OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

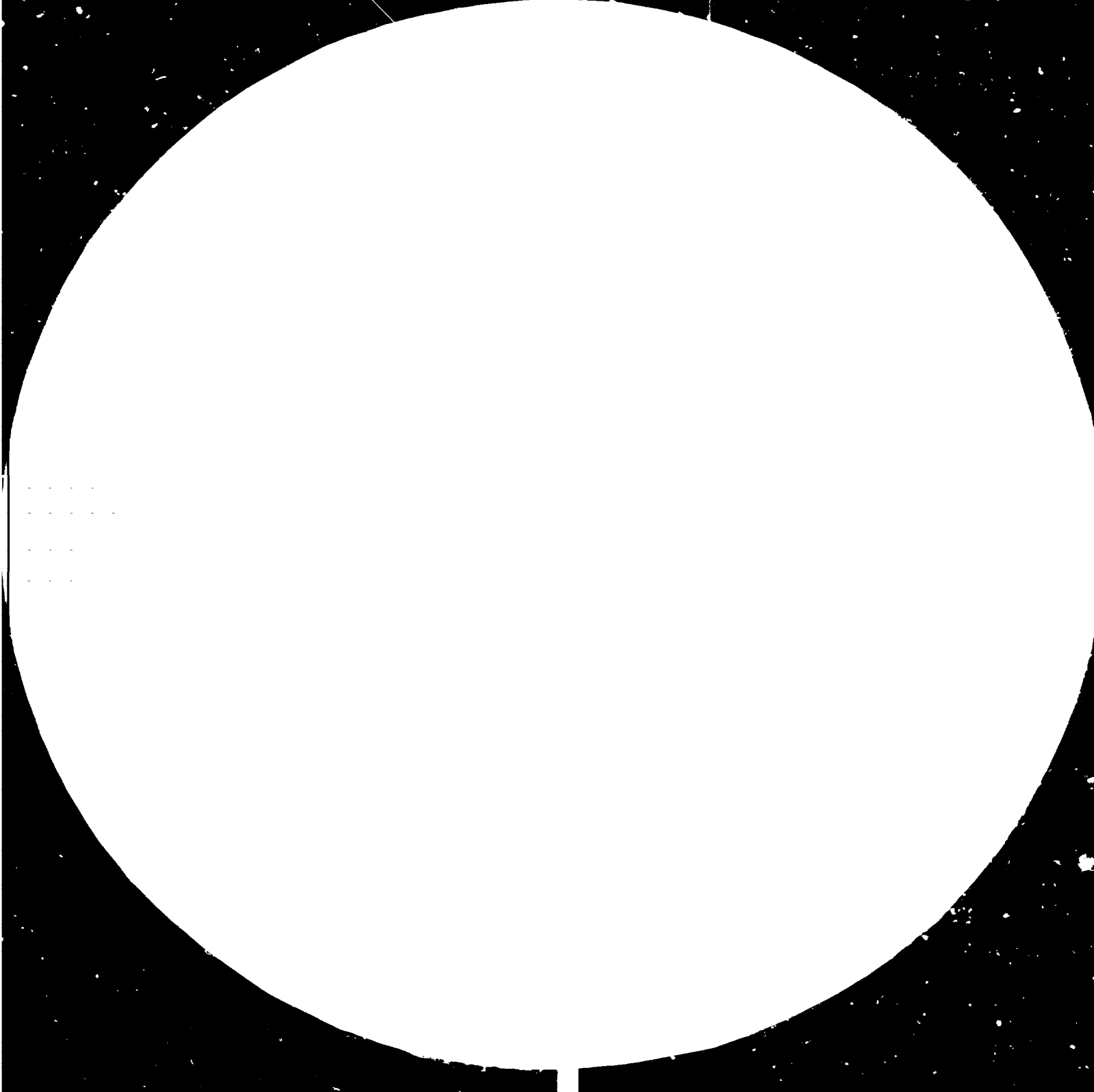
FAIR USE POLICY

CONTACT

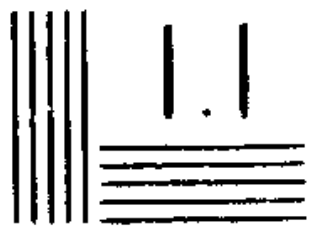
Please contact publications@unido.org for further information concerning UNIDO publications.

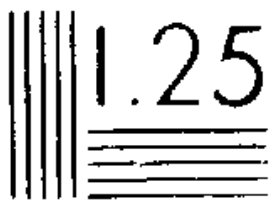
For more information about UNIDO, please visit us at www.unido.org

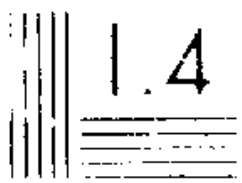
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

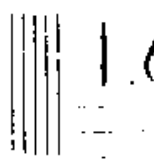



1.0


1.1


1.25


1.4


1.6

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Distr.
RESTRICTED
UNIDO/IO/R.56
14 March 1983
English

Seychelles

ESTABLISHMENT AND OPERATION OF A BOATYARD AND BOAT MAINTENANCE COMPLEX

UC/SEY/80/044

SEYCHELLES

Mission report*

Prepared for the Government of Seychelles
by the United Nations Industrial Development Organization

Based on the work of Bronislaw J. Tarnacki,
expert in design of boats and equipment

United Nations Industrial Development Organization
Vienna

* This document has been reproduced without formal editing.

V.83-53362

INTRODUCTION

The mission to the Republic of Seychelles was arranged according to the agreement between the Government of the Republic of Seychelles and United Nations Industrial Development Organization concerning the establishment of a complex for the production and maintenance of wooden boats on the basis of traditional skills and locally available raw materials.

The basic document during the mission has been Job Description UC/SEY/80/044/11-03/31.9.D. which listed all duties connected with the position of the Expert in Boat and Equipment Design, during the mission to the Republic of Seychelles and during the design work in the home country, as well.

The main results of the mission are generally presented in "REALIZED PROGRAMME OF THE MISSION AND DAILY TECHNICAL REPORT" and in attached annexes. Some other results will be taken into consideration in the design drawings and technical specifications.

LIST OF ANNEXES:

ANNEX 1 : "PROPOSED PROGRAMME OF TECHNICAL AGREEMENTS CONCERNING 6.3 m FISHING BOAT DESIGN."

ANNEX 2 : "FIXED FISH CONTAINER" - SKETCH NO. 1
"REMOVABLE FISH CONTAINER" - SKETCH NO. 2

ANNEX 3 : "TECHNICAL DESCRIPTION OF THE 6.3 m FISHING BOAT FOR THE REPUBLIC OF SEYCHELLES."

ANNEX 4 : "BASIC TECHNOLOGICAL ASPECTS OF 6.3 m FISHING BOAT CONSTRUCTION".

ANNEX 5 : "SELECTION OF THE ENGINE FOR THE 6.3 m FISHING BOAT."

ANNEX 6 : "DIMENSIONS OF SAILS".

