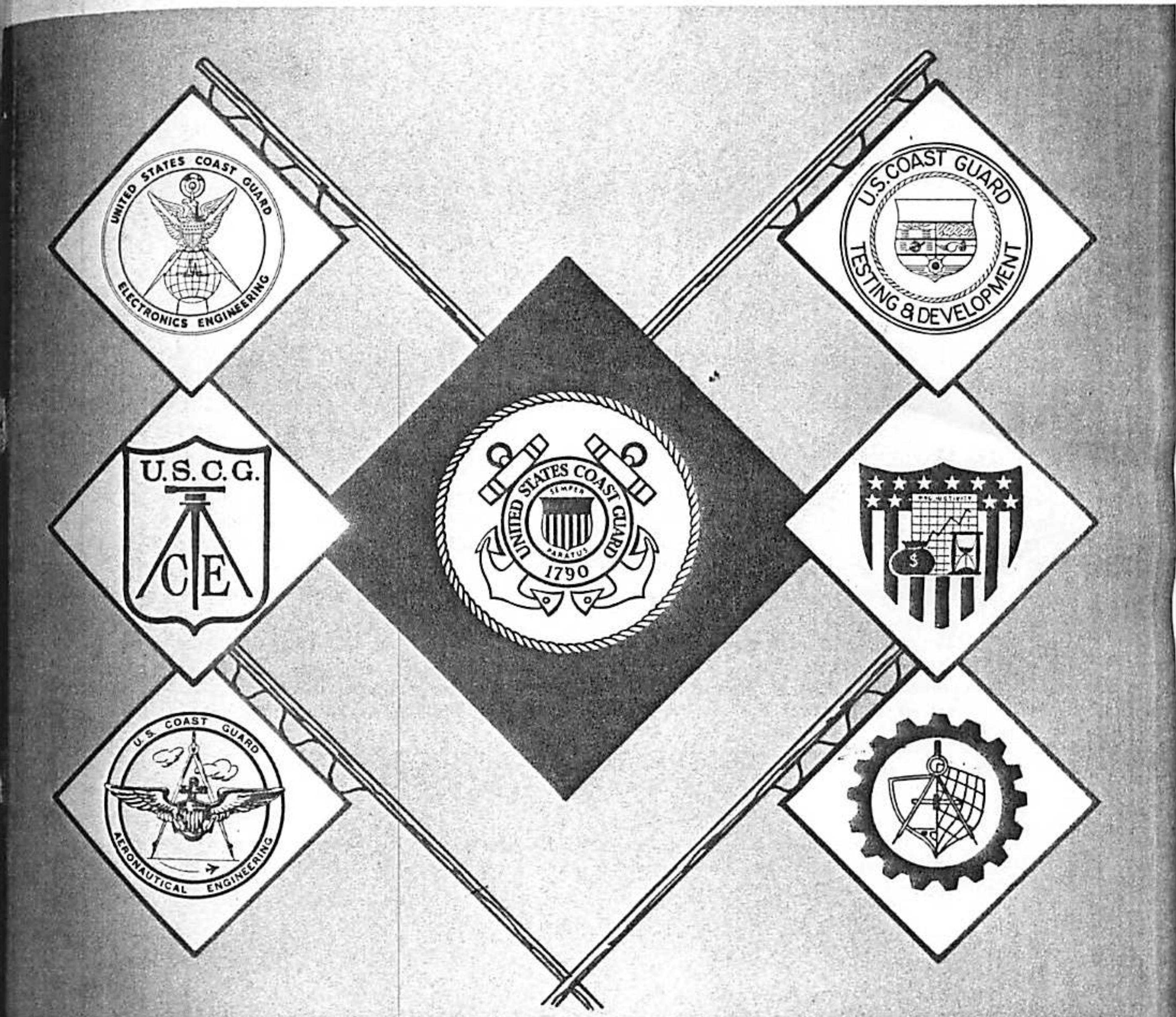
The ENGINEER'S Digest



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NAVAL ENGINEERING

The 82-Foot Class Patrol Boat

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Over 200 of the familiar 83-foot patrol boats were built during World War II for a variety of coastal patrol and invasion support activities. For approximately 20 years these wooden-hulled, gasoline-powered boats have been the backbone of the Coast Guard's search and rescue patrol boat fleet. During the past year the 83-footers have been relinquishing their search and rescue/law enforcement duties to new steel-hulled, diesel-powered, 82-foot patrol boats.

