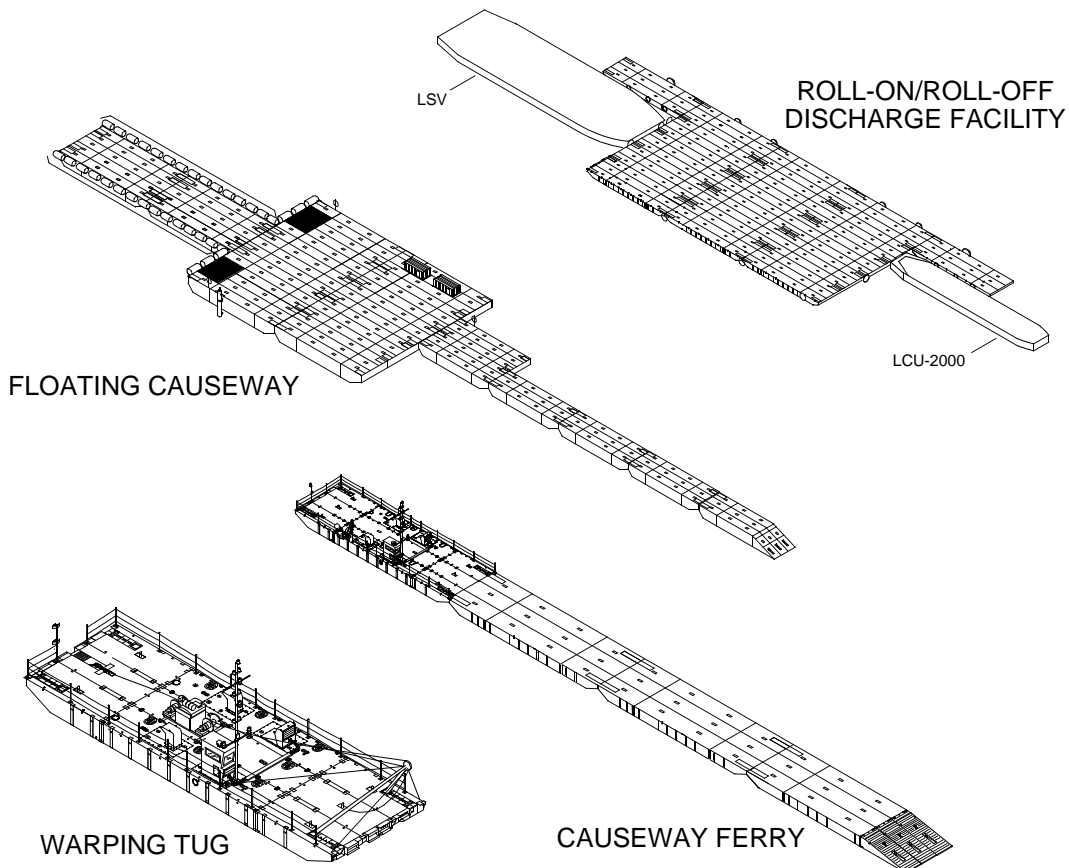


# TM 55-1945-205-10-3

## TECHNICAL MANUAL OPERATORS MANUAL FOR

### MODULAR CAUSEWAY SYSTEM (MCS) WARPING TUG (WT) WT-1

NSN 1945-01-473-2285



This manual supersedes TM 55-1945-205-10 dated 29 August 1997, including all changes.

DISTRIBUTION STATEMENT A - Approved for public release; distribution is unlimited.

**HEADQUARTERS, DEPARTMENT OF THE ARMY**

**13 SEPTEMBER 2003**

TECHNICAL MANUAL  
  
OPERATORS MANUAL  
FOR  
  
MODULAR CAUSEWAY SYSTEM (MCS)  
WARPING TUG (WT)  
WT-1  
NSN 1945-01-473-2285

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**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Equipment Technical Publications), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is <http://aeeps.ria.army.mil>. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or email your letter or DA Form 2028 direct to: AMSTA-LC-CI / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The email address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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## HOW TO USE THIS MANUAL

This manual contains certain features to improve the convenience of using this manual and increase the user's efficiency. These features include:

### a. Accessing Information

Information is accessed by referring to the Table of Contents, located in the front of this manual, or by looking in the Alphabetical Index, located in the back of this manual.

