A REPORT ON THE

ICLARM EXPERIMENTAL SMALL FISHING BOAT

by

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As part of the ICLARM program of evaluating small fishing craft for use in tropical artisanal fisheries, a study of the Ponape Dory Project has been prepared. Conclusions drawn from this report indicate a need for further research in locating suitable designs for small fishing craft.

Coupled with the worldwide fuel crisis--and in deference to the adage that the duckbill platypus was designed by a committee--a committee was formed, led by Stephen Ritterbush. Remaining members on the committee were William Travis and Glen Fredholm.

Stephen Ritterbush, ICLARM Program Coordinator, began his fishing and boating experience as a youth on the Maine Coast, and has been actively involved in the "Dory" program, a "ferro cement" boat project, and many fisheries programs throughout the Pacific and Indonesia. William Travis, former Fisheries Officer of Western Samoa, presently is operating a successful commercial fishing operation in Kona, Hawaii. Travis has long been involved in boat building and development in Spain as well as in many areas of the Pacific. Glen Fredholm, Honolulu Marine Designer, is a Corporate Officer in charge of design and construction for a large development company, and has also been involved in both commercial and sport fishing operations in Hawaii. Fredholm is a Research Affiliate of the University of Hawaii's Institute of Marine Biology and has traveled extensively through the Pacific Basin. His most well-known design is a 27-foot fiberglass sport fishing boat, 38 of which are now operating in Hawaiian waters.

Conclusions reached by this group were:

+ No <u>ONE</u> design would be able to fulfill all requirements and conditions; therefore, compromise must be acceptable.
+ No boat should be introduced as a "solve all," or be mass produced until a prototype had been completely tested and evaluated.
+ No boat can be developed by criteria and "paper" design alone; full-size prototypes must be built, sea tested, and true operating costs established.

With acceptance of these conclusions the committee drew up the following design targets:

A. <u>Hull</u>: 20-foot length, easily driven, non pounding, dry, beachable shallow draft with protected propeller, large fishbox, crew of three or four fishermen.

B. <u>Power</u>: Inboard, low cost, lightweight, gasoline/kerosene, diesel, parts easily repaired or replaced, speed enough for trolling.

Problem "A" was given to Glen Fredholm whose approach was to re-examine boats produced during the early decades of powerboat development. The boats in question had one or two cylinder, low RPM marine engines with 5 to 15 hp swinging propellers of large diameter and blade area.

Many of these boats developed speeds in excess of 10 knots. Fredholm saw two obvious reasons: the "hull design" and the "propeller shove." According to Weston Farmer (well-known marine architect and author of articles on old-time power boats), this was brought about by using a propeller at least 25 percent of the midsection area in size, and an easily driven hull.

Small 10 to 20 hp engines and low-power "Seagull" outboards which are used to moor 20 to 40 foot sailboats with ease and speed, are unable to propel today's modern powerboats.

ICLARM's experimental small fishing craft utilizes some features which can later be developed for sail-assisted power. The boat's profile includes: 1) a flat section along the keel; 2) 15-inch wide midships used in the old "Jersey sea skiffs"; 3) local "sampans" for ease in beaching; and, 4) a full skeg for propeller protection and steering help in following seas. To combat typical 20 to 30 knot trade wind seas, a narrow entry with a high sheer forward was incorporated, and sheer sponsons were designed to help solve spray problems.

After developing lines and offsets based on the above (see Exhibit C), a 1/12th scale model was built. This flotation model was used to give the designer some satisfaction as to the general wave pattern created, and, far more important, to allow checking on loading and trim as the displacement of a model and prototype will vary arithmetically with the cube of their linear ratios. In other words, three factors (length, breadth, and width) change as a boat's size is increased. The size of crew and fish loads could be experimented with by varying these calculations and engine weights.

The committee found Problem "B" to be more difficult. Parts availability and simplicity became prime goals; cost was critical from an amortization standpoint, and the designer was concerned with weight. Many engine manufacturers, distribution points and service centers were contacted for prices, and it was finally decided to first test an 18 hp air-cooled gasoline/kerosene engine from the Philippines with a reduction gear assembly. Two of these engines were donated to ICLARM by Briggs & Stratton for the experiment. The low weight of this engine allows installation in the dry, forward compartment of the boat, clear of all fishing activity.

While ICLARM had not intended to enter into a boat building operation, there seemed no other way to gain firsthand information on the use of the new construction method proposed, and obtain a full-size prototype required by the committee's resolve to test all designs. As a result, Ritterbush and Fredholm volunteered to build the boat on weekends, enlisting the aid of other interested parties.