I. REALIZED PROGRAMME OF THE MISSION AND DAILY TECHNICAL REPORT

27th January 1983 - travel from Gdansk, Poland to Vienna, Austria

28th January 1983 - briefing in UNIDO, Vienna

29th January 1983 - awaiting for flight in Vienna

30th January 1983 - travel from Vienna to Frankfurt, Germany and then to Victoria, Mahé, Seychelles

31st January 1983 - arriving to Mahé

Meeting with officials from Government of Seychelles:

Mrs Jeannette d'Offay - Director of Economic Cooperation

Mr Philippe Michaud and Mr Erik Van Overstraeten - Economists from Ministry of Planning and External Relations

Proposed programme of technical agreements (Annex 1) is presented. Mrs J d'Offay has started to arrange terms of meetings and technical agreements. Term of high level meeting with UNIDO representatives, concerning the establishment of the boatyard in Praslin, is discussed. Principal Secretary will send the answer to UNIDO telex from 20 Jan. 1983. In opinion of the officials from Ministry of Planning they are still not ready for the meeting and they are suggesting to postpone the high level meeting (see enclosed telex).

1st February 1983 - Meeting with Miss Lablache and Mr Joel Nageon, research workers from Fisheries Development Company, Victoria. Conditions of using the boat and expected fishing performance were discussed (see Annex 1, item 2).

Technical results of discussion:

1. Following points are agreed:

   (a) range from the coast: 15 - 20 nautical miles.

   (b) duration of one trip - 8 hours. In it: steaming time 3 - 4 hours, fishing time 4 - 5 hours.

   (c) number of crew: average - 5, maximum - 7.

   (d) expected speed under engine - 6 knots.

   (e) expected maximum catch - approx. 140 kg.

2. For small boats like this one drums for handlines are not necessary.

3. With regard to feasibility of fish containers in boatyard, fixed type ice box will be built in. Capacity of this box - around 240 litres.

4. Hand bilge pump (diaphragm type) is appointed.

5. In opinion of research workers a cheap echo sounder (yacht type) should be foreseen with regard to possibility of quick finding proper depth for fishing in areas round about Mahe.

6. Main data of designed boat are approved.

2nd February - 09.00 a.m. Meeting in Ministry of Planning. Telex concerning the high level meeting is prepared.

- 2 p.m. Meeting in Fisheries Development Company (FIDECO) with:

Mr Jacquelin Lablache - General Manager
Mr Kenneth Albert - Fleet Manager

Discussion regarding yesterday's agreements carry out the following alternations:

1. Required speed of the boat is 7 - 8 knots (not less than 7 knots). This requirement is connected with necessity of quick delivery catched fishes to the market.

2. In opinion of FIDECO General Manager maximum catch should be increased up to 200 kg.

3. In case of using heavy duty engine and when expected catch is increased to 200 kg, maximum number of crew should be limited to 5 persons.

4. Fixed ice box should be changed to a removable one. In opinion of FIDECO there are fibreglass workshops in Seychelles which are prepared to the such production.

Technical results of discussion:

1. Approved speed of the boat will be 7 - 8 knots.

2. According to local conditions and experiences in maintenance of engines one of YANMAR diesel engines should be selected to propulsion of the boat. Taking into consideration increased speed it should be YANMAR 2QM20 or 3GMD type, according to actual production range. Better for fishing boat application would be the heavy duty 2QM20 engine. For delivery possibilities of YANMAR firm, FIDECO will ask by telex, then designer of the boat will select proper engine. Quality of service and cooperation with YANMAR in Seychelles are good. Experiences on the same field with "Lister" and "Peter" engines are bad, with relatively high prices of engines. Weights of "Peter" and "Lister" engines are 50 - 180 kg higher than Yanmars' - that reduce catch capacity with the same quantity.

3. Removable glassfibre ice box will be designed. With the width of ice box adequate to three frame intervals, capacity will be around 330 litres (see enclosed longitudinal section).

4. Designer's proposition to built temporary fish container for the last catch is approved (see Annex 3, chapter IV).

3rd February - before noon. Visit to the Sawmill (Seytim).
Recognition of sawmill's production for needs of boatbuilding.

Discussions with Mr Berry Antat - saw doctor.

Technical results

1. Production of sawmill is of proper quality for boatbuilding.

2. Range of production of sawmill is sufficient for boatyard's purposes:
   (a) planks - typical thicknesses are:
   1 inch (25 mm) and 2 inches (50 mm).

   It is possible to make the planks from 15 up to 50 mm thick.
   Width of planks up to 8 inches (200 mm).

(b) logs - with maximum dimensions 300 x 300 mm.

Typical length of planks and logs - 2,5 m. Possible, on special order, up to 4,0 m length.

3. All products of sawmill are impregnationed by bath.

4. Humidity of products is on 9 - 10% level. This value is adequate for boatbuilding materials (maximum humidity up to 15%).

3rd February - afternoon. Visit in "CIMAGLASS" - fibreglass workshop on Mahe. Meeting with Mr C. Pool, Manager.
Discussed possibility of production of ice-boxes on 2 semi-industrial scale (see Annex 2, sketch No. 2).

Technical results Removable ice-boxes (described Annex, Chapter IV) should be carried out in specially prepared moulds. Methods used to one - off production do not allow to obtain a proper quality of surface. Occasionally built different of ice-boxes are made of plywood covered, in and outside, with glassfibre laminate. For production in moulds good quality gelcoat should be used. Both boxes, inner and outer, will be glued with strip of rowing-met and polyester resin. Space between the walls will be filled, through the holes in the bottom of the box, with expanded polyuretane foam. From the technical point of view the workshop "CIMAGLASS" is prepared to production like that.

4th February - Meeting with Mr Samsoodin, Chief Fisheries Officer, Ministry of National Development, Fisheries Division.

Discussions concerning main data of designed boat, exploitation features and equipment of the boat.

Technical results

1. Chief Fisheries Officer has approved main technical data of the boat and confirmed previous technical agreement appointed in FIDECO.

2. He has agreed with designer's opinion with regard to limitation of crew number (to five persons) taking into consideration safety and exploitation possibilities as well.

3. Equipment of the boat (see Annex, Chapter VIII, items 1 and 2) has been discussed and confirmed. Equipment as in item 2 should also be approved by local port authority.

7th February - earlier intended visit to La Digue and Praslin has been postponed.

- afternoon. Meeting with Mr BEAUDOIN, owner of "FIBREGLASS" workshop, in Victoria, in his workshop. Possibility of production of fibreglass ice-boxes are discussed. Also this workshop is ready to undertake production of ice-boxes for boatyard in Praslin.

8th February - Departure for Praslin by plane.
- Meeting with Mr Roch Henriette, Protocol Officer.
- Departure for La Digue by boat.
- Meeting with Mr Gregoire Payet, Manager of boatbuilding and maintenance workshop.

Visit to Praslin and La Digue has been arranged by Government official (Mr Philippe Michaud) to discuss technical matters concerning boatbuilding on Seychelles and to recognize skills of local boatbuilders and materials traditionally used for boats' construction. The repair on one of schooners and major repair process on the second one was observed. Standard of craftmanship in yard on La Digue is relatively high.

Timber The traditional material, for the hulls, is local timber, takamaka. Battens or planks of takamaka can be bent to the required curves after steaming or boiling process. Pieces of crooks and compass timber are a available on La Digue - both are used for frames, floors, knees and parts of heel-line as well. All these parts are cut out of growned timber. When the glue is not being used for connection all parts of frames, cross-sections of combined frames are large and hull become heavy. Losses of materials during such a process of construction are very high as well as losses of time for searching for proper timber. Planks are nailed to the frames, not riveted. Only important parts like keel-line members, some floors are connected with copper bolts, other with boatnails (with "harpoon").