### b. Illustrations

Various methods are used to locate and repair components. Locator illustrations in Controls and Indicator tables, PMCS tables, exploded views and cut-away diagrams make the information in the manual easier to understand and follow.

### c. Using This Manual

When using this manual, read and understand the entire maintenance action before performing the task. Also, read and understand all warnings, cautions and notes as well as general safety precautions that apply to the task to be performed. The warning summary will inform personnel of hazards associated with the equipment to be worked on. However, the summary is not all inclusive and personnel should be aware at all times of hazardous conditions that may arise.

Prior to starting the procedures in this manual, the initial setup requirements are located directly above each procedure. The information is given to ensure all materials, expendables, tools and any other equipment necessary are readily available for use. The initial setup will be accomplished prior to starting the actual steps of each maintenance procedure.

## Locating Major Components

Obtain the manual for the system to be worked on. Open to the Table of Contents located in the front of this manual. Find Chapter 1, *Description and Theory of Operation*. Under the chapter title you will find the work package titled *Location and Description of Major Components*. Turn to the work package indicated. This work package will give a brief description of the major components, and show an illustration of what the component looks like and its location.

The Alphabetical Index, located in the back of this manual, contains an alphabetical list of all sections of this manual. *Location and Description of Major Components* is found in section L. The work package is found on the right side of the title where the *Location and Description of Major Components* is located. Turn to the work package indicated to find the description and location of each component.

## Operator Instructions

To locate an operator task, open the manual to the Table of Contents located in the front of this manual. Locate the procedure that is to be performed. Next to the procedure, on the right, locate the work package number. Turn to the work package number in the manual. Perform the initial setup by obtaining the expendables, tools, materials and other items listed prior to starting the task. Perform the listed steps in order. The Alphabetical Index can also be used to locate the item and procedures to follow.

**Tools:** Lists all tools (standard or special) required to perform the task. Tools are identified with an item number and work package number from the *Tool Identification List* located in Chapter 4, *Supporting Information*.

**Materials/Parts:** Lists all parts or materials necessary to perform the task. Expendable and durables are identified with an item number from the applicable work package located in Chapter 4, *Supporting Information*.

**Personnel Required:** Lists all personnel necessary to perform the task.

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**Equipment Condition:** Notes the conditions that must exist before starting the task. The equipment condition will also include any prerequisite maintenance tasks to be performed with reference to the work package number or to the TM number.

**References:** Includes any other manuals necessary to complete the task. When there are no references listed, all steps necessary to complete the task are contained within this manual. A listing of reference materials is contained in the work package *References* in Chapter 4, *Supporting Information*.

### Location of Controls and Indicators

To locate a particular control and/or indicator, open the manual to the Table of Contents located in the front of the manual. Find Chapter 2, *Operator Instructions*. Locate the work package titled *Description and Use of Operator Controls and Indicators*. Turn to the work package indicated. Locate the control and, or indicator that you are attempting to identify. Take note of the number pointing to the control or indicator. Refer to the table below the picture and find the number in the column on the far left hand side. Reading from left to right, find the number that matches the number from the picture, then read the name of the control/indicator and following function of the item, as detailed in the far right hand column.