The compound curves and complex shape of the proposed hull ruled out the use of plywood and a standard bent frame, and plank construction was complicated and too slow. Hence, it was decided to use a new material called "C-FLEX", a fiberglass planking made by Seeman Plastics of New Orleans which was developed for the purpose of building fiberglass boats without a traditional mold.

The material is composed of parallel rods of fiberglass and reinforced polyester resin alternating with bundles of continuous fiberglass rovings, with the whole held together by two layers of lightweight, open weave fiberglass cloth. Each "plank" is 12 inches wide, and the grade used for this project was "CF-65", (65 ounces per square yard in a 250-foot coil). These planks were laid over lightweight plywood frames 18 inches on center running fore and aft. (The C-FLEX is more or less self supporting and conformed easily to the compound curves). After the "planks" were tacked in place, they were wetted down with resin; next, the fastenings were removed and the hull lightly sanded. Fiberglass layup was then applied at right angles over the C-FLEX with alternating butt joints. We used the following layup in the project:

<u>Outside Hull</u>

1 layer C-FLEX
1 layer 1½ oz. mat
1 layer 18 oz. woven roving
1 layer 1½ oz. mat
1 layer 18 oz. woven roving

<u>Keel</u>

Additional layer of mat and woven roving

<u>Finish</u>

1 layer mat veil and resin

<u>Inside Hull</u>

1 layer 1½ oz. mat
1 layer mat veil and resin

Microballoons and resin were used as filler and fairing compound and the hull will be painted for final finish.

The C-FLEX system has another advantage in that a minimum of tools and equipment are required; the only three power tools used on this project were an inexpensive six-inch disc sander, ¼ inch drill, and a Saber saw.

As of this writing, the exterior hull layup is complete except for final sanding and finishing. The actual man hours spent on the project to date are given in Exhibits A and B, with estimated costs and completion times.

EXHIBIT A

Days	Work Performed	No. Men/Hrs.	Man Hrs.
	I. MAN HOURS TO DATE		
1st	Set up; construct base and level; start frame layout	2 / 8	16
2nd	Set up; complete frame; cut out; start assembly	2 / 8	16
3rd	Set up; complete frame; set up and fairing	2/8 2/2	20
4th	Prepare frames; tape/wax form for rub rails;	3 / 2	6
	install C-FLEX;	3 / 4	12
	wet down C-FLEX	1 / 1½	1½
5th	Line up and set shaft tube; build up rub rail; mat lows; pick up supplies	2 / 8	16
6th	Light sand; first layup mat and roving	2 / 8	16
7th	Sand hull; built up and foamed and matted skeg;	2 / 3	6
	second layup mat and roving	3/2 1/1	7
8th	Clean up work area; complete skeg forming; spot fill with microballoon	2 / 8	16
9th	Sand hull; add extra layup to keel and skeg; level fill with microballoon; sand hull	2/6 1/10	22
10th	Faired hull with filler	2 / 4	8
	Total man hours to date		162½

II. ESTIMATED MAN HOURS TO COMPLETE

Exterior of hull; finish/paint	48
Interior mat; filler	32
Glass in bulkheads and fish box	16
Install seats and hatches	32
Finish and paint interior	16
Mechanical/hardware installation	32
Total estimated man hours to complete	176
GRAND TOTAL -- MAN HOURS	338½

