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

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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

be equipped with newly developed gear. The Bureau of Commercial Fisheries approves the design of the vessel and the applicant.

Once the applicant and his vessel have been approved, detailed plans and specifications are forwarded to the U.S. Maritime Administration. From the time the plans and specifications arrive until the end of the six month guarantee period, the Maritime Administration is responsible for essentially all aspects of the program. This includes a review of the plans and specifications, including a detailed check on the stability of the vessel, the issuing of the invitation for bids, and a detailed cost estimate, both domestic and foreign. After the bids are received, the low bidder's capabilities are ascertained for labor force, management, experience, facilities, etc. The Maritime Administration inspects the vessel during construction and conducts the sea and dock trials and the inclining experiment. A six month guarantee survey is also conducted.

Since the first vessel was received in December 1964, approximately 30 vessels have been submitted to Maritime Administration. These vessels have been for owners in all areas of the country. The types and sizes have varied and have included the following: steel stern scallopers, approximately 100 feet in length; wooden scalloper draggers, approximately 90 feet in length; 100 foot combination king crab vessel; 100 foot steel stern draggers; refrigerated steel shrimp vessels, approximately 85 feet in length; 88 foot combination steel scalloper draggers; 170 foot steel menhaden vessel; 90 foot combination purse seiner; 150 foot steel tuna seiners and factory stern trawlers 296 feet in length.

INTRODUCTION

GOVERNMENTAL AID to the American fishing industry is not new. From 1789 to 1854 the Congress paid bounties to American fishermen. For example, in 1792 cod fishermen operating off Newfoundland were paid $1.50 to $2.50 per ton based on the size of their vessel. Many governmental aids to the fishing industry have transpired since that time. In 1960, the first fishing vessel construction subsidy program was authorized by Congress. This program lasted for three years under an authorization of $2.5 million dollars annually and allowed up to 33-1/3% subsidy, representing the difference between the domestic and foreign cost, and was limited to the New England groundfish industry. Under this program ten fishing vessels (seven wood and three steel) were constructed ranging in length from 73 feet to 124 feet. While this program was limited in nature, it demonstrated that if this principle were expanded and broadly applied it could make a major contribution to the revitalization of the entire fishing industry.

FISHBOAT SUBSIDY LAW

On August 30, 1964, a new fishboat construction subsidy program, Public Law 88-498, went into effect with an authorization of not more than $10 million annually for the next five years. Through this law, the government indicated that it was interested in aiding the domestic commercial fishing fleet by paying up to 50% of the cost of construction of new fishing vessels. The purpose of the law is to aid in the rebuilding of the domestic fishing fleet so that it can become competitive with those of foreign countries. To do this, vessels have to be of advanced design, have

modern gear aboard and the best equipment that is available. The vessels must also be able to fish in extended areas and, in general, must be superior to existing vessels in the same fishery. All of these requirements are written into the law. The approving of the applicant and the vessel for eligibility in the program is determined by the Bureau of Commercial Fisheries. In each case the Bureau holds a public hearing to obtain the views of anyone who feels the construction of the proposed vessel would cause him to suffer economic hardship.

The Maritime Administration, U.S. Department of Commerce, enters the program after the Bureau of Commercial Fisheries approves the applicant and his vessel. The writer believes that the majority of those who read this paper are aware of the Bureau's activities with regard to the Fishboat Subsidy Program; however, most are not familiar with the Maritime Administration's activities in regard to the construction of fishing vessels under the program. Therefore, before describing the design and construction details of the vessels which have entered the Fishboat Subsidy Program, the writer would first like to set down the Maritime Administration's activities in this program, its philosophy in carrying out these activities, and what it hopes can be accomplished through this approach.

ADMINISTRATION OF THE CONSTRUCTION PHASE OF THE SUBSIDY PROGRAM

The applicant, after receiving approval from the Secretary of the Interior through the Bureau of Commercial Fisheries, has his naval architect prepare the necessary plans and specifications that are required for competitive bidding. When these are completed, they are submitted to the Maritime Administration for action. Review and approval of the plans and specifications fall into three areas. (1) They are reviewed to see that they are complete and acceptable for bidding purposes. If an item of material or equipment is desired, it must be specified accordingly. Mistakes in the specifications and mistakes or discrepancies between the specifications and the plans are corrected. (2) Technical advice and suggestions are offered to the naval architect. (3) A complete stability analysis is made on the vessel. The hydrostatics are checked by computer and the stability of the vessel is checked against Rahola's criteria in all operating conditions.

