BOLLINGER SHIPYARD • U.S. COAST GUARD

PRODUCTION OF THE UNITED STATES

COAST GUARD ISLAND CLASS

PATROL BOATS

Wm. Gary Rook

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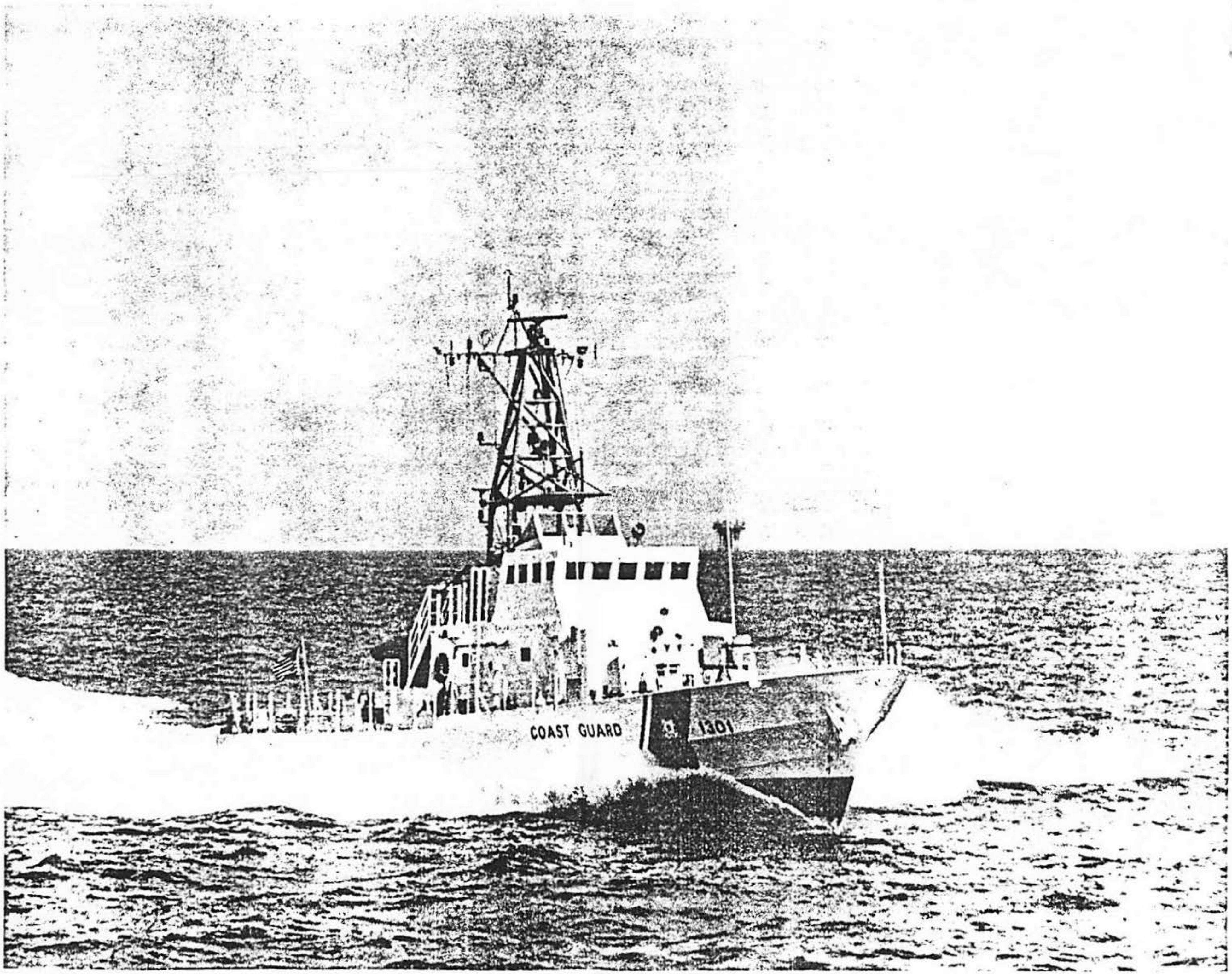
COAST GUARD
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PRODUCTION OF THE UNITED STATES COAST GUARD ISLAND CLASS PATROL BOATS

Wm. Gary Rook and Marc Stanley

THE AUTHORS

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Marc Stanley is a Vice-President of Bollinger Machine Shop & Shipyard, Inc. He presently is Program Director and Contract Manager for the United States Coast Guard WPB program. Mr. Stanley attended Gulf Coast Community College in Panama City, Florida and Louisiana Technical University in Ruston, Louisiana. He has been involved in marine construction for the past eighteen (18) years, being involved in such projects as the Trident Sub Base at Cape Kennedy, and the Naval Air Station at Mayport, Florida. Before joining Bollinger Machine Shop & Shipyard, Inc., he was Yard Superintendent at Delta Shipyards in Houma, Louisiana for five (5) years. He is an associate member of the Society of Naval Architects and Marine Engineers.

ABSTRACT

The United States Coast Guard is having sixteen (16) 110' Fast Patrol Boats built by Bollinger Machine Shop & Shipyard, Inc. in Lockport, Louisiana. These boats are based on a parent craft vessel as required by the Coast Guard Circular of Requirements (COR). The changes required to make the vessel totally comply with the COR are discussed. Production philosophy developed by Bollinger to handle this procurement is presented.

INTRODUCTION

The concept of a parent craft was specified in a COR issued by the United States Coast Guard in May of 1983. This concept and its philosophy are discussed in length in another paper presented at this symposium, "110' Island Class Patrol Boats - Concept to Completion", but briefly, its primary purpose was to reduce the technical risk to the Coast Guard and allow the quick procurement of a proven vessel with few, if any, inherent weaknesses.

