeoff and landing (VTOL)/short takeoff and landing (STOL)		
U	Utility	X	Research		
V	Staff transport				
W	Weather reconnaissance				

1. Mission/type modification symbol
2. Basic mission/type symbol
3. Aircraft series number
4. Model series letter

Now, let's try out this system of aircraft designation. For example:

EA-6B Prowler

1. Find the letter "E" in the first column of the table. This aircraft has special electronics.
2. Find the letter "A" in the second column of the table. The basic mission symbol tells you that this is an attack aircraft.
3. The third column of the table explains the number after the dash. This is the sixth aircraft of this series.
4. The fourth column explains the last letter of the aircraft designation. This is improvement/alteration B.

Let's try another one:

CH-46 Sea Knight

1. First letter is "C." This is a cargo aircraft.
2. Second letter is "H." This is a helicopter.
3. 46. This is the forty-sixth of the series.
4. No letter. There have been no improvements/alterations.

CURRENT FIXED-WING NAVY AIRCRAFT

This section briefly describes some of the fixed-wing aircraft (fig. 8-41) currently operational within the Navy.

Attack Class

Attack planes are used for low-level bombing, ground support, or nuclear strikes. They do not need the speed of fighters, but should be capable of heavy payloads, have good stability, and be able to carry

enough fuel to remain on station long enough to render extended support to troops, if needed. Attack aircraft normally operate under conditions of good visibility, but some have the equipment needed for all-weather and night attacks.

EA-6B PROWLER.—The *Prowler* (fig. 8-42) is an all-weather tactical electronic warfare aircraft, based on the A-6 airframe. The *Prowler* provides jamming coverage to prevent missile engagement of U.S. or allied aircraft during strike operations. The *Prowler* also carries the high-speed antiradiation missile (HARM).

AV-8B HARRIER.—The *Harrier* (fig. 8-43) is the western world's only operational fixed-wing vertical short takeoff or landing (V/STOL) strike aircraft. It is an integrated V/STOL weapons system incorporating the inertial navigation and attack system (INAS) with an electronic display. The aircraft is used by the Marine Corps and is operated from the decks of aircraft carriers and amphibious support ships.

Fighter Class

Fighters are high-performance aircraft generally employed to gain air superiority. They may be deployed defensively as interceptors, offensively as escorts for bombers or on ground support missions, or independently to counter enemy aircraft. Some are capable of carrying sufficient payloads for bombing missions.

F-14 TOMCAT.—The F-14 *Tomcat* (fig. 8-44) is an aircraft-carrier-based, jet-powered fighter aircraft. The aircraft is mainly missile oriented, carrying the new air-to-air missile, Phoenix, and capable of carrying the older Sidewinder and Sparrow. The *Tomcat* can be configured for bombing and rocketry.

F/A-18 HORNET.—The *Hornet* (fig. 8-45) is a sonic, single-seat, twin-engine jet. The fighter and attack versions are identical, except for selected interchangeable external equipment. Conversion from the fighter to attack mode (and vice versa) takes less than 1 hour. The aircraft is designed for aerodynamic agility, high reliability, high survivability, and reduced manpower maintenance requirements.

Student Notes:

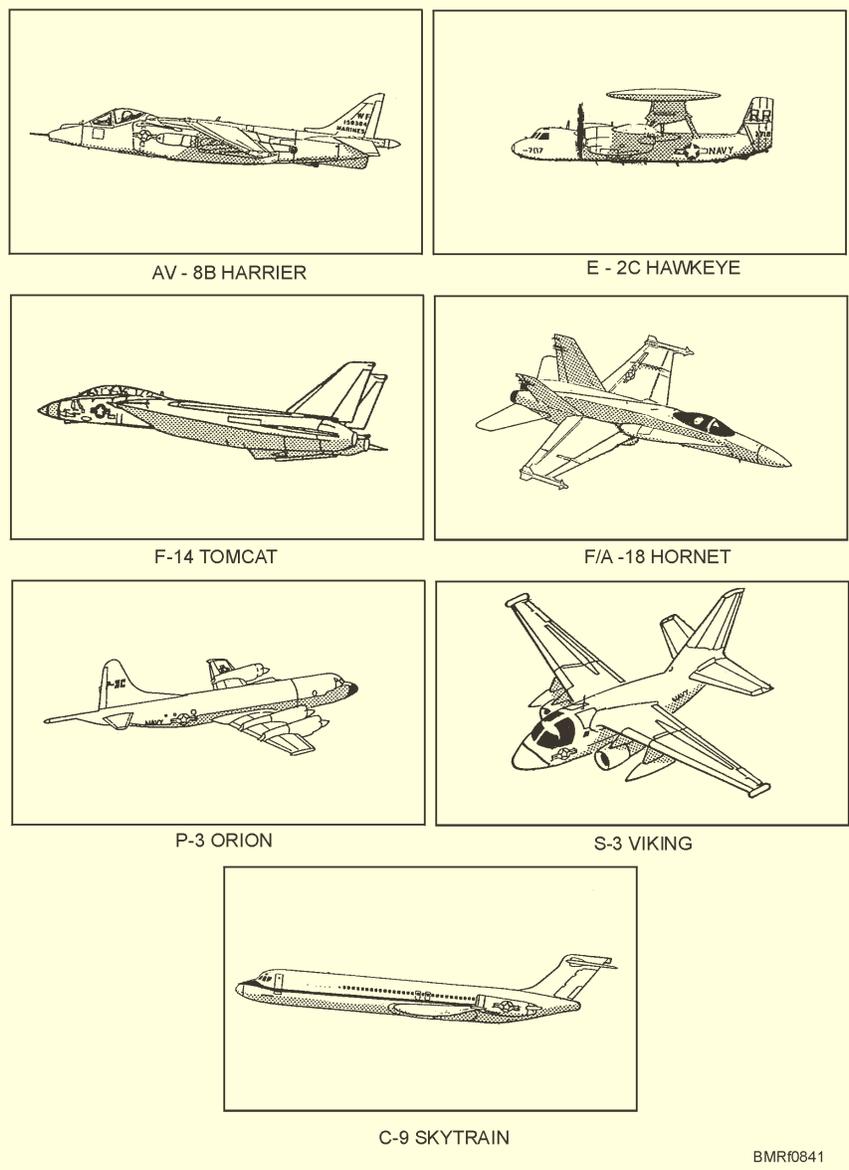


Figure 8-41.—Representative of fixed-wing aircraft.



