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Design and Economics of a New 86-foot Aluminum Multi-purpose Fishing Vessel

ROSS PETERSON
Commercial Marine Subcommittee
The Aluminum Association
New York, New York

TO REMAIN COMPETITIVE with foreign fishermen, U.S. operators are becoming keenly aware that their vessels must be highly efficient for maximum utilization of both equipment and personnel, inexpensive to operate and maintain, fast and with sufficient range to reach distant fishing grounds, big enough to carry a profitable load safely, capable of remaining at sea for prolonged periods of time, and capable of operation with a degree of flexibility impossible with existing fishing vessels.

The Aluminum Association, representing the industry, and with a background of successful marine applications of the light metal, recognizes the importance of the needs of the U.S. commercial fishing industry. The association commissioned Robert H. Macy, naval architect, Pascagoula, Mississippi, to design an all-aluminum fishing vessel with the most modern features for economical operation, and to conduct an economic study of its costs in comparison with a similar vessel in other materials. Mr. Macy was told that his design criteria must meet all the requirements of the Fishing Vessel Construction Differential Subsidy Act, and also that it should incorporate features as recommended by personnel at the Pascagoula Base of the U.S. Bureau of Commercial Fisheries, as well as recommendations by experienced commercial fishermen. The final design complies with requirements of the Subsidy Act.

Mr. Macy has designed a vessel that should be more efficient and more economical than any now in operation. We would like to tell you about its features and the economies both possible and practical with this all-aluminum fisherman.

The vessel has a waterline length of 80 feet, with an overall length of 86 feet 4 inches (Fig. 1). Her beam is 24 feet, and draft loaded is 9 feet 6 inches. This hull design incorporates a fine entrance for speed and drive; a double chine hull form for easy motion; deep draft and ample beam for stability and seaworthiness; and raised forecastle for dry decks and protection of personnel in heavy weather. She also has an all-hydraulic, centralized gear-handling complex, watertight divisional bulkheads for increased safety, and a shroudless a-frame mast. She features a stern ramp — a concept that has helped to revolutionize fishing throughout the world.

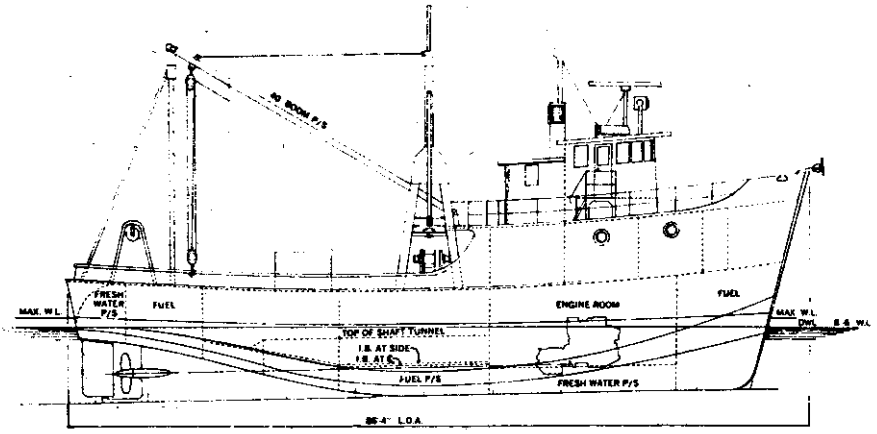

FIG. 1. Dimensions of multi-purpose aluminum fishing vessel.

Her advanced design permits considerable flexibility without further structural modifications or alterations. Fig. 2 shows the vessel as a double-rigged shrimp trawler. The hull design suits her to the rough seas common to the Gulf of Mexico, Caribbean, and the Atlantic Ocean. Adequate power and winch capacity enable her to exploit the deep-water royal red shrimp resource. She can operate as a stern trawler using midwater trawls, such as the Cobb pelagic trawls, for exploiting presently unutilized midwater industrial fish reported by the Bureau of Commercial Fisheries in commercial quantity in the Gulf, or for fishing rough bottom areas with V-D roller-rigged trawls. She may also be rigged as a tuna long-liner.