During this review, the plans and specifications are forwarded to the Department of Defense for approval of national defense requirements. All fishboats to date, under the program, have been granted approval by the Department of the Navy.

After the plans and specifications have been approved by the Maritime Administration, the invitations for bids are issued to all yards on our bidding list. Notification is also placed in the Department of Commerce's *Commerce Business Daily*. Additional yards are placed on the bidding list upon request. If a yard decides it wishes to look at the plans and specifications it can write to the owner c/o the naval architect, enclosing a deposit for the plans and specifications to be forwarded. Bids

on the vessel are prepared in accordance with instruction in the invitation for bids and are submitted to the Maritime Administration. The Maritime Administration has the function of receiving the bids and determining the lowest responsible bidder. The yard of the low bidder is inspected to insure that it has the capability of building the fishing vessel. The yard's labor force, management experience, and facilities are checked along with their financial condition. In addition, the Maritime Administration develops a complete domestic estimate of the cost of each vessel prior to the bid opening, which is used as a check to determine whether the bid price is fair and reasonable. After the yard is approved, the foreign cost determination is given and the contract is awarded.

The Maritime Administration realizes that the subsidy is designed to benefit the fisherman and every attempt is made to streamline the government's administration procedures. With regard to inspections, there is no full time Maritime Administration inspector at the shipyard. Inspections are made on a periodic basis. The naval architect and owner obviously have the basic responsibility of inspection. Dock and sea trials of the vessel are supervised by the Maritime Administration; also an inclining experiment is performed. The Coast Guard requirements are written into the specifications, but there is no Coast Guard inspection. The Coast Guard requirements cover only those normally called for on any fishboat, whether built under subsidy or not.

Vessels have been designed to meet ABS structural requirements; however, there is no actual ABS inspection requirement on vessels about 100 feet and under. On certain larger vessels, the structural plans are sent to ABS for their approval, and hull inspection by ABS is required. ABS certificates (+A1 Fishing Service and +AMS) are obtained only at the owner's request, except in the case of the 294 foot factory vessels on which they were required.

Where there is a change which involves either an increase or decrease in the contract price and is agreed upon by the owner and the yard, the change is submitted to the MA for approval describing the change and the amount of increase or decrease in the contract price. Changes are promptly approved and are not held to the end of the contract for cost adjudication. Under the fishboat program, there are no specific requirements for submitting purchase orders, schedules, progress reports or items normally associated with the construction of large oceangoing ships. The only requirement is that we receive copies of plans used in the construction or any correspondence which takes place between the owner and the yard.

The administration is interested in having capable yards build sound vessels which make a profit for the owner and hopefully give the yard a fair profit in the construction. In our opinion, we have been successful in carrying out this policy.

TYPE OF VESSELS IN PROGRAM

The request to process the first fishboat under the new subsidy program was received by Maritime in December, 1964. This vessel, a stern scalloper for Boat PAT-SAN-MARIE, Inc., was bid; however, it was not

built due to the high price. Like all programs there appear to be many problems at the outset and this one is no exception. Many growing pains were experienced. Some of these included: (1) Over-designing of the vessels, (2) Convincing the small boat yards of the limited participation by the government and the regulatory bodies, (3) Convincing the fishermen to drop the idea, "Well, let's put it on the vessel anyway. The government will pay half the cost." (Attitudes such as this invariably hike the bidding price up to a point where the owner cannot afford the vessel even with subsidy.) (4) The government is developing adequate information with which to obtain actual foreign costs of the vessels. These are a few of the problems that beset those in charge of administering the program.