Photograph courtesy of Senior Airman Greg L. Davie
Figure 8-42.—EA-6B Prowler.



Photograph courtesy of PH3 Timothy C. Ward
Figure 8-43.—AV-8B Harrier lands and launches for deck qualifications on USS Constitution (CV 64).



Photograph courtesy of LCDR Mike Harrison

Figure 8-44.—F-14 Tomcat.



Photograph courtesy of PH2 Damon J. Mortiz

Figure 8-46.—P-3 Orion.



Photograph courtesy of Randy Hepp

Figure 8-45.—F/A-18 Hornet.

Patrol Class

Patrol craft are land-based, long-range, multiengine aircraft used primarily for antisubmarine warfare (ASW) patrol. Patrol squadrons operate from the continental United States and overseas bases. The P-3 *Orion* is the Navy's primary ASW patrol aircraft.

The P-3 *Orion* (fig 8-46) is equipped with magnetic anomaly detection (MAD) gear, sonobuoys, radar, and other submarine detection systems. It is armed with torpedoes, bombs, missiles, and depth charges for kills. It has the primary mission of detecting, locating, and destroying enemy submarines. The P-3 *Orion* can respond quickly to hunt down submarine contacts long before surface units can arrive. Other duties include convoy escort, photographic missions, and aerial mining.

Antisubmarine Class

Antisubmarine aircraft operate from CVs in conjunction with hunter-killer group helicopters and surface craft. The S-3 *Viking* is an example of such an aircraft.

The *Viking* (fig. 8-47) is a high-wing, jet-powered, twin-engine, carrier-based ASW aircraft. It carries surface and subsurface search equipment with integrated target-acquisition and sensor-coordinating systems that collect, interpret, and store ASW sensor data. It has direct attack capability with a variety of armaments.



Photograph courtesy of LCDR Mike Harrison

Figure 8-47.—S-3 Viking refueling an F-14 Tomcat.

Warning Aircraft

Carrier-based airborne early warning (AEW) aircraft maintain station at some distance from a task

Student Notes:

force to provide early warning of approaching enemy aircraft and direct interceptors into attack position.

E-2C HAWKEYE.—The E-2C *Hawkeye* (fig. 8-48) has long-range antennas that are enclosed in a saucer-shaped, rotating disk atop the fuselage. The *Hawkeye* is manned by a crew of five.



BMR10848

Photograph courtesy of PH2 Damon J. Mortiz

Figure 8-48.—E-2C *Hawkeye* waits for direction prior to flight operations on the USS *Enterprise* (CVN 65).

ES-3 SHADOW.—The ES-3 *Shadow* (fig. 8-49) is a jet aircraft used to collect and disseminate tactical aircraft resembles the S-3 *Viking*, with the addition of numerous antennas and antenna housings. The ES-3 *Shadow* is a carrier-based, subsonic, all-weather, long-range, electronic reconnaissance aircraft. It



Photograph courtesy of LCDR Mike Harrison

Figure 8-49.—ES-3 *Shadow* landing aboard USS *George Washington* (CVN 73).

operates primarily with carrier battle groups providing indications and warning support to the battle group and joint theater commanders. It carries an electronic sensors and communications gear.

C-2A GREYHOUND.—The C-2A *Greyhound* (fig. 8-50) is a twin-engine cargo aircraft, designed to land on aircraft carriers. The C-2A *Greyhound* provides logistics support to aircraft carriers. It's powered by two PT-6 turboprop engines and can deliver a payload of up to 10,000 pounds. The cabin can carry cargo, passengers, or both. It's also equipped to accept litter patients in medical evacuation missions. Cargo such as jet engines can be transported from shore to ship in a matter of hours. A cage system or transport stand provides cargo restraint for loads during carrier launch or landing. The large aft cargo ramp and door and a powered winch allow straight-in rear cargo loading and downloading for fast turnaround. The C-2A's open-ramp flight capability allows airdrop of supplies and personnel from a carrier-launched aircraft. This, plus its folding wings and an on-board auxiliary power unit for engine starting and ground power self-sufficiency in remote areas, provide an operational versatility found in no other cargo aircraft.



Photograph courtesy of Larry Smith

Figure 8-50.—C-2A *Greyhound* landing aboard USS *John F. Kennedy* (CV 67).

C-2 SKYTRAIN.—The C-9 *Skytrain* (fig. 8-51) fleet is located throughout the continental United States, Europe, and Asia. The Navy and Marine Corps C-9 aircraft provide cargo and passenger transportation as well as forward deployment logistics support. The Air Force C-9s are used for medical evacuation, passenger transportation, and special missions. The C-9 *Skytrain*

Student Notes:

is the military version of the McDonnell Douglas DC-9 used for many years by commercial airlines.



Photograph courtesy of Senior Airman Delia Castillo

Figure 8-51.—C-2 Skytrain.

C-12 HURON.—The C-12 *Huron* is a twin-engine logistics aircraft that carries passengers and cargo between military installations. The C-12F provides logistics support between Navy air stations. It's powered by two PT-6A-42 turboprop engines and can deliver a total payload of up to 4,215 pounds. The cabin can carry cargo, passengers, or both. It is also equipped to accept litter patients in medical evacuation missions.

C-130 HERCULES.—The C-130 *Hercules* (fig. 8-52) is a four-engine turboprop aircraft. It's the



Photograph courtesy of SGT David W. Richards

Figure 8-52.—C-130 Hercules.

workhorse of the military services, capable of landing and taking off from short, rough dirt runways. It's a people and cargo hauler that's used in a wide variety of other roles, such as gunships, weather watchers, tankers, firefighters and aerial ambulances. There are more than 40 versions of the *Hercules*, and it is widely used by more than 50 nations.

