MILBOATSTECHMAN/BK-06

VERSION 1

MILITARY EMERGENCY BOAT SERVICE
TECHNICAL MANUAL
BOOK 06

PATROL BOAT 440 CLASS

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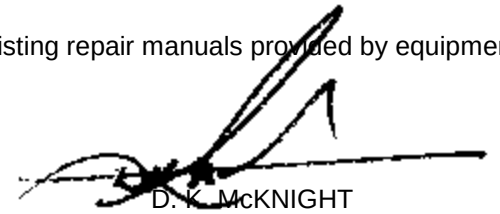
From: Commander, New York State Military Emergency Boat Service

Subj: PROMULGATION OF MILITARY BOATS TECHNICAL MANUAL SERIES
BOOK 6; PB 440 CLASS PATROL BOAT

1. The New York State Military Emergency Boat Service Technical Manuals (MILBOATSTECHMAN) are consolidated information for each class of patrol boat in the boat service. They are intended to provide basic information regarding each class, with an overview on operational parameters, missions, equipment layout, and some basic troubleshooting guides if not provided by commercial owner's manuals.

2. Book 6 of the MILBOATSTECHMAN covers the PB 440 Class patrol boat.

3. This manual does not replace existing repair manuals provided by equipment suppliers.



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PB 440 CLASS PATROL BOAT
INFORMATION AND OPERATIONAL CAPABILITIES

A. General.

The PB 440 Class patrol boat is a 44 foot boat with twin inboard diesel engines and water-jet drive.

The class consists of one boat, built by Moose Boats of Petaluma, California. The boat was received in December 2007.

1. The model of boat is: M1-44
2. Length: 43 feet 6 inches
3. Beam: 16 feet
4. Hull type: catamaran
5. Draft: Vessel: 26 inches
6. Freeboard: 19 inches (stern)
6. Dead rise forward: 45 degrees
7. Dead rise aft: 15 degrees
8. Air draft: 15 feet, 6 inches
9. Average weight: 25,000 lbs.
10. Fuel capacity: 485 gallons (diesel)
11. Range: over 300 nm
11. Crew size: 2-3 (Maximum 23 persons, on partially protected and protected waters.)
12. Propulsion: Two Cummins 600 HP diesel engines/Hamilton waterjet
    a. Maximum speed: 42 knots
    b. Service speed: 30 knots
13. The hull, decking, superstructure, and tubing are constructed of marine-grade aluminum.
14. The boat is not capable of being air lifted.

B. Operational Parameters.

The boat capabilities fall within the following parameters:

1. Capable of operating with a wind speed of 30 knots with a sea height of 12 feet.
2. Capable of surviving with a wind speed of 50 knots with a sea height of 16 feet.
3. Capable of operating in air temperatures of 0 – 100 degrees Fahrenheit.
4. Capable of operating in water temperatures of 28 – 95 degrees Fahrenheit.

C. Missions.

The boat is capable of several missions, including maritime vulnerability assessment and maritime patrol. Due to its inherent stability, it is particularly suited to off-shore vessel boarding missions. With an enclosed and heated cabin, it is suitable for year-round operations. The boat is capable of operating on most waters in or contiguous to New York State, with the exception of the smaller rivers.

D. Description and Operation

The Moose Boats M1-44 Series Boats are built on a catamaran style hull. The hull is welded marine grade 5086 Aluminum. The boat is powered by twin Cummins/QSC8.3 l engines (600 HP each). These engines supply power to twin Hamilton Jet HJ322 water jets through a transmission (marine gear). The water jets provide forward and reverse thrust much like a propeller driven boat. However, there are differences in some of the maneuvering aspects of the jet as compared to propellers. This will be covered in greater detail in the "System Operation" section.

The boat hulls, or sponsons, are divided into 3 water tight compartments. First we will review the Port side. The aft-most compartment is considered an engine room with access through hatches to engine, jets and related mechanical and electrical systems. The mid compartment, forward of the engine area, contains a fuel tank (approx. 250 gallon capacity). Forward of the tank, in the compartment, is a potable water tank and pressure pump and an accommodation space accessible from the main cabin. The compartment at the very bow is divided from the accommodation and storage area by a "crash bulkhead". No functional equipment is contained within this compartment. However an inspection port is provided in the partitioning bulkhead.

The starboard sponson is similar to the first one described with the following differences: The engine room contains, besides the main engine and Jet, the AC generator. The mid compartment contains the fuel tank and the Vac-U-Flush head equipment and waste tank and air-conditioning equipment as well as a storage area. Again the forward most compartment is a sealed void forward of the crash bulkhead. Thus, the boat really has 6 compartments, twin fuel tanks totaling approx. 500 gallons and obviously a twin propulsion package.

The cabin essentially sits on a bridge-deck between the two sponsons. (The underside of the deck, between the sponsons, is referred to as "the tunnel".)

The cabin is all aluminum and it is largely insulated. The cabin is heated and air-conditioned. It seats 10 people and contains all controls for operating the boat. The following is a description of specific functional areas of the vessel. Detailed information concerning all components and their applicable warranties are covered in user manuals supplied with the boat. Specific functional and maintenance information is contained in these manuals compiled in binders.

PORT ENGINE ROOM

The port engine room contains one of the two propulsion engines (consult Cummins manuals for all engine related details). The forward portion of this compartment contains primary electrical equipment. There are three pairs of 12 volt sealed batteries wired in series providing three power sources at 24 volts each. One set is dedicated to general needs or "House" loads. The other two sets are dedicated to each engine's "starting" and running services. The generator shares the port engine battery bank. Battery switching (on, off and combine) is remotely controlled from within the cabin.