The request for processing the second vessel under the program was submitted in late April, 1965. Since that date to the present, the program has gathered steam. In the year and a half that has passed, three vessels have been delivered, nine are under contract, four have contracts pending, eight are currently out for bids and six are under review by the Maritime Administration. Out of a total of 22 vessels bid during this period, contracts were not awarded on six. The vessels included all types: scallopers, draggers, trawlers, combination scalloper-trawlers, scalloper-draggers, combination king crab vessels, menhaden vessels, shrimp vessels, factory stern trawlers, combination purse seiner-trawlers, tuna vessels and the like. Five have been wood, the rest steel. Vessels have ranged in length from 85 feet to 294 feet and have been designed for owners in the states of Maine, Massachusetts, New York, Virginia, Florida, Texas, California and Washington. The vessels were or are being constructed in shipyards in Wisconsin, Maine, New Jersey, Maryland and Washington.

In describing the various vessels that have come under the Fishboat Subsidy Program to date, great detail will not be given. Space permits that only highlights of the various designs be given.

Scallopers

In 1958, there were 70 to 80 boats in the New England scallop fleet, mainly centered about New Bedford, Massachusetts. It was at this time that the Canadian fleet expanded from two scallop vessels to 90 with an average length of approximately 90 feet. In the last five years the New England scallop fleet has dropped to less than 30 boats. One of the reasons for this decline was that the small boats (about 73 feet) could not stay out as long, and small catches resulted. Also, they were unable to operate in rough weather conditions on the Georges Bank and became non-competitive.

Therefore, it is not surprising that nine of the vessels under the program are scallopers. The scallopers fall essentially into three categories: (1) steel stern scalloper-trawlers (2) steel scalloper-draggers and (3) wooden scallopers. All of the scallopers were designed by John W. Gilbert Associates, Inc., of Boston, Massachusetts. There are three steel stern scalloper-trawlers, one each for Boat Ouingondy, Inc., Ellingsen Fishing Corporation, and Boat PAT-SAN-MARIE, Inc. All three of these

vessels are about 100 feet in length, single screw, diesel powered, rake stem, transom stern and multi-chine hull designed for stern scalloping and bottom and mid-water stern trawling in the west North Atlantic fishing grounds. This design, with the "A" frame mast, boom and gallows located aft and the trawl winch shucking houses, pilot house and accommodations located forward, provides numerous advantages such as: (1) A more sheltered working deck for the crews' handling of rakes and catch (2) A steadier working platform (3) The ability to operate in rough weather (4) Protective shucking houses (5) All living and operational spaces located forward and (6) 360° visibility and control of vessel and winch from the pilot house.

The vessel has an "A" frame mast suitable for handling large fishing loads normally expected on a stern trawler. Though the vessels are designed for working two large scallop rakes, one from either quarter, they can, when desired, be converted to stern trawling by using the stern ramp and a modified rigging arrangement.

The engine room is placed forward and crew accommodations, i.e. sleeping quarters, are located in the forecastle. The officers and special members of the crew, such as cooks, mates and engineers are in staterooms on the main deck. The capacity of the fishhold, which is sheathed with aluminum and insulated with urethane, is 168,000 pounds. A 12 cylinder, 765 horsepower diesel drives a three bladed propeller through a 3.95 to 1 reverse reduction gear. The trawl winch is a four-drum diesel-driven model with a capacity of 450 fathoms of 1 inch diameter wire on each drum. Two single drum fish and loading winches are mounted on the mast legs. The hydraulic ram steering gear is connected with an automatic pilot. Bridge equipment includes radio telephone, radar, depth recorder, lorans, etc. The Ellingsen Fishing boat and PAT-SAN-MARIE have A-C generators and a Kort nozzle which will provide increased propeller thrust, greater steering torque and protection for the propeller.

The operation of these vessels is as follows: After the rakes are towed for a predetermined period, they are lifted up to the deck and turned upside down. The catch is sorted and the scallops are taken from the pile, placed in baskets, and carried forward to the shucking houses. The stone and debris are shoveled overboard through the rock doors built into the bulwarks. The scallops are dumped into the shucking boxes where they are opened. The meat is removed and then placed in the wash box. The empty shells are dropped into the space outboard of the shucking box where they fall overboard through the shell doors. The meats are washed in clean sea water, placed in clean linen bags, and stored in the fishhold in ice.