Upon receipt of the COR, Bollinger surveyed the worldwide market and selected a vessel that they felt most closely paralleled the Coast Guard's requirements. This vessel was a 110' (33m) patrol craft, of which twenty-four (24) had been produced by Vosper Thornycroft (UK) Limited of Portsmouth, England.

While the initial concept was to buy 'off-the-shelf' technology, it quickly became evident that this would not totally be the case. Due to requirements imposed by the COR, it was necessary to make modifications to the parent craft in many areas. It should be noted that these changes took a fine vessel and made it much better.

ENGINEERING DESIGN DEVELOPMENT

Visibility

The parent craft was fitted with a single center stack, just aft of the open bridge, which obscured the astern visibility from this position. The enclosed bridge (pilot house) was recessed into the 01 deck and did not extend the full width of the superstructure. This offered little or no visibility astern, and restricted visibility to the bow, forward gun, and boarding quarter points forward.

As visibility was extremely important to the Coast Guard, modifications were made to the parent craft to improve visibility. The aft stack was eliminated and side exhausts were installed. This did not violate the parent craft concept, as a series of parent craft had been built with this exhaust arrangement. The elimination of the stack greatly improved astern visibility from the open bridge. It also provided a greater amount of usable deck space, which proved essential at later stages. The command spaces, pilot house and open bridge were raised so that the floor of the pilot house was at the level of the 01 deck instead of recessed, and the pilot house was widened to the full width of the superstructure. By raising the pilot house, better visibility was obtained for the bow and the forward gun mount. By widening the pilot house, side visibility was improved so that quarter points both forward and aft were visible. The additional width allowed the fitting of aft doors to the 01 level just beside the open bridge side wall. These doors were fitted with large glass inserts which provided a level of visibility aft from the pilot house.

To house the increased amount of electronics, it was necessary to increase the length of the pilot house. This created a problem with the forward visibility from the open bridge and a field change was made to raise the deck level of the open bridge to a height that the bow was visible from the operator's chair. This also increased the visibility of the forward quarter points from the open bridge which is important in docking/boarding operations.

Habitability

The parent craft were all built as coastal patrol vessels. They were essentially 'day boats' and not designed for prolonged voyages at sea. They were fitted with berthing for quite a large complement of crew, as is normally the case with Middle Eastern Navies, and as they were 'day boats' only a small galley/mess was fitted. The berthing areas were crowded and much of the 'amenities' were left out.

The COR required berthing for eighteen (18)---a crew of sixteen (16) plus two (2) spare. This was substantially less than the twenty-eight (28) fitted on the parent, so more area per person was available. The raising of the pilot house also provided additional area for berthing as the recessed 'cab' of the parent only allowed for a 4' vertical clearance below the pilot house floor. This was basically lost space in the parent which became the executive officer's stateroom and head on the WPB.

The COR requirement for a 5-day endurance required that additional galley and storage space be located. To create this additional space, the galley was moved to the 1st deck level, with the commanding officer's stateroom going to the main deck level. This allowed the galley/mess to be adjacent to each other, eliminating the need to move foodstuff from one area to another for preparation/meals. It also allowed for an increase in size of the space to handle the USCG-specified equipment, i.e., stove, hood, refrigerator/ freezer, dishwasher, trash compactor, and microwave oven.

To handle the number of crew required comfortably, it was necessary to redesign the interior arrangement of the parent. A portion of the after berthing of the parent craft, that is, aft of the engine room, still had to be utilized. To ease access from this area to the rest of the boat, doors were added to the engine room bulkheads. A table, similar to those in the mess, was located in this space, along with an identical entertainment center to that in the mess area. A private head was located in this area also. These added amenities make these spaces among the most desired on the vessel.

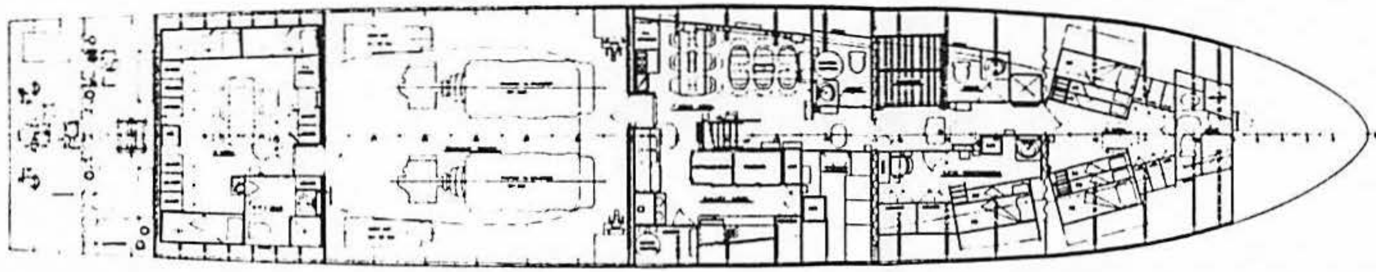
The forward crew quarters are the most crowded on the vessel, being fitted with two (2) sets of triple bunks. To add to the spaciousness of the room, the bunks were tiered, i.e., each of the bunks being placed further outboard as you go upward. While on the drawing the space seems quite crowded, it is in actuality, quite comfortable. A private head was fitted for this space also.

The CPO's stateroom is located just forward of the galley. This room is fitted with tiered double bunks, along with a lavatory unit and a desk. A private head for this space is located across the passage from the stateroom.