The simple addition of a power block makes her suitable for purse-seining with minimum crew. This is possible by incorporation of a parallel shaft, a combination purse-seine-trawl winch, centrally-controlled hydraulic sacking and hoist winches, and adequate clear deck space aft.

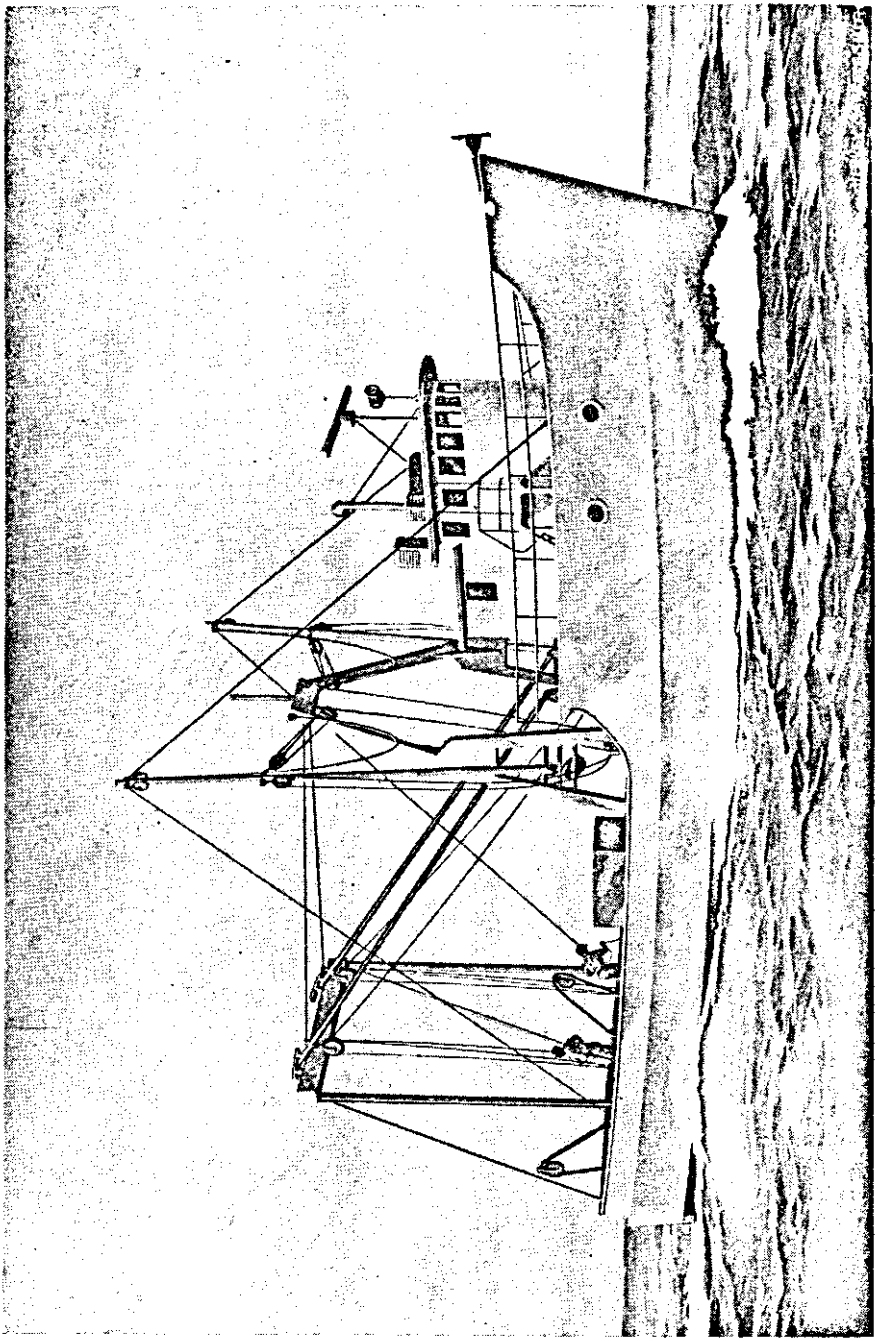

FIG. 2. As a double-rigged shrimp trawler.