T-45A GOSHAWK.—The T-45A *Goshawk* (fig. 8-53) is a tandem-seat, carrier capable, jet trainer. The T-45A aircraft is used for intermediate and advanced portions of the Navy/Marine Corps pilot training program for jet carrier aviation and tactical strike missions. There are two versions of T-45 aircraft currently in operational use at this time.

- The T-45A has an analog design cockpit.
- The T-45C is built around a new digital “glass cockpit” design.



Photograph courtesy of Bob Lawson, USN (Ret)

Figure 8-53.—T-45A Goshawk.

T-34C TURBOMENTOR.—The T-34C *Turbomentor* is an unpressurized two-seat, tandem cockpit low-wing turboprop trainer. The T-34C is used to provide primary flight training for student pilots attached to the Chief of Naval Air Training. As a secondary mission, approximately 10 percent of the aircraft provide pilot proficiency and other aircraft support services.

Student Notes:

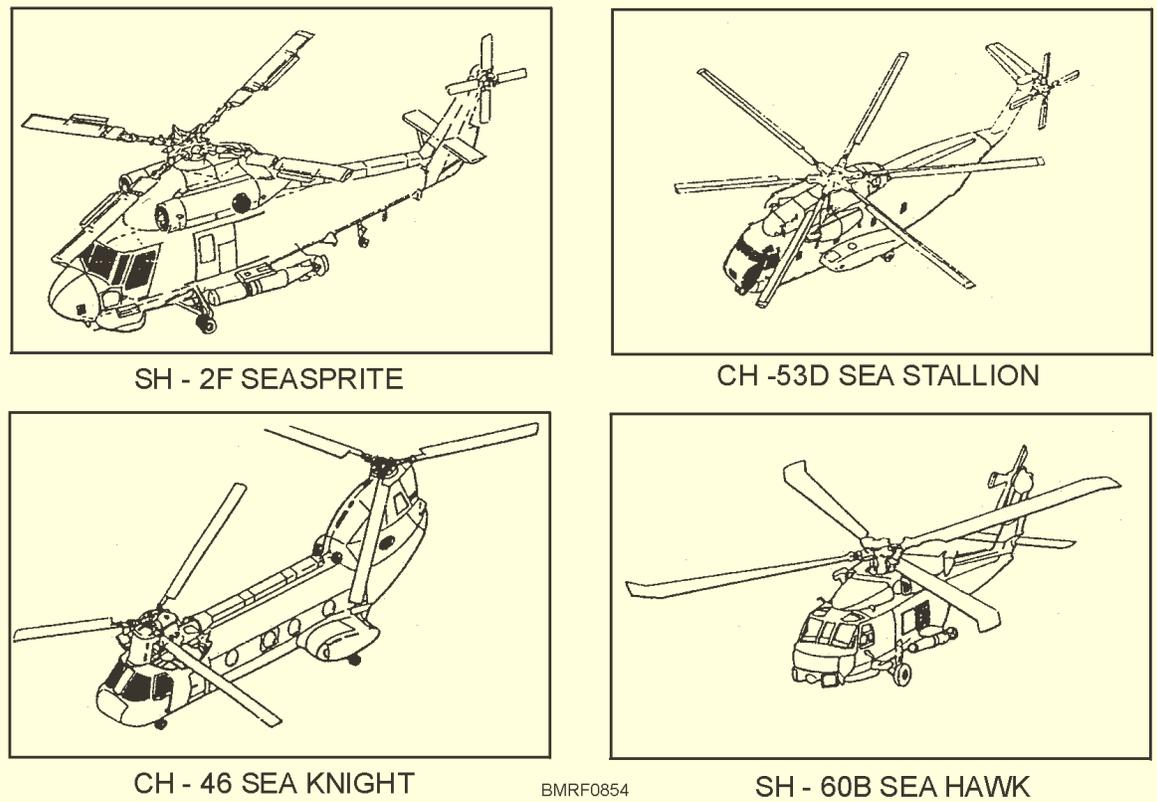


Figure 8-54.—Representative types of rotary-wing aircraft.

CURRENT ROTARY-WING NAVY AIRCRAFT

Since World War II, the helicopter has become an indispensable part of naval warfare. Its applications seem limitless—ASW; pilot rescue; transfer of supplies, mail, and personnel within dispersed forces; amphibious warfare; evacuation of wounded; counterinsurgency; minesweeping; and others. Figure 8-54 shows representative types of rotary-wing aircraft.

CH-46 *Sea Knight*

The *Sea Knight* (fig. 8-55) is a twin-turbine transport helicopter that provides the fleet with a day/night underway replenishment capability. It is used primarily for supply missions at sea and for casualty evacuation. Its carrying capacity is 25 troops, 15 litters and attendants, or 4,000 pounds of cargo. Rotor blades fold for shipboard use. The CH-46 is a small version of the Army's *Chinook*.



Photograph courtesy of PHAN Mahaya Jordan

Figure 8-55.—CH-46 *Sea Knight* transports ordnance from flight deck of the USS *Independence* (CV 62).

Student Notes:

SH-2 *Seasprite*

The *Seasprite* (fig. 8-56), an ex-utility helicopter, is now serving in the LAMPS (light airborne multipurpose system) program with the destroyer Navy.



Photograph courtesy of PH2(NAC) Jeff Viano

Figure 8-56.—SH-2 *Seasprite*

CH-53D *Sea Stallion*

The *Sea Stallion* (fig 8-57) tows and operates various mine countermeasure devices designed to detect and neutralize submerged naval mines. CH-53D squadrons are capable of rapid worldwide deployment.



Photograph courtesy of SSGT D.W. Mobley

Figure 8-57.—CH-53D *Sea Stallion* airlifts grain for Somalia.