Above the batteries is a watertight enclosure that contains battery control relays, primary high amp circuit breakers, control breakers and a primary positive buss bar. Normal conditions should not require any need to access this enclosure as all circuit breakers contained within should remain ON at all times. A negative buss bar is outside this enclosure. A 30 amp battery charger (20-5-5) is located adjacent to the negative buss. This unit charges the three banks of batteries when the boat is connected to shore power or running on the AC generator. A remote DC volt meter is located in the cabin; this indicates the "state-of-charge" of each battery through a selector switch.

The primary fuel filter is located on the outer engine room wall. It is a Racor 900 fuel/water separator. It has a visible fuel bowl, as well as a water-in-fuel sensor connected to the "Vessel View" display in the cabin. A secondary fuel filter is located on the engine (consult Cummins manual for service of both filters). The fuel flow valve should remain open at all times, except when changing the filter element. Engine and Gear oil change pumps are located in the aft amidships corner of the engine hatches for use in changing the oil in both units. Use of the hand pumps will enable the maintenance provider to change the oil at frequencies specified by Cummins and Twin Disk. (See manuals)

Important grease fitting:

There is one grease fitting on the Hamilton HJ 322 that must be greased at 100 hour intervals. It is located at the forward bearing of the Jet Drive main shaft. See Hamilton Jet manual for details.

STARBOARD ENGINE ROOM

The Starboard engine room contains one of the two propulsion engines (consult Cummins manuals for engine related details). The forward portion of this compartment contains the Northern Lights 8 kW generator. (See Northern Lights manual.)

The primary fuel filter for the Starboard engine is contained here. It is a mirror image of the filter in the Port engine room. The generator also has its own fuel filter located on the outboard hull wall near the main Racor filter. Below the engine Racor filter is the generator cooling water intake filter. Periodically check this filter for debris especially if the generator has been run in a "dirty" harbor.

Note: There is no connection between the two tanks or filters (no cross over) between port and starboard related fuel supplies. When running the generator for extended periods of time the fuel quantity in the starboard tank should be monitored as it is shared with the starboard main engine.

Forward of the Starboard engine room is a compartment accessed through the hatch panel located under the mattress in the accommodation space. This compartment contains the air-conditioning unit and an AC powered water pump for the seawater-cooled condenser for the air-conditioning system. The seawater for this purpose is drawn from a pickup located about 1/3 of the way back from the bow in the starboard hull. Seawater enters through a seacock then to a filter prior to going through the pump. Inspection of this filter should be done frequently during air-conditioning season. Water is ejected through a fitting located above the waterline on the outboard side of the starboard sponson. During freezing weather the air-conditioning system should be secured and winterized and this seacock closed. At all other times this seacock should remain open. Remember to periodically check this filter especially if low water flow is observed exiting the hull or air-conditioning performance decreases.

Operationally there is no need to access either engine room while underway for the normal function of the boat. It is, however, advisable to open the hatches before getting underway for a visual inspection of mechanical equipment and the contents of the bilge (water, oil, antifreeze?). During each pre-underway inspection, (see separate DMNA operational SOP), please take note of the engine cooling seawater strainer (one per engine). It should be inspected for accumulation of debris. Be sure that the "O" ring is in place and the gasketed cover is dogged down tight after each inspection.

Though all systems are remotely controlled and monitored, it is prudent to always visually inspect this very complex machinery area before getting underway.

Both engine compartments are protected by an automatic heat activated, gaseous fire suppression system. When this system is activated it automatically shuts down all engines and activates an alarm located on the main electrical and alarm panel in the main cabin. Engine operation can be restored after an event by using the over-ride switch on the fire control panel.

JET PUMP AREA

The Jet Pumps are accessed from the Jet Guard (swim platform) hatches above each jet. The jet pump has an integral hydraulic system that is dedicated to providing all motion and control of the moving parts of the Water Jet. This includes the "Reverse Duct" also known as the deflector or "the bucket", which diverts water for thrust direction, and the steering nozzle for directional control. All functions of engine and jet are under control of the Hamilton Jet "blueArrow" control system. Hydraulic valves to operate this system are controlled via this completely digital, "drive-by-wire", system. (Details and service needs of the jet are covered in Hamilton Jet manuals.)

On both inboard hull sides are the seawater intakes for engine cooling. A large shut-off valve is associated with these intakes. These valves should never be closed except for hose replacement or in the event of engine room flooding from an unknown source. Engine must be shut down before this valve is closed. The engine room heaters are located near the forward end of the jet pumps on the outboard walls. These are activated at the same time that the engine block heaters are turned on via circuit breaker switches in the cabin. NOTE: These heaters should only be used at dockside, generally in the winter months, when freezing temperatures can be expected. ALWAYS turn these heaters off when underway.

ELECTRICAL CONTROL PANELS

Located on the outboard, starboard side of the coxswain's control console, there are two panels, described from Left to Right.

METERING PANEL (Smaller left hand panel)

… from top to bottom…

Air-conditioning control panel
Twin fuel gauges
Potable water level gauge
Vac-U-Flush waste tank level gauge
Fire suppression status and override switch

CIRCUIT BREAKER PANEL

The main circuit electrical panel is to the right (or forward) when viewed from the "observer" seat. It contains the following functions:

In the upper left corner there are two meters. The top meter is AC line voltage. Immediately below is the battery meter. There is a three position rotary switch located below the meters to select which battery is currently being viewed. It can also function as an Amperage Meter that reads instantaneous current flowing into or out of the house battery bank. There is a small selector button on the meter face to change to the amp function. When in Amp mode this meter should always read in the positive direction while underway. Normal voltage while underway should be in excess of 28 VDC indicating charging.

BATTERY CONTROLS

There are four locking toggle switches. (Pull out on the handle to unlock and move these switches.) These switches activate relays that provide power for "House", "Port engine", "Starboard engine" and "Generator". All four switches must be on to activate the boat.

BATTERY PARALLEL

Above the control switches is a momentary switch that is marked "Battery Parallel". This switch joins both sets of engine batteries together for emergency starting purposes.