The seine skiff is hauled up the stern ramp and secured clear of the seine — a decided advantage over the standard practice of stowing the skiff on top of the seine.

From a single, independent, self-contained fishing vessel, she can with simple changes become a mother ship, ministering to the needs of catcher vessels — storing their catches, refueling, and replenishing their fresh water. Shrimp and ice may be loaded into a nylon or neoprene bag and winched up the ramp right on the fishing grounds, precluding the need to seek calm water for off-loading and fueling as is now the case.

To repeat . . . no further structural modifications or alterations from the basic plan for these five uses.

One modification may be of interest, however. The vessel can be easily converted to serve also as a pocket-size factory ship by extending the forecastle or deckhouse aft to accommodate processing equipment such as heading and filleting machines, or shrimp peeling and canning equipment.

The vessel can be equipped with complete processing and freezing facilities for shrimp, and will be able, alternately or simultaneously, to preserve industrial fish in refrigerated brine or seawater (Fig. 3). Shrimp can be graded in four sizes, quick-frozen in the main deck plate freezer and stored at minus 10F. Capacity is 200 pounds of shrimp tails per hour, which can be increased to meet the demands of mothership operation — storage capacity for 90 tons. The freezer storage hold can be divided, and 40 tons of industrial fish stored in refrigerated seawater in the aft hold.

For every pound of shrimp caught, whole weight, it's reported that about 8¼ pounds of industrial fish are taken in the trawl and now discarded. In the northern Gulf, for example, shrimp trawlers could utilize this industrial catch. Applying a catch ratio of 1:8 and an average price-to-vessel of $27 per ton based on $35 per ton for pet food and $20 per ton for reduction, this represents good business.

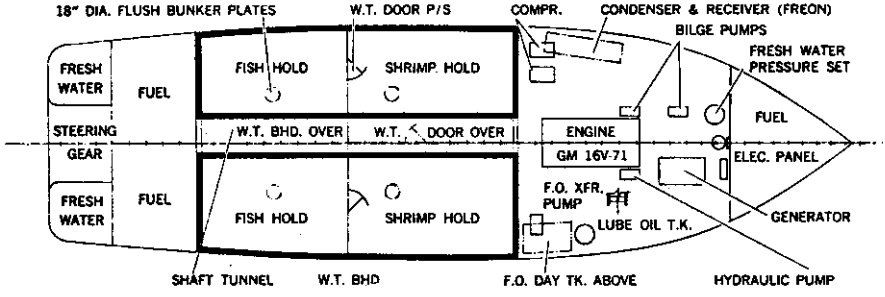

FIG. 3. Below decks processing and freezing facilities for shrimp.

A special feature is the capability for long-range operation. Normal fuel capacity is 26,000 gallons, permitting 80- to 90-day trips to fishing grounds 1,000 to 1,400 miles from port. For extended trips of up to 136 days to fishing grounds as far away as 4,800 miles, an additional 22,000

gallons of fuel can be carried in the aft freezer tank. Portable water tank capacity is 4,000 gallons. A waste heat seawater distiller with 100-gallon-per-day capacity provides for extended trips.

Designed and equipped for multi-purpose fishing, the vessel has the flexibility necessary to avoid economic handicaps if ruled ineligible to participate in a given fishery.

Due to less weight in the aluminum hull structure, the vessel built of this material will be able to carry 38 more tons of fish than a steel craft of the same size and draft.