### Troubleshooting Procedures

The Table of Contents or Alphabetical Index may be used to locate sections within this manual. To locate a particular troubleshooting procedure, open the manual to the Table of Contents located in the front of this manual. Find Chapter 3, *Troubleshooting Procedures*. Under this section, find a work package titled *Troubleshooting Index*. Turn to the work package indicated, which lists all of the troubleshooting procedures. Look down the list until you find the appropriate work package for the problem you are trying to solve. To the right side of the procedure will be a work package number. Turn to the work package indicated and follow the steps to complete the troubleshooting procedure. The procedures list the malfunction, symptom and the corrective action. The corrective action will indicate which maintenance procedure to go to for the repair of the symptom or what level of maintenance is capable of repair of the problem. Follow the procedures indicated to complete the task. At the top of the task you will have a section called INITIAL SETUP. There are five basic headings listed under INITIAL SETUP.

**Test Equipment:** Lists all test equipment (standard or special) required to troubleshoot, test and inspect the equipment covered in this manual. The test equipment is identified with an item number and work package number from the *Tool Identification List* located in Chapter 4, *Supporting Information*.

**Tools:** Lists all tools (standard or special) required to perform the task. Tools are identified with an item number and work package number from the *Tool Identification List* located in Chapter 4, *Supporting Information*.

**Personnel Required:** Lists all personnel necessary to perform the task.

**Equipment Condition:** Notes the conditions that must exist before starting the task. The equipment condition will also include any prerequisite maintenance tasks to be performed with reference to the work package number or to the TM number.

**References:** Includes any other manuals necessary to complete the task. When there are no references listed, all steps necessary to complete the task are contained within this manual. A listing of reference materials is contained in the work package *References* in Chapter 4, *Supporting Information*.

### Maintenance Instructions

To locate a maintenance procedure, open the manual to the Table of Contents located in the front of this manual. Find Chapter 4, *Maintenance Instructions*. Look down the list and find the maintenance procedure to be accomplished. On the right side of the maintenance procedure will be a work package number. Turn to the work package indicated.

Before beginning the maintenance task, look through the procedure to familiarize yourself with the entire maintenance procedure. At the top of the task you will have a section called INITIAL SETUP. There are five basic headings listed under INITIAL SETUP.

**Tools:** Lists all tools (standard or special) required to perform the task. Tools are identified with an item number and work package number from the *Tool Identification List* located in Chapter 4, *Supporting Information*.

**Materials/Parts:** Lists all parts or materials necessary to perform the task. Expendable and durables are identified with an item number from the applicable work package located in Chapter 4, *Supporting Information*.

**Personnel Required:** Lists all personnel necessary to perform the task.

**References:** Includes any other manuals necessary to complete the task. When there are no references listed, all steps necessary to complete the task are contained within this manual. A listing of reference materials is contained in the work package *References* in Chapter 4, *Supporting Information*.

**Equipment Condition:** Notes the conditions that must exist before starting the task. The equipment condition will also include any prerequisite maintenance tasks to be performed with reference to the work package number or to the TM number.

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**OPERATOR MAINTENANCE  
WARPING TUG  
GENERAL INFORMATION**

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**SCOPE**

This manual contains descriptions and instructions for the Warping Tug (WT).

Type of Manual: Operator Maintenance.

Purpose of Equipment: The purpose of the WT is for towing, anchor mooring and recovery, craft salvage during Logistics-Over-the-Shore (LOTS) deployment and handling of supplies between ship and beach.

**MAINTENANCE FORMS, RECORDS AND REPORTS**

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS) and AR 700-138, Army Logistics Readiness and Sustainability.

**REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)**

If any component in your system needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368, Product Quality Deficiency Report.

**CORROSION PREVENTION AND CONTROL (CPC)**

CPC of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling or breaking of the materials may be a corrosion problem. If a corrosion problem is identified, it can be reported using SF 368, Product Quality Deficiency Report. Use of key words, such as "corrosion", "rust", "deterioration" or "cracking", will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA PAM 738-750, Functional Users Manual for The Army Maintenance Management System (TAMMS).

**OZONE DEPLETING SUBSTANCES (ODS)**

The continued use of ODS has been prohibited by Executive Order 12856 of 3 August 1993.

**DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE**

The procedures for destruction of Army materiel to prevent enemy use are contained in TM 750-244-6.