Two scallop-draggers are under contract; one for Mussel, Inc., is under construction and the VICTOR for Bethel, Inc. has been delivered. The VICTOR was the first United States steel scalloper to have been built and is unique in that it has an air clutch winch in lieu of the conventional mechanical clutches. It has large horsepower (765), and the galley is located on the main deck. The pilot house is located above the after deckhouse and has a separate chart room area. It should be noted that the captain does not sleep in this area, as usual on conventional scallopers, but in

his own stateroom on the main deck. Across the transom the vessel has a refrigerator, oil skin locker, toilet, and shower area for the crew. The crew forward have their own recreational area, head, and a heated oilskin locker. The interior is of marlite paneling. The steel constructed shucking house superstructure is portable and may be removed when the vessel is converted to dragging. There are individual heating systems in both ends of the vessel with zone thermostat controls for the different crew spaces. The aluminum-lined urethane foam fishhold is provided with aluminum penboards. The vessel is hydraulically steered and has two hand steering stations for quick acting control from either bridge wing. This vessel is comparable to the larger Canadian types that have been so successful in recent years.

The four wooden scallopers (COMMODORE, Lepire Fishing Corp., Hercules Fishing Corp., and Tonnessen Fisheries, Inc.) under the program are far more modern than the other wooden scallopers in the fleet. They have many of the features already mentioned on the other scallopers, including aluminum fishhold, large engine and winch, many pieces of electronics, shucking houses, etc.

King Crab Vessel

The first fishboat to be constructed on the West Coast under the subsidy program is a 98 foot king crab combination fishing vessel for Einar Pedersen of Seattle, designed by William Reid of Vancouver, British Columbia. This vessel is unique and truly a combination vessel. It can be used for the following purposes: (1) Catch trawl fish using split drums forward and a trawl drum aft. Presently, the trawl fish will be held in ice. However, in the future, if desired, the trawl fish may be sharp frozen in a 12x18x7-foot portable freezing chamber and stored in the fishhold at 0F storage temperature. Refrigeration in the fishhold will be by direct expansion ammonia coils. (2) The vessel can catch halibut using long line equipment. Halibut is sharp frozen. (3) Tuna may be caught using a purse seine and power block. Tuna is frozen in brine. (4) The vessel will be used initially for king crab which must be kept alive in circulating sea water after they are removed from the crab pots. Four 10 horsepower vertical pumps are provided for sea water and brine circulation.

The sea water circulating system is designed for both king crab and tuna service. When operating under king crab operations, each of the two tanks will circulate sea water at 1800 gallons per minute. The water is taken directly from the sea chest and pumped into the hold through the bottom discharging overboard at the deck hatch. The water for the king crab must be changed every 20 to 25 minutes. When under tuna service individual chillers serving both the fore and aft tanks will be utilized.

Stern Trawler

The 100 foot vessel for the Jacobsen Fishing Co. designed by John W. Gilbert Associates is a steel stern trawler suitable for ground fishing. The arrangement of the crew quarters and machinery spaces on this vessel

is of unique design. The main engine drives a geared controllable pitch propeller in a Kort nozzle. The gear box and controllable pitch unit are in way of the fish tank aft of the fishhold. The main deck arrangement has a split winch with direct lead to the gallows on the quarters. This vessel is provided with a ramp for hauling up the fish. The nets are pulled aboard and stowed on net rails port and starboard of the working area. Other unique design features of the vessel include a trolley fish dumping box for conveying fish into the hold and a lobster tank aft of the fishhold with control on the water level. The vessel is also provided with twin A-C generators and refrigeration plant for the fishhold to assist in reducing the amount of ice meltage.

The 130 foot stern trawler for the Old Colony Fishing Co. of Boston, Massachusetts, was designed by Potter & M'Arthur, Inc., of Boston, Massachusetts. This stern ramp trawler is of steel construction with round-bilge hull form, intended for ground fishing off the banks of New England and Canadian Maritime coast. The basic idea of the owners was to produce a vessel of optimum size for the advanced fish handling system proposed. The model of this vessel has been tank tested and a computer analysis has been made of the hydrostatic and stability characteristics for the vessel, as have most of the larger vessels under the program. Most stern ramp trawlers have a full length sheltered deck, the net being dragged up the ramp and stretched along the deck and the fish being spilled through a hatch onto the main deck for processing before passing to the hold below. In this design the shelter deck is done away with aft of the mid-length of the vessel, saving cost, weight and admeasurement tonnage, and cutting down on windage. The trawl doors hang up at the stern without special handling and the net is hauled up along the main deck with the fish being spilled through the hatch into the processing room forward of the ramp. Most of the shooting and hauling of the trawl gear is controlled from the pilot house using one six-drum hydraulic powered winch. The result is a simplified installation and handling procedure with minimum number of men on deck. The working deck is well sheltered by the superstructure and house forward and by high bulwarks on the sides and aft.