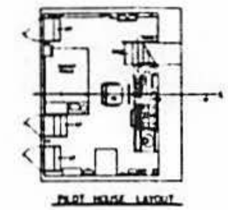
Both the commanding and executive officers' staterooms are located on the main deck. Each is fitted with a large single bunk, wardrobe, secretary/ bureau, and a private head. Location at this level is closer to the command and electronic spaces.

Damage Stability

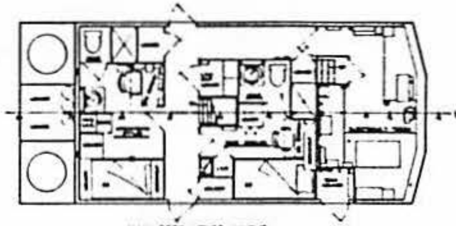
The COR requirement was for a 2-compartment subdivision based on the U.S. Navy Design Data Sheet DDS 079-1 (Stability and Buoyancy of U.S. Naval Surface Ships). This was to include a margin for a future growth of ten (10) tons amidships at the deck level. This allowance is for future weapons installation. Upon evaluating the parent, it was determined that these requirements were not met. This necessitated the relocation and



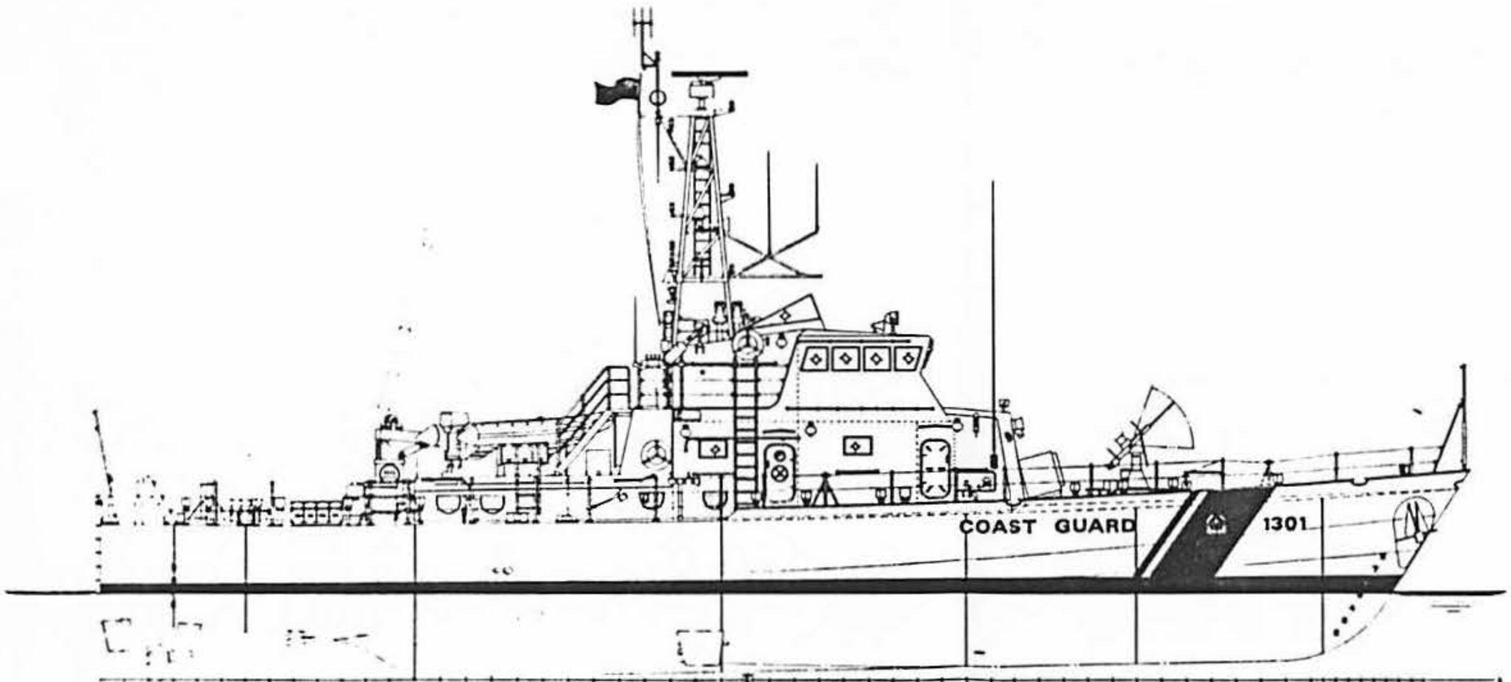
PLAN VIEW



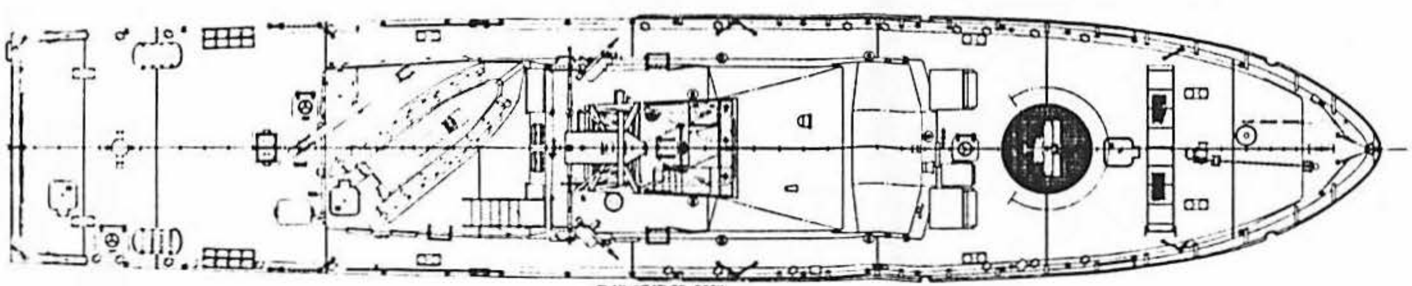
PILOT HOUSE LAYOUT



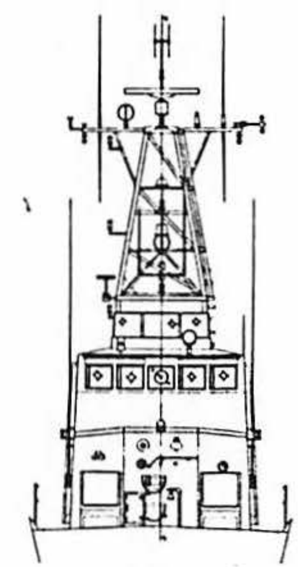
MAIN DECK HOUSE LAYOUT



OUTBOARD PROFILE



PLAN-WEATHER DECK



VIEW LOOKING AFT

addition of division bulkheads. The forepeak (collision) bulkhead of the parent did not meet the criteria for required spacing aft of the forward perpendicular. This required the movement of this bulkhead aft by one (1) frame space (approximately 12"). The after berthing area of the parent was extremely large, and when coupled with the engine room compartment in a damage condition, failed to meet the criteria. An additional bulkhead was added at a quarter point of the after berthing area to provide adequate stability. This reduced the size of the berthing space, but as less people were housed in this area, the space is still quite comfortable and spacious. The area divorced from berthing was well utilized as a compartment for auxiliary machinery, with the batteries/charger, A/C compressor, spare outboard motor, and tow cable reel being located here. The vessel inclining proved that all preliminary estimates of stability were quite conservative, and the vessel met all required criteria with margins.

Equipment

The COR did not specifically call out make/manufacturers of equipment, but offered only performance parameters. Of course, by the parent craft concept, the propulsion configuration had to be identical to the parent, meaning that the same main engine/reduction gears were to be utilized. It was found that the same engine as fitted on the parent now offered a substantial increase in horsepower due to improvements of the engine. This allowed us, by limiting rack settings, to keep the developed horsepower to that utilized by the parent craft, while still only using a portion of the power available. The engine manufacturer thus increased the overhaul intervals required, as the engines were basically being run de-rated, which offered a life cycle cost savings to the Government.