**PREPARATION FOR STORAGE AND SHIPMENT REFERENCE**

Reference WP 0036 10 through 0051 00 for preparation for storage or shipment of the WT.

**CHAPTER 1**

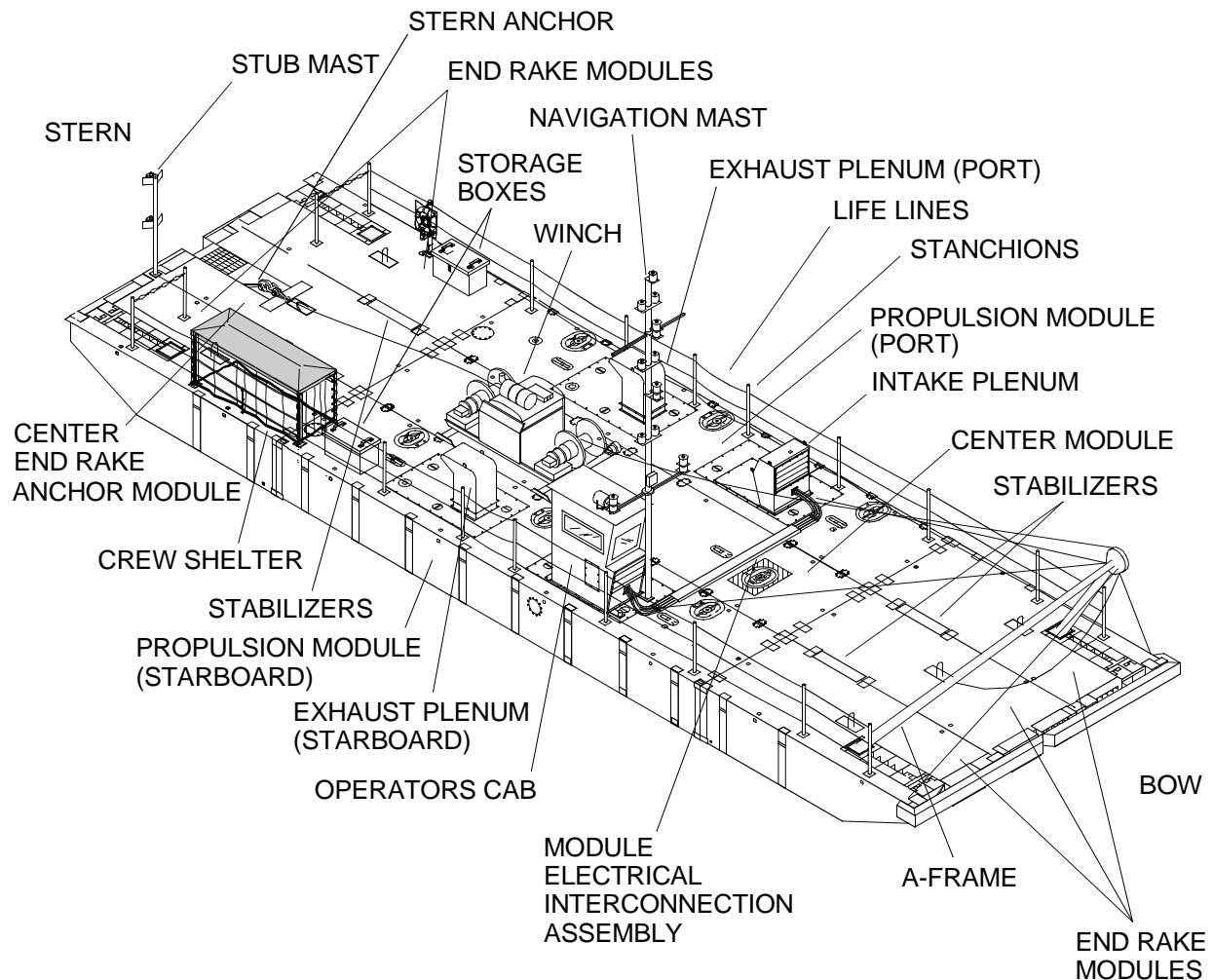
**DESCRIPTION AND THEORY OF OPERATION  
FOR  
MODULAR CAUSEWAY SYSTEM (MCS)  
WARPING TUG (WT)**