SH-60B *Seahawk*

The *Seahawk* SH-60B (fig. 8-58) is placed aboard frigates and destroyers. The *Seahawk* is the airborne platform segment of the LAMPS Mk III weapons system. It can carry personnel as well as weapons to detect, localize, and destroy submarines at long range. It is designed to be in constant voice and data link contact with the ship's CIC. In addition to its primary mission of seeking and engaging submarines many miles from the ship, the *Seahawk* helicopter is able to provide targeting information for over-the-horizon, surface-to-surface missiles. The secondary mission of the *Seahawk* helicopter is search and rescue, medical evacuation, vertical replenishment, and communications relay.



Photograph courtesy of PH3 Anthony Haley

Figure 8-58.—SH-60B *Seahawk* aboard USS *Carney* (DDG 64) during VERTREP.

MH-53E *Sea Dragon*

The MH-53E (fig. 8-59) is used primarily for airborne mine countermeasures, with a secondary mission of shipboard delivery. The MH-53E *Sea Dragon* is heavier and has a greater fuel capacity than its ancestor, the CH-53E *Super Stallion*. MH-53s can operate from carriers and other warships. The *Sea Dragon* is capable of carrying up to 55 troops or a 16-ton payload 50 nautical miles or a 10-ton payload 500 nautical miles. The MH-53E is capable of towing a variety of mine-sweeping countermeasures systems, including the Mk 105 minesweeping sled, the ASQ-14

Student Notes:



Figure 8-59.—MH-53E *Sea Dragon*.

side-scan sonar, and the Mk 103 mechanical mine-sweeping system.

V-22A *Osprey*

The V-22 *Osprey* is a joint-service, multimission aircraft with vertical take-off and landing (VTOL) capability. It performs VTOL missions as effectively as a conventional helicopter while also having the long-range cruise abilities of a twin turboprop aircraft. The Marine Corps is the lead service in the development of the *Osprey*. The Marine Corps version, the MV-22A, will be an assault transport for troops, equipment and supplies, and will be capable of operating from ships or

from expeditionary airfields ashore. The Navy's HV-22A will provide combat search and rescue, delivery and retrieval of special warfare teams along with fleet logistic support transport. The Air Force CV-22A will conduct long-range special operations missions.

The *Osprey* is a tiltrotor aircraft with a 38-foot rotor system and engine/transmission nacelle mounted on each wing tip. It can operate as a helicopter when taking off and landing vertically. Once airborne, the nacelles rotate 90 degrees for horizontal flight, converting the V-22 to a high-speed, fuel-efficient turboprop airplane. The wing rotates for compact storage aboard ship. The first flight occurred in March 1989. The V-22 is the world's first production tiltrotor aircraft. Planned purchases include 360 for the Marine Corps, 48 for the Navy, and 50 for the Air Force.

TH-57 *Sea Ranger*

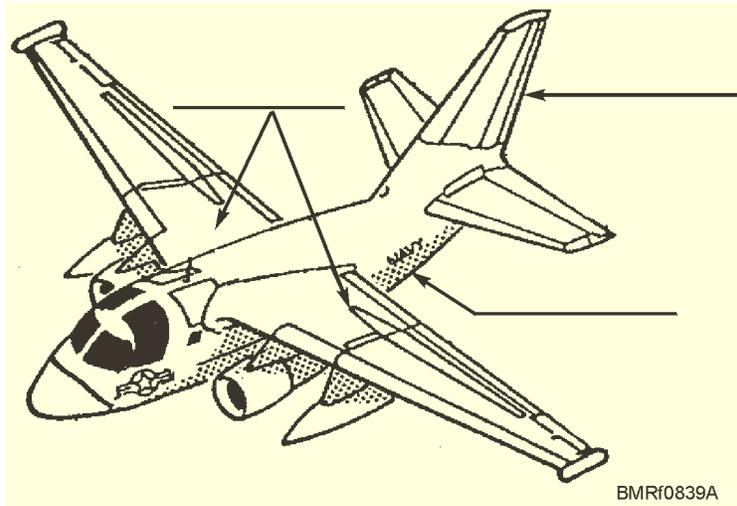
The TH-57 *Sea Ranger* is a derivative of the commercial Bell Jet Ranger 206. Although primarily used for training, these aircraft are also used for photo, chase, and utility missions. The Jet Ranger was initially designed to compete in a U.S. Army light observation helicopter competition. Bell lost that competition; but, the 206 was commercially successful. The TH-57 *Sea Ranger* provides advanced (IFR) training to several hundred aviation students a year at Naval Air Station Whiting Field in Milton, Florida.

Student Notes:

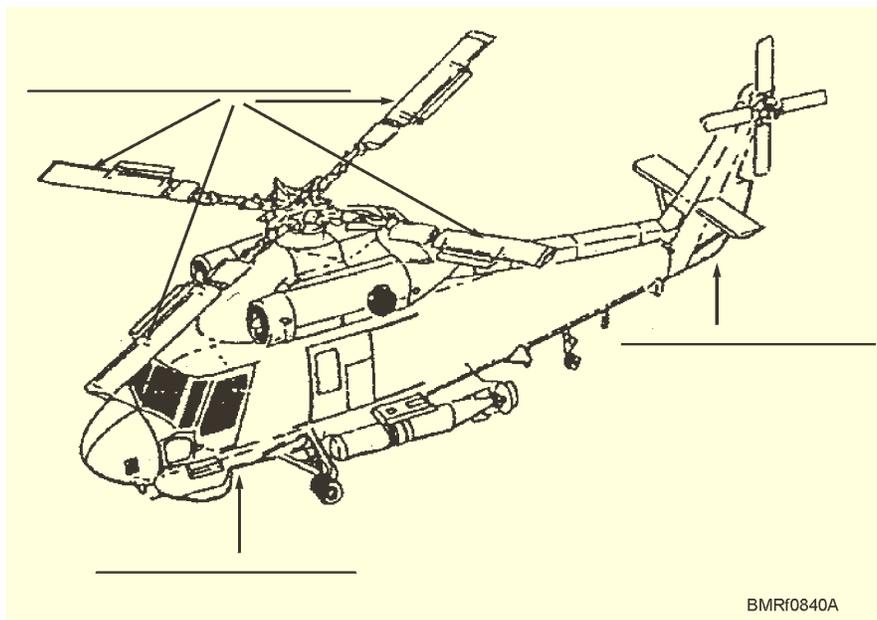
REVIEW 6 QUESTIONS

Q1. When did the Navy acquire its first aircraft?