Although the 82-footers have only been in production for a little over a year, the story of the design begins approximately ten years ago. Early in the 1950's, the 95-foot patrol boat design was developed. Initially, the 95-footer was intended as a search and rescue patrol boat which would eventually replace most 83-footers. With the outbreak of hostilities in Korea and the expansion of port security activities, however, additional capabilites were incorporated and the A and B class 95-footers were deployed as harbor entrance patrol vessels and replacement of 83-footers was deferred.

By 1957 a number of 83-footers were suffering from advanced material deterioration and replacement was urgently required. Two solutions were proposed: complete structural rehabilitation and dieselization of the 83-footers; or construction of an austerity model 95-footer. In the latter case, the existing 95-footer design would be utilized but range, speed and other capabilities would be reduced by elimination of two main engines and other equipment not required for search and rescue and routine law enforcement duties.

Careful analysis of both proposals did not justify adoption of either and the C-Class 95-footer design and construction followed. Foreseeing the neeed for replacement of all 83-footers, the design of a patrol boat specifically intended for search and rescue and the traditional phases of law enforcement was resumed. The product of that project is the 82-footer.

Structurally the 82-footer is very similar to the 95-footer. The shell plating is 3/16-inch black steel, longitudinally framed with five watertight bulkheads and eight web frames for transverse stiffening. The deckhouse and mast are aluminum. Also, the basic hull form is a ⅞ copy of the 95-footer.

The significant differences between the 82-footer and its predecessors, however, are: an arrangement tailored for streamlining operations, vessel habitability, and utilization of up-to-date materials and construction practices.

Operationally the boat is arranged for centralized control of nearly all phases of operation. Beginning with the pilot house, all communications, navigation, steering, and propulsion controls are assembled in an operator's console. A seat is provided for the operator. In addition to the above equipment, the searchlight and interior communication controls are all within reach of the seated operator. Further, the operator is afforded nearly unobstructed visibility around the entire horizon. For rescue and docking operations during darkness, sealed beam lights are recessed in the hull to provide peripheral lighting close to the vessel.

Aft of the deckhouse, permanent obstructions are minimized. This was achieved by installing main engine and auxiliary generator exhausts through the transom and utilizing the kingpost for the heating boiler exhaust. The primary towing bitt is installed on the kingpost. This permits nearly unlimited maneuverability even with a heavy tow. An alternate bitt is welded to the deck further aft for light tows. Both bitts, however, are designed for the breaking strength of a 4-inch nylon towing hawser.

A 16-foot outboard motor boat is launched and recovered by a light boom. Initially a suitable electric hoist was not available for boat hoisting. Later boats, however, have been equipped with a hoister capable of lifting the boat from the water to close up on the boom in approximately 13 seconds. The hoisters are now being installed on all boats by Boat Alteration.

Other main deck mounted equipment includes portable fire and salvage pumps with associated hoses, life raft stowage, and a 20-mm gun tripod forward. Such equipment as portable boarding ladders, litters, a reel for the towing hawser, and the 20-mm barrel and operating mechanism are stowed in the after cargo hold out of the weather. Since the gun was installed for training and the relatively rare requirement for an armed law enforcement vessel, the ammunition storage and ready box were also relocated from the main deck to the stateroom of the officer-in-charge.

Access to all living and engineering spaces is through a weathertight door on the after side of the deckhouse. The stateroom for the officer-in-charge and the engineer are on the main deck immediately below the pilot house. An athwartships passageway on the main deck includes access to this space as well as to ladders down to the machinery and messing spaces and an emergency access to the pilot house. When proceeding down and forward one passes through the messing space. The galley compartment includes an electric range, combination refrigerator/freezer, the messing space, and berthing for two men. Forward of the messing space is the crew's berthing compartment and finally the crew's head.

All living spaces are temperature conditioned by individual heating/cooling units through which hot or chilled water, depending upon the season, is circulated from the machinery space. Noticeably absent are the noise and drafts of conventional air ventilating systems since only a nominal amount of fresh air is supplied to the heating/cooling units which control air temperature primarily by recirculation of compartment air.

Insofar as possible, all piping and wiring is consolidated into runs in the void spaces at the overhead on either side of the vessel. This removes the traditional maze of piping and wiring from overhead. Also, all living spaces are completely insulated and covered with aluminum sheathing to improve appearance, deaden sound and reduce the number of areas where dust and dirt can settle on flanges of structural members.

Deep fuel tanks insulate machinery space noise from living spaces. Also to minimize excitation of hull vibrations by machinery, all major machinery components are mounted on vibration isolators. Recent tests established that removal of the main engine vibration isolators

Figure 1.

Figure 2.

would increase broad band noise levels in living and control spaces approximately 10 decibels.

The machinery arrangement was developed with the concept that the space is not ordinarily attended. Once preparations to get underway are complete, all equipment is either automatic or operated from the pilot house except for the fire and bilge pumps.

The 82-footer is propelled by two hydraulically started, 600-horsepower diesel engines. Although the propeller shafts rotate in opposite directions, both engines are identical including their direction of rotation. The latter feature was adopted to simplify engine parts support. The reverse-reduction gears, in addition to providing opposite shaft rotation, also provide for clutch slippage permitting operation of the vessel at speeds as low as 3 knots.

Since "in place" main engine overhauls would be hindered by space restrictions, bolted deck plates are provided over each engine. Spare propulsion units can be readily installed in place of units requiring major repairs or overhaul.

Two 20-kw, 440-volt, alternating-current, auxiliary generators furnish ship's power. One generator will carry the load for any vessel evolution. Also, in the event of power failure an alternate battery circuit supplies power for navigation lights, the steering booster system automatically reverts to manual, and main engine controls are independent of auxiliary power. Therefore, vessel operations can continue practically uninterrupted by total power failure.

Where possible, simplified systems and new materials have been utilized. During various stages of construction epoxy or polysulfide coatings or compounds are applied to all bilge areas and between dissimilar metals in exterior locations. Also, insulmastic, a cork filled mastic, is applied as an antisweat, preservative coating in other than living or machinery spaces. The bilge suction system is non-corroding polyvinylchloride piping. In addition, unicellular insulation has been used on ventilation ducting and, on later boats, also on the piping systems.

In general, where there was a choice between small boat and ship practice, small boat practice was followed in installation of equipment. Typical examples are: the absence of dual or alternate service systems, the substitution of circuit breaker panels for sophisticated switchboards, and the use of only a minimum number of closures to place the boat in a state of maximum material readiness.

Currently, forty-one 82-footers are in operation or authorized for construction, and are divided into three contract groups, designated A-, B-, and C-class, respectively. The principal characteristics shown in Table 1 are applicable to the A- and B-class boats, CG-82301 through CG-82331 except CG-82314 and CG-82318. Differences between A- and B-class boats are largely limited to installation details, the major differences being the relocation of the fresh-water tank.

The CG-82314 is equipped with two 1000-horsepower gas turbine propulsion units with controllable pitch propellers in lieu of the

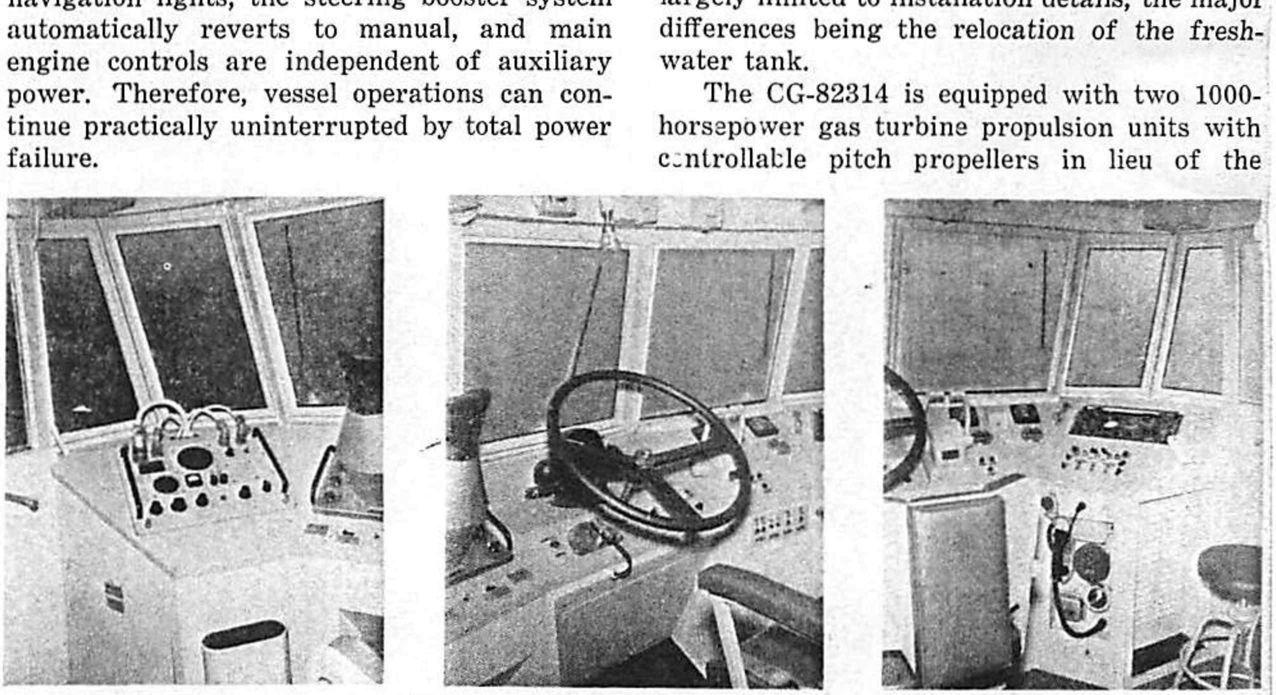

Figure 3. The operator's console in the wheelhouse.

Table 1. Principal Characteristics.

Length—overall	82′ 10″
Length—load waterline	78′ 0″
Beam—moulded at midship	17′ 7″
Depth—moulded at midship	13′ ½″
Displacement	
Full load	67.5 tons
Light load	57.8 tons
Draft—full load	
Forward	3′ 7″
Aft	5′ 11″
Horsepower—shaft	1,200
Propellors (2)—5 bladed	42″ x 42″
Speed vs range	
Maximum—17 knots	430 miles
Sustained—15 knots	540 miles
Economical—12 knots	1,000 miles
Fuel capacity	1,840 gal
Water capacity	1,340 gal
Accomodations	10
Crew	8

diesel units. Maximum and sustained speed of the CG-82314 is 26 knots. The purpose of the gas turbine installation in this boat is to gain installation and operating experience with the propulsion equipment for direct application to other vessel designs.

The CG-82318 is equipped with two 800-horsepower diesel propulsion units recently offered for marine use. Maximum and sustained speeds of the CG-82318 are 23 and 20 knots, respectively.

The C-class 82-footers, CG-82332 through CG-82341, will include the 800-horsepower diesel engines as well as numerous other minor changes to reduce maintenance or improve performance.

Both the CG-82314 and the CG-82318 are equipped with impressed current hull protection systems in lieu of the conventional zinc anodes. As with the gas turbines, these systems are being evaluated for future use of other vessels. Further use on 82-footers is not contemplated at this time.

To conclude, the 82-footers are not only replacing the aged and obsolescent 83-footers, but are representative of a modern trend: greater vessel capability with reduced personnel. The A- and B-class 82-footers are somewhat faster than their predecessors and the C-class boats will be the first diesel-powered patrol boat capable of sustained cruising at 20 knots.

Hydrostatic Test Tool for GM-268-A Diesel Engines

A tool developed aboard the CGC ROCKAWAY is used to hydrostatically test GM-268-A cylinder liner seals. The tool fits over the top of the cylinder liner making a watertight fit possible without the necessity of installing the piston, head and associated components. It is made from a condemned cylinder liner cut off at the upper shoulder. The ferrules are removed, and the ferrule holes enlarged to 7/16-inch diameter, ¾ inches deep. Water passages on the underside are sealed with suitable material such as plastic steel to retain the water pressure. A petcock is installed over one of the ferrule holes to bleed entrapped air. Care must be exercised to keep the ferrule holes

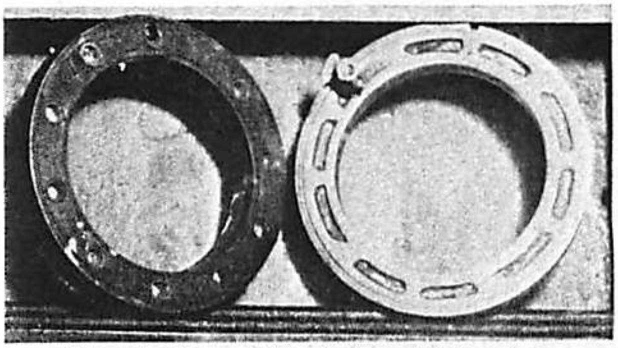

Figure 1. The complete tools, top and bottom views

clear. To hydrostatically test a liner, the tool is set on the cylinder, remembering to put grommets on the water ferrules of the installed liner. A steel plate is bolted to the exhaust manifold to seal its water passage.

If the piston has been removed, standard liner removal tools are used as strongbacks and a ⅜-inch draw rod is used to pull the tool up tight, sealing the top of the liner. If the connecting rod and piston are in place, set four pieces of 1-inch-diameter pipe, 3 inches long, over each of the four cylinder head studs. Position the pipes to bear on the lip or outer edge of the tool, then place suitable sized washers over each stud and on top of the pipe.

This was a military suggestion. If this idea is adopted by your unit, please inform the Commandant (CAM) of the benefits you expect to gain (annual savings or intangible returns) so the suggester may receive full credit for the application of his suggestion.