**OPERATOR MAINTENANCE  
WARPING TUG  
DESCRIPTION AND DATA**

**EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES**

The WT consists of one powered section with the application of a WT conversion kit, consisting of a diesel-hydraulic deck winch, foundation adapter, a weight-handling A-frame forward, a self-deploying/retrievable stern anchor to assist in beach retraction/salvage, and required above deck equipment. The above deck equipment includes the following: operators cab, intake/exhaust plenums, a main navigation mast, aft stub mast, electrical interconnection assembly, crew shelter and stanchion mounted lifelines.

The WT is used to assist in the assembly, movement and positioning of non-powered modules, strings, sections, Floating Causeway (FC) and Roll-on/Roll-off Discharge Facility (RRDF), to set and retrieve anchor moorings for FC and for other weight handling and towing tasks.



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**OPERATOR MAINTENANCE  
WARPING TUG  
DESCRIPTION AND DATA**

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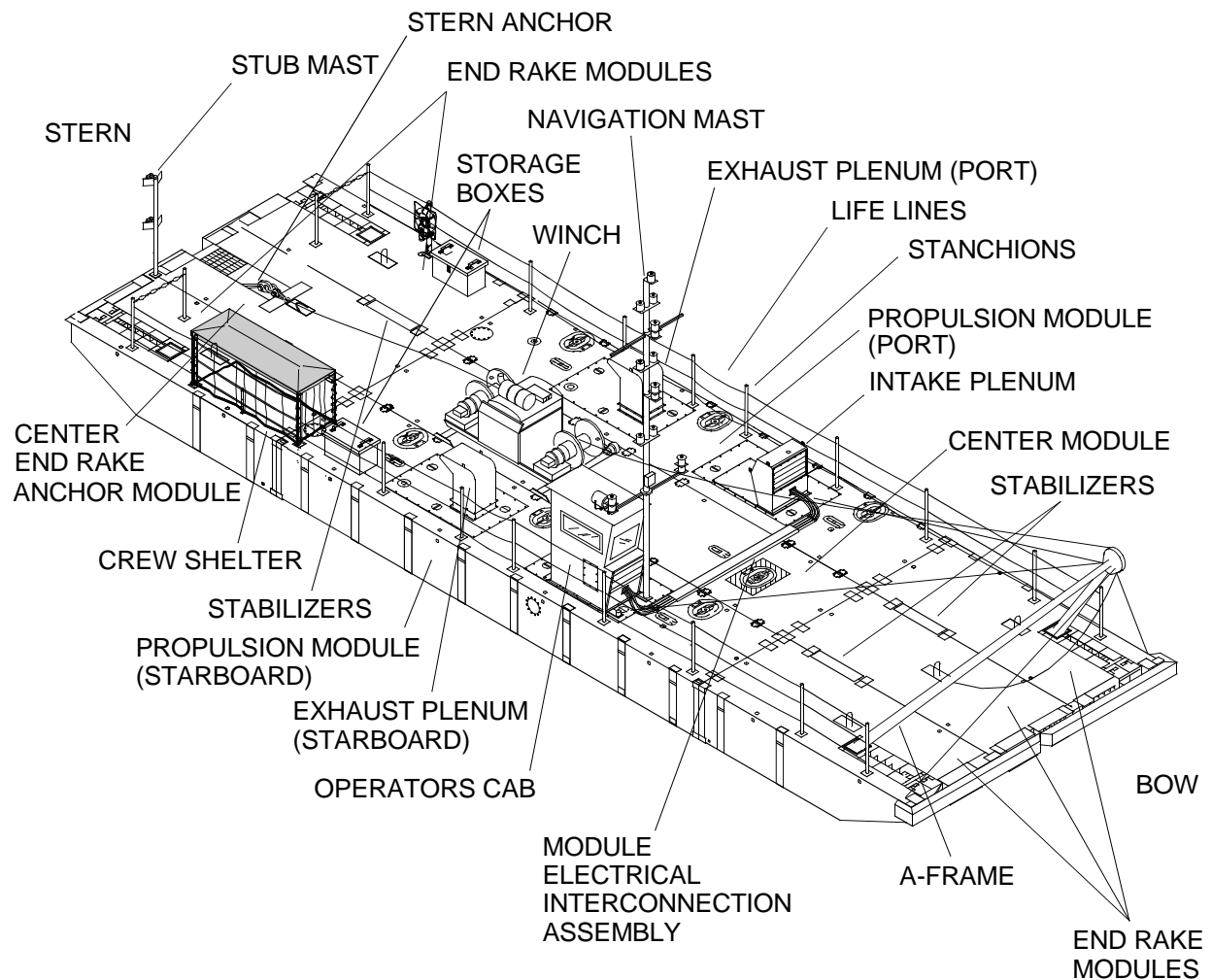
### **LOCATION AND DESCRIPTION OF MAJOR COMPONENTS**