When the fish spill through the main deck hatch they land in a large pond or bin with sloping bottom and sides making them slide forward and through the bulkhead opening onto a sorting and ripping table. Discarded fish are thrown into a sump and discharged overboard by screw conveyor. Rock are lifted out by bucket. Selected fish are carried by conveyor to the gutting table and into the automatic washer, then through the hull bulkhead and diverted by gates to the selected pen. In case of conveyor trouble, there are chutes and other methods to move the fish from one operation to another. All work is at table height. The hold is intended for ice fish storage in aluminum lined pens in the conventional way and also for box fish and ice. Crushed ice is stowed in the after pens in the hold and is delivered to the area where the fish are being stowed by a system of screw conveyors. Refrigeration for the hold may be added later.

The engine room is located forward of the hold but with main engine and engine control station as far aft as possible. This helps to

keep weight out of the bow for less tendency to plunge in a seaway. The main engine is 1275 horsepower diesel driving a solid propeller through a reduction gear. Controls are located in the pilot house in a normal position and also at the winch control station. Quarters are all above the main deck with two men to a room except for the captain and mate each of whom has a single room near the pilot house. This vessel will operate out of Boston, Massachusetts and will be the first such vessel to employ any fish handling processing on board the vessel. In addition, it will be the largest trawler operating out of the New England area, except for the factory trawlers to be discussed later.

Dragger

The trawler JEANNE D'ARC, Inc., designed by the John W. Gilbert Associates is a high speed trawler with conventional dragger arrangements. Special care was made with regard to heavy construction at the same time achieving high hull speed in that this vessel travels as far as Labrador in search of fish. Among the newer unique features on this vessel, as opposed to similar vessels built in recent years, is that the trawl winch is both air clutched and braked and has an automatic level winder. The entrance to the whale back forward has been enlarged to include an oilskin locker with adequate heat in this area. The outfitting on this vessel, although not very extensive compared to the stern trawlers, is of large heavy duty, first class equipment.

Shrimp Vessels

Bids were received but contracts were not signed for the construction of five shrimp boats from the Gulf area. It may be of interest briefly to point out some of the features of these advance type shrimp boats designed by John W. Gilbert Associates.

The four 85-footers (Tormala, Franks, Olsen & Kiesel) were intended to operate out of Southern Florida having a range extending all the way to northern Brazil and Honduras. These vessels would have had much heavier outfitting than previous shrimpers. The boats were to have a refrigerated fishhold with shrimp processing equipment on the main deck capable of freezing them with liquid refrigerant. The boats would have had a heavier capacity trawl winch than has existed on previous vessels. The crew quarters would have been finished out in imitation interiors such as marlite, and would be air conditioned. These vessels were modern in design and would provide good living quarters for a period of 90 days at sea. The refrigeration equipment, generators, would be provided in duplicate so that in case of a breakdown of one of the units at sea, sufficient back-up would remain to permit the vessel to make the necessary long run home.

In the 95-footer for Wallace J. Boudreaux and also designed by John W. Gilbert Associates, all of the crew would sleep above the main deck and again all the cabins would be air conditioned. Machinery on this vessel would be of large capacity and was to have an all A-C electric plant. The fishhold would be insulated and refrigerated by the cold air freon system. In the design this vessel was arranged with a hydraulic trawl winch of much heavier than normal capacity permitting it to tow

a deep water centerline net over the stern for royal red shrimp. It was expected that this vessel would run as far south as Rio de Janerio and fish for royal red shrimp along the entire continental shelf of South America. This vessel would have had the largest installed power of any shrimp boat in the world and would have been capable of towing exceptionally large fishing gear. On the shrimp vessels, as on all the other steel vessels under the program to date, inorganic zinc silicate paints would have been provided. The larger steel shrimp boats would have had certain advantages to the owners over the smaller wooden shrimp boats. The larger steel vessels would have more stability, would be tougher boats, could handle larger drags at increased power, could carry larger fuel supply, and would last longer. With the above advantages, they would have been able to stay out longer in rougher weather, fish for longer periods at greater distances from port and therefore catch more shrimp.