With the exception of the main engines/gears, much of the machinery and electronics was different from the parent. The vessel was basically 'Americanized', with as many standard, off-the-shelf items utilized as possible. In most cases, the parent craft equipment fell far short of the performance parameters specified in the COR. Several examples are: Parent craft 48 KW generators vs. WPB 99 KW; Parent craft 3 HP fire pumps vs. WPB 30 HP; Parent craft simplex strainers vs. WPB duplex strainers; No heating in parent craft vs. 18 KW heating in WPB.

Materials

The COR had specific criteria for all materials to go aboard the WPB. In most instances, these did not agree with the parent craft materials, therefore the material specs were changed to conform to the COR. The exception was the hull steel. The COR specified for all steel plate to be either ASTM 570, ASTM A-131, or ASTM A-36, while the parent craft was built utilizing steel to a British specification, BS-4360. As the COR requirement was for the shell and principal hull structure to be identical to the parent craft, it was necessary to utilize steel to the BS-4360 specifications. A special mill run was done by U.S. Steel to the BS-4360 specifications to satisfy these requirements for plates. It was necessary to purchase all structural shapes from the United Kingdom, as no U.S. steel manufacturer could provide the structural shapes to match those of the parent craft.

The COR requirement for pipe allowed some flexibility, allowing the use of steel, aluminum, copper-nickel, and GRP pipe. The parent was fitted primarily with plastic pipe, however, not to the MIL-SPEC required by the COR for GRP. Our original intention was to utilize as much GRP as possible for weight saving, however, it was found that GRP to the required MIL-SPEC offered no weight savings. Therefore, copper nickel piping was used extensively aboard the WPB.

As far as interior finish was concerned, the COR required the use of non-combustible materials, with no wood in any form to be used. As the entire interior outfitting of the parent was by the use of plywood, it was obvious that this segment had to be redesigned. All wooden flats/decks of the parent were replaced with steel/aluminum, dependent on the surrounding materials. All division bulkheads which were plywood were replaced with aluminum honeycomb panels 5/8" thick. These panels were also used for fabrication of the 'floating floors' in certain areas. All furniture which was wooden on the parent, was fabricated out of light weight aluminum sheeting, and the galley cabinets were fabricated out of stainless steel sheeting to fall in line with USPHS criteria.

At the time the parent was being built, England was going from imperial systems to metric. This meant that some structural components were in metric sizes, while others were imperial. As it was necessary to purchase all structural shapes from the