Q2. Label the three basic parts of a fixed-wing aircraft.

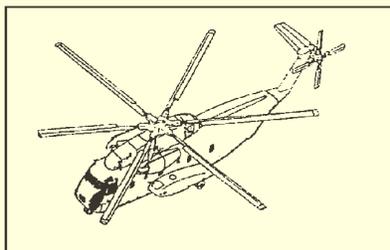
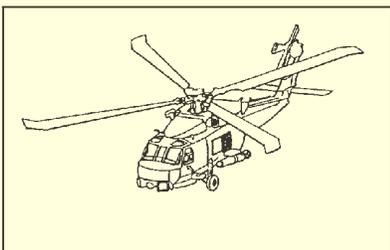
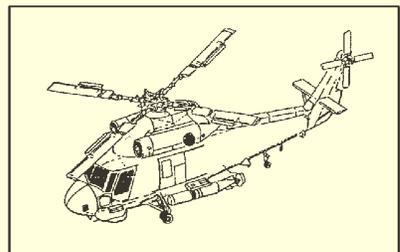
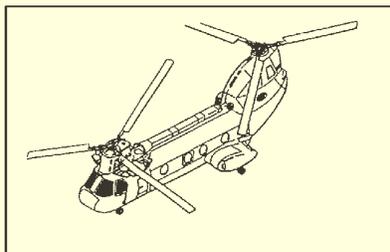
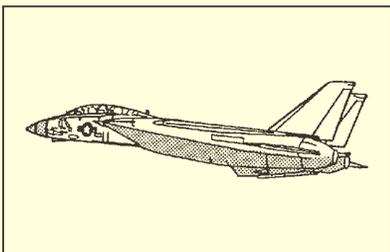
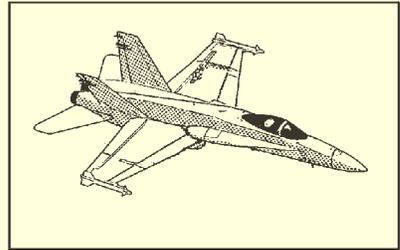
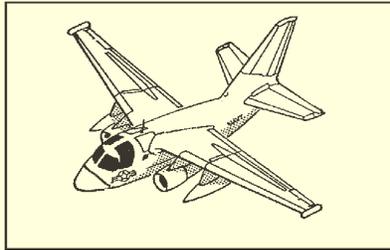
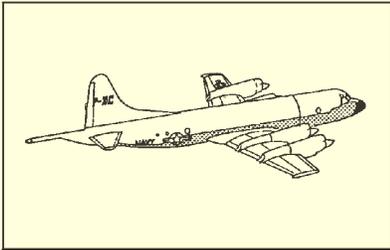
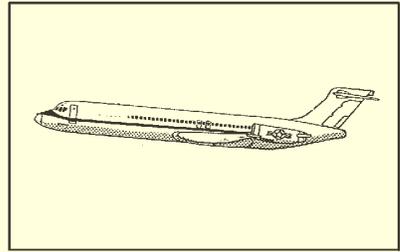
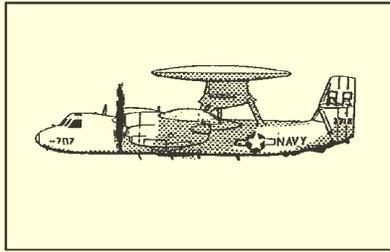
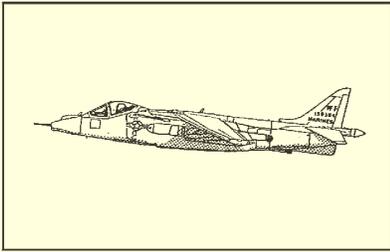


Q3. Label the three basic parts of a rotary-wing aircraft.



Q4. All aircraft have what type of designation?

Q5. Identify the following aircraft.



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Student Notes:

SUMMARY

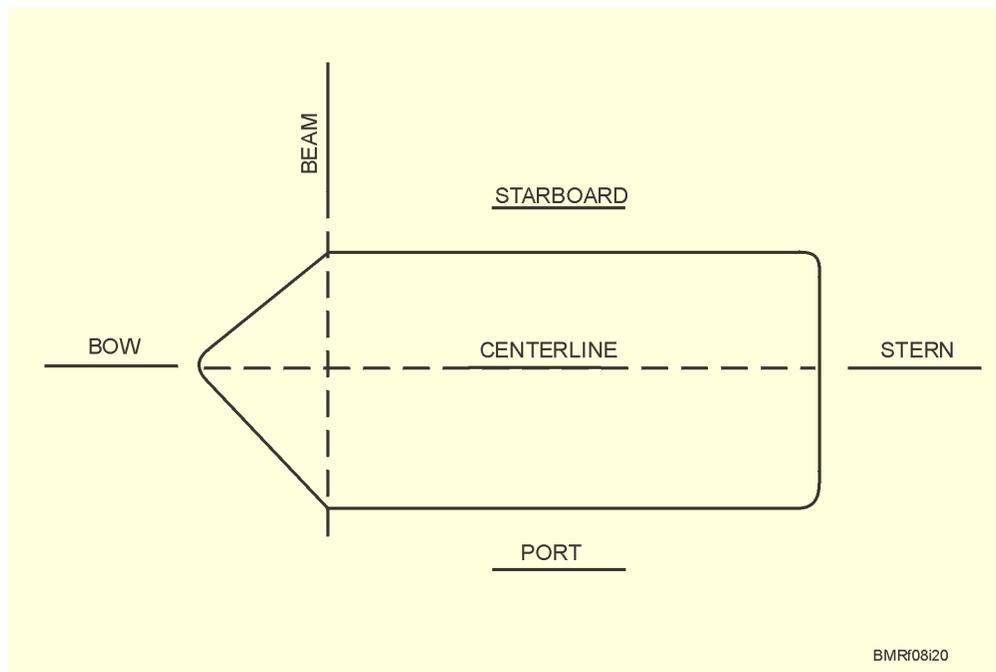
In today's world, the United States requires military power adequate to strengthen national security objectives. The United States Navy is an integral component of this nation's military forces. Freedom of the seas is not a gift; it must be won through naval presence or engagements. Naval forces provide our nation with the ability to provide a significant presence in crisis areas, or, if required, a rapid offensive capability.