Plywood - there is no plywood factory on Seychelles. All marine plywood used for boatbuilding is imported (mainly from Singapore). Different quality of plywood is met in workshops, however, high quality (e.g. of Bruynzeel) is frequently applied.

Equipment - used for boats are generally imported, some small parts of fittings are locally made, especially for fishing boats (deck fittings). Cleats, blocks, anchors, windlesses, hatches, bilge pumps - are imported from Italy or UK.

Shaftline parts and engine accessories - are imported and delivered together with engine, mainly from UK and Japan.

Nails, washers, bolts (copper) are imported from UK. Different sizes of square-section copper nails and washers are imported. Bolts are delivered with ready heads. Threading of bolts is made themselves.

Pairts and fillers are applied. Mostly used are good quality marine paints and epoxy fillers, imported from british firms. Boatbuilders have different experiences with antifouling paints. Some types of antifoulings have not sufficient durability and activity of poisons is too short in tropical conditions. Perhaps choise of antifouling for local conditions was accidental.

Sealings materials - all kinds of modern sealings materials are applied.

Metal plates - Generally stainless steel or brass plates are used for fabrication of important part of hull fitting or equipment. Thin copper sheet plates are sometime applied as a protection of wooden parts. Tinplates (zinked steel plate) are not applied for boats.

Metal bars - Stainless steel, brass or copper round-bars are used for connectors' manufacturing and for fittings. Zinked flat-bars or iron bands are not applied.

Glues - Urea formaldehyde glues, "Cascophen", "Cascamit" are applied for gluing of deck and superstructure elements.

9th February - Departure for La Digue by boat.
- Meeting with Mr Roch Henriette
- Visit in private boatyard on Praslin.

Discussions with Mr William Rose, boatbuilder.
17 m long wooden schooner, under construction, has been inspected. The main features of boatbuilding process and applied materials are the same like on La Digue.

The differences are:

1. The shell is made as a carvel construction with seam battens. The planks are nailed to the battens and then riveted.

2. The floors, on the cut out frames, are connected to the keel with bolts, through the keel (screwed and then clenched).

3. Glue is applied more often for connection straignt parts of keel.

General remarks Design drawings are used accidentally and mainly for outfitting. Usually wooden model of the hull is made. On base of this model profiles of frame - moulds are drawn, on the loft floor, in natural scale. Sometime they draw desired profiles and the plan view of the sheer in reduction scale, from the model. Then draw full size to inside of planking for midship sections and a few moulds on intermediate sections and for transom.

10th February - Departure Praslin for Mahe by plane.
- Meeting with Mr P. Michaud.

Terms of meetings with Port Authority and with Chief Fisheries Officer are appointed.

Calculations for selection of the propulsion engine for new conditions concerning boat speed have been made. Results of calculations are presented in Annex 5.

11th February - Meeting in FIDECO with Mr Kenneth Albert.

Results of propulsion calculations is presented. Engine of YANMAR type 2GM20 is recommended by designer of the boat. Selection of gear ratio is connected with choice of adequate propeller and will be done after receiving all information concerning propellers' standard series. Telex concerning selection of the propeller and engine's drawings needed for designing of the boat has been prepared by designer and sent by FIDECO Manager.

14th February - Meeting in Port Authority, with Captain R. Morgan, Harbour Master, Department of Transport.

Discussion concerning the designed boat. The lines drawing, sheer plan and technical description of the boat are presented. Critical comments tc the technical description will be prepared. Harbour Master recommend to design a set of sails as an emergency means of propulsion. The fog horn is cancelled from list of equipment (Annex 3, chapter VIII, item 2).

Afternoon - Proposition of the emergency set of sails is prepared by designer.

15th February - Meeting in FIDECO. New item concerning the emergency means of propulsion is discussed.
Manager of FIDECO, Mr. J. Lablache, approves technical description of the boat.

Afternoon - Meeting in Port Authority with Captain R. Morgan, Harbour Master. Critical comments concerning painting of the boat are accepted by the designer, warmishing the inner surface of the hull will be replaced with painting (see enclosed comments). Sketch with dimensions of the sails is accepted by Harbour Master.

Technical description of the boat is approved for Port Authority (copies with approvals are enclosed to the report).

16th February - Second meeting with Mr. Samsoodin, Chief Fisheries Officer. Technical specification with all changes is discussed. Final meeting, in order to approval of project of tne boat by Principal Secretary of Ministry of Development, has been appointed by Mr. Samsoodin.

17th February - Recommendations for Government are prepared by expert.
Works connected with preparation of the report of the mission.

18th February - Meeting with Principal Secretary of Ministry of Development and technological aspects.

Project of the designed boat are discussed. Recommendations for the Government are presented. Ministry of Development approve technical specification of the boat. Letter with approval will be sent to Ministry of Planning for general approval.

21st February - General approval by Principal Secretary of Ministry of Planning.

- Departure for Vienna (via Frankfurt)by plane.

Closing remark

All items of the programme, which are listed in Annex 1, have fulfilled with exception of item 6. Manager of FIDECO had difficulties with appointment of a day fishing trip with local fisherman because FIDECO have no small boats for day fishing (all belong to private sector).

II. RECOMMENDATIONS TO THE GOVERNMENT CONCERNING BUILDING AND MAINTENANCE OF 6.3 M FISHING BOATS DESIGNED FOR THE REPUBLIC OF SEYCHELLES.

Locally available materials as well as skills of local boatbuilders are satisfactory. After modernization of production methods, what will be after establishment of new boatyard and maintenance complex, only a few recommendations concerning building of wooden boats may be given.

1. Where it is applicable hot zinced steel elements should be applied in boats construction, instead of expensive stainless steel and brass. Establishment, in Seychelles, of a small workshop executing zinc protection covers, might be taken into consideration.

2. Establishment of a sailmakers workshop, separate or as a division of one of local boatyards, is recommended. According to requirements of Department of Transport fishing boats should be equipped with set of sails as an emergency means of propulsion. There is also need for sails for local schooner fleet and pleasure crafts. At present all sails are imported with the exception of a few home-made cotton sails of poor quality. The sailmakers' workshop would produce sails from imported synthetic sail-cloth. Rigging for boats equipped with sails should be made in the same workshop. Riggings met on boats and schooners are also of different, frequently poor, quality.

3. One of the boatyards or workshops should undertake production of rivets, boat nails and bolts for boatbuilders. At present all of these elements are imported and relatively expensive. Production of these elements is simple. It requires the importation of basic materials such as copper, brass or stainless steel round-bars. These materials are probably used also for other purposes.

ANNEX 1

PROPOSED PROGRAMME OF TECHNICAL AGREEMENTS CONCERNING 6.3M FISHING BOAT DESIGN

1. Meetings with officials from Ministry of Planning and External Relations.

   Proposed programme will be presented.

2. Discussions concerning conditions of using the boat and expected fishing performance:

   a) range from coast
   b) duration of trip - steaming and fishing
   c) number of crew - average and maximum
   d) expected speed under engine (approx.)
   e) expected maximum catch.

3. Choice of proper engine for the boat according to purchasing conditions and possibility of maintenance (service) in the Seychelles. Choice from four types of the engines proposed in temporary technical description of the boat.