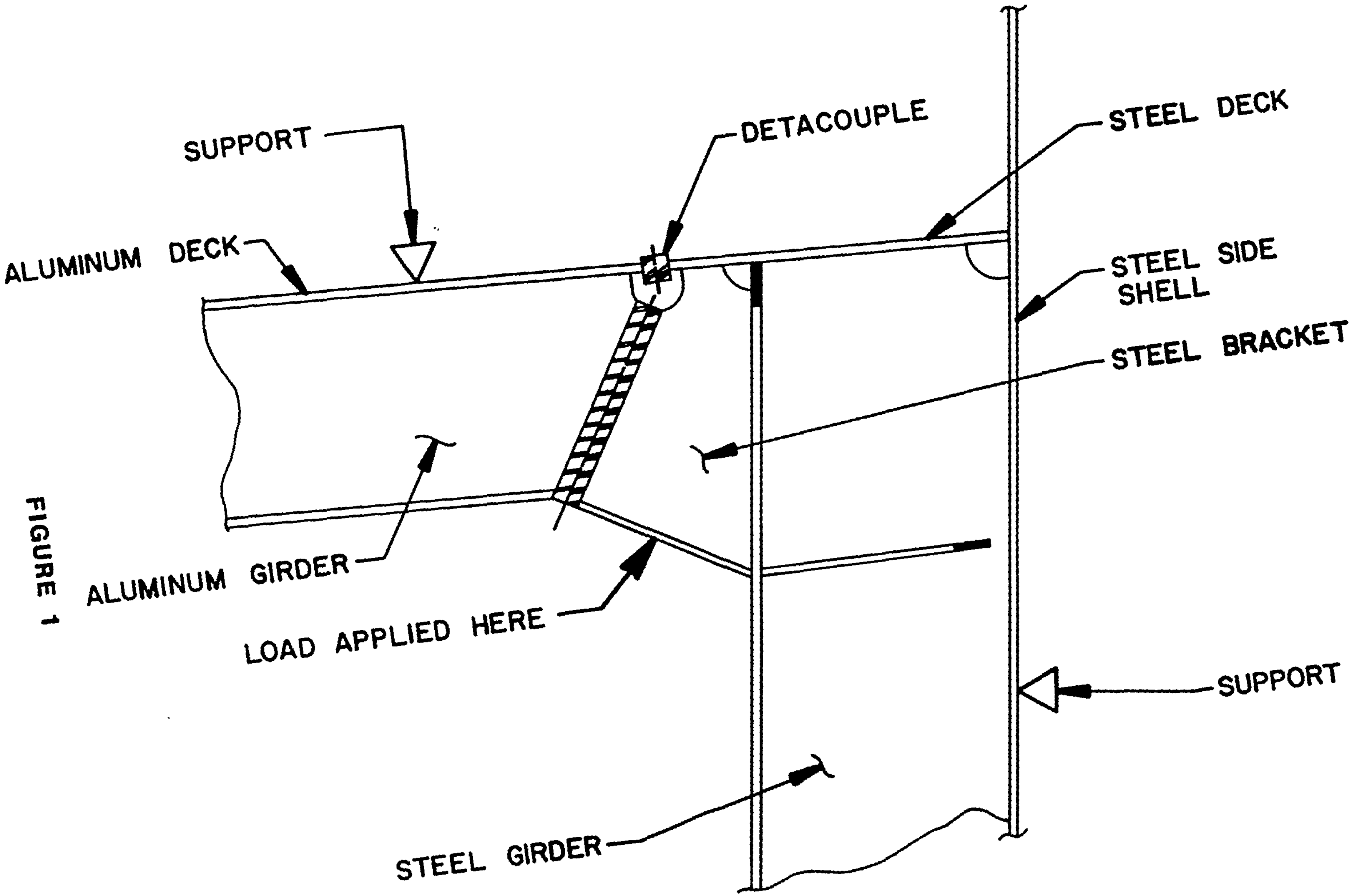

SUPPORT
DETACOUPLE
STEEL DECK
ALUMINUM DECK
STEEL SIDE SHELL
STEEL BRACKET
ALUMINUM GIRDER
LOAD APPLIED HERE
SUPPORT
STEEL GIRDER

FIGURE 1

United Kingdom, which is now totally metric, it was necessary to develop an equivalency table of metric vs. imperial shapes based on their strength. In all cases where this had to be done, a sacrifice was paid in weight as a 2" x 2" angle (imperial) would now be a 50 x 50 angle (metric), or slightly less than original. To obtain equal or greater strength, it was necessary to go with the next largest size, or 60 x 60 in this case. It was also necessary to do a contract modification to allow the use of metric call outs. This was, or course, a no cost change modification.

Hull Fairing

A set of offsets on frames was included in the data received from Vosper on the parent craft. The parent craft had been lofted by hand full size, and full size templates of parts were developed for use with an optical trace burning machine. Also, a scrieve board (full size body plan) with all seams, stiffeners, bulkheads, and girders, along with full size templates of parts, was available for our use.

Even though all of the above data was at Bollinger's disposal, it was elected not to use it for production, but to have the vessel refaired by computer so that the parts could be defined for N.C. burning. The offsets on frames were utilized as the starting point. After computer fairing, the faired offsets were compared to the parent craft offsets and the scrieve board. It was found that all offsets on frames were within ± 1/16" of the parent craft offsets. After the faired offsets were verified, part generation was performed, and N.C. burning tapes were developed.

Construction Variances

The parent craft was constructed with a riveted main deck and superstructure. When the parent craft was surveyed, this was seen to be a problem, as some leakage had occurred over the years, and corrosion areas were evident. This was particularly evident on the main deck transition joint from steel to aluminum. This portion of the vessel, main deck and superstructure, was exempt from the parent craft identicality requirement of the contract. Therefore, it was determined that a structural design concept that would improve the vessel from a maintenance standpoint should be developed.

The primary problem was two-fold: (a) The transition joint between the steel sheer strake and the aluminum deck, and (b) meeting the fairness tolerance with welded connection rather than riveted.

The deck was re-evaluated structurally. It was found that by slightly increasing the plating thickness, we could meet fairness tolerances with welded construction. This allowed us to modify the structural sections utilized in the parent to more weight efficient welded sections. While we did pay a slight weight penalty, it was far offset by the stronger, maintenance free deck that was provided.