The Warping Tug (WT) consists of two propulsion modules, one non-powered center module and six rake modules (two right, two left and two center) connected together by male/female connector assemblies. At each connector location there are upper and lower engagement points. Both engagement points are actuated simultaneously by lifting the guillotine bar vertically from the deck. The pairs of vertical connectors are spaced evenly around the perimeter of each module allowing for universal module configuration. The male connector assembly contains a retractable connector pin designed to be flush with the surface when in a stowed position. In the stowed position, the tapered shear lugs of the lock housings protrude around the pin housing. In the retracted position, the pin is compressed against the deployment spring and is held in place by the guillotine bar. The female connector assembly receives the male connector pin and, when locked, forms a positive mechanical interlock. The female connector assembly can be identified by the projecting shear lug which completely surrounds the housing. The female connector shear lug is internally tapered and sized to fit tightly with the mating lugs on the opposing male connector. This arrangement enhances the strength of the connectors, enabling it to withstand heavy shear loads.

The propulsion modules and the center module are each 8 ft wide, 40 ft long and 4 ft 6 in. high. The end rake modules are each 8 ft wide, 20 ft long, 4 ft 6 in. high and are configured as right rake assemblies, center rake assemblies and left rake assemblies. All non-powered center modules are fully ISO-compatible and are completely interchangeable. The propulsion modules are the prime mover for the WT and each is propelled by a 8 cylinder, 600 hp water cooled, turbo charged, diesel marine engine driving a 360° steerable, 5,000 lb output pump-jet.

The following items complete the WT assembly. The operators cab, with controls, is a self-contained unit designed to be removed for transport and can be mounted on either port or starboard propulsion module. Plug-in type electrical connectors are provided to tie electrical control into the cab location. A module electrical interconnect assembly is the electrical control link between the cab to the propulsion module opposite the cab. Navigation lighting is provided in the form of a 28½ ft main navigational mast mounted to the cab and a 8½ ft stub mast that is installed on the stern of the powered section. Both masts are removable for shipment. Air intake and exhaust plenums are installed on the powered modules to provide air flow through the machinery spaces. One air intake is integral to the cab. The deck equipment includes a winch, an A-frame, crew shelter and a stern anchor. The deck winch is a dual drum diesel hydraulic reversible winch with capstans that provides pull for the A-frame and stern anchor. Four stabilizers are installed, two forward and two aft, to provide stability during operation at sea. A hand held portable fire extinguisher mounts to either exhaust plenum. A removable personnel safety railing system, made up of stanchions, life lines and life rings, is installed along both sides of the powered section. The powered section, completely assembled and without fluids, weighs approximately 95 tons.





