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TECHNICAL COOPERATION PROGRAMME

TRAINING IN SEA SAFETY DEVELOPMENT

Based on the Work of
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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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SUMMARY

The Consultant travelled to New Delhi, Kakinada and Visakhapatnam for discussions with fishermen, fishing boat owners, boatbuilders, staff from the Kakinada Port Office, Marine Department in Visakhapatnam, Fisheries Department, Fisheries Training Institute (CFTI) and FAO, on questions of fishing vessel safety. During the cyclone in November 1996, 110 trawlers and 569 crew members were lost. Only the 10-12 m multi-day trawlers were caught at sea in the cyclone since the smaller boats were not out fishing due to bad weather. It was noted that the safety equipment required in the "Merchant Shipping Act" is not carried when the boats go fishing. Concrete steps are recommended to improve the safety of the fishing vessels, including lashing down of hatch covers and providing larger scuppers in the bulwark, together with better training of the crew in dealing with heavy weather. The lifejackets supplied in India with cotton cover and kapok floatation are outdated. None of the crew on the fishing boats or the instructors of the CFTI knew how to tie on the life jackets properly. The Syllabus of the CFTI puts too little emphasis on training for heavy weather boat handling and safety drills. Two training courses aimed at different levels of participants were held in Kakinada.

A prototype of a rigid lifefloat for 8-10 men was made in a FRP boatbuilding yard in Kakinada and demonstrated in the fishing harbour. The life float is designed to be carried on top of the wheelhouse and will increase the chances of survival of the crew and the probability of being seen by search boats and aeroplanes.

The scantlings of the wooden trawlers built in Kakinada are considerably below what is considered to be the minimum in other countries. This increases the possibility of foundering in heavy weather due to leaks, especially on older boats. Poor workmanship and scantlings were also seen in FRP boats. Many of the FRP boats have no, or inadequate, buoyancy compartments to keep the boats afloat if a sudden leak occurs.

A tender specification was prepared for the supply of 12 diesel engines by the project for installation in Navas.

RECOMMENDATIONS

1. The Merchant Shipping Act should be revised to take into account the latest developments regarding safety of smaller fishing vessels.
2. The Mercantile Marine Department should ensure that the requirements in the Merchant Shipping Act are enforced.
3. Only lifejackets made with rot resistant synthetic covers and foam buoyancy material should be accepted. The crew must be drilled in how to tie on the life jacket.
4. A lifefloat (based on the prototype demonstrated and modified to include improvements) should be included as additional safety equipment for small trawlers where it is impractical (due to size or cost considerations) to carry a rigid or inflatable liferaft with sufficient buoyancy to support the crew.
5. A complete stability calculation should be made for a typical "Sona" boat, taking into account all loading conditions as well as ice boxes on deck and water on deck, to check whether the high Depth/Beam ratio of these boats represents a danger.
6. All multiday fishing vessels should carry a radio (either VHF or at least a transistor - see rec 1 above).
7. Guidelines for the scantlings of wooden and FRP fishing boats should be introduced in India based on accepted scantlings in other countries for use by boatbuilders, boat owners and insurance companies.
8. The recommended scantlings and safety measures should be incorporated into the revised regulations and enforced.
9. The Syllabus of the Fisheries Training Institute should give greater emphasis to practical training in handling boats in heavy weather and drills in the use of safety equipment.
10. Buoyancy blocks of polystyrene sufficient to keep the boat afloat if a sudden leak occurs, should be required in all FRP "Teppa" and "Nava" craft.
11. The installation of the 20 hp engines supplied by the project should be supervised by a National Consultant. The Consultant should travel to Cuttack and Paradeep to contact suppliers of the sterngear incorporating a thrust bearing and double universal joints. The possibility of making these items in Kakinada should be considered.

Contents

	Page
Summary	
Recommendations	
1. Terms of Reference	1
2. Background	1
3. Findings	1
3.1 Types of Boats	1
3.2 Casualties during the Cyclone	3
3.3 Causes of Loss of Trawlers	3
3.4 Survival of Crew after Capsize	3
3.5 Safety Regulations for Fishing Boats	4
3.6 Observations Regarding Safety Regulations	4
3.7 Vessel Construction	5
4. Training Courses	6
4.1 Training Courses for Boatowners and Crew	6
4.2 Training Courses for Personnel from Fisheries Dept, CFTI, Merchant Marine Dep. and Port Office	7
5. Lifefloat	7
5.1 Design and Construction	7
5.2 Demonstration of Lifefloat	8
6. Engine Installation in Nava	9
6.1 Specification	9
6.2 Selection of Navas and Supervision of Installation	9
References	10
Figures 1- 20	
Annexes	
1. Itinerary and Persons Met	
2. Design of Life Float	
3. Specification for Engines	
4. Design of Engine Installation in Nava	
5. National Consultant – Terms of Reference	

1. Terms of Reference

International Consultant Naval Architect (one month)

Under the supervision of the technical and operational units of FAO, and in close collaboration with the Team Leader and project staff, the consultant will demonstrate measures to bring about improved safety at sea on board mechanised fishing vessels operating from the coast of East Godavari District. In particular, he will lead a training workshop addressing the safety aspects of the design, construction and operation of mechanised fishing vessels and their equipment.

He will also provide advice on the correct installation of inboard marine diesel engines supplied by the project into traditional craft.

The report will be addressed to the project operation officer at RAPA (hard copy and diskette in Word 6 format). Editing is the responsibility of the consultant.

2. Background

In the cyclone that struck the East Godavari River delta on the 6 November 1996 approximately 1,435 fisherfolk were reported dead or missing. Of these 569 were crew members from 110 boats that were lost at sea. Most of the vessels had departed from Kakinada several days before the cyclone.

As a result of a request for assistance by the Government of India, a FAO national consultant drafted a TCP proposal which was subsequently approved as the TCP/IND/6712 Training in Sea Safety Development Programme. A part of this programme concerns measures to improve the safety on trawlers operating along the coast of East Godavari District.

3. Findings

3.1 Types of Boats

The following are the main types of craft used in the fishery in the East Godavari District:

- **Mechanised trawlers of 10 - 15 metres**
- **Wooden Nava** of 5-12 m length. Planked boat without keel, originally a river boat used in the Godavari delta powered by sail and oar. The larger Nava of 9-12 m length are now increasingly motorised with 16-20 hp diesel engines and used for sea fishing (Fig. 1).
- **FRP teppa** of 9-10 m length, fitted mainly with a 6 hp aircooled diesel engine and a "longtail" shaft.
- **FRP Beachlanding craft (BLC)** of 8.5 m length with deck, fitted with a 9 hp watercooled engine and a liftable propulsion system (Fig. 3).
- **FRP open "Nava"** of 9.1 m length fitted with 16 hp diesel engine and fixed propeller (Fig. 2).
- **FRP decked boat** of 9.8-10.4 m length fitted with mainly 20 hp diesel engine and direct drive to propeller (Fig. 3 and 4).

The FRP open "Nava" and the FRP decked boat are both based on the mould for the FRP beachlanding craft modified by increasing length, beam and depth. The construction of FRP craft was introduced by the Bay of Bengal Programme (BOBP) in 1985. At present there are 3 FRP boatyards in Kakinada, 5 in Uppada (Fig. 4) and 2-3 in other parts of Andhra Pradesh. In Orissa there are about 5 FRP boatyards, of which 3 are in Puri.

The "Hand Book on Fisheries Statistics - 1996" (Ref. 1) gives the following number of fishing craft in Andhra Pradesh as of 1994-1995:

Total number of craft:	66,180
Unmotorized traditional craft:	54,000
Motorised traditional craft:	3,269
Mechanized boats:	8,911

It is commonly understood that a "motorised boat" is a traditional design to which a motor has been added, whereas a "mechanised boat" is an introduced or new design which included mechanical means of propulsion from the outset. Usually it means a boat that has some mechanical means of hauling the fishing gear in addition to an engine. The FRP boats have no mechanical hauling device, but must be included since these are the only "non traditional craft" together with the trawlers. The total number of trawlers in Andhra Pradesh is estimated at 1,500, but the resulting total number of FRP craft of 7,400 is probably an exaggeration.

The approximate number of trawlers based in the various ports are as follows:

Visakhapatnam:	500
Kakinada:	600
Machilipatnam:	200
Nizampatnam:	200
Krishnapatnam:	40
Total number:	1,540

There are still some trawlers of the original 10 m "Royya" type, built for one day fishing, but the majority are of the so-called "Sona" type of 11- 13 m length, but with considerably more beam and depth than the "Royya" type and fitted with insulated fishboxes below deck to make them suitable for trips of 10-15 days. These boats operate as far as the northern Orissa coast and the "sandheads" off the Bengal coast and have proven profitable because of low investment in contrast to the 23-25 m Mexican-type trawlers based in Visakhapatnam. There are approximately 15 wooden trawlers now under construction in Kakinada. The most popular type has the following main particulars (Fig 5 and 6):

Length over all:	LOA = 11.6 m
Beam moulded:	BMD = 3.75 m
Depth moulded:	DMD = 1.81 m
Cubic Number:	CUNO = LOA x BMD x DMD = 79 m ³
Engine:	Ashok Leyland 6 cyl, 100-110 hp
Fish hold volume:	5.2 m ³
Fish box on deck:	1.0 m ³
Fuel tanks:	4,000 litre

Fresh water tanks: 800 litre
Crew: 8 men

3.2 Casualties during the Cyclone

During the day prior to the cyclone, the smaller boats going for day or overnight fishing were not out at sea due to bad weather. Many of these boats were damaged when the villages were struck by the tidal wave, but it seems that few fishermen drowned in this connection. The main casualties on land, altogether 830 fisherfolk, were among the seed collectors working on exposed islands in the Godaveri delta.

The 567 fishermen who were reported lost, worked on 110 trawlers that capsized or foundered when struck by the cyclone. These boats had left Kakinada port several days before the cyclone and were fishing in an area south-east of Kakinada along the coast of the Godaveri delta. September to December is considered the peak fishing season in this area and the good catches had lured many trawlers to go fishing.

3.3 Causes for Loss of Trawlers

Through interview with survivors from capsized or foundered trawlers it was possible to get a clearer picture of the course of events that led to the disaster. The main conclusions are as follows:

- Most of the trawlers did not carry a transistor radio and the crew did not regularly listen to the weather forecast. The crew members did not want to take their radio with them on the boat because of the risk of spoiling it and the boatowner did not feel obliged to provide one.
- When the trawlers were hit by the cyclone late at night on 6 November 1996, the first thought of the skipper was usually to head back to Kakinada. When the wind and wave direction made progress very slow, they decided to turn around and go with the wind and the waves in order to seek the nearest port in that direction. A breaking wave from astern or the side filled the deck, washed away unsecured hatch covers, filled up the engine room and stopped the engine. The boat could not be manoeuvred and capsized from