Menhaden Vessel

The 170 foot steel menhaden vessel, MARGARET, INC., is for the Reedville Oil and Guana Company, Reedville, Virginia. The vessel, designed by Clancey Horton, is similar to the AMMON DUNTON with an increase in length and certain modifications. The vessel is all welded steel, double-chine hull with raised forward deck and a continuous trunk above the main deck. The vessel is designed to carry approximately 1,500,000 non-edible menhaden. She has an upper and lower engine room containing twin propulsion units with 900 horsepower each. Propulsion is by twin screw and it has fixed Kort nozzles. The vessel has been specifically designed to fish in Gulf of Mexico in shallow waters. In other words, in 6½ to 7 feet of water. The vessel can still fish 300 to 400 miles east or west from her home port. The vessel is designed with three fishholds, two forward and one aft, all about equal in size. The fishhold sides, ends, decks and trunks are all insulated with a mixture of vermiculite and portland cement.

The brine circulating system is cooled by an ammonia refrigeration plant. The refrigeration plant includes two diesel driven ammonia compressors, one ammonia receiver, one ammonia condenser, and all the other necessary equipment associated with this type of system. There are three 12 by 36 feet diameter single path water chillers, one for each hold. An associated 7½ horsepower brine circulating pump is connected with its respective chiller. Suction in the fishholds is taken from two 12 inch pipes perforated, raising up to the main deck level and from a brine suction screen at the aft end of each hold. The brine, after leaving the chiller is returned to the fishhold and sprayed onto the fish from perforated piping located on top of the fishhold.

The purse boats are 36 feet in length by 9 foot beam and are of aluminum construction. They are diesel-driven with electric start, 2 to 1 reverse reduction gear, clutch front and power take-off and keel cooling. The main engine in addition to driving a gypsy head also operates a hydraulic pump which operates the boom and power block assembly. The boat davits are operated by hydraulic ram cylinders capable of maximum pull of approximately 14,000 pounds on each of two lines. The hydraulic pumps, driven off the fish pump engine, also supply the power for

strapping winch and hose winch. The fish pump is diven by a 95 horsepower diesel engine located in the raised deck area between the fishholds. An aluminum screen and dewatering tower is located between the fishholds on the raised deck area. This large menhaden vessel, of shallow draft, employs those advance features which have permitted the menhaden industry to prosper in recent years. Among them are nylon nets, fish pump, hydraulic purse blocks, aluminum purse boat, refrigeration and hydraulic systems, and equipment.

Seiner-Dragger

This 90 foot combination seiner-dragger for Maine Marine Products was designed by Potter and M'Arthur, Inc. It has a multi-chine hull form with principle emphasis on herring, seining and a secondary capability for midwater and bottom trawling. The working deck is sheltered by the forecastle structure and pilot house forward and is in a position for least motion. The pilot house is well aft in contrast to the usual seiner giving a dryer, steadier post for the skipper and better visibility of the full working deck. The trawls are duplicated so steering and engine controls can be operated at the back of the pilot house, and the main winch, power block, side thrusters, headline transducer winch, and other equipment can all be operated from this position. The spars and rigging are designed for easy conversion for either method of fishing. Seining is by conventional methods and equipment. Trawling is over the stern with a rampless system. In this rampless system there is less likelihood of taking water on deck. Further, it is possible to split the catch in a repeated cycle of filling and emptying the cod end, thus handling any size catch while reducing to a minimum the piles of netting which choke the work area.

The propulsion system is combined with the hydraulic system and has some unique features. The main engines are a pair of tandem diesels driving through a common gear box to a controllable pitch propeller. By declutching the aft engine and clutching the power take-off, the engine becomes a hydraulic pump engine individually controlled for this service while the forward engine continues to drive the vessel. Controllable pitch propeller, while not absolutely necessary, does give good efficiency with a single engine or with both engines attached. A fixed nozzle around the propeller gives greater towing and shields the propeller. The tandem engine arrangement is an added safety feature in case one engine breaks down.

The deck equipment, winches, etc., are all hydraulic driven, the biggest load being the main winch when trawling. Seining operation requires less power, leaving a surplus of hydraulic power. This is used to drive the side thrusters, one at each end of the vessel, which do the same job as the seine skiff but are more controllable and instantly available even in bad weather. On all the vessels under the program, a large amount of electronic equipment has been employed. This vessel is no exception. It will have two sonars, one with the scanner and the other with a recorder. An echo sounder with a white line recorder and a recorder for the head line transducer used for mid-water trawling is also provided. Navigational electronics include loran, radar, RDF, multi-channel radio telephone system, and citizen band radios. A television installation for use when in

port or close to shore is provided. There are only two men to a room, with skipper and engineer each having a room to himself.

Tuna Vessels

Whether they are called purse seiners or combination vessels, tuna boats from the West Coast have entered the fishboat subsidy program in full force. There are nine tuna vessels currently out for bids or under review. Eight are from the San Diego area and one from San Pedro, California. The five vessels currently out for bids for Marilyn M. Fishing, Inc., et al. were designed by Arthur DeFever of San Diego, California. A great deal of time and effort went into designing these vessels, not to mention the many hours of hearings that were necessary before this phase of the program could get underway.

This design is unique to the West Coast fishing industry and what the owners feel is a break-through so far as the tuna fishing trade is concerned in southern California. The conventional tuna clipper developed over the years has had engine room forward, single screw, and fishholds aft. This has necessitated flooding the aft fish wells with sea water to bring the stern down to run on even keel even in the light load condition.

The new design incorporates many new design concepts. The vessel is designed with a stern engine room and fishholds forward, permitting navigating without ballasting the fishholds, even though the bow might be high. With the engine room aft and the stack arranged on the starboard side, the heat and diesel exhaust fumes normally thrown up to the crow's nest on the conventional seiner are eliminated. The fumes have often been nauseating to the lookouts. The long shaft alleys in the conventional West Coast designs are eliminated, reducing maintenance costs of intermediate shafts, shaft alignment problems, and loss of horsepower through several intermediate bearings. Quietness is an extra dividend in the crew's quarters with this arrangement in lieu of quarters over the engine room.

While twin screw is not entirely new on the West Coast, so far as fishing vessels are concerned, they have only come into being during the last five years. The bow thruster is new for the West Coast and will be particularly beneficial in seining to assist in thrusting the vessel's bow away from the seine net, which often engulfs the vessel. With the aid of the controllable pitch propellers, it is felt that the usual practice of the seine skiff towing the vessel while in a set may be largely eliminated.

The tank tests revealed that a minimum of one-quarter knot speed was gained at cruising speed with the bulbous bow. The 14 knot speed of this vessel will shorten the time element of trips to the far distant fishing grounds. In addition, it could increase production on the fishing grounds by allowing the vessel to arrive at a fish school faster than her competitor. Often a boat length or two makes the difference as to who can set on the fish first. The vessel with her sleek profile, fine lines, and considerable flare forward, together with a rakish bow should make for a dry boat with good seakeeping capability in rough weather.

The stern ramp is an innovation in the last 3 years on tuna boats. The seine skiff is carried on a stern ramp in an immediate position for launching. The old method was to pull the skiff on top of the seine

net, causing wear on the net. Then when ready to fish, it was necessary to tow the skiff off the stern, thereby creating drag.

Consideration has been given in design for simple and quick conversion of the vessel to stern trawling for hake and other fish. Gallows and net reel can quickly be installed, and the seine winch is so designed that it is adaptable to either type fishing.

The heart of the preservation system is an ammonia, brine-circulating freezing system. The refrigeration system is powered by four 50 horsepower ammonia compressors. The system is set up so that it can have maximum pull down at the same time that it is holding the load in any combination of fish wells. This system provides for great flexibility in the operation of the vessel. These vessels have the standard equipment associated with the new tuna vessels being built on the West Coast including 36 foot power skiff, four small speed boats, anchor windlass, complete hydraulic system for topping winches, vang winches, seine trawl winch and power block. The vessels will be air conditioned throughout. The vessels are also provided with a dual switchboard in which all major pieces of equipment are powered off two separate lines. The reason for this arrangement is that tuna vessels are gone for such long periods of time and travel to such great distances they cannot afford to lose any electrical load, upon which the refrigeration system is dependent. The vessel is provided with such electronic equipment as radar, depth sounder, loran set, automatic direction finder, radio telephone, citizen band radio, and a PA amplifier and intercom system along with an entertainment system for the crew. An electronic trunk is provided for future installation of fish finding devices, thermocline recorders, etc.

The four other tuna vessels were designed by Robert Rados Engineering Co. of San Pedro, California. They are for Pacific Tradewinds and Pacific Prince, et al. These vessels are very similar to recent constructions on the West Coast. They differ only from the five other vessels in that their engine room is forward; they do not have a bulbous bow or bow thruster and they have single screw propulsion.

Stern Factory Trawler

The first American factory stern trawlers are now under contract with Maryland Shipbuilding & Dry Dock Co. of Baltimore, Maryland. The owners are American Stern Trawlers, Inc., a newly formed fishing company owned primarily by the American Export-Isbrandtsen Lines, with Samifi, a refrigeration company, a minor partner. The company conducted extensive studies into the feasibility of a vessel of this type being economical in this country. They believe it is possible. Such items as labor agreements, key personnel, and customers for the fish and fishmeal were arranged prior to going out for bids. Equipment and layout of the vessel have been carefully considered. It is highly automated and equipped with the most modern equipment available.

The factory ships are 294 feet long with a 44 foot beam. The heart of the ship is the fish processing plant which includes heading and gutting machines, filleting machines, skinning machines, package fishmeal plant, and quick freeze plate and blast freezers. Using this processing system there is no wastage. One of the advantages obtained with the floating

fishmeal plant is the more intensive utilization of the raw material due to the fact that the offal, heads, guts and bones from the heading, gutting and filleting machines are used. Further, all types of fish which are not directly used as human food, and therefore normally thrown overboard, can be utilized as raw material for fishmeal production thereby increasing the trawler's profit. Every part of the fish is used, and by freezing fillets at sea, only an hour or so after catching, the vessel will be able to deliver high quality fish retaining all the taste which is lost in the present fish handling method. After the fish are removed from the plate or blast freezers, they are put in the refrigerated cargo holds. A complete freon refrigeration system is provided for the plate and blast freezers, cargo holds and galley ships stores refrigeration spaces.

The power plant is a single screw, diesel electric, constant current system of 3,000 horsepower. This unique type of power plant has come into recent use aboard large trawlers and other vessels where large electrical auxiliary loads are carried. The main propulsion motors, the DC-AC converter motor and the trawl winch motor are on a common system and are regulated to operate at a constant current. The main advantage is that the system is able to control a large number of different machines of different horsepower from one or more generators on a common circuit. Other advantages of this system are that large loads may be cut in and out without losing the plant and that the trawl winch motor acts as a generator when letting the net out and supplies current back into the system. The trawl winch and rigging set-up is also new, being designed by Rickmers Shipyard of Germany. The trawl winch is electric split drum type with a pulling force of about 9 tons at about 105 meters per minute. The vessel is equipped with automatic pilot and vane type hydraulic steering gear. The vessels have the latest electronic equipment, including vertical, horizontal and net fish finders. The ship also has a closed circuit television to allow the captain to view the net and stern ramp area. The vessel is air conditioned throughout and even has a sauna bath for the crew. The factory vessels are a radical departure from any other type of fishing vessel ever built in this country and represent a giant step forward in the building up of the United States commercial fishing fleet to make it competitive with vessels of other major fishing countries.

The writer has attempted in this paper to give a brief indication of the role the Maritime Administration plays in the Fishboat Subsidy Program and to briefly describe the new types of fishing vessels along with the features the vessels have that make them modern, of advanced design, and able to compete with vessels of foreign countries. While the fishboat program itself is only two years old, the first vessel to be signed under contract began processing at Maritime approximately a year and a half ago. Although the program started slowly, it is obvious from the 37 vessels that have entered the program it is building up steam quite rapidly, both in the number of vessels and the size of vessels. The writer feels that the Fishing Fleet Improvement Act can make a significant contribution to the United States fishing industry if the needs of the industry are truly recognized by all and the intent of the law is administered realistically and adequate funds are available.