4. Recognising of:

   a) production range of local sawmills for needs of the boatyard - list of products and dimensions
   b) production of local GRP workshop (fibreglass)
   c) possibility of delivery of marine plywood for production of mentioned boats

5. Deck and fishing equipment

   Choice of delivery firms.

6. Taking part in the fishing trip with local fishermen.

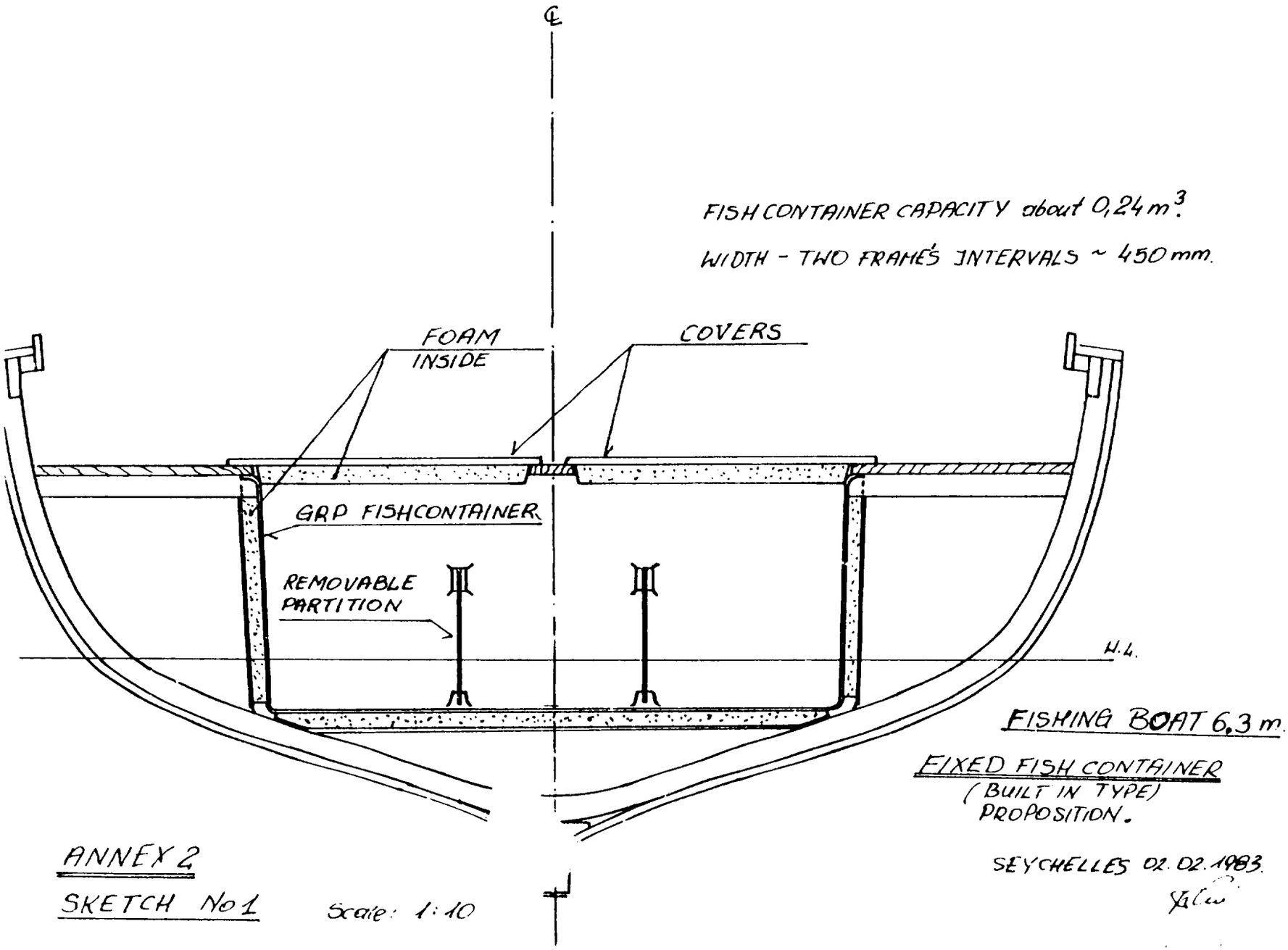
7. Discussions about presented technical description of 6.3 M fishing boat with representatives of:

   (a) Fisheries Development Company (FIDECO)

   (b) Local Port Authority - Department of Transport. Approval by officials from above mentioned institutions.