GENERATOR CONTROL

Located at the top right of the panel. These controls preheat and start as well as stop the generator and provide monitoring functions and an engine hour meter. To start the generator: Press and hold the preheat rocker switch for ten to fifteen seconds depending on ambient temperature. While holding this rocker depressed, press the upper half of the start / stop rocker to crank the generator. A light will illuminate when the generator is running. See Northern Lights manual for additional operation and service information.

BILGE PUMP CONTROL PANEL

There are four bilge pumps, one located in each primary compartment. They are powered by a separate circuit, off the House battery, that is always on (does not shut off with battery control switches). This will assure that the pumps will work at dockside as long as shore power is also available to keep the batteries charged. In the event of water exceeding "normal" level there is an alarm to indicate a flooding condition. This alarm must not be ignored. Check the compartment indicated by the red run light on the bilge pump panel. Note: The red light, without the alarm, will also illuminate when the pump runs normally and is able to keep up with the inflow. Any unanticipated or excessive running of the bilge pumps should be investigated and the condition corrected.

The switches associated with each pump also allow for manual operation and testing. Be sure all pump circuit breakers are on with a green light illuminated at all times.

AC POWER, Shore and Generator

The center section of this panel contains the AC distribution circuits. This panel is energized by either a main 50 A. Shore circuit breaker or a 50A. Generator circuit breaker. They are mechanically interlocked and the appropriate one must be turned on to energize the AC panel and sub-circuits below as follows:

Battery charger
Utility outlets
Three (3) floor heaters
Domestic hot water heater
Microwave
Air-conditioner
Engine room heat (Port)
Engine room heat (Starboard)

The engine room heat circuit breakers protect and activate both a block heater and space heater in respective engine rooms. During cold weather these circuit breakers should be on when attached to shore power. When underway and on generator power it is recommended they be turned off as they are unnecessary.

Shore power is provided by a 120V / 50A shore power cord. Do not use adapters to reduce this cord to a single 30A circuit. (There is an adapter, not supplied, that can connect this 50A circuit to a pair of 30A circuits for additional power.)

The generator supplies the entire AC electrical needs of the boat while underway. It is only necessary to transfer the main interlocked circuit breakers to power all the AC circuits. The Charger breaker could be shut off while underway because the main engine alternators provide all the DC power that the boat requires. In addition, always shut off the engine room heat circuit breakers while underway.

General note: It should not be necessary to use the air-conditioner and heaters of any kind at the same time. Turn off all AC heater circuit breakers during summer operation.

The circuit breaker panel is hinged and bolted closed. It can be opened should access for trouble shooting electrical issues be required. Items within this enclosure are: The fire system shut down controls, the anchor winch relay and the 24V to12V Power Converter.

There is a second electrical enclosure located under the coxswain's flat. It contains the Cole-Hersee electronic control and circuit protection devices called PDMs (Power Distribution Modules). They in turn are controlled by SIMs (Switch Interface Modules) located in the cabinet directly below the instrument panel.

Complete electrical plans are supplied which show all components and interconnections. All wires and terminal boards are permanently marked for trouble shooting or servicing of components if required.

Entry into to the electrical enclosures should only be made by a qualified technician.

VESSEL OPERATION

Operating the Moose Boat M1-44 (DMNA PB-440) does require some new, but easily learned, operational skills. As with any vessel, the operator must first have knowledge of boat handling, including navigation skills, "Rules of the Road" and an understanding of the hazards and safety issues present while operating small craft.

No person should attempt to operate this boat without being proficient at all boating skills. It is suggested that, at a minimum, persons involved with boat operation take safe boating courses offered by the USCG Auxiliary or the US Power Squadron.

THE DASHBOARD

The dashboard contains: operational switches, engine starting controls, radar/GPS/depth sounder screen, "Vessel View" engine data, tachometers and blueArrow system controls as well as indicator lights and warning buzzers.

RADAR / GPS /.DEPTH SOUNDER. This instrument provides navigational and safety (radar) information. Operational functions and screen options must be reviewed in Furuno manuals supplied.

ELECTRICAL SWITCHES Two groups of switches are on the left side of the wheel. The right-hand group of switches (10 functions) should all be turned on after battery controls are activated. These switches provide operational power and secondary circuit protection to various pieces of onboard equipment. The group of switches on the left are all for various lighting needs, plus the control of the refrigerator. They are turned on as required. Example: engine room lights, navigation lights, deck lights, cabin lights, etc.

To the right of the Radar display is located a conventional Horn button and a diving ladder stowage indicator (LED). This LED is illuminated when the ladder is removed from its stowed location and is intended to notify the operator not to move the vessel as the dive ladder is probably deployed and would be damaged if the boat is operated above idle speed. Replace the dive ladder in its mounting brackets to extinguish this warning light.

ENGINE START / STOP. The vessel does not have a standard ignition key, but rather locking toggle switches. These must be turned on before starting as they activate the engines ECM (Electronic Control Module), fuel pumps, sensors and the "Vessel View" display. The black buttons are for start and the red buttons are stop. Important: The engines are stopped by the red stop button and then the locking toggle switches are turned off. These switches must be set to the off position before turning the battery controls off. This is required to allow engine data to be down loaded properly in the ECM system. (Doing this improperly is like turning off a PC by pulling the power cord out of the wall plug.)

THE "Vessel View" DISPLAY. This Cummins/Mercruiser display shows numerous engine parameters in addition to standard oil pressure temperature, battery voltage, etc. It show fuel level and fuel consumption data. It is connected to the GPS via NMEA cable, which affords management and navigational information. The unit also displays fault information, fault codes and, most important, audible alarm alerts for any fault condition. The operator must familiarize himself with the functionality of the system by reviewing the "Smart Craft/Vessel View" manual.