The steel/aluminum deck interface was more of a problem. It was determined to develop a section utilizing a DetaCouple (steel/aluminum interface piece) joint so that the two (2) decks of different material could be joined by welding. In the past, Bollinger had used DetaCouple joints many times, but not in the load plane that was required for this application. Normally, the DetaCouple forms the joint between an aluminum deck house and a steel deck, which puts the joint in a compression loading. This application required that the joint be in a plane that would subject the transition zone to all different modes of loadings, tension, compression, and shearing. To insure that our design was adequate, a model section, approximately 12" long, of a deck joint at a transverse frame was built and tested (see Fig. 1). As the weakest point of the DetaCouple is the transition zone, it was determined that the supports and loading should be arranged to put a tension loading on the transition zone at the deck level. This would closely resemble the loading of the vessel working in a seaway. Again, Figure 1, shows the support and loading layout for the test specimen. Varying loads were applied in 10,000# intervals, until the specimen failed. Upon failure, it was found that the transition joint had withstood the test, with the failure occurring in the weld to the aluminum deck.

In the superstructure, the only problem to be dealt with was the fairness. Test specimens were done with varying plating thicknesses, stiffener designs, and welding techniques. The parent superstructure was built primarily out of .080" plate, with 'Z' bar stiffeners for riveting. Test results showed that by increasing plating thickness to .125" and modifying the stiffener to an angle section, we could meet the fairness tolerances while providing a totally welded superstructure of greater overall strength than the parent.

The parent craft was designed and

built in the United Kingdom where there are many foundries and casting shops. It was their philosophy to utilize casting for components in as many cases as possible. The philosophy at Bollinger is just opposite to this, and in the past we have always strived to design parts and components so that they can be fabricated in-house, rather than depending on a subcontractor over whom we had limited control. For areas that were not included in the parent craft identicality requirement, these castings were modified into fabricated components and built in-house. Areas that were a part of the underwater body of the vessel remained unchanged, and castings were made from parent craft patterns and to the specifications of the parent craft.

Weight Control

The COR specified that a weight control plan be in effect for construction of the WPB's. This plan had to be submitted during the bid stages for review and evaluation by the U.S. Coast Guard. Realizing how extremely critical the weight of the vessel was in relation to its performance, Bollinger developed a very rigid plan to be instituted for the WPB project.

It was determined that the standard Navy weight program, SDWE (Ship Design Weight Estimate), and UPDAT (Update), would be utilized to handle the weight program. A copy of this program was obtained, and modifications as required were made to run on the Bollinger engineering computer. This is utilized throughout the project to provide bi-monthly and updated weight reports.

To accurately track parts and pieces, it was necessary to develop a numbering system and assign each piece/part a number. These numbers were assigned utilizing the Navy breakdown structure, with some modifications for Bollinger's use. An example of a standard piece number for a structural component would be: 117-1840/P-14:

117 - SWBS code for transverse frame;
1840 - Piece no. 0001-9999;
/P - Shipyard designation for port side; and
14 - Shipyard designation for FR 14.

The above piece number would be a structural component of transverse frame no. 14, piece number 1840 on the port side of the frame. If a similar piece was on the starboard side, the 'P' designation would be 'P/S', for port and starboard.

A similar example of a piece number for an item of equipment would be: 541-2342:

541 - SWBS code for fuel system; and
2342 - Piece no. 0001-9999.

This piece number would define a component of the fuel system with a piece number of 2342. This number would appear in the Bill of Materials of the system drawing.

All piece numbers were assigned by the Weight Control department during detail drawing development with each component of the vessel being assigned a number. These numbers served the dual purpose of inventory control numbers also.

It is standard procedure for steel mills to produce their plates to above specified thicknesses, in other words, a plate designated as .25" (1/4") would be rolled to a minimum of .25" thick, but would in all probability be as much as .2516" thick as standard mill tolerance is minus 0, plus .0016". Should this tolerance be at the maximum, it could mean that a plate 8' x 40' x 1/4" could be as much as twenty (20#) pounds over the estimated weight. When considering this for all plates in the vessel, a substantial amount of excess weight is realized. To offset this, Bollinger required that all plates provided for the WPB be rolled to mill tolerance and below. This was the practice on the parent craft, and it insured that estimated plate weights would be maintained.

To maintain and control weights of purchased or subcontracted items, it was required that each vendor or subcontractor submit a form specifying the weight and center of gravity of each component over 5# that they were supplying. This had to be returned with their quotation for them to be considered. In some instances, this form was the final factor in determining the successful vendor, as in some cases it was necessary to sacrifice price for weight. The weights specified on these forms were the equipment weights utilized in the weight program. These weights were verified upon receipt of the equipment in the yard, with a receiving report sent to Weight Control for updating of the weight plan.

As most of the local vendors were accustomed to supplying equipment to go in oil field support vessels, which had basically unlimited space available, with no consideration at all for weight, it was extremely difficult to make them understand the importance of the weight plan. It was found that many vendors had just guessed at a weight or used old catalog weights that had not been corrected. In several instances, equipment came in that was twice the weight that had been supplied on the weight form. In several instances, equipment was refused because of gross over weight.

Weight impact was a primary factor in approval/disapproval of Engineering Change Requests (ECR's). These are requests for changes to components/concepts that would aid or ease production. These are sent from Production Engineering to Design Engineering/Weight Control for approval. In some cases, weight was the only factor in the disapproval of some of these ECR's.