EXHIBIT B

Material for 20-foot ICLARM Fishing Boat

C-FLEX Method

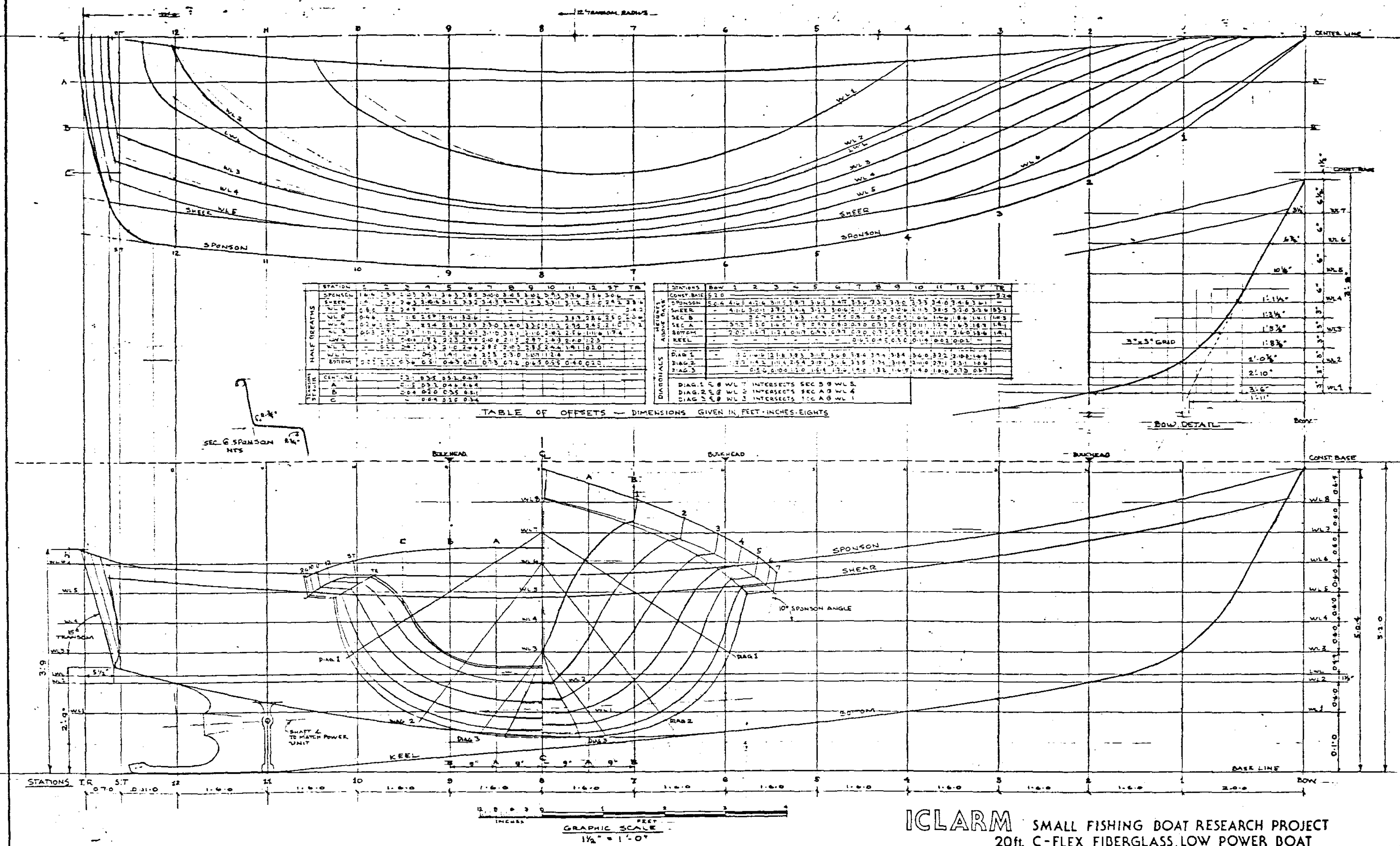
		Prices*
Fiberglass Material		
C-FLEX: 1'w coil 250' x 1 = 250 sq. ft. @ $0.94		US $ 235
1½ oz. mat 38"w 80.5' x 3 = 241.5 lin. ft. @ $0.20		48
18 oz. woven roving 38"w 80.5 x 2 = 161 lin. ft. @ $0.27		44
Fish box/bulkheads: mat/roving 60 lin. ft. @ $0.47		28
Laminating resin 6/5 gal. = 30 gal. @ $6.70		201
Fillers, catalyst, lacquer thinner		60
Miscellaneous: roving tape, veil mat, etc.		30
	Sub total	US $ 646
Lumber		
Plywood for frames**, bulkheads, seats, etc.		US $ 120
Other lumber: setup base, battens, rail form		60
	Sub total	US $ 180
Other		
Sandpaper, brushes, rags, respirators		US $ 40
Paint: monopoxy, bottom		32
Miscellaneous: screws, protective cream, small hand tools		35
Contingency: power tool rental		50
	Sub total	US $ 157
	GRAND TOTAL -- HULL, COMPLETE***	US $ 983

* Prices shown are F.O.B. Honolulu, Hawaii from stock (no volume discount shown).

** Multi-use item.

*** Not including engine, gear, and hardware.

EXHIBIT C



ICLARM SMALL FISHING BOAT RESEARCH PROJECT

20ft. C-FLEX FIBERGLASS, LOW POWER BOAT

DESIGNER: GLEN FREDHOLM, Honolulu, Hawaii '75