Naval Architect Macy, as a part of this project, made a detailed economic analysis of the vessel constructed in aluminum vs. steel. Wooden vessels were not considered because of lack of suitability for distant water fishing because of a limited space below decks. A wooden vessel of comparable size is unable to carry sufficient fuel and still have hold space because the shell cannot be utilized for tanks as with aluminum or steel.

For identical vessels in aluminum and steel, here is a comparison of outward bound speeds. Aluminum is 1.35 knots faster, with only 170 long-ton displacement vs. 208 long tons for steel. Aluminum has a one-knot advantage in speed with a 23-ton catch aboard. Loaded with an 80-ton catch, aluminum gives a 1.35-knot edge on the homeward bound trip.

Loaded to 9-foot 6-inch draft for maximum displacement, both vessels have the same design hull speed. But — as you'll note — the aluminum vessel carries 38 more tons of fish.

Normal range for the aluminum vessel is 1,050 nautical miles more than the steel craft. In both instances, a 10% fuel margin and a 10% weather allowance were included.

Mr. Macy developed these cost figures on aluminum (approximately $242,000) vs. steel (approximately $216,000) construction. Overhead is based on 70% of labor and profit is 10% of cost of material, equipment, labor, and overhead. The 11.5% higher cost of aluminum construction will be more than offset by economies of the aluminum vessel in greater payload capacity and versatility . . . and is within the range of 11.5 to 17.6%, calculated by several qualified boat builders.

Mr. Macy's estimates show that labor and material costs for shipyard engineering, main propulsion, shafting and propellers, generators, wiring, piping, outfitting, refrigeration, and insulation are all identical — in aluminum or steel.

The labor costs in fabricating the hull are identical, whether in steel or aluminum. This is based on Mr. Macy's estimates after careful research among builders working in both materials.

The principal difference in the total cost of building the 86-footer in aluminum or steel lies in the cost of the material for the hull. The higher cost of the aluminum is nine-tenths of the total cost difference, yet the advantages offered by aluminum construction and the operating economies it permits make aluminum preferable.

Mr. Macy has worked out detailed operating costs vs. expenses for four specific fishing trip cycles to show the time required to amortize

the 11.5% higher cost due to aluminum construction. After only 3.4 years on the Miami-Honduras run, the cost differential is paid up. Even less time is needed for pay-out for regular runs to South America and West Africa, and for industrial fishing in the northern Gulf of Mexico, the pay-out time is less than one year.

The evidence supports the use of aluminum as a fishing vessel hull material in preference to conventional structural materials such as steel and wood.

We have shown that aluminum construction will increase the vessel's earning power as well as reduce operating and maintenance costs because of aluminum's resistance to corrosion, ease of cleaning, and need for no painting or chipping. And we have shown that the increased initial cost of aluminum construction can be recovered in a reasonable time.

Complete design consisting of lines and offsets, construction profile and plan, construction sections, engine installation plans, arrangement plan and profile, and complete specifications can be obtained for the nominal charge of only $250. This entitles the purchaser to build one vessel. A similar payment is required for each additional vessel built. Write Robert H. Macy, P.O. Box No. 758, Pascagoula, Miss. 39567.

The Aluminum Association is delighted to be of service to the U.S. fishing industry by making these plans available through Mr. Macy at a fraction of what they might otherwise cost individuals building such a vessel. If we can be of further help, please write: Commercial Marine, The Aluminum Association, 420 Lexington Avenue, New York, New York 10017.

Fishing Vessels Designed and Built Under the Fishing Vessel Construction Differential Subsidy Program

THOMAS W. PROSS, JR.
Maritime Administration
Washington, D.C.

Abstract

The Fishing Vessel Construction Differential Subsidy Program known as the United States Fishing Fleet Improvement Act, Public Law 88-498, was approved August 30, 1964. This law endeavors to aid in the development of United States fisheries, and provides for subsidy up to 50% of the cost of the vessel providing the vessel meets certain requirements. In general, the vessel must be modern and upgrade the fleet. It must also be of advance design, be able to operate in expanded areas, and