



## *U.S. Coast Guard History Program*

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### **Summary of the Development of Early Motorized Lifeboats for the USLSS and USCG**

**By Tim Dring**

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Early type motorized lifeboats for US service developed initially by the retrofit in 1899 of an internal combustion engine into an already existing pulling/sailing type of wooden lifeboat, the **34ft. modified Merryman type lifeboat**, which had been under construction starting around the early 1890s. This was then followed in 1908 by the introduction of the first purpose-designed and built motor lifeboat, the **36ft. McLellan type E lifeboat**, which was series built primarily by the Electric Launch Company in Bayonne, New Jersey until around 1916. Following the merger of the US Revenue Cutter and Life Saving Services to form the US Coast Guard, the next purpose-designed and built version was the **36ft. Type H motor lifeboat**, which can be considered an important transitional design incorporating more modern types of internal combustion engine installations.

#### **34 Foot Modified Merryman Type Motorized Lifeboat**

In September 1899 on Lake Superior at the station located in Marquette, Michigan, Lieutenant McLellan of the Revenue Cutter Service, with the cooperation and support of station keeper Henry Cleary and USLSS headquarters, arranged for the installation of a Superior 12HP/400RPM, two-cylinder/two-cycle gasoline engine, manufactured by the Lake Shore Engine Works of Marquette, Michigan, in the aft end air case of a standard 34-foot modified Merryman type lifeboat. By this time, the 34ft. Merryman had become the standard type of pulling/sailing lifeboat in general service, and it had a fairly roomy aft end air case into which this machinery could be retrofitted. Few structural modifications were needed to accommodate the 1350lb. engine and its auxiliary equipment. The engine was geared to twin propeller shafts, each shaft having a two-bladed 18-inch reversible propeller. Wire cages were installed around each prop to protect them against fouling from debris in the water. Air supply to the engine was achieved by means of two brass pipes which led from the top of the air case on the inside down along the air case's inside forward bulkhead, then through the bulkhead 6 inches above the main deck. In the event of a capsized, engine air would be available from the interior air space since the air case was watertight. The 75 gallon fuel tank was located in the forward end air case, and fuel was supplied to the engine by gravity feed. With this fuel capacity, the motorized lifeboat had a range of about 275 nautical miles when traveling at its top speed of 7.5 statute miles per hour. With the twin screw configuration operating ahead and astern, the boat was capable of a turning diameter of just 50 feet.

The successful results of extensive testing in September of 1899 of this motorized boat prompted the service to install shortly thereafter a slightly different gasoline engine arrangement in a second 34-foot lifeboat shortly thereafter. One of the results of these tests was the recommendation that reversing gears be installed instead of reversible propellers, that the height of the gasoline fuel tank and engine mount be lowered, and that the propeller cages be removed.

In November of the same year, additional tests resulted in the following modifications to the boat: 1) main deck, thwarts, and rails raised 4 inches; 2) metal centerboard reduced in thickness from 1 inch to  $\frac{3}{4}$  inches; 3) heavy oak and mahogany thwarts and side seats replaced with lighter ones made of spruce or pine; 4) fuel tank left at its original height to retain the gravity feed to the engine and not have to resort to the installation of a fuel pump; 5) all exposed iron work replaced with gunmetal; and 6) lengthening of the aft end air case by about 18 inches and raising it about 7 inches, with modification of the forward end air case to provide more of a crown to it.

It was at about this time that the British RNLI introduced its first gasoline engine-powered lifeboat, which underwent trials in April of 1904. The boat was a standard 38-foot self-righting, pulling/sailing lifeboat into which a 10HP, two-cylinder Fay & Bowen gasoline motor had been installed amidships, driving a single, three-bladed propeller. It is interesting to note that the RNLI did not use the aft end air case location for motor installation, preferring instead the amidships location, a design approach that the United States would not adopt for another fifteen years.

Following the testing of these two modified boats, additional pulling/sailing versions of the 34-foot lifeboat still under original construction were retrofitted with gasoline engines. Fifteen of these were then under construction at the Marine Construction and Dry Dock Company at Mariners Harbor, New York. The Electric Launch Company (ELCO) of Bayonne, New Jersey took these boats and converted them to motorized propulsion by the installation of one 20HP gasoline motor. Exhaustive tests revealed that several additional structural changes were needed before placing the retrofitted boats in service. These included raising the sheer, as well as two longitudinal bulkheads, two thwart bulkheads, the centerboard trunk, and the longitudinal deck bearers. The solid spruce spars were replaced with hollow ones, a special sliding canvas spray hood was installed forward, and the weight of the keel was increased. Several other minor changes were made as well

The success of these boats in tests and actual rescue service served to convince the USLSS leadership that all of the remaining 34-foot pulling/sailing lifeboats should be converted to gasoline engine power as soon as it was financially and practically possible. As such, between January of 1906 and June 30, 1909, the remaining forty 34-foot lifeboats were so converted, with all of the work done by ELCO at their Bayonne facility. Trials indicated that a 20HP Standard gasoline motor/single propeller installation was preferable to the original 7.5HP Buffalo gasoline engine/twin propeller configuration, and the next fourteen boats to be converted were powered with the larger Standard motor. This program lasted through to the end of June of 1907. Starting in mid 1907, the remaining twenty-six boats converted had larger 25HP Holmes gasoline motors (manufactured by the Holmes Motor Company of West Mystic, Connecticut) installed. This engine, an improvement over the 20HP Standard motor, was an auto-marine type weighing 575lbs. with an open base, four-cylinder/four-cycle design with jump spark ignition. The single bronze shaft had a 3-bladed, 21-inch diameter propeller. While the earlier conversion boats retained their original sprit sailing rig, the last twenty-three boats were refitted with a lug sailing rig. The conversion cost for each boat averaged \$4,300. The largest number of motor lifeboats (about 61%) were returned to stations on the Great Lakes where they had been initially assigned. Most of those assigned to the Atlantic coast were at stations located at inlets or deep water harbors where they could be launched directly from a boathouse or kept at a mooring. Only a few were assigned to the Pacific coast, and these to stations where there were high surf conditions at harbor inlets.

#### **Characteristics:**

*General:* Self-righting and self-bailing; 34ft. LOA, 8ft. 1.5in. maximum beam (some had beams of 8ft. 2in., 3.25in., or 3.5in.), 3ft. 11.5in. depth, 2ft. 5in.-2ft. 8in. gunwale sheer, sheer of deck 0 ft. 4in.; 7ft. 4.5in. length of end box inside of stem rabbet/8ft. 7in. length of end box inside of sternpost rabbet; 3 or 5 thwarts for 6 or 10 oars rowed in double-banked configuration; two-masts with sprit sail rig of jib, foresail, and mainsail; early conversion prototypes had 1350lb., 2-cylinder/2-cycle, 400 RPM, 12 HP "Superior" (Lake Shore Engine Works, Marquette, MI) single

motor (6in. bore and stroke) with twin shafts/18in. reversible propellers (caged); later conversions were single motor/shaft/prop; motor installation and batteries inside aft air casing, with two external reversing levers and gearing, starting shaft, and oil cups; 75gal. fuel in forward air casing (2 gal/hr. consumption rate); maximum speed 7.5 Statute MPH, 275 nautical mile range, 50 foot turning radius with propellers running in opposite directions.

*Construction:* Double-diagonal planked wooden hull of 3/8in. Honduran mahogany planks over 1.5in. by 2.5in. white oak frames; white oak upper keel, gunmetal lower keel and centerboard (3/4in. thick); 16oz. copper air cases, air cases at bow, stern, and along both sides (some had cases under the watertight deck as well); ten 6in. self-bailing tubes.

### **36 Foot McLellan Type E Motor Lifeboat**

The design for the 36-foot McLellan Type E motor lifeboat was the result of three factors: 1) the overall hull and propulsion plant ideas of Charles McLellan who based them on his previous experience with USLSS lifeboats; 2) the mechanical engineering expertise of Charles Holmes, the founder of the Holmes Motor Company of Mystic, CT; and 3) the power boat construction facilities and expertise of the Electric Launch Company. This design, the first purposely built as a motor lifeboat, probably represented the first successful cooperative venture of its scale for the USLSS, and probably the last since it was shortly after the completion of all of the 36-foot lifeboats that the newly formed Coast Guard would make major changes in the manner in which future lifeboat types were designed and built.

A contract had been awarded in mid 1907 to the Holmes Motor Company to build a 36-foot motor lifeboat designed as such from the keel up by McLellan. It was to be powered by a 35-40HP, six-cylinder/four-cycle Holmes Automarine gasoline motor, which had been designed and manufactured by Holmes. By this time, Holmes had acquired considerable experience in developing reliable marine motors for lifeboat use and, as noted previously, had supplied twenty-six of the 34-foot motor lifeboats with their 25HP motor. Plans for the 36-foot lifeboat were developed by McLellan himself, and generally represented a larger and more powerful version of the 34-foot lifeboat.

The Canadian government, also interested in placing modern motor lifeboats on its coasts, obtained permission from the USLSS to purchase one of the new 36-foot lifeboats, which was being built by ELCO and was finished in late 1907. This boat actually became the first 36-foot motor lifeboat to be completed, since the first boat being built by Holmes was not completed until Spring of 1908. The Canadian boat was assigned to their lifesaving station at Bamfield Creek on Vancouver Island in British Columbia. The first Holmes boat built for the USLSS, named ***Audacious***, was assigned to the station at Waaddah Island (now Neah Bay) in Washington. Thus the first two 36-foot motor lifeboats both wound up being stationed in the Pacific Northwest.

The McLellan 36-foot lifeboat design continued the practice of double-diagonal hull planking as well as the installation of the motor and power train in the aft end air case, with a single 3-bladed propeller of 22-inch diameter and 24-inch pitch. While the Canadian 36-foot lifeboat was reported to have a top speed of 9.75 statute MPH at 650RPM, the ***Audacious*** was capable of just under 10 statute MPH at about 700RPM, which was an improvement over the 34-foot lifeboat's top speed. Self-righting and self-bailing capabilities were achieved by the same means used in the 34-foot lifeboat; i.e., high end air cases, air cases below deck, a heavy bronze keel of 1500lbs., and ten through-bottom relieving valves. Like the 34-foot lifeboat, the 36-foot version was also equipped for rowing and sailing as auxiliary forms of propulsion in the event the motor failed. Visually, the main difference between the 34-foot motor lifeboat and the 36-foot version is the length of the aft end air case, which was longer on the 36-foot model.

Over the period 1907 to 1915 (the last year of construction for the 36-foot McLellan Type E design) a total of forty-six 36-foot motor lifeboats were built for the USLSS, with only two

constructed by Holmes (***Audacious*** and another one assigned to the Isle of Shoals station in New Hampshire), and the remainder being built by ELCO at their Bayonne facility. In general, the 36-foot motor lifeboat was assigned to stations: a) to replace a previously-assigned 34-foot motor lifeboat that was near the end of its service life, or b) where no lifeboat had been assigned previously, but where a motor lifeboat was needed, such as on the Atlantic and Pacific coasts. For each of these stations, however, slipways and boathouses had to be constructed for launching purposes if the boat could not be kept moored afloat. This was because this design was clearly too large and heavy for direct beach launch from a boat carriage, setting a trend that was to continue with future motor lifeboat designs. In the case where the 36-foot motor lifeboat replaced a 34-foot version, the 34-foot lifeboat was reassigned to another station or retired from service.

While Holmes had been engaged in the construction of some of the first 36-foot lifeboats, their boat construction capabilities were much more limited compared to ELCO, and the USLSS believed that Holmes would be more efficiently employed by focusing only on motor production, leaving construction of the boat hulls to ELCO. As such, Holmes boat construction was limited to just the two for the USLSS. Charles Holmes was also engaged in the design of motors for other marine applications, and developed a 400HP, 12 cylinder, high speed engine for use in submarine chasers that were built in World War I. Holmes also modified the 36-foot lifeboat design to allow its use as a ship's boat or as a yacht, exhibiting their patented redesign at motorboat shows in New York and in Chicago in 1914.

ELCO, founded in 1892 at Morris Heights on the Harlem River in New York, was one of the early pioneers in the development of mechanical propulsion for yachts and small craft. In 1900, they relocated their construction and manufacturing facility to Bayonne, New Jersey where it remained until closed in the years just after World War II. Through acquisition, ELCO ultimately became a division of the Electric Boat Company of Groton, Connecticut, the shipyard famous for the construction of submarines. Besides their work for the USLSS, ELCO also built motor launches for the Revenue Cutter Service and the U.S. Navy. Later in World War II, they were one of the largest builders of PT boats for the U.S. Navy. They were also a major builder of very fine pleasure boats.

Operational experience with the McLellan 36-foot motor lifeboat showed that it was a very rugged and seaworthy design, although crew and survivors were quite exposed to the elements during a rough weather rescue. In addition, the high quality of their construction resulted in a boat having very beautiful and graceful lines, including their original USLSS-era paint scheme with varnished woodwork. The wooden, double-diagonal planked hull, however, required careful maintenance and/or repairs.

In July of 1910, the USLSS Board of Lifesaving Appliances tested one of the new 36-foot motor lifeboats, ***Victory***, assigned to Station Wood End, Massachusetts, on the tip of Cape Cod. The results of these tests caused the Board to state in their report that:

*“The Board is of the opinion that the 36-foot self-righting and self-bailing power lifeboat...is the highest type of power lifeboat as yet developed for the uses of the Life-Saving Service, and that it surpasses any type or plan of lifeboat so far submitted to or known by the Board...The introduction and rapid development within the last decade of mechanical propulsion in nearly all classes of undocumented vessels, has resulted in a corresponding increase in the scope, work and duties of the crews of life-saving stations to such an extent that the use of mechanical propulsion as an auxiliary power in many of the boats of the service is imperatively necessary to the growth and efficiency of the Lifesaving Service, and the Board therefore earnestly recommends that the type of lifeboat as exemplified in the model and fit out of the 36-foot self-righting and self-bailing power lifeboat ...together with such changes and improvements [that] time and experience may develop and render advisable, be furnished as expeditiously as conditions and the funds ... will permit...”*

Foreign lifeboat services were also developing motor lifeboats. As has been already mentioned, the first RNLI experiments with gasoline motor installations in lifeboat occurred in 1904, with the first purpose-built gasoline motor-powered lifeboat being built in 1908. This was a 42-foot model with a single, four-cylinder Tyler engine, with self-righting capability and a tunnel stern for propeller protection, followed shortly thereafter by a "standard" 40-foot model. As with all RNLI motor lifeboats for several years thereafter, the motor was considered to be an auxiliary means of propulsion, with sail as the primary means of propulsion.

France introduced a steam-powered lifeboat, the **Amiral Lafant**, in 1902 and installed a diesel engine in a pulling/sailing lifeboat in 1908. This was a Marchand diesel of 11HP, which was only capable of propelling the 6-ton lifeboat along at 5.5kts. This engine was much too heavy and clumsy, and in 1909 a much lighter diesel of 24HP was installed in a 32-foot, 6-ton lifeboat, which used a turbine type of jet propulsion rather than a conventional propeller, but was still only capable of 7kts.

The German Society for the Rescue of the Shipwrecked developed its first motor lifeboat in 1911-1912, which had a double-diagonal planked hull with four relieving tubes, and 18 copper air cases (9 on each side). With an overall length of 32 feet 9 inches and a beam of 9 feet 9 inches, she was powered by a single 2-cylinder, 15HP Korting engine which gave her a top speed of 6kts. She was also equipped with a tunnel stern for propeller protection. The North and South Holland Life Saving Society experimented with their first motor lifeboat in 1906, and the Swedish Sea Rescue Institution completed its first three motor lifeboats in 1912.

The timing of motor lifeboat development in the United States was generally running parallel to the developments in these foreign services.

### **Characteristics:**

*General:* Self-righting and self-bailing; 36ft. 0in. LOA, 8ft. 7.5in. beam, 4 ft. 2.5in. depth from skin to gunwale amidships, 7ft. 4in. length of end box inside stem rabbet, 9ft. 7in. length of end box inside stern post rabbet, 6ft. 7in. depth at rabbets of stem and stern post, 0ft. 4.5in. sheer of deck between end boxes, 3ft. 4.5in. distance between centers of thwarts, 2ft. 0in. station spacing; 8 tons displacement; single 6 cylinder, 4 cycle open base Holmes Automarine gasoline engine of 35-40HP (initially only 28HP) with two fuel tanks (125gal. main/25gal. aux.; gravity feed) and single, adjustable, 3-blade, 22in. diameter/24in. pitch prop; rudder control via steering rod coupled to pinion and quadrant ; maximum speed just under 10 statute MPH at 700RPM/40HP; Patterson wireless G-U-84 battery, jump spark ignition; engine controls located on forward bulkhead of aft air case; sailing rig consisted of two hollow spruce masts 5in. diameter at tack, 3.5in. at head, foresail 18sq.ft., mainsail 16.5sq.ft., rake 1.5in. to the foot with jib plus fore-and-aft lug sails; self-righting within approximately 30sec.; five thwarts for 10 oars rowed in double-banked configuration; equipped with canvas spray cover which extended aft of forward air casing approximately half-way down the cockpit.

*Construction:* Double diagonal planked (45 degrees) wooden hull of 3/8in. Honduras mahogany with No. 10 canvas in-between, copper fastened and riveted, along with brass screws; frames of white oak sided 1.5in., molded 2in. at throat, and 1in. at ends; white oak upper keel and 1500lb. gunmetal lower keel plus bronze droppable metal centerboard 1/2in. thick; 112 air cases of 18 ounce copper located below deck and along sides; ten 7in. diameter copper relieving tubes from deck to bottom with self-acting balanced valves; Honduran mahogany watertight main deck double-planked; 34 watertight compartments, 70 air cases.

### **36 Foot Type H Motor Lifeboat**

An immediate result of the Coast Guard's formation was the centralization of small boat building at the service's depot at Arundel Cove on Curtis Creek, just outside of Baltimore, Maryland, a facility which is now called Curtis Bay. In 1900, a small marine railway was constructed to repair lifeboats for the Lifesaving Service. Major overhauls of and repairs to Revenue Service cutters and small craft were made at the Curtis Bay Yard, and by 1915 the Yard had become a major installation.

Parallel to the development of small boat construction facilities at Curtis Bay, was the centralization of small boat design in the Office of the Superintendent of Construction and Repair at Coast Guard headquarters in Washington, DC. Before the consolidation of small boat building at Curtis Bay was completed, a few interim contracts were awarded to private builders for lifeboat and surfboat construction as had been the custom in the Lifesaving Service. The boats built under these contracts were very few in number, but are of interest as they represent the first phase of a transitional period between the lifeboats/surfboats designed and built under the Lifesaving Service, and the completely new types of lifeboats/surfboats designed and built by the Coast Guard.

In August of 1918, the Coast Guard issued proposed specifications for a new, improved design 36-foot motor lifeboat (machinery specifications were issued in September, 1918). The first boat built to this design, No. 1560, was completed by the Curtis Bay Yard in early March of 1919, initiating trials on March 20<sup>th</sup> of that year. It was given the designation of Type H in recognition of Constructor Hunnewell. The Type H motor lifeboat was the first standard model lifeboat design developed since Captain McLellan's 36-foot Type E of 1907/1908, and would remain the service's standard lifeboat for almost a decade until 1929. Improving upon the developments incorporated into the 1916 Type E lifeboat, Hunnewell further modified the stern by bringing the rudder completely inboard of the sternpost for better protection, and installed a steering wheel instead of the original steering rod/quadrant arrangement. The semi-tunnel for the propeller was retained in this model, as well as through-bottom freeing trunks (four total) in lieu of freeing tubes for self-bailing. The engine was installed in an amidships deckhouse, and included a door on the aft bulkhead for easier access to the engine. Self-righting ability was achieved by means of high-profile end air cases along with an 1800lb. cast iron keel, which extended aft as a strut for protection of the propeller and rudder.

For propulsion, the Type H had a 50HP Wisconsin Model J-M gasoline engine, with a single 3-bladed 22-inch diameter/16-inch pitch propeller; maximum speed was just under 9kts., with a cruising radius of about 275 nautical miles. A two-masted dipping lug sailing rig was carried, and four thwarts were provided for rowing, both intended as an auxiliary means of propulsion.

Hull construction was similar to earlier lifeboat models, but with some important exceptions. The Type H had single carvel planking of 1 1/8" cypress rather than double planking. Although a few isolated attempts at a single-planked design lifeboat had been made in previous years, the Type H was the first standard design to incorporate this feature. This was a major break with past tradition, with double diagonal planking believed necessary for stronger lifeboat hull construction. Single plank construction, however, continued not only with the Type H, but also with subsequent lifeboat model designs until the end of wooden lifeboat construction for the Coast Guard in 1956.

The Coast Guard recognized that the double diagonal mahogany planking of the earlier lifeboat types was stronger, but it had become increasingly difficult to find domestic boat builders who had the skill either to construct or repair boats with this type of hull. Double diagonal planking was also considerably more expensive than single planking. To compensate for the loss of strength associated with double diagonal planking, the single-planked Type H lifeboat (as well as future designs) was provided with watertight subdivisions both below and above the watertight main deck. In the Type H, the number of watertight compartments was reduced to only 12 (including the engine compartment, which was a separate watertight space), achieved by eliminating most of the longitudinal (fore and aft) bulkheads except around the engine compartment and freeing trunks. There were no air cases or buoyancy blocks installed. In regards to single planked hulls

without air cases, the Coast Guard at this point took an approach quite different from that of the European lifeboat organizations, particularly the RNLI, where this practice was continued for many years afterwards.

Between 1919 and 1928, a total of 76 Type H motor lifeboats were constructed, all by the Curtis Bay Yard. The initial construction boats cost about \$8200, while later construction boats cost almost \$10,000 each (one of these boats was constructed by the Curtis Bay Yard for the South American government of Columbia). Despite the overall ruggedness of the Type H design, by the early 1930s there had been reports from individual stations of cracked or broken hull frames that a class-wide repair program was necessary, which was undertaken by the Curtis Bay Yard.

### **Characteristics:**

*General:* Self-righting and self-bailing; 36ft. 0in. LOA/34ft. 6in. LWL, 9ft. 6in. beam over fenders/9ft. 0.25in. outside planking beam at deck/8ft. 10in. beam inside planking/8ft. 6in. beam LWL, 1ft. 11.25in. draft centerline to rabbet; 5ft. 6in. depth amidships above keel; draft 3ft. 2.5in. aft/1ft. 11in. forward; 14285lbs./6.38tons displacement (12231lbs. hull, 932lbs. outfit, and 1122lbs. machinery); 0.45 block coefficient; 13 sq. ft. area section; 182.12 sq. ft. area LWL plane; 0.669 coefficient LWL plane; approximately 17deg. angle of entrance; 3.40ft. metacentric height above CG; displacement to length ratio 1.56; speed to length ratio 1.45; single 1200lb., 50HP/970RPM (Plan 90282 states 1000RPM; 2<sup>nd</sup> Intl. Lifeboat Conference notes state 44HP at 1000RPM), 4 cylinder/4 cycle Wisconsin J-M gasoline engine mounted in amidships watertight engine compartment, with 3-blade, right handed 22in. diameter/16in. pitch propeller in semi-tunnel stern and unprotected rudder located inboard of sternpost; some boats had 4 cylinder, 36HP Gray-Prior gasoline engines, but these wore out too soon; some boats later were equipped with Buda engines; maximum speed was 9.2 kts.; two copper fuel tanks under main deck, one of 120gal. and the other of 28gal. (gravity fed); fuel consumption was approximately 5gal./hour at 9kts.; 275 nautical mile cruising range; steering wheel mounted on aft bulkhead of engine compartment, port side with no protection for coxswain; two-masted dipping lug sailing rig of jib (39 sq. ft.), foresail (133 sq. ft.), and mainsail (57 sq. ft.), for a total of 229 sq. ft. of sail area; canvas spray screen mounted on forward air casing covering aft about six feet; electric lights; four thwarts for eight oars rowed in double-banked configuration.

*Construction:* Carvel-built wooden hull of single 1 1/8in. cypress or white pine planking (and oak gunwales) over oak frames, copper and bronze fastened; watertight wooden end air cases forward and aft above watertight main deck, with six watertight bulkheads/twelve watertight compartments (plus two side and two forward and aft collision bulkheads) under deck (fewer longitudinal bulkheads than on earlier design lifeboats); no separate air cases or buoyancy blocks along sides or below deck; 1800lb. molded cast iron keel; self-bailing within 16sec. by means of four freeing trunks (two each side around engine compartment), rather than tubes, through bottom (last motor lifeboat design with self-bailing device through bottom of hull); self-rights in 7sec.

Type H-Revised (HR) differs from the Type H in having a watertight wooden survivors cabin mounted forward in place of canvas spray hood, and in some boats the replacement of the original 50HP Wisconsin engine with a 100HP Sterling gasoline engine.