## PROPULSION MODULE

The propulsion module is the prime module in the WT and is divided into three compartments separated by watertight bulkheads with hatches. The center (machinery) compartment is the largest and contains engine cooling and exhaust components, the drive train, hydraulic system and all electrical components with the exception of one bilge pump, a single bilge pump control panel and a pressure operated switch that are located in the lazaret end compartment.

The drive train consists of a diesel engine, marine gear, transfer case and pump-jet. Guarded drive shafts connect the marine gear to the transfer case and the transfer case to the pump-jet.

The engine cooling and exhaust system consists of a sea chest (raw water inlet integral with the structure of the module), a butterfly valve, a duplex strainer, engine raw water pump, fuel cooler, engine cooler heat exchanger, marine gear oil cooler, exhaust water shut-off valve, transfer case oil cooler, transfer case shut-off ball valve, water cooled muffler and exhaust flappers.

The hydraulic system consists of a hydraulic pump driven by the marine gear, a hydraulic motor that drives the primary steering planetary gearbox mounted on the pump-jet, a hydraulic brake which is integral to the auxiliary steering planetary gearbox mounted on the pump-jet, an electrically actuated way-valve with auxiliary manual control, manually operated ball valve, needle valve, braking valve unit, pressure filter and a hydraulic reservoir with return line filter. A manual hydraulic hand pump is also provided for manual release of the hydraulic brake in case of system malfunction.

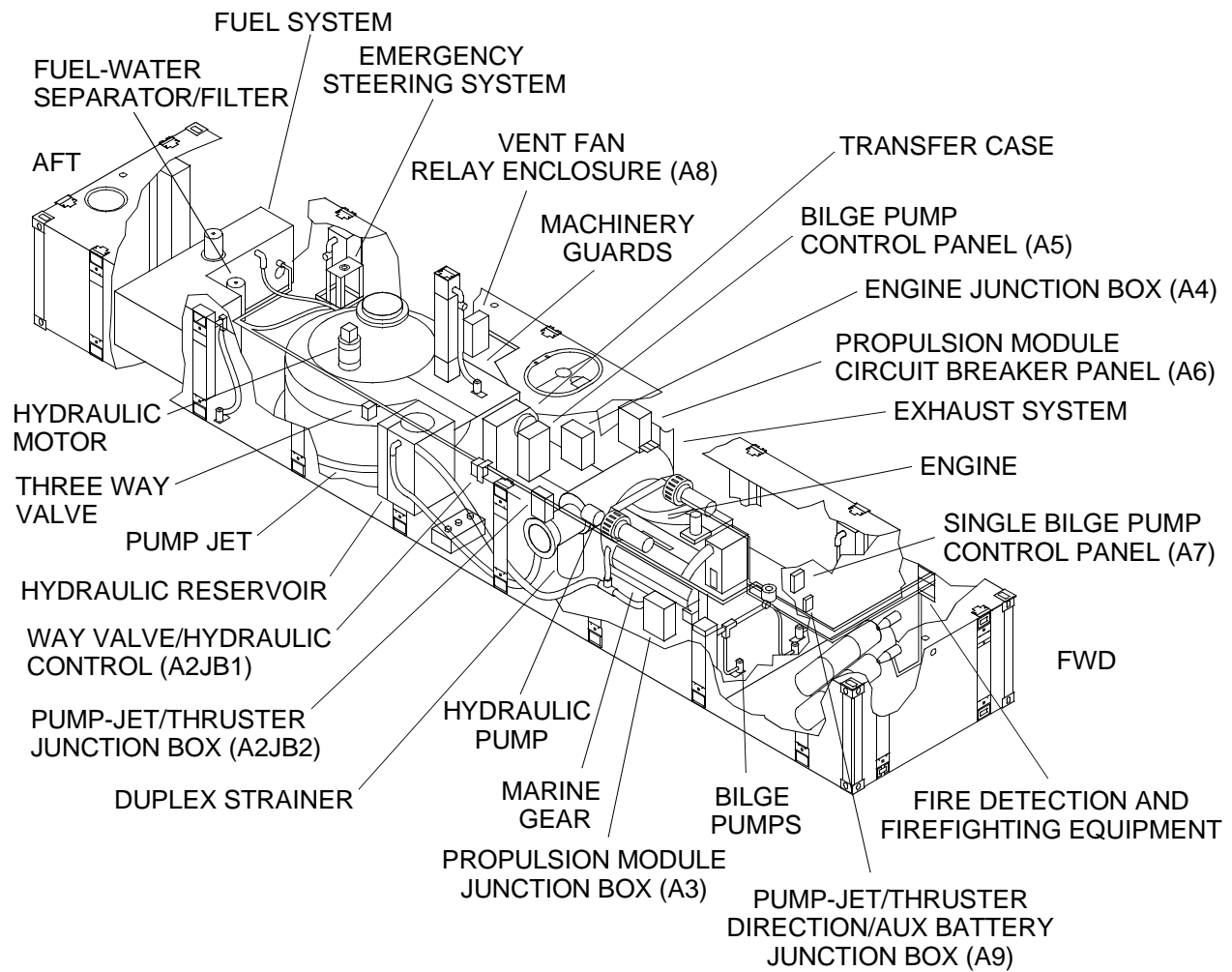
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The propulsion module electrical system consists of an engine mounted alternator, six lead-acid storage batteries, propulsion module circuit breaker panel A6, battery selector switch, high current multi-battery solenoid and operators cab 50 amp circuit breaker all located on the A10 panel, bilge pump control panel A5, single bilge pump control panel A7, engine junction box with emergency stop control A4, emergency stop push button, propulsion module junction box A3, pump-jet thruster junction box A2JB2, vent fan relay enclosure A8, pump-jet thruster direction/auxiliary battery junction box A9, fire detection system consisting of two thermal detectors and a thermal switch electrically tied into the cab controls. This compartment is also equipped with five electrically operated bilge pumps.

The aft (fuel) compartment contains the fuel tank, fuel/water separator and fuel system shutoff valves. This compartment is also protected by the fire detection system. It is important to note that there are no electrical connections, controls or operating devices in this compartment. A bilge pump is not provided in this compartment. Fire detection is accomplished by means of a probe extending through the bulkhead that separates the fuel and machinery compartments with all electrical terminations made on the machinery compartment side. In the event of fire, this compartment is flooded with CO2 upon activation of the fire suppression system.

The forward compartment (lazaret) contains the fire suppression system control and agent storage components and provides stowage for the emergency steering assembly when not in use. This compartment is equipped with a bilge pump and is not protected by the fire suppression system.

Each propulsion module has six 3,700 GPH, submersible bilge pumps; five in the machinery compartment and one in the lazaret. The pumps are locally controlled from control stations mounted in the machinery compartment and lazaret or remotely controlled from the operators cab. The pump-jet is driven by an eight cylinder, marine diesel engine delivering 600 hp at 2,100 RPM on the output shaft. Weight of the propulsion module is approximately 41,100 lb dry or 45,000 lb fully loaded. Listed are detailed descriptions of the major components found in each propulsion module.



PROPULSION MODULE MAJOR INTERNAL COMPONENTS

### Engine

The engine is an 8 cylinder, water cooled, turbo charged, after cooled, two-cycle diesel marine engine delivering 600 hp at 2,100 RPM. All operator controls of the engine are accomplished from the operators cab, with the exception of below deck emergency stop push buttons and emergency stop actuation control of the fire suppression system.

### Exhaust System

The propulsion module exhaust system consists of a water cooled muffler assembly with inputs directly coupled from both engine turbocharger exhaust ports. The muffler is supplied with two exit ports. One is plugged and one is ported to the exhaust flapper for configuration as either a port or starboard exhaust system. The piping between the turbocharger, muffler and exhaust flapper is a flexible silicon hose to accommodate for thermal expansion in the system.