The U.S. Navy has the ability to control enemy naval forces in three areas—air, surface, and subsurface. It can also conduct amphibious and mine warfare operations.

One of the most important aspects of naval warfare is the ability to provide supply and support operations. With the Navy's wide range of underway replenishment and supply ships, we can keep U.S. Navy battle groups under way in crisis areas for long periods of time. The most recent example of this ability is the Persian Gulf War. Today's Navy consists of a new generation of cruisers, destroyers, fighter and strike aircraft, high-speed amphibious assault ships, mine countermeasures ships, replenishment ships, submarines, and weapons systems. With these craft, vessels, and weapons systems, our nation employs the most modern and capable naval force in existence.

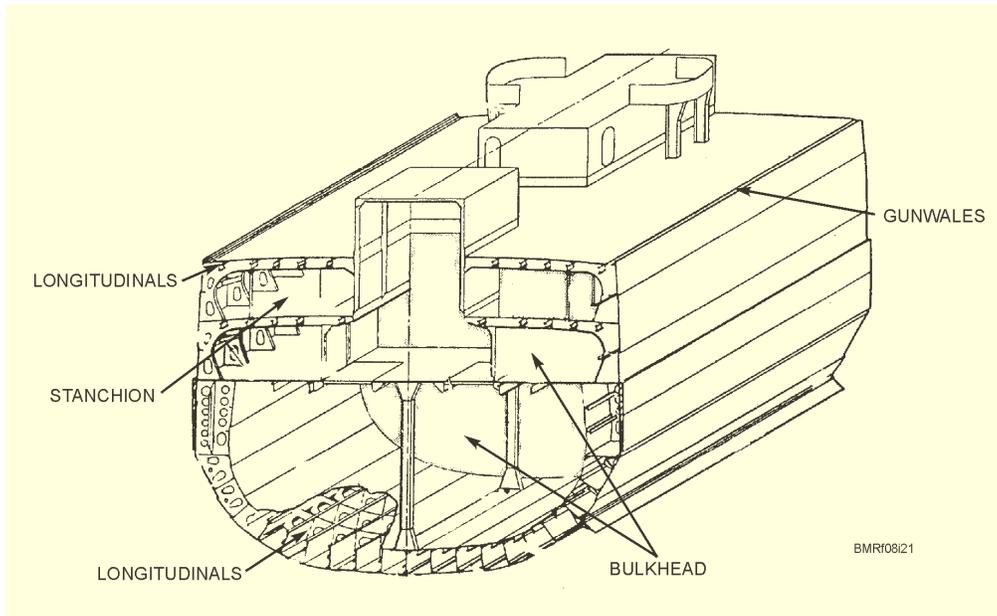
REVIEW 1 ANSWERS

A1. Ship's parts are labeled as shown.

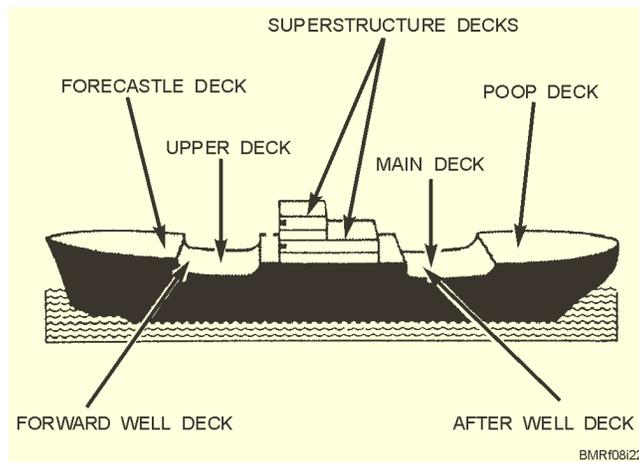


Student Notes:

A2. Some of the areas of a ship are labeled as shown.

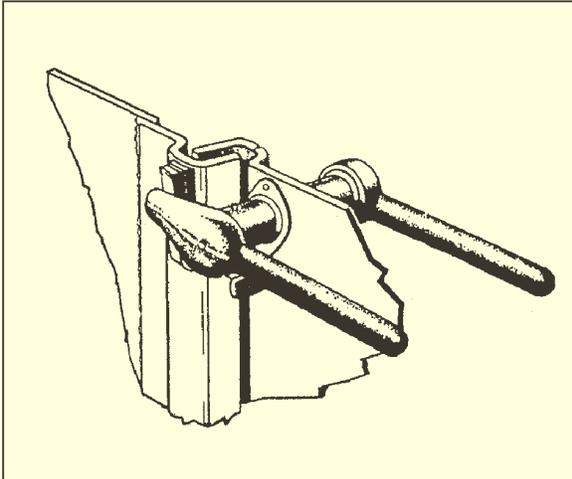


A3. Some of the decks of a ship are labeled as shown.