CONSTRUCTION PHILOSOPHY

Module Fabrication and Assembly

While the parent craft had been built utilizing modular construction, many small modules were utilized. This created the need for additional handling and fit-up time, as well as additional welding. Bollinger also elected to utilize modular construction techniques, but the modular breakdown was quite different from the parent. It was elected to use a minimum number of larger modules, thereby reducing handling and fit-up time. A specific team or group of workers would be assigned to each specific component, allowing them to do the same job repeatedly, thereby maximizing their skills and efficiency, and allowing for maximum utilization of learning curves for production.

As previously mentioned, Bollinger elected to have the vessel faired numerically, with all pieces being burned by a numerically controlled plasma burning machine. After burning, the component pieces enter the subassembly hall where they are immediately checked for proper markings and piece numbers and routed to their proper areas. Small pieces are moved to the platen assembly area where they are fitted together and fully welded into fabricated parts of assemblies. These parts are then routed to their respective destinations. Much care is exercised in welding the small pieces, as the material is very light weight, typically 4# and 5# plate, and all welding is double continuous.

Due to the extremely light plate and structural members, it was felt that the fairness tolerance of $\pm 1/4"$ could be a problem to meet if extreme care was not taken. It was elected to try various welding methods and techniques to determine the most effective in both terms of efficiency and freeness from distortion. A test section of the double bottom in the engine room, approximately 20' long, from the keel to the spray rail, was built. Various welding techniques and procedures were experimented with in welding this test section to determine the best method. After thorough evaluation of the results, it was determined that the best and final solution was to totally utilize MIG equipment.

After the method of welding had been determined, welding procedures had to be developed and welder qualifications performed. A large number of procedures were qualified to be utilized in the construction of this vessel, ranging from simple mild steel butt joints to stainless steel and copper nickel pipe welding. Most trademen were required to qualify for various procedures, thereby not limiting their usefulness.

It was decided to fabricate the vessel in ten (10) major components. Most of these components (modules) are fabricated on large fixed jigs to insure accuracy. The modular break down of the vessel is shown in Figure 2.

The two (2) bottom assembly units (1 and 2), are fabricated in an inverted position, and are completely welded out on the jig, with the exception of the mating ends which are left unwelded for fit-up. A major portion of the piping and through-hull appendages are installed at this level of construction, prior to leaving the module shop. After verification of welds by x-ray is completed, the unit is moved from the module shop on a transportation fixture. This fixture is so designed as to keep the module from distorting during the move to the blast/paint area.

The bow and stern units (3 & 4) are also fabricated in an inverted position. Unlike units 1 & 2, which are only completed to the spray rail, these units are completed up to the main deck. They are fully welded out, again with the exception of the mating ends, and most is piping installed. After welding verification, these units are moved from the module shop to the blast/paint area.

Units 5 & 6 (port and starboard) are the side units from the spray rail to the main deck that mate up to units 1 & 2. It is necessary to fabricate these units in place, as there is no internal structure to hold them rigid to assure tolerance conformance. These units follow the same inspection procedure as the hull modules, but no pre-outfitting is required for them.

The deck is built as one (1) unit on a large inverted jig. As the deck construction was sub-contracted and not built at Bollinger Machine Shop &