8. Final approval of technical specification of the boat in Ministry of Development.

9. Discussions concerning presented "Basic technological aspects of 6.3 M fishing boat construction".



ANNEX 2

SKETCH No 1 Scale: 1:10

ANNEX 2

SKETCH No.2

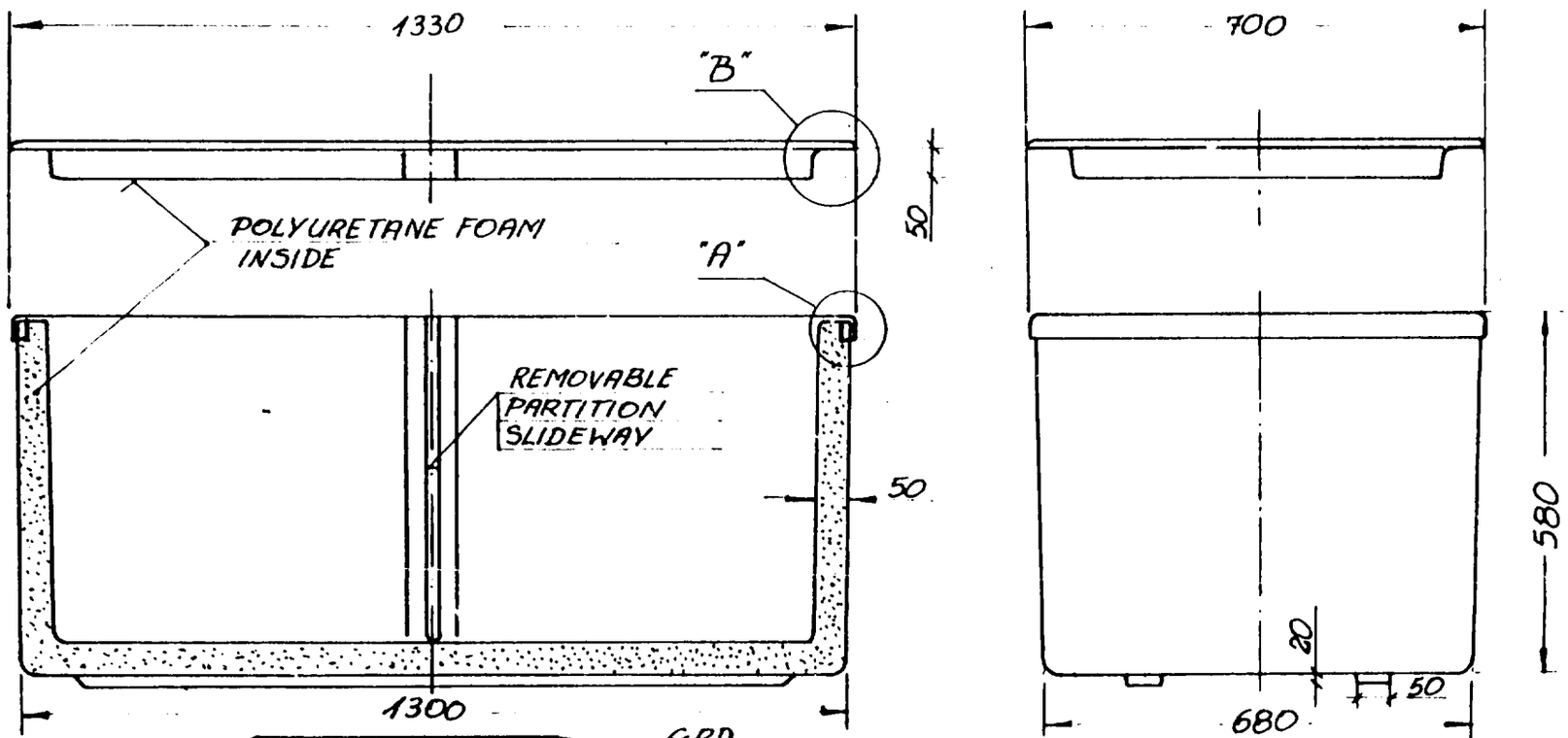
Scale: 1:10
1:1

ICE-BOX (~0.33 m³)

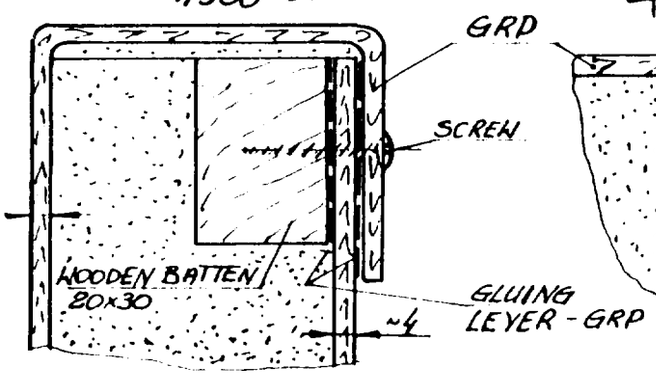
REMOVABLE FISH CONTAINER

PROPOSITION

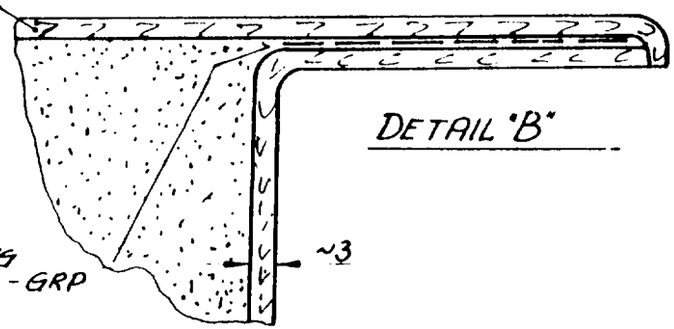
FISHING BOAT 6.3 m



DETAIL "A"



DETAIL "B"



ANNEX 3

TECHNICAL DESCRIPTION OF THE 6.3 m FISHING BOAT FOR THE REPUBLIC OF SEYCHELLES

I. MAIN DIMENSIONS OF THE BOAT:

Length overall	6.30 m
Length waterline	5.40 m
Beam overall	2.40 m
Beam waterline	2.02 m
Extreme draught	0.60 m
Freeboards	1.09/0.66/0.69 m
Displacement	1.65 ton
Boat speed	7-8 knots
Engine	described in chapter VI.
Number of crew	5

II. HULL OF THE BOAT:

1. The hull of the boat is designed taking into consideration the requirement that length overall will be amount to 6.3 m. Shape of the hull is characteristic of boats which have a good see-keeping qualities. Expanded sides of the boat, in the bottom part, makes the hull with adequate stability. Maximum drought of 0,6 m allows to operate with the boat on shallow water and pull the boat out on the beach.

2. Most frequently used local timber for boatbuilding - takamaka (callophylum inophylum) is fiting to gluing and to steam bending as well. Both methods will be applied in construction process of this boat.

A. Hull's shell will be built of takamaka timber as a clinker-type construction. This type of shell construction gives very stiff and relatively light hull. The planks will be bent over web-frames and temporary mounted section moulds. The planks will be riveted to the web-frames and one to another, then to the bent frames. To the keel line (stem, keel and sternpost) the planks will be glued and screwed. Ground strakes and gunwale planks will be of bigger thickness.

B. Keel line will be glued of takamaka timber with using of "West system", "Cascophen" or "Cascamite" glue. The transom will be made of takamaka planks with back straps (inside). Moulded transom frame will be in the place of connection to the planks. To connection of all members of the keel line steel bolts and glue will be used. Stainless steel is recommended for this purpose. When low-carbon steel will be applied, the bolts should be protected by hot zinc plating (electro-galvanizing is not recommended).

C. Bent frames (steamed) of takamaka timber will be bent into the hull when the shell will be made. Where it will be only possible, the bent frames will be bent in one piece. In other places additional floors will be mounted over the frames. Moulded floors will be mounted under the engine bed.

D. Web-frames

Four moulded web-frames are foreseen. To two of web-frames the bulkheads of fore and afterpeak will be attached. Bulkheads will be made of plywood or of takamaka planks. Between the other web-frames, in the middle part of the boat, the fish container (ice box) will be situated.

E. Decks

Decks over the forepeak and afterpeak are foreseen. Decks will be made of marine plywood or of takamaka planks lied on deck beams glued or cutted out of takamaka timber. The decks will be covered with layer of GRP (glassfibre) or of cotton cloth lied on the putty, then painted.

III. STEERING DEVICE

Rudder plate will be glued of takamaka planks and bolted lengthwise. Rudder hinges, of stainless - or hot zinced steel, will be bolted to the false sternpost. Wooden tiller will be put into the hollow in the rudder plate head and protected against moving forward. Propeller protection with lower rudder bearing will be mounted.

IV. FISH STORAGE DEVICES

Fish container ("ice box") will be situated between two web-frames in the middle part of the boat. Removable ice box will be made of GRP (fibreglass) and consist of inner and outer box formed in the moulds. Between the walls of these boxes will be heat insulation layer of expanded polyuretane foam (about 50 mm thick). Outside and inside surfaces of the ice box should be moulded with gelcoat layer - it gives very smooth and clean surface. The ice box will be covered with one large cover of fibreglass, also with heat insulation inside. Removable partition of the icebox, in the centre line of the boat, should be foreseen. Capacity of the ice box should be of 330 litres. Temporary, dismantled wooden container for last catch will be foreseen. It will consist of sides and cover made of planks. Cover should be covered with wet cloth when there are fishes inside.

V. DECK EQUIPMENT

The boat will have mooring cleat and mooring fairlead on each side offore and after deck. When the anchor will be often used, roller fairlead on the fore deck (near centre line) should be attached. Gunwale will be protected with gunwale fitting made of zinked steel section. Zinked steel flat-bar will be screwed to the stem and to the keel. Drainage installation will consist of hand bilge pump (diaphragm type), strainer and hoses.

VI. PROPULSION OF THE BOAT

A. Engine

For propulsion of the boat YANMAR 2QM20..... type, four-stroke, vertical diesel engine will be used.

Technical data of the engine:

Number of cylinders: 2

Bore x stroke: 88 x 90

Intemittent rating (DIN 6270 B):

Continuous rating (DIN 6270 A): 20 HP/2600 r.p.m.

Starting: Hand starting

Cooling: Water cooling with rotary pump

Reduction ratio:

Weight (dry): 240 kg

Dimensions: 825 x 527 x 675 mm

B. Engine systems

Exhaust system with water injected exhaust silencer. Exhaust gases outlet through the valve on the shell in after part of the hull. Engine bed - moulded of timber, supported on moulded floors. Standard shaft line with propeller shaft, shaft flange, propeller shaft sleeve and three-blades propeller will be delivered together with the engine. Standard control for reverse gear and speed.

Fuel system with fuel tank capacity of 40 litres. Plywood or GRP cover will be over the engine. Special tub for collecting of leakages of fuel or lubricating oil will be mounted under the engine.

VII. PAINTING OF THE HULL

To inner surfaces of the hull, after treating with marine impregnation, will be applied varnish (6 - 8 coats).

To outer surface of the shell, after impregnating and filling areas of roughness with epoxy filler, one coat of undercoating should be applied. After filling scratches and other imperfections 3 - 4 coats of enamel will be applied, with sanding between coats. To the shell below waterline 2 coats of antifouling will be applied.
All painting should be done according to instruction of te producer.

VIII. OTHER EQUIPMENT

1. Echo sounder (yacht type) for quick finding proper depth on the fishing grounds is recommended.

2. The boat will be also equipped according to requirements of regulations of local port authority.

   Equipment, for day sailing, will be consisting of:

   (i) anchor
   (ii) anchorline
   (iii) oars
   (iv) bucket
   (v) fire extinguisher
   (vi) radar reflector
   (vii) lifebuoy
   (viii) lifejackets

(ix) flares - red rockets

(x) red stars

(xi) First Aid box

(xii) Fog horn

(xiii) torch

(xiv) compass

IX. RIGGING AND SAILS

According to requirements of Port Authority in Victoria for fishing boat emergency propulsion should be foreseen. For this purpose the boat will be equiped with mast, boom and set of sails.

1. Mast and rigging

Mast made of wood (hollowed inside), standing on short keelson support structure. W oden boom will be connected to the mast by the jaw-end. Standing rigging will be consisting of two shrouds and one stay - galvanized wires, wires with bottle rigging screws. Running rigging will be consited of sheets and halyard for main sail and jib.

2. Sails

Set of sails will be consisting of jib and bermudian (triangle) main sail. Sails will be made of synthetic sailcloth (weight about 220 g/sq.m/o Total sail area about 13.2 sq. m.

ANNEX 4

BASIC TECHNOLOGICAL ASPECTS OF 6.3M FISHING BOAT CONSTRUCTION

The technological process is based on the information given by the following papers:

1. Temporary technical description of a 6.3m fishing boat for the Republic of Seychelles.
2. The report of the second mission to the Republic of Seychelles (by B.K. Mazurkiewicz) Sect. 15.5.
3. The report of the third mission to the Republic of Seychelles (by B.K. Mazurkiewicz) Sect. 15. Basic boatyard equipment - items 15.1 - 15.4

The technological process of 6.3m fishing boat building contains several stages as described in sections I to VIII.

I. INITIAL MACHINING (TREATMENT)

The timber is stored in an open-air store. Parts of timber according to production plan are machined to form logs, planks and battens suitable for prefabricating of the hull construction members.

II. PREFABRICATING OF THE HULL CONSTRUCTION MEMBERS

1. The keel-stems line elements are glued from thin planks with use of screw press device and timber mould. The same method applies to knee and deadwood.
2. The web-frames members are moulded with the same method. The web-frames and bulkheads are set up with use of flat shape moulds (plywood).

3. Moulded floors are prefabricated and cut to fit the proper shape.

4. The transom is prefabricated in way of glueing all together planks and stiffening members.

5. The rudder plate is prefabricated and machined to meet the shape and section profile.

III. HULL ASSEMBLY - STAGE I

(Production post No. 1)

This stage of production takes place on production post No. 1 - see the enclosed drawing.

1. The web frames are mounted on the hull assembly platform in the upside-down position, followed by stem and sternpost.

2. Two additional section moulds are mounted on the assembly platform in places of greater curvature of the shell shape (bow and stern). The planks shall be bent over web-frames and section moulds.

3. The keel line is mounted and fixed to the stem, frames and sternpost.

4. The planking starts with the keel side plank and is continued downwards finishing with the gunwale plank. After fitting and temporary mounting with nails, the planks are rivetted to the web-frames and screwed to the stem, keel and sternpost. Copper nails are used to rivet the planks one to another. Filler is used to tighten the connection between planks.

5. Until the boat is upside-down the stern tube hollow should be drilled with use of direction aids. Then the keel protection fitting is mounted.

6. The hull is lifted from the assembly platform with electric lift and turned over to natural position, with the keel down.

7. The hull is transported by the lift with transverses applied to the production post No. 2.

IV. HULL ASSEMBLY - STAGE II

(Production post No. 2)

After reaching post No. 2 the hull should be nivelated on the assembly base, and the assembly sequence is as follows:

1. The shell is painted with maintain primer on the inner surface.

2. Bent frames are steamed, bent in and rivetted to the shell.

3. Beam shelves are mounted and bolted through.

4. Floors are fitted and fixed.

5. Beams are mounted followed by deck stringers.

6. Fore- and after deck planking is fixed.

7. Half decks and cockpit coaming are mounted. Gunwale fitting is screwed.

8. The engine bed is assemblied and bolted to the hull.

9. The fish containers supports are mounted.

10. The cockpit gratings and benches are fitted.

11. Maintain primer is applied to all members built in stage II.

12. The assembled hull is lifted with use of transverse frame and transported to production post No. 3 and located on a cradle cart.

Note that according to the requirement (see "Job Description") on each of production posts (1 and 2). Simultaneously two hulls will be built.

V. FITTING OUT THE EQUIPMENT

(Production post No. 3)

General remark. All the items of the equipment for deck fitting out, fishing devices, and engine with shaft set should be completed in the store (concerning also those fittings that are manufactured in the boatyard) in sets complying to each boat.

Fitting out the equipment sequence is as follows:

1. Setting and nivelating of the hull on the cradle cart with use of the movable supports of the cart.

2. The axis of the propeller shaft is found with help of a string. Then the stern tube is mounted.

3. The engine is settled on its bed and fixed.

4. The propeller shaft is mounted.

5. Rudder hinges are bolted to the hull and the steering device is mounted.

6. The systems of the engine are set up:
   - fuel system
   - exhaust system
   - cooling pipelines
   - engine control system.

7. The engine cover is fixed in place.

8. Drainage system is completed and mooring fittings mounted.

9. Fishing devices (if any) are completed on the boat.

10. Lockers' covers are mounted with hinges and locks.

11. The boat's interior is painted.

12. The outside surface of the shell is painted with use of the movable supports to heel the boat in both directions.

13. The boat is transported outside on the cradle cart.

14. Preparations for launching are made.

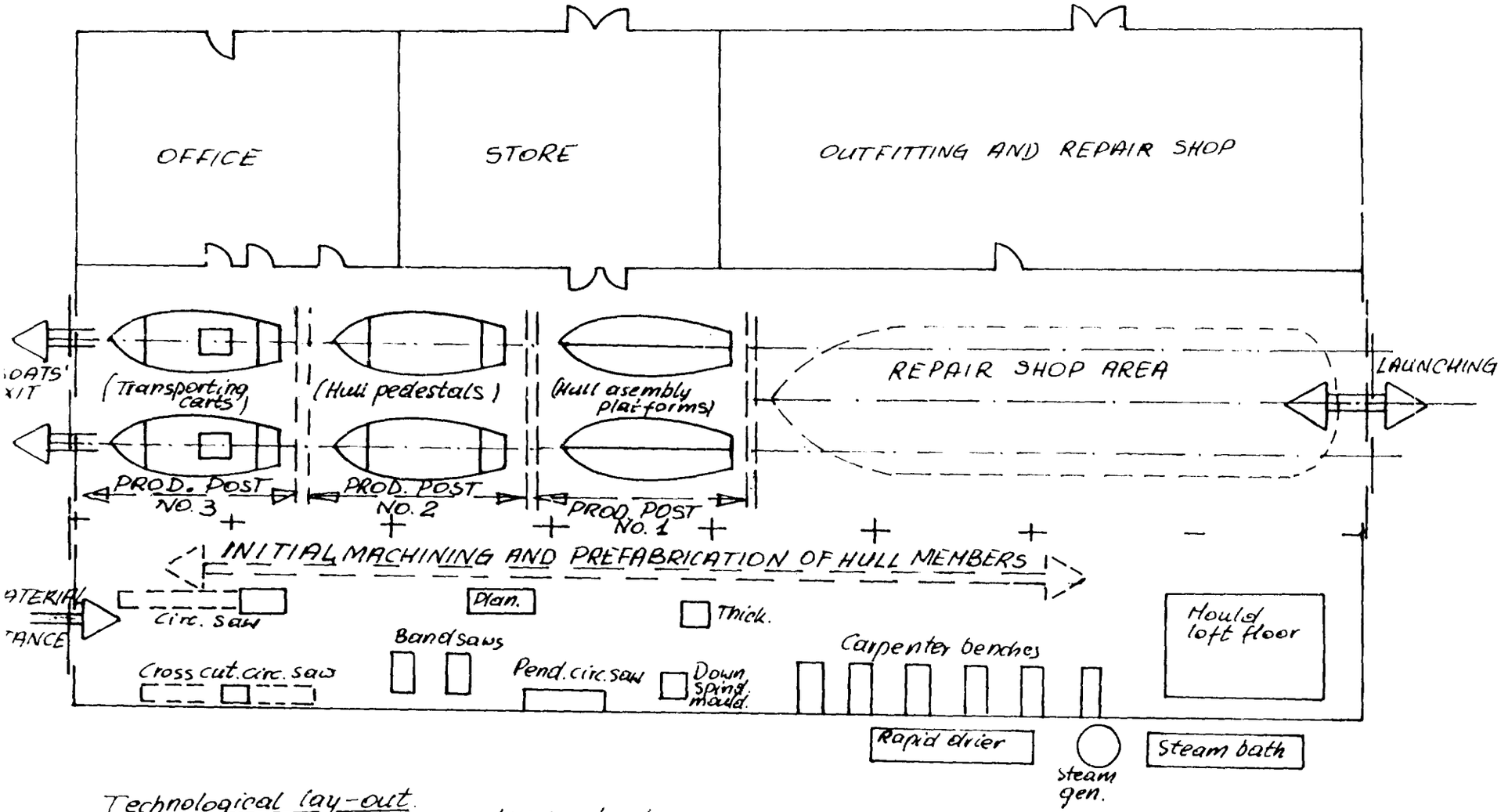
VI. LAUNCHING

VII. WATERTIGHTNESS CHECK

The watertightness of the shell and sterntube is checked.

VIII. TRIALS

Trials on water are carried out according to trials programme.



Technological lay-out
Production process of 6.3 m fishing boats in boat building and hull repair shop in Praslin - Seychelles.

(See - "Basic technological aspects of 6.3 m fishing boat construction")

ANNEX 5

SELECTION OF THE ENGINE FOR 6.3 m FISHING BOAT

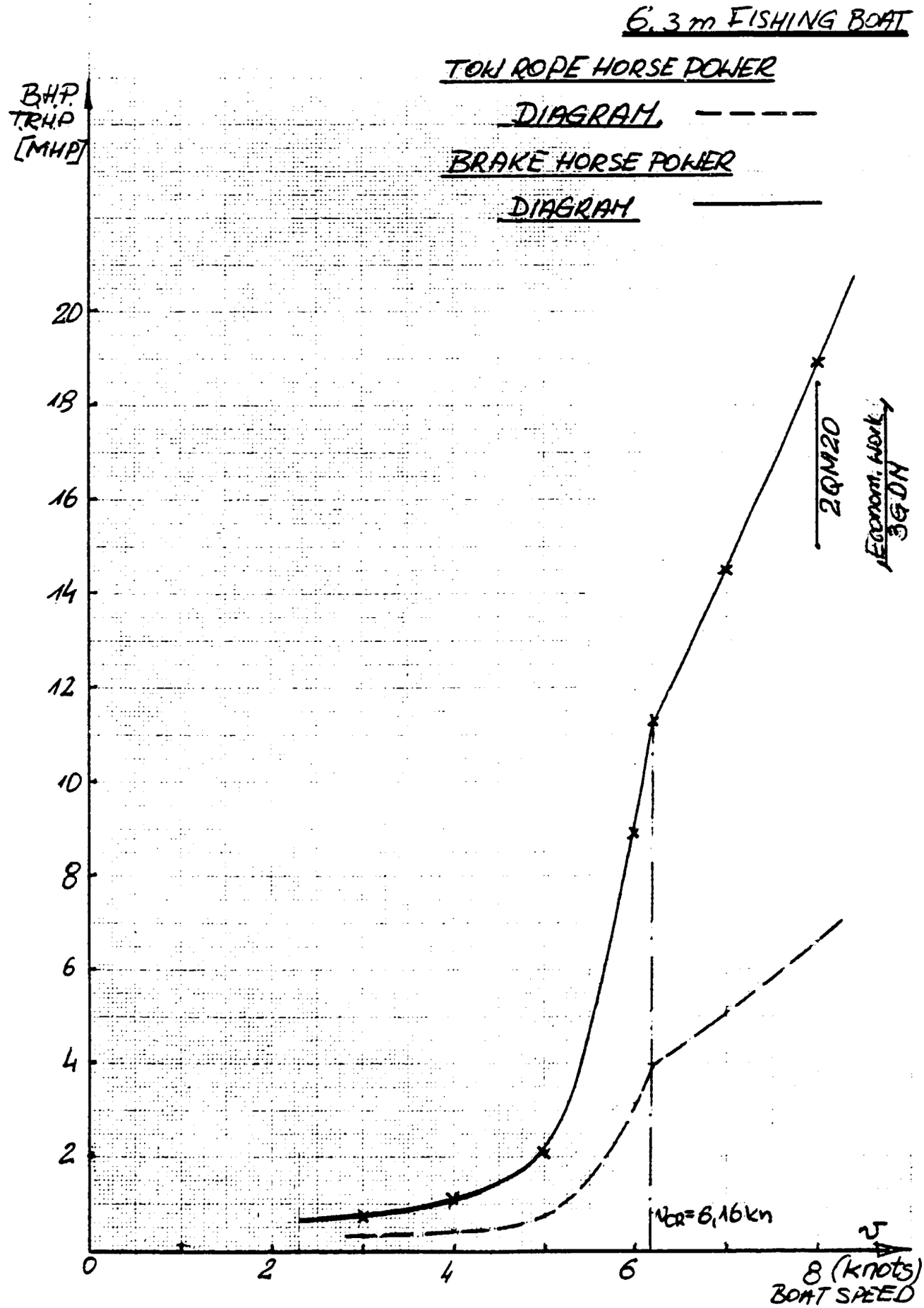
As it is shown on Brake Horse Power Diagram both, 2QM20 and 3GDM YANMAR MARINE ENGINES, allow to obtain required boat speed 7 - 8 knots.

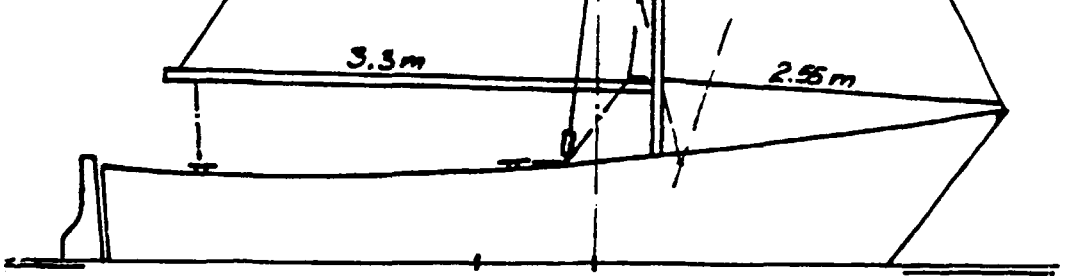
For fishing boat more suitable will be heavy duty diesel engine YANMAR 2QM20. Data of engine - see Annex 3, Chapter VI.

FISHING BOAT 6.3 M.

RESULTS OF CALCULATIONS
TOW ROPE HORSE POWER.

BOAT SPEED	KNOTS	3,0	4,0	5,0	6,0	6,16	7.0	8.0
BOAT SPEED	m/s	1,542	2,056	2,57	3,08	3,17	3,6	4,11
FRICTIONAL RESISTANCE	kp	4,35	7,74	12,09	17,41	18,49	23,70	30,96
FORM RESISTANCE	kp	1,126	2,003	3,13	4,51	4,79	6,14	8,015
WAVE RESISTANCE	kp	(0)	2,60	3,75	46,77	61,77	65,8	70,36
TOTAL TOW ROPE RESISTANCE	kp	12,04	13,57	20,87	75,55	93,55	105,2	120,26
TOW ROPE HORSE POWER	MHP	0,247	0,371	0,715	3,102	3,95	5,05	6,6
BRAKE HORSE POWER	MHP	0,70	1,062	2,05	8,89	11,33	14,46	18,91


6.3 m FISHING BOAT
TOW ROPE HORSE POWER DIAGRAM
BRAKE HORSE POWER DIAGRAM
B.H.P.
T.H.P.
[MHP]
20
18
16
14
12
10
8
6
4
2
0
2
4
6
8 (knots)
BOAT SPEED
v
v_CR = 6,16 kn
2QM20
Economic Work
3GDN



MAST TOR ABOVE WATER LINE-6.2m

JIB HALYARD -"- -"- -"- -5,7m

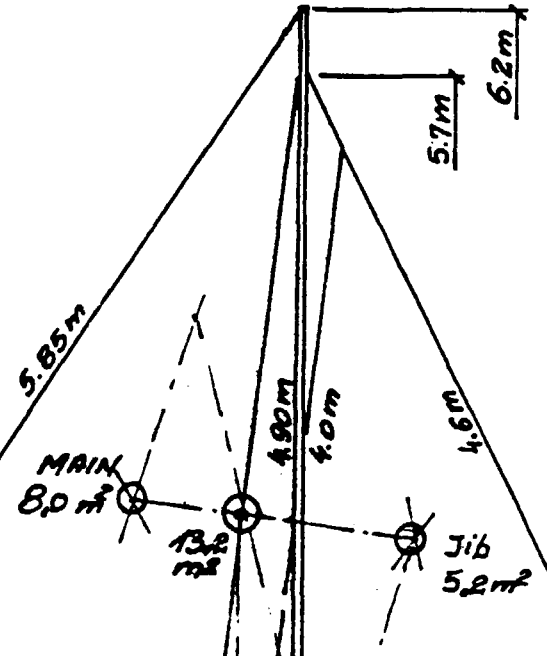
WET. SURFACE : SAIL AREA FACTOR - 1.46

MAIN SAIL	8.0 m²
JIB	5.2 m²
TOTAL SAIL AREA	13.2 m²

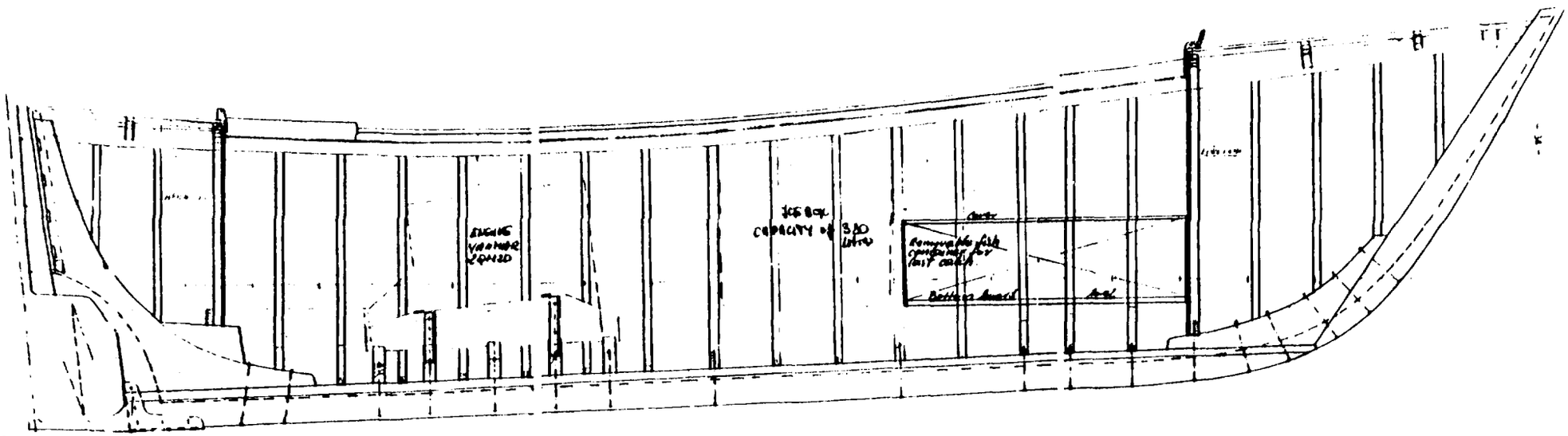
ANNEX 6.

FISHING BOAT 6.3 m.

DIMENSIONS OF SAILS.



SHEER PLANE of 6.3m FISHING BOAT
SCALE 1:10
(PROVISIONAL)




-214