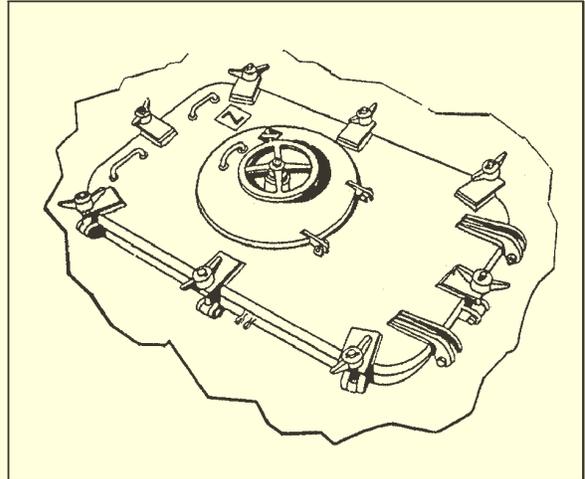


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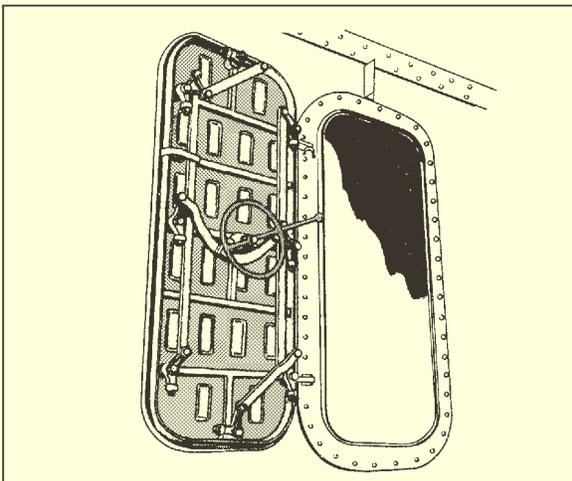
A4. Doors and hatches.



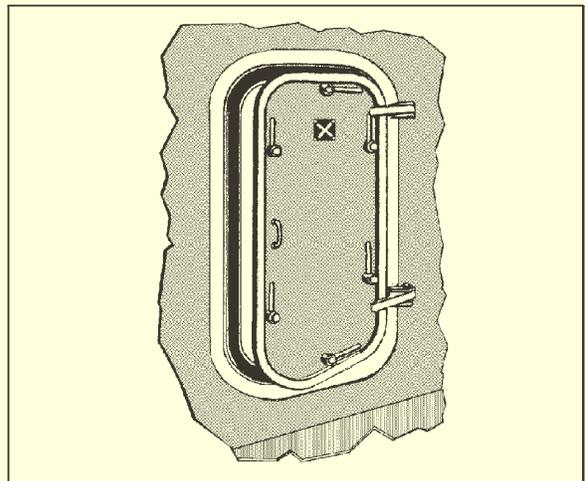
DOGS AND GASKET FOR WATERTIGHT DOOR



BOLTED HATCH WITH ESCAPE SCUTTLE



QUICK-ACTING WATERTIGHT DOOR



WATERTIGHT DOOR WITH INDIVIDUALLY OPERATED DOGS

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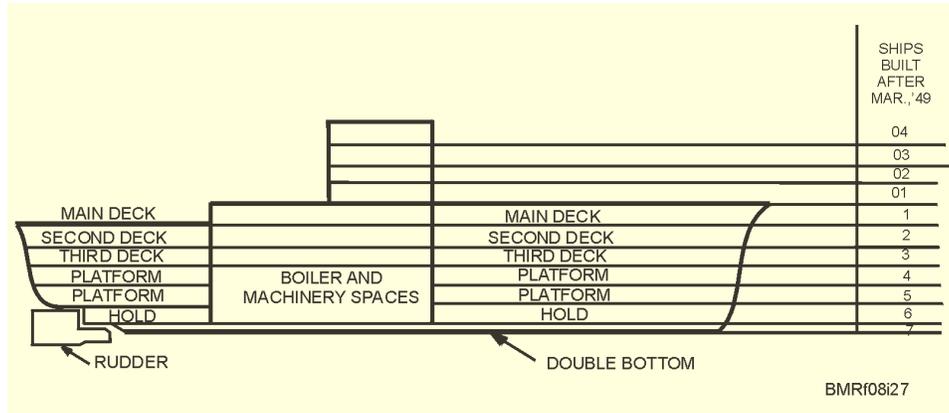
REVIEW 2 ANSWERS

A1. Compartment designation number 01-56-2-Q is identified as follows:

- 01— **Main deck**
- 56— **Frame number**
- 2— **First compartment on the portside**
- Q— **Miscellaneous or office space**

Student Notes:

A2. The following spaces of a ship are shown.



REVIEW 3 ANSWERS

- A1. The size of a ship is usually given as **displacement in long tons**.
- A2. A ship's armor is **the protective armor along the sides of the ship, on the deck, and on some gun mounts and turrets**.
- A3. The term used to indicate the speed of a ship is the **knot, which is 1 nautical mile per hour or about 1 1/8 statute miles per hour**.

REVIEW 4 ANSWERS

- A1. The four categories of ships are—
- Auxiliary ships**
 - Combatant craft**
 - Combatant ships**
 - Support craft**
- A2. The categories of warships include—
- Aircraft carriers**
 - Battleships**
 - Cruisers**
 - Destroyers**
 - Frigates**
 - Submarines**
- A3. The battleships are named after **states**.
- A4. The two basic classes of cruisers are—
- Guided-missile cruisers (CG)**
 - Guided-missile cruisers nuclear (CGN)**
- A5. For protection, the destroyer depends on its **speed and mobility**.
- A6. The class of ship developed for the purpose of open ocean escort and patrol was the **frigates**.
- A7. The two classes of submarines are the—
- Attack submarine**, and the
 - Ballistic missile submarine**
- A8. The class of ship used to land large numbers of personnel, equipment, and supplies on enemy held territory is the **amphibious war ship**.