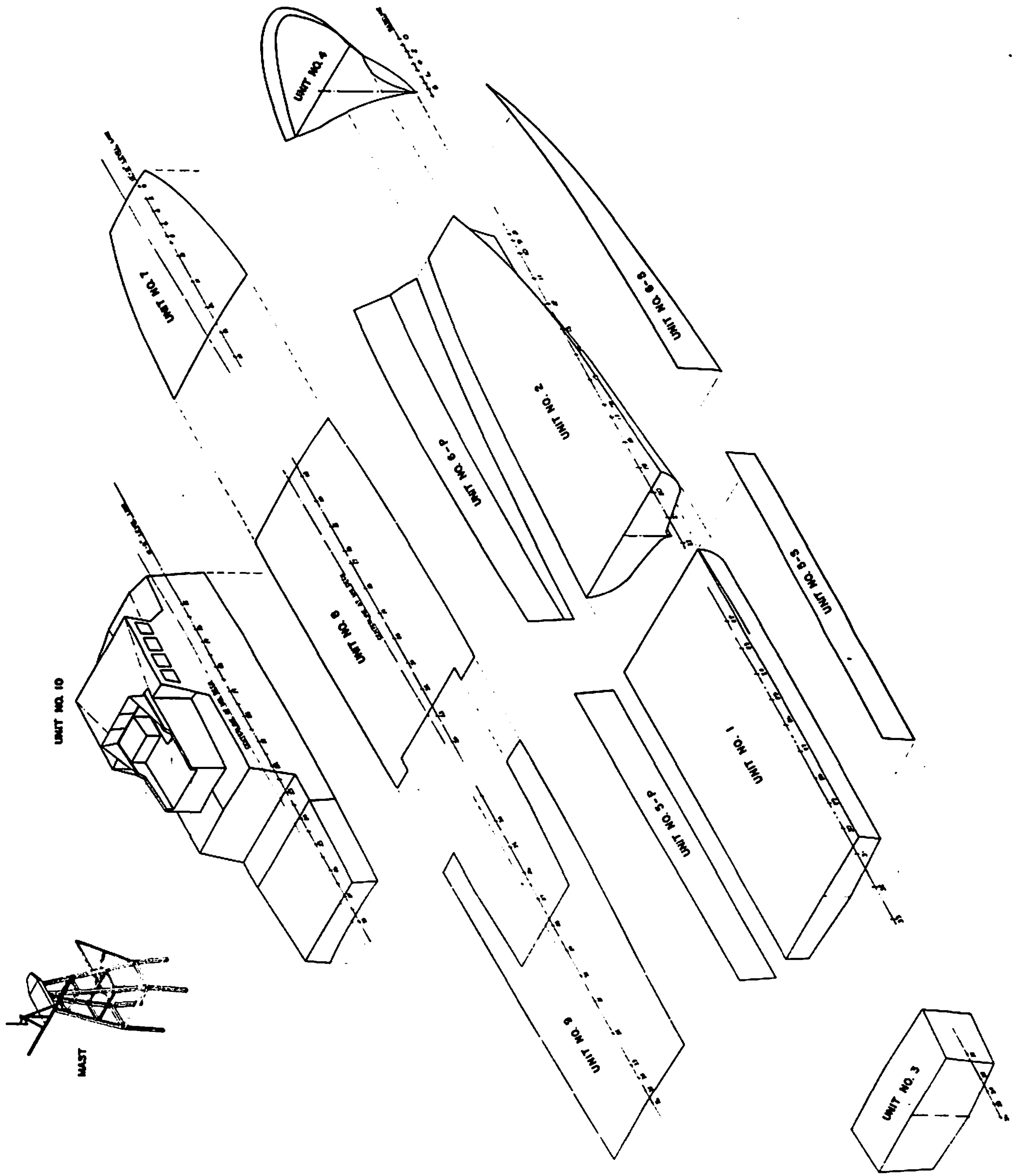

UNIT NO. 4
UNIT NO. 7
UNIT NO. 6-S
UNIT NO. 2
UNIT NO. 6-P
UNIT NO. 10
UNIT NO. 8
UNIT NO. 5-S
UNIT NO. 1
UNIT NO. 5-P
UNIT NO. 9
UNIT NO. 3
MAST

FIGURE 2

Shipyard, Inc., shipping of such a large component was a problem. The deck, which is fabricated in an inverted position, when finished, is lifted from the construction jig and placed on a transport jig. The deck is rigidly attached so that the fairness and shape is not affected during transit. After arrival at Bollinger, the deck is removed from the transporter jig in three (3) pieces and stored until the units are ready for installation.

The entire superstructure is built as one (1) complete unit and erected on the middle section of the main deck. Prior to setting this composite unit on the hull, a major portion of the piping, outfit, and electronics are installed.

Final Assembly

Final assembly takes place in the main assembly building. This building is equipped with four (4) assembly bays, which allows for four (4) vessels in various stages of completion. Each bay is fitted with building cradles to support the vessel during assembly.

After the modules are fully blasted and painted, they are moved to the assembly building. The four (4) modules composing the hull are placed into position and aligned optically. Then the four (4) side modules are fitted and aligned, which completes the shell of the vessel to the main deck. The units are restrained and master joints welds are made. After the joint welds are x-rayed and approved, equipment installation begins. It was found to be quite advantageous to install most of the vessel's equipment prior to the installation of the forward and after main deck units for ease of access. The center portion of the deck, on which the vessel's superstructure is installed, is fitted soon after the hull is completed. This does not interfere with work as the large hatch cover above the engine room is left off, allowing adequate access for work and equipment passage. This allows the carpenters and electricians to complete the superstructure at the same time the fitters are completing the equipment installation.

After all major equipment is fitted in the hull, the stern and bow sections of the main deck are fitted and welded. The engines and reduction gears are aligned and chocked. Shafts, struts, and propellers are fitted and aligned. All furniture, electrical, electronic components, and ship's equipment is installed.

When this level of completion is achieved, the vessel is moved out of the assembly hall and placed in wet dock for final hook-ups and testing. This move is accomplished by means of a launching transporter developed specifically for this project. It is composed of two (2) launching beams which pin to the two (2) main transverse building cradles. The ends of each beam are fitted with wheel assemblies which allow the entire launch cradle assembly to be rolled to the water's edge. At this point, the launch cradle, with the vessel, is lifted from the wheel assemblies by means of a 250-ton heavy lift crane, and lowered into the water. The cradle is lowered to the bottom so that it is clear of the vessel and its appendages. The vessel is then floated off, and the launch cradle lifted back onto the bank until required for the next launch.

Once the vessel has been launched and moved to the wet dock, final outfitting begins. This includes the installation of the mast, and final hook-up for electrical and electronic components. The main engine and gear alignment is checked and reconfirmed, and the engines and all associated systems are run and tested

After final hook-ups and adjustments are made, dockside trials are conducted by the Quality Assurance Department. During this same period, it is necessary to install the flooring. This requires several days of 'no passage', therefore, this must be scheduled as one of the last tasks to be accomplished prior to sea trials.

After all dockside trials are completed and the floors installed, all GFE and outfitting items are brought aboard. A dead weight survey or inclining is run to verify the weight and stability of the vessel. The vessel is then towed to Grand Isle, Louisiana, where both Builder's and Acceptance Sea Trials are conducted. After completion of sea trials, the vessel is presented to the Coast Guard for acceptance.

CONCLUSION

The Island Class Patrol Boat contract is presently at maximum production at Bollinger's Lockport, Louisiana, yard with several vessels delivered and in operation. Many lessons have been learned during this contract, the primary one being the only parent craft that would have any chance of being totally acceptable 'as is' to the Coast Guard, would be another Coast Guard vessel as their overall requirements are totally different and unique from any others in the world.

While some flexibility of

deviations from parent craft were available, in some areas, rigid adherence was required. This maintained the concept of a proven vessel in some areas that were important as far as performance was concerned, while still allowing flexibility to utilize more modern technology in other areas.

Overall, the project has been a great success. Vessels are being delivered to the Coast Guard in a short period of time, and are able to go out and work immediately with no problems. This procurement philosophy has proven to be a viable one, and undoubtedly will be used for future government procurements. By no means does this concept eliminate the need for the development of new and unique vessels, but it should be used to support new development.