HAMILTON blueArrow CONTROLS

These controls provide all steering and propulsion functions through a "drive-by-wire" electro/hydraulic system. They function as substitutes for old fashioned push/pull cables and hydraulic steering controls on a conventional vessel.

The primary blueArrow controls are: The Station Control Panel (with display and joy stick), Helm (wheel), Twin, Single-Lever shift and throttle controls and the blueArrow "Mouseboat", a low speed integrated, maneuvering control. The Hamilton Jet - blueArrow User Guide is incorporated in these instructions by reference. The User Guide should be read and understood by all operators.

MARINE GEAR (Transmission)
The transmission or marine gear provides three functions. One, it is a reduction gear to match proper engine RPM to impeller size and pitch. Two, it provides a total disconnect between transmission and the jet pump (positive neutral). Three, it gives the user the ability to "back flush" the jet pump, should debris or weeds be sucked into the system. Back flushing effectively pulls water in from the output nozzle and pumps water out the intake grate under the boat.

See Hamilton Jet blueArrow documentation for control of the marine gear.

NOTE: The inherent safety of jet drive makes it optional whether or not the gear is engaged when the engines are started. Therefore this function is NOT interlocked. It is strongly recommended that the engines be started in neutral to avoid a powerful "wash" from the jet drives.

FIRE SYSTEM

The boat is fitted with an automatic fire suppression system in each engine room. It is temperature activated and will automatically release FM200 into the compartment and simultaneously shut down ALL engines. A fire system monitor panel is located on the meter panel and is accessible to the coxswain and observer. It should always display a green light. An override switch is provided within this panel to allow an engine to be restarted after the fire system has discharged and the engines have shut down.

OVERHEAD CONSOLE

The overhead console contains:

Two VHF Marine Band radios
Siren Loud/Hailer
IR Camera Display
Windshield wiper control

120VAC AIR CONDITIONING The air-conditioning is provided by an 18,000 Btu Marine Air system comprised of a single unit containing an air handler, refrigeration unit and a seawater cooled condenser. It is located in the Starboard mid hold along with a seawate strainer and pump. Together they provide ducted (conditioned) air to four locations within the cabin. Note: The air-conditioner will function only when the boat is connected to shore power or while the generator is running.

The air-conditioning controls are located at the top of the metering electrical panel and consist of on/off and temperature controls. Air temperature sensing is done through a remote sensor in the cabin. The air-conditioner is capable of providing heat through a reverse cycle feature as long as the seawater is reasonably warm. See Marine-Air manuals for complete operating instructions.

Note: It is extremely important to winterize this unit before freezing weather is expected. Failure to do this could result in damage to the condenser coils or a broken intake filter and compartment flooding.

FINAL WORDS

This vessel is designed to be used. Water jet propulsion units can not be effectively "bottom painted" internally with anti-fouling paint because of the high water volumes and water speeds within the drive. Therefore they are susceptible to accumulating marine growth and possibly even barnacles within the jets if not used for extended periods. The best defense against this is regular use of the vessel.

D. Additional Features.

The boat includes the following additional features and components:

1. Hull:

   a. Aluminum construction, with ¼-inch plate.

   b. Catamaran hull, 6 watertight compartments

   c. Supplementary fendering – four per side

   d. 30 gallon fresh water tank – plastic

   e. 24 gallon sewage tank - plastic

   f. AWLGRIP polyurethane paint system

2. Deck:

   a. Aluminum

   b. Self bailing scuppers

   c. (8) welded cleats, (3) mooring bits

   d. Fore and aft bollards

3. Cabin:

   a. Forward leaning windshield with ¼-inch clear, tempered glass – Diamond Sea Glaze

   b. Sliding ¼-inch side windows

   c. Seats ten persons

   d. Includes chart table

   d. Air conditioner -18,000 Btu, 120VAC

      (1) Unit is located forward of starboard engine room

   e. Forward berth

   f. Overhead and dash grab rails

   g. Heater, electric baseboard

   h. Air circulation fans – one each on three forward windows

   j. Fold-down (military) mast

k. Deck flood lights

4. Engines:

a. Cummins 600 hp diesels (2) model QSC 8.3 ltr turbocharged

(1) Cruise speed: 2600 rpm (30 knots)

(2) Full speed: 3000 rpm (42+ knots)

(3) Ref: Cummins Bulletin No.3666022-04, *Operation and Maintenance Manual B and C Series Marine Propulsion Units Worldwide*; and Cummins Bulletin No. 3381982-003, *C-Series Aftercooled [Family M14TA] Technical File*

5. Transmission:

a. Twin Disk Marine Transmission MG5075

b. *Ref: Twin Disk Incorporated Marine Transmission Owners Manual* #1016313

6. Drives:

a. Hamilton HJ322 water jets

b. Access through hatches on swim platform

7. Generator:

a. Northern Lights 8.0 KW Model M753W2

b. Located in starboard engine compartment

8. Steering:

a. HamiltonJet blue-arrow electronic “drive by wire” controls

(1) Wheel and clutch throttle controls (electronic/manual)

(2) “Mouseboat” electronic control (electronic/computer)

(3) Joystick controls (electronic/backup system)

(4) Manual controls by using a screwdriver at the control heads

9. Fuel system:

a. 480 gallons (240 gallon tanks port and starboard). The tanks are not cross-connected.

b. Fuel filter – Racor 900 fuel/water separator

10. Electrical system:

a. 24 VDC batteries in three pairs wired in series

b. Power distribution management system – Cole Hersee

c. Bilge pumps (4), 2000GPH

d. 12 VDC outlets in cabin (4)

e. 120 VAC outlet in cabin (1)

11. Lighting:

a. Navigation/anchor lights

b. Blue strobe light bar on mast

c. Spotlight

d. Interior fluorescent and LED lighting including red night lights

12. Navigation and electronics:

a. Radar/GPS/Plotter – Furuno all in one system with NAV-NET

b. Binnacle magnetic compass - Ritchie

c. VHF radios (2) - Standard Horizon Matrix GX3000S 25 watt marine

d. Hailer – Whelen

e. Infra-red camera – 360 degree rotatable – Therma-Eye 4000M

13. Ground tackle:

a. Anchor, 44 lbs plow type; 200 feet of chain and anchor line

15. Trailer: None

16. Other:

a. Microwave oven - Tappan

b. Fridge/freezer – Nova Kool R2600C

c. Water heater

d. Swim/dive platform aft, with fold down swim ladder

e. Buoyancy collar

f. Lifting slings – 40,000 lbs SWL capacity

g. Vacu-Flush head

h. 30 gallon water tank

i. 18 gallon holding tank (plastic)

E. General Maintenance Requirements.

MAINTENANCE OVERVIEW

ELECTRICAL

When dockside, always keep the boat plugged into 120VAC shore power. This will keep battery maintenance charger, engine block heaters and the bilge heater running. This will also insure that the batteries will support the bilge pump demands should the pumps turn on for an extended time.

Batteries are of the AGM type and are maintenance free. It is a good idea, however, to periodically look at the battery terminals, check for any corrosion and the security of the battery wire connections and battery hold down fixtures.

ENGINE

Scheduled maintenance for engines including oil filters, fuel filters and oil changes must be adhered to. Information regarding all service aspects is covered in the Cummins manuals.

COOLING SYSTEM

The Seawater intakes pass all water through a strainer mounted adjacent to the engine. This strainer should be inspected often for accumulated debris. The gasketed lid can be opened only when engines are stopped. The strainer should be removed, cleaned, and extra care should be taken in replacing the lid. Always make sure that the "O"-ring is in place and that all the lid fasteners have been securely tightened.

The engine coolant must be completely filled within the expansion tank to the highest level. The coolant overflow bottle should always show some amount of coolant liquid. Even a small loss of coolant will result in a "Low Coolant" alarm.

TRANSMISSION (MARINE GEAR)

There is no maintenance on the transmission other than oil changes. However, consult Twin Disc manual for all transmission service needs. Moose Boats has provided manual oil change extraction pumps for both engine and gear oil, clearly marked in each engine room.

JET PUMPS

The most important maintenance issue with the pump is to be sure that the intake port is free of marine growth. This is particularly important if the boat is not frequently used. It may be necessary (especially in summer months), to have a diver remove the intake grate and inspect and/or remove growth from the interior housing.

There is only one grease fitting on the pumps main thrust bearing. This should be greased every 100 hours of use. Never attempt to run the Hamilton Jet when the boat is not in the water as the main shaft is supported by a water lubricated cutlass bearing.

Hamilton manuals should be consulted for further maintenance guidelines.

CORROSION

The boat should be kept clean and washed with fresh water after each use. This will prevent crevice corrosion around windows or where hardware is attached to the aluminum.

- There are several places where protective zinc anodes are installed to protect against galvanic corrosion.
- The engines have several pencil zinc anodes in various places (consult Cummins manual)
- The exhaust riser (muffler) has one zinc anode on bottom of each unit.
- There are several zincs anodes on the Hamilton Jet, (inside and out). Consult Hamilton manual for location.
- There are four large zinc anodes bolted to the hull. Two within the tunnel and two on the transom adjacent to the jet pumps.

IMPORTANT During the first in the water month, all anodes should be inspected. Degradation of these anodes can largely be affected by unique conditions within the harbor. This early inspection will then give an indication of the future maintenance needs specific to the boat in a particular environment.

COLD WEATHER OPERATION

There are several systems on the boat that require decommissioning and winterization if the boat is operated in or exposed to temperatures below 32 deg F.

Domestic (Potable) water system.

This system consists of a polyethylene storage tank in the mid compartment, Starboard, a variable speed water pump co-located with the tank, PEX plumbing, an electric "on demand" hot water heater and faucet. All components are subject to freezing and must be winterized before freezing weather is anticipated.

- To minimize water spilled in the bilge, run the pump and drain the tank through the normal plumbing and discharge overboard through the galley sink drain.
- Disconnect the hose from the tank.
- Connect a short extension hose, long enough to reach the bottom of a 1 gal potable antifreeze jug to the pump input.
- Run the pump and discharge water through both hot and cold water taps until significant red fluid is discharged.
- DON'T FORGET the Head ! Flush several times until antifreeze appears in the bowl.
- To prevent inadvertent running of the pump after winterizing, disconnect the provided "bullet connector" at the pump positive wire.
- After winterization is complete, reconnect the hose to the tank
- DO NOT add antifreeze solution to the tank. Draining the tank is all that is required.

Vac-U-Flush Head

- Empty holding tank in the normal fashion at an approved facility.
- Close the water feed valve.
- Pour a half gallon of antifreeze into the bowl and flush.
- Repeat.
- Secure the vacuum pump electrically by disconnecting the bullet connector in the positive wire.
- See Vac-U-Flush for additional information on cold weather preparation.

Air-conditioning System

During freezing weather it is necessary to winterize the saltwater cooling circuit including the sea strainer pump and condenser.

- Close the seacock and secure it so it can not be opened.
- Remove and drain the water strainer bowl.
- Utilizing the 3 way valve rig a hose and funnel to introduce potable antifreeze into the water line. Have an assistant run the air conditioner to have the pump circulate the antifreeze until a significant amount is discharged overboard.
- Fill the strainer bowl with antifreeze and reinstall.
- Secure the electrical power for the air-conditioning system by removing the plug behind the A/C control panel. This will prevent inadvertent operation "out of season".
- See Marine-Air manual for additional cold weather hints.

(PB 440 Bow view)

(PB 440 Stern view)

(Mast assembly)


(Communications and Infra-red control module)


(Cabin)

(Cabin galley)

(Helm console)

(Electrical panel)

(Generator set control)

(Generator set starboard engine room)

(Starboard main engine)

U.S. Department of Transportation
United States Coast Guard

Commander
United States Coast Guard
Sector New York

212 Coast Guard Drive
Staten Island, NY 10305
Phone: (718) 354-4003
Fax: (718) 354-4009

16710
21 October 2008

Captain Robert H. Pouch
Deputy Commander, Operations
New York Naval Militia
17 Battery Place, Suite 230
New York City, NY 10004

Subj: NEW YORK NAVAL MILITIA MOOSE BOAT (PB 440); STABILITY LETTER

Dear Captain Pouch:

On July 31, 2008, U.S. Coast Guard Sector New York Marine Inspectors performed a simplified stability proof test in accordance with 46 CFR 178.330 on the subject vessel. Subsequently, the Marine Safety Center conducted a technical analysis to evaluate the lightship characteristics and intact stability on the subject vessel. The results of the proof test and technical analysis indicate that the vessel has satisfactory stability for the carriage of 23 persons (based on 185 pounds per person) on "partially protected waters." "Partially protected waters" is defined in 46 CFR 170.050 and means those waters within 20 nautical miles of the mouth of a harbor of safe refuge.

The previous stability letter dated 12 August 2008 for the subject vessel is cancelled.

The following restrictions apply:

1. Consistent with pollution prevention requirements, the bilges of all compartments shall be kept pumped to a minimum at all times.

2. No weights, permanent ballast or watertight bulkheads shall be added, removed or relocated without the authorization of the Officer in Charge, Marine Inspection.

3. This vessel does not meet the rails and guards criteria required by 46 CFR 190.25 small passenger vessels.

It shall be the responsibility of the Master to maintain the vessel in a satisfactory stability condition and to follow the instructions and precautions listed above at all times.

Sincerely,

Robert R. O'Brien

ROBERT R. O'BRIEN, JR.
Captain, U. S. Coast Guard
Officer in Charge, Marine Inspection

Enclosure: Coast Guard Marine Safety Center letter dated 9 Sep 2008

U.S. Department of Homeland Security

United States Coast Guard

Commanding Officer
United States Coast Guard
Marine Safety Center

2100 2nd St., SW
Washington, DC 20593
Staff Symbol: CG MSC-1
Phone: (202) 475-3401
Fax: (202) 475-3920

16710/P014377
Serial: H1-0802605
9 Sep 2008

MEMORANDUM

From: R. C. Compher, LCDR
CG MSC-1

Reply to Attn of: LT M. Venturella
(202) 475-3361

To: CG Sector New York, Prevention Department

Subj: MOOSE BOATS INTACT STABILITY ANALYSIS

Ref: (a) Email between Mr. Castillo (CG Sector New York) and LCDR Compher (MSC) of 06 AUG 08

1. As requested in reference (a), we have performed a technical analysis to evaluate the lightship characteristics and intact stability of the catamaran PB-440 being used by Station New York for boardings. This analysis was based on the deadweight survey results submitted with reference (a) and the vessel drawings submitted separately by Roger Fleck, President of Moose Boats.

2. A more detailed explanation of the stability analysis can be found in enclosure (1), but in summary, the vessel has adequate intact stability for service with 23 persons on partially protected and protected waters. When evaluated for exposed waters, the vessel fails to meet one of the righting energy requirements because the engine vents (downflooding points) submerge within 30 degrees of heel.

3. If you have questions or need additional information, please contact LT Michael Venturella at the number above.

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Enclosure: (1) Explanation of Analysis & Assumptions for Stability

ENCLOSURE (1)

EXPLANATION OF ANALYSIS & ASSUMPTIONS

General Assumptions Made for Conducting the Stability Analysis

1. A brackish water specific gravity of 1.018, as measured at the time of the deadweight survey, was used in the reduction of lightship values. A saltwater specific gravity of 1.025 was used for the stability analysis.

2. As an accurate calculation of the vessel's vertical center of gravity can only be obtained from an inclining, an indisputably conservative estimate of the lightship vertical center of gravity was assumed at the main deck level.

3. The loading conditions were developed using the following assumptions:
   a. The vessel will carry a maximum of 23 passengers, of which 6 will be in the deckhouse structure on the main deck. The remaining 17 passengers will be located on the aft portion of the main deck. An average weight per passenger of 185 pounds was used and a passenger vertical center of gravity of 2.5 feet was utilized.
   b. The vessel will depart with fuel and fresh water tanks full and return with a minimum loading of 10% of its fuel and water capacity.
   c. The vessel will carry approximately 90 lbs of body armor vests in the deckhouse structure at all times.

Definitions

1. *Exposed Waters* (46 CFR 175.400):
   a. Waters, except the Great Lakes, more than 20 nautical miles from a harbor of safe refuge;
   b. Those portions of the Great Lakes more than 20 nautical miles from a harbor of safe refuge from October 1 of one year through April 15 of the next year (winter season); and
   c. Those waters less than 20 nautical miles from a harbor of safe refuge that the cognizant Officer in Charge, Marine Inspection, determines are not partially protected waters or protected waters because they present special hazards due to weather or other circumstances.

2. *Partially Protected Waters* (46 CFR 175.400):
   a. Waters not more than 20 nautical miles from the mouth of a harbor of safe refuge, unless determined by the cognizant OCMI to be exposed waters;
   b. Those portions of rivers, estuaries, harbors, lakes, and similar waters that the cognizant OCMI determines not to be protected waters; and
   c. Waters of the Great Lakes from April 16 through September 30 of the same year (summer season)

3. *Protected Waters* (46 CFR 175.400):
   Sheltered waters presenting no special hazards such as most rivers, harbors, and lakes, and that is not determined to be exposed waters or partially protected waters by the cognizant OCMI.

4. *Downflooding* (46 CFR 170.055):
   The entry of seawater through any opening into the hull or superstructure of an undamaged vessel due to heel, trim, or submergence of the vessel.

5. *Downflooding angle* (46 CFR 170.055):
   Static angle from the intersection of the vessel's centerline and waterline in calm water to the first opening that cannot be closed watertight and through which downflooding can occur. For intact stability, CG-5212 policy allows for the downflooding angle to be calculated to the first opening that cannot be closed *weathertight*.

Deadweight Survey Results

1. A deadweight survey was conducted by Sector New York on July 31, 2008 at 0900 in Staten Island, NY. The results of the deadweight survey were submitted with reference (a) to MSC on August 6, 2008.

2. Six port and starboard freeboard readings were taken, evenly spaced along the hull. These freeboards are listed in Table (1):

Location Name	Location (feet aft of bow)	Freeboard		
		Port (in.)	Stbd (in.)	Avg (in.)
Bow	0	23	23	23
Station 2	9.5	21	22	21.5
Station 3	19	22	23	22.5
Station 4	28.5	22	22	22
Station 5	38	21	22	21.5
Stern	44	19	19	19

Table (1): Freeboards

3. Weights to remove were submitted for the purpose of lightship calculation. These weights are listed below in Table (2). Table (3) shows the reduction of lightship values.

Weights to Remove		Center of Gravity		
Item	**Weight (LT)**	**Longitudinal (ft aft of bow)**	**Transverse +s/-p (ft off centerline)**	**Vertical (ft above baseline)**
Fuel (346 gal)	1.1276	23	0	2
F/W Tank Port (14 gal)	0.0519	21	-4.5	2
F/W Tank Stbd (10 gal)	0.0371	21	4.5	2
Body Armor (90 lbs)	0.0402	22	0	4
Total	**1.257**	**22.83**	**0**	**2.06**

Table (2): Weights to Remove

	Displacement (LT)	LCG (ft aft of bow)	TCG (ft off centerline)	VCG (ft above baseline)
As Surveyed	14.09	23.67	0	
Weights to Remove	1.257	22.83	0	2.06
Lightship	**12.83**	**23.75**	**0**	**4 (Assumed)**

Table (3): Reduction of Lightship

4. The downflooding points were identified as the port and starboard engine room vents, located 13 feet forward of the stern, 6 feet 4 inches off centerline, and 6 feet 3-1/4 inches above the baseline.

Analysis and Stability Results

1. A model was digitized to the main deck from the lines plan submitted by Roger Fleck, President of Moose Boats, EBDG, Inc. Dwg. No. 05152-6-9000, dated December 13, 2005. Figure (2) is an image of the resulting General Hydrostatics (GHS) model.

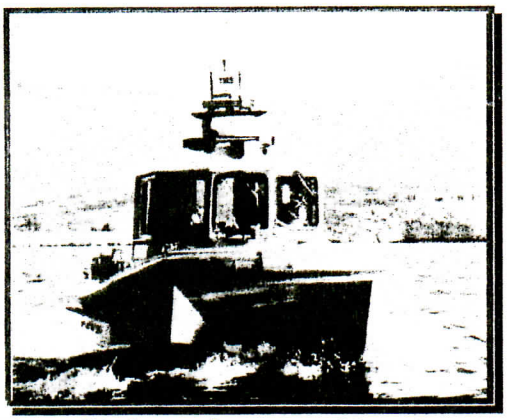

Figure (1): Image from www.Mooseboats.com

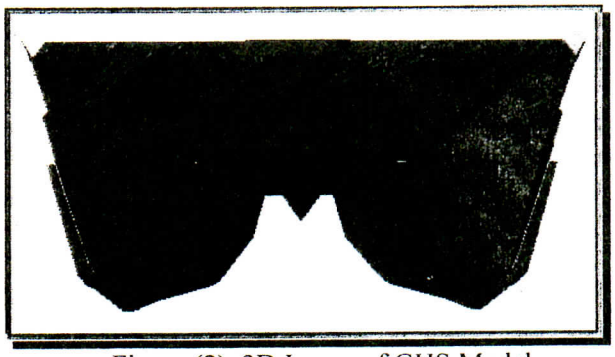

Figure (2): 3D Image of GHS Model

2. Table (4) is a summary of the weights to add to lightship for the departure condition:

Departure Condition				
	Displacement (LT)	LCG (ft aft of bow)	TCG (ft off centerline)	VCG (ft above baseline)
Lightship	12.83	23.75	0	4
Fuel (100%)	1.630	23	0	2
F/W Tank Port (Full)	0.052	21	-4.5	2
F/W Tank Stbd (Full)	0.037	21	4.5	2
Body Armor Vests	0.040	22	0	4
Passengers (6) Deckhouse	0.496	18	0	6.5
Passengers (17) Main Deck Aft	1.404	30	0	6.5
Departure Condition	**16.49**	**24.02**	**0.00**	**4.08**

Table (4): Departure Condition

3. An intact stability analysis was conducted on the model utilizing the standards for inspected passenger vessels. Both arrival and departure loading conditions were evaluated for intact stability, but only the more conservative and limiting departure condition results are presented. Results indicated that the PB-440 has adequate intact stability for service with 23 persons on partially protected and protected waters. When evaluated for exposed waters, the model meets the intact stability requirements of 46 CFR 170.170 (GM Weather) and 46 CFR 171.050 (Passenger Heel), and all of 46 CFR 170.173 (Righting Energy) except for 170.173 (c) (4). Specifically, the model did not meet 46 CFR 170.173 (c) (4) that requires an area under each righting arm curve (righting energy) between the angle of 30 and 40 degrees or the downflooding angle, if this angle is less than 40 degrees, of not less than 5.6 foot-degrees.

   In this case, the downflooding angle is the angle of submergence of the port and starboard engine room vents. Figures (3) and (4) are the results of the 46 CFR 170.173 (c) analysis for the departure condition.

Critical Point			LCP	TCP	VCP
(1) Engine Room Vent		FLOOD	26.72a	6.33	6.27

INTERVALS OF AREA AND ENERGY

From	To	Area	Energy
0.00	28.47s*	48.10	13.84
Angles in deg		Areas in Ft-Deg	Energy in Ft-LT

* Flood pt. immersion

LIM	46CFR170.173(C) CRITERION		Min/Max		Attained
(1)	GM Upright	>	0.49	Ft	7.94 P
(2)	Absolute Angle at MaxRA	>	15.00	deg	23.70 P
(3)	Area from abs 0 deg to abs 40 or Flood	>	16.90	Ft-deg	48.10 P
(4)	Area from abs 30 deg to abs 40 or Flood	>	5.60	Ft-deg	
(5)	Area from abs 0 deg to MaxRA at abs 15	>	13.11	Ft-deg	41.48 P
(6)	Area from abs 0 deg to MaxRA at abs 30	>	10.30	Ft-deg	32.60 P

Figure (3): Failed Criteria for Departure Condition

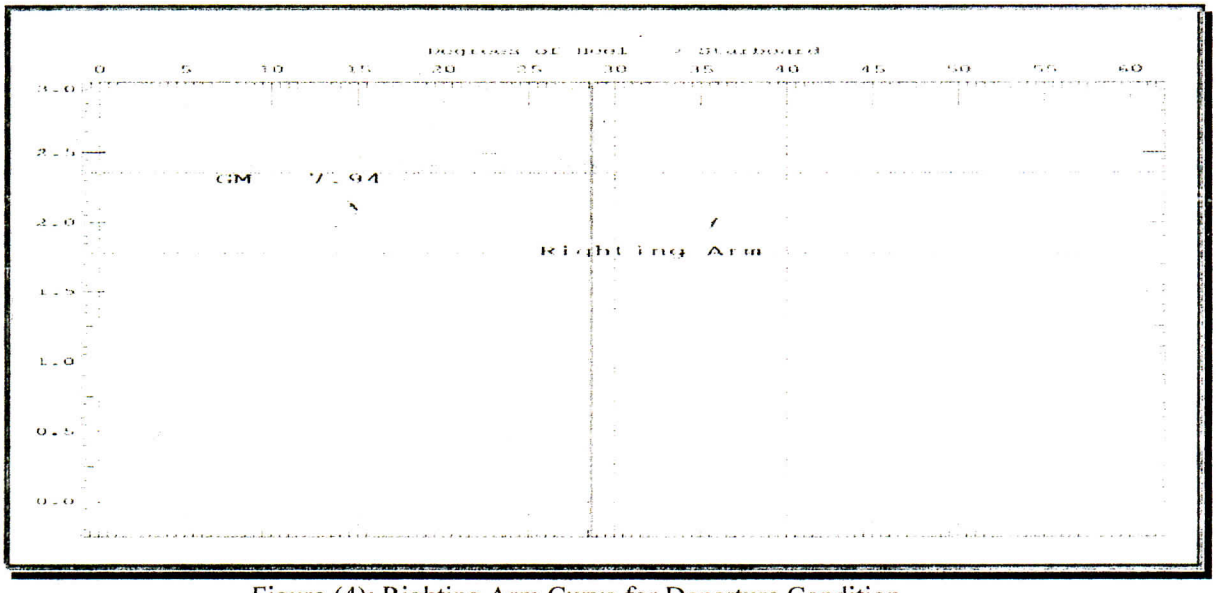

Figure (4): Righting Arm Curve for Departure Condition

The downflooding angle in this case is 28.47 degrees, marked by a green line in figure (4), so there is no righting energy after 30 degrees to the downflooding angle as required in 46 CFR 170.173 (c) (4). The model fails this criterion in both arrival and departure conditions.

The model is able to pass 46 CFR 170.173 (e) which is a less stringent criteria for partially protected and protected routes. These criteria have no requirements for righting energy past 30 degrees.

Recommendations

1. If this were a certificated vessel requesting to carry passengers on an exposed waters route, we would provide the following recommendations for the purpose of further evaluation of the vessel's stability:
    a. Locate the vertical center of gravity via an inclining experiment and reevaluate the stability with the actual (not conservatively assumed) lightship VCG.
    b. Provide a means to make the engine room vents either watertight or weathertight, eliminating them as downflooding points. The weathertight/watertight closures for these vents must be easily accessible to the vessel's crew during heavy weather.
    c. Raise the height of the engine room vents and reevaluate intact stability.

MOOSE BOATS
REAL PEOPLE – REAL BOATS

DMNA Paint Schedule

Boats are finished by the following process.

1. Mechanical sanding of all surfaces
2. Wash with ZEP fallout Wash
3. Wash with AlumiPrep Etching Wash
4. Apply Etching Primer on top-sides only
5. Apply 3 coats of InnerProtect 2000 gray below waterline
6. Apply 2 Coats of Trilux 33 Black below rubstrake
7. Apply Gray Epoxy Primer (Sandable) on entire cabin and hull surfaces
8. Light Sanding
9. Apply Top Coat Barrier Polyeurathane Grey- (Haze Gray – Awlgrip brand)

Description	Manufacturer	Manufacturer P/N
Zep Fallout Remover	ZEP	52935
Alumiprep Etching Wash	Awlgrip	73001
Etching Primer	Awlgrip	G9072
Grey Bottom Paint Primer	Interlux	Interprotect 200E
Gray Epoxy Primer	US paint	D-1001
Haze Grey Polyeurathane Top Coat	AwlGrip	1305-595-26270
Anti-fouling Bottom Paint	Interlux	Trilux 33 - Black

MILBOATSTECHMAN/BK-05
PB 400 CLASS

NEW YORK NAVAL MILITIA
MILITARY EMERGENCY BOAT SERVICE