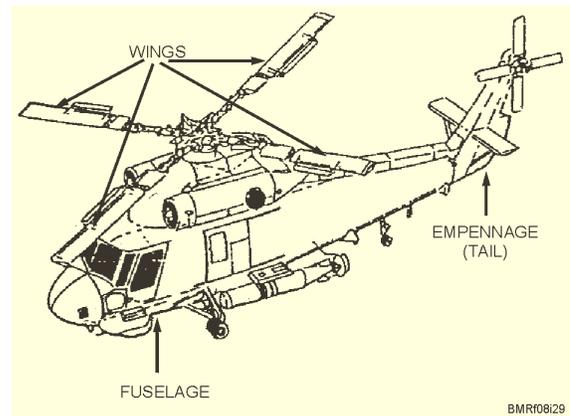
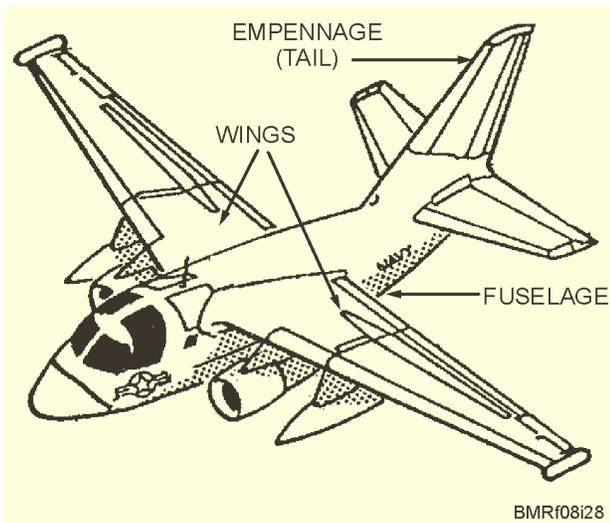
Student Notes:

REVIEW 5 ANSWERS

- A1. The term used to describe the transfer of fuel and supplies between ships while under way is **replenishment at sea**.
- A2. Usually, ships maintain a distance of **100 feet** while taking on supplies at sea.
- A3. A receiving ship can stay on station in combat formation while undergoing **vertical replenishment**.
- A4. The largest and most powerful auxiliary ship is the **fast combat support ship (AOE)**.
- A5. Rescue, salvage, and towing ships provide **rapid firefighting, dewatering, battle damage repair, and rescue towing assistance**.
- A6. Support craft designators usually start with the letter **Y**.

REVIEW 6 ANSWERS

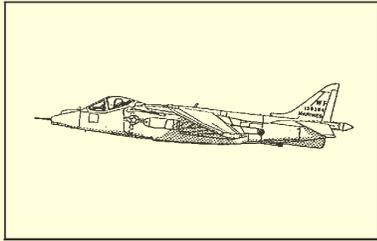
- A1. The Navy acquired its first aircraft in **1911**.
- A2. The three basic parts of a fixed-wing aircraft are shown below.
- A3. The three basic parts of a rotary-wing aircraft are shown below



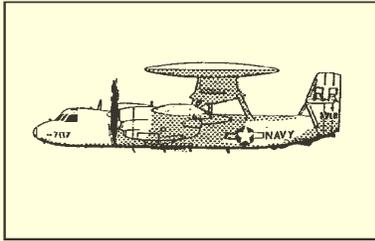
- A4. All aircraft have **tri-service designations**.

Student Notes:

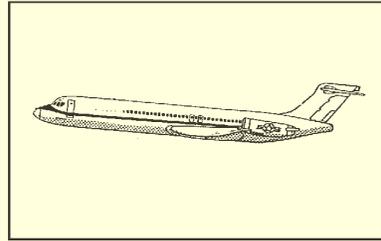
A5. Aircraft identification.



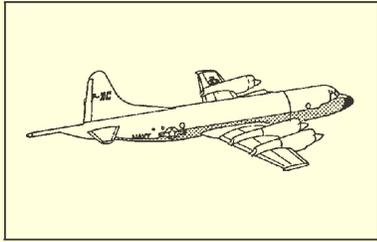
AV-8B HARRIER



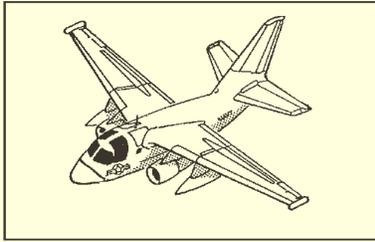
E-2C HAWKEYE



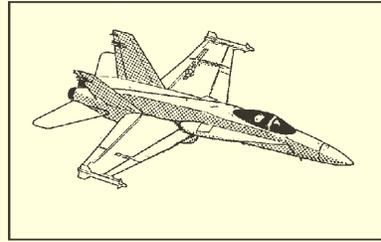
C-9 SKYTRAIN



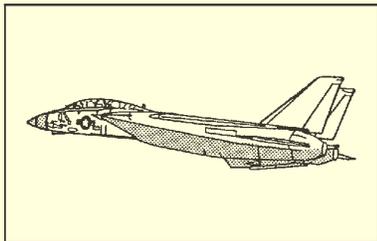
P-3 ORION



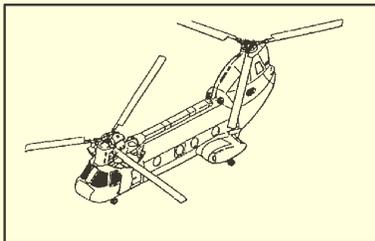
S-3 VIKING



F/A-18 HORNET



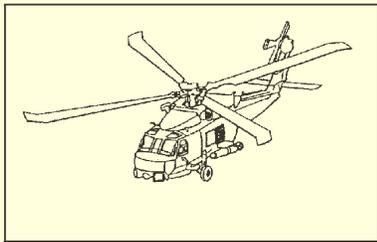
F-14 TOMCAT



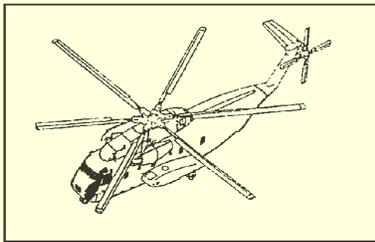
CH-46 SEA KNIGHT



SH-2F SEASPRITE



SH-60B SEA HAWK



CH-53D SEA STALLION

BMR0841A

Student Notes: