INTRODUCTION

The ARS-50 (SAFEGUARD) Class Ships are a new class of ship which combines a proven hull with state-of-the-art machinery and equipment. The ship is designed to perform combat salvage, lifting, emergency repair, and rescue towing of combatant and support ships. It is equipped with sufficient on board equipment and Navy personnel to perform a broad contingency of salvage tasks, from a position of forward deployment, without the benefit of air lifted equipment or outside support. These tasks include: Ocean towing, diving, off-ship fire fighting, deep mooring, heavy lift, ocean engineering and salvage of a stranded vessel. Salvage of a stranded vessel may include patching, shoring and emergency repair, de-watering and retraction using beach gear. The four ships within the program are being constructed by Peterson Builders, Inc. of Sturgeon Bay, Wisconsin under the direction of, and using a design developed by, the Naval Sea Systems Command.

TOWING

Each ship is powered by four Caterpillar D-399 diesels driving through two reduction gears and shafts, turning controllable, reversible propellers (CRP's) in KORT nozzles. Developing 120,000 pounds of bollard pull, the SAFEGUARD Class is equipped with two 2-1/4 inch wire tow hawsers on Almon A. Johnson series 322 double drum automatic tow machines. The Class is also equipped with an Almon Johnson series 400 traction machine for use with fiber hawsers. The tow machines use DC electricity which is converted from the 60 HZ ships' service system by motor-generator sets. The 60 HZ power is supplied by one of the three Caterpillar D-399 ship service diesel generators. Some of the ancillary features installed on the ships to optimize towing are highlighted within Figure 1.

The ARS-50 Class was specifically designed for the rescue towing of any type of vessel which is unable to propel itself. Rescue towing entails the hook-up of the tow, at sea in inclement weather situations, where there exists a requirement for exerting high bollard pulls at short stay. The equipment installed to accomplish the towing task includes the double drum automatic towing machine, the two tow wires, a lateral control winch, wire rope fairleads, two tow bows and four retractable tow rollers. The towing machine provides stowage and handles the tow wire during hook-up operations. It also protects the tow wire from breaking by automatically limiting tow wire tension to a preselected value during towing operations. The tow wire provides the means of connecting the tow to the ARS with sufficient strength to accomplish the task. The remainder of the equipment is provided to enable the ship to pivot the main tow wire about the tow fairleads for high maneuverability and to restrict the tow wire sweep during special situations. The Fairleads, lateral control winch and the four retractable tow rollers are used to control and restrict the tow wire movement as desired or required. The portable tow bows provide a bulwark-to-bulwark surface for the sweeping tow wire to ride, thus avoiding fouling or chafing on capstans, bitts, hatches, and other deck fittings. The tow bows also provide a haven for the crew to work the aft deck in relative safety. The fairleads act as a pivot point on the ship on which the tow wire can bear. They absorb all athwartship loads from the tow wire forward of the fairlead, and thus prevent side loading on the tow machine's level wind device. The lateral control winch provides an automatic tensioning device that restrains the tow wire in the stern rollers, as well as being used to retrieve the slack wire during harbor

Figure 1. ARS-50 CLASS SALVAGE SHIP ARRANGEMENT DETAILS

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maneuvering. This action will keep the wire rope out of the ship's screws. The pair of retractable tow rollers on the transom, and the two single rollers (one port and one starboard) on the bulwarks, act as limits to the sweeping tow wire arc. Any one or combination of these equipments may be used to ensure a safe and efficient tow operation.

The towing machine is an Almon A. Johnson Series "322" winch, automatic towing double drum, automatic handling machine combined with a Model "400" traction winch. The wire rope towing drums and the synthetic hawser traction heads, with their respective electro-mechanical drive and wire drum spooling devices, are located in a towing machinery room on the main deck at frame 7B. Tow power units, controls, mechanical drum brakes and mechanical clutches constitute the remainder of the towing machine components. Each wire rope towing drum and the traction heads may be operated either automatically or manually, and may be shifted from the manual to automatic mode without loss of power or control. The Main Deck Remote Control Station, known as the COOP, has manual and automatic mode controls for the wire rope drums and traction machine.

When emergency towing or performing other operations using fiber hawsers, power blocks and a rope transport tray facilitate handling of these lines from stowage bins to the traction machine. The MARCO power block consists of a 30 inch diameter sheave which has a 16-1/4 inch diameter throat. The sheave is driven by a hydraulic motor mounted on its shaft. A pressure roller receives the line from the rope scuttle and keeps the line in the sheave by applying an adjustable, preset tension. After the line passes over the sheave, it proceeds to the rope transport tray. The power block hydraulic motor is driven by a hydraulic power unit located in the Steering Gear Room.

A lateral control winch, located within the lazarette, provides the ability to dynamically restrain, direct and retrieve the main tow wire. This winch is equipped with 250 feet of 1/2 inch diameter wire rope. The bitter end of the wire rope is fitted with a galvanized guy line sleeve which is large enough to pass and ride the main tow wire. A snatch block and padeye are located on the fantail in such a way that the lateral control wire and the tow wire may sweep the fantail with minimum obstruction. The lateral control winch is capable of paying in and out against a line pull of 2,000 pounds at 60 feet per minute and a light line speed of 120 feet per minute at the average layer. The winch will not be damaged when it is overhauled by the main tow wire. The motor brake will hold 4,000 pounds at the average layer.

The lateral control winch is powered by the same hydraulic power unit that powers the power blocks and the retractable tow rollers. The lateral control winch is controlled from the Main Deck Remote Control Station.

The retractable tow pins are controlled from the Main Deck Remote Control Station and each pin can be raised or lowered independently. A pair of automatic retractable rollers is located on the centerline at the transom. Two single automatic retractable rollers are located at Frame 99 port and starboard bulwarks. The retractable tow rollers (see Figure 1) replace the two pairs of Norman pins found on older Navy ARS ships and serve to restrain the sweep of the tow wire. They can also be used to trap the tow wire at the stern. The tow pins rotate and act as fairleads as they restrain the wire. Each roller is raised and lowered by means of a hydraulic cylinder, linkage, and trunnion mechanism. The rollers are 38 inches in outside diameter and extend 3 feet above the caprail. The tow roller cylinder circuit is designed to automatically and fully retract the tow roller when the wire rope exerts a 50,000 pound side load at mid-height of the extended roller. Once the tow roller has been automatically retracted, either by the lower control or by the tow wire load, the raise button must be actuated to raise the tow roller.

DIVER'S LIFE SUPPORT SYSTEM (DLSS)

Any salvage or ocean engineering operation may require the use of divers to survey the site of a grounding, make an underwater hull or equipment inspection and repairs, make underwater connections to equipment in preparation for raising, effect underwater repairs or other underwater tasks. The ARS-50 Class ships will carry a complement of divers in conjunction with the DLSS that enable the ships to perform diving tasks with either of two tethered diving systems or SCUBA. The tethered systems are the MK-1 Lightweight Diving System and the MK-12 Surface Supported Dive System, with a floor of 190 feet seawater (FSW). SCUBA is limited to dives of 60 FSW. The tethered diving systems are supported from the DLSS by an umbilical bundle consisting of an air hose, communications cable, and a strength member. The breathing medium is air supplied from two 300 psi compressors through 100 cubic foot receivers, filters, valving and piping, or through a 3000 psi air flask bank to the Surface Supported Diver Consoles (SSDC). The divers are transported to and from their work site either on a diving stage or in an Open Diving Bell, both of which are handled by the powered diving davits. The ARS-50 Class ship also has a double lock recompression chamber to treat decompression sickness or to provide a surface decompression.

OFF-SHIP FIRE FIGHTING

The ARS-50 Class ship can fight fires on other ships and on pier structures with either seawater or Aqueous Film Forming Foam (AFFF). These can be delivered to the fire by two fixed fire monitors located on top of the 04 level, or through hoses connected to the off-ship manifolds on the main deck aft and the 01 level forward. Additionally, seawater and AFFF are piped to a valve manifolds located on the 01 level at Frame 1. The portable fire monitor can be secured to this flange to provide additional off-ship capability. The system is supplied by four 1000 gallon per minute, 150 psi pumps located in the machinery spaces. These pumps can also be placed in series during salvage operations to supply 300 psi to either the monitors or the fire fighting manifold on the main deck starboard side.

The ARS-50 Class ship has two fixed monitors and a portable monitor. The two fixed monitors are located on the centerline of the 04 level at Frames 44 and 61. The portable monitor mounts to a flange located on Frame 1, 01 level. The portable monitor inlet valve and the monitor's deck flange connection are covered with a blank flange when the monitor is stowed in the Boatman Storeroom. The three monitors are shown in Figure 1.

HEAVY LIFT

The ARS-50 Class ship is equipped with a heavy lift system used to supply the external lift force required to salvage a sunken vessel. Parbuckling of capsized vessels and sawing of broken ships are other operations performed with the heavy lift system.


The heavy lift system is made up of bow and stern rollers, deck machinery and tackle (see Figure 2). The rollers provide a low friction fairlead for the lift lines. The deck machinery and tackle supply the required hauling force of up to 150 tons, 75 tons to each lift line, to make the lift. The two main bow rollers or the two stern rollers, each carrying half of the load, are used to accomplish lifts to 150 tons. The two auxiliary bow rollers, each carrying one half of the load, are used for lifts up to 75 tons as well as sawing and parbuckling. Any lift may be accomplished at depths up to 190 feet with the salvage equipment on board.

Figure 2. STERN ROLLERS AND NORMAN PINS

The aft capstans, forward anchor capstan windlasses, hydraulic pullers, and towing machines are used to provide the primary force for making a lift. A nine part 5/8 inch wire rope purchase tackle, a nine part 7/8 inch wire rope purchase tackle, or a 1-5/8 inch wire rope fairlead block are used to multiply the capstans' or pullers' primary force to lift up to 150 tons.

The lift lines for a 150 ton lift are 2-1/2 inch diameter wire rope. The 1-5/8 inch wire rope can be used for 75 ton lifts. A carpenter stopper is used to connect each 5/8 inch or 7/8 inch nine part purchase tackle or the 1-5/8 inch fairlead block to the 2-1/2 inch wire rope lift line.

BEACH GEAR

A ship aground is restrained by weight and lost buoyancy. If unable to free itself, it is stranded. Beach gear is a tool used to provide the force necessary to free the stranded vessel. The ARS-50 Class carries six complete legs of beach gear consisting of STATO anchor, chain, 1-5/8 inch wire rope, buoys, purchase tackle and hydraulic pullers.

The additional pulling force acquired with beach gear is provided by either a nine part tackle or a hydraulic puller system heaving on the beach gear ground legs. The hydraulic puller system is easily rigged, requires little deck space for operation and never requires fleeting out during operation as does the nine part purchase tackle. The ARS-50 Class ships carry two hydraulic puller systems. A hydraulic puller system consists of two pullers, two control consoles, a power unit and the necessary hoses to connect them. The installed system's power source is located in the Forward Generator Room with the hydraulic lines hard piped to the O2 level for the pullers and control unit.

SALVAGE SUPPORT AND HANDLING

The ARS-50 Class ship can provide extensive salvage support to a disabled vessel through the use of the assortment of pumps, generators, welding units and compressors carried aboard. In addition, shoring and piping materials are also carried. Experienced personnel utilizing the Machine Shop and Salvage Shop are capable of fabricating the necessary temporary patches and shoring to restore a disabled vessel's seaworthiness. The salvage handling system, consisting of the forward and aft booms, is used to remove this equipment and material from the stowed position and shift them to the main deck for use when alongside, or to the workboats for transport.

The boom systems provide the capability of loading/offloading the ship from a pier or another ship alongside, moving equipment on board, striking below and breaking out salvage equipment, plumbing the hold of a disabled vessel to increase its buoyancy, and launching/recovering deck loaded boats. In addition, the forward kingpost is equipped to receive the following Replenishment At Sea (RAS) rigs: Standard Tensioned Replenishment Alongside Method (STREAM) using a Standard Underway Replenishment Fixture (SURF), STREAM (with manila outhaul), housefall and Manila Highline.

Each handling system consists of a kingpost, boom and vang posts, topping tackle, vang tackle and hoisting winches. The topping tackle and vang tackle are interconnected to provide a compensating rig. The rig adjusts for the difference in vang tackle length port and starboard, thereby permitting simultaneous tending of both vang tackle and topping tackle. The arrangement of the vang, topping and compensating purchases insures a proper load balance at the compensating rig so as to maintain boom stability and smooth operation throughout the boom operating range.

Six winches, three per boom, provide power for slewling, topping, and hoisting. Each winch consists of a reversible drive electric motor, gear reduction, automatic fail safe brake, grooved wire rope drum, level spooling device, geared limit switch, and accessories necessary for operating.

Each boom is controlled from a portable control unit consisting of a chest harness, two joy-stick control levers and an emergency run switch on a control box with a dead man feature. The control unit permits simultaneous operation of the topping and vang winches with one lever and the hoisting winch with the other lever. The control unit cable is sufficient in length to permit the operation of the boom at the port or starboard bulwark at each boom location. A back-up control unit with chest harness is supplied for each boom. Figure 3 depicts the aft boom arrangement and the compensating rig.

1080
Summary

The SAFEGUARD Class has long been needed by the Fleet to improve the Navy's salvage posture. Its missions are similar to the ARS' in the Fleet today; however, the Class' capability is improved to reflect the advances in the state-of-the-art as well as the changes in the make-up of the fleet. The ARS has always been a workhorse. It is anticipated that the SAFEGUARD Class will continue in that tradition; she will tow harder, dive more safely, and salvage more towage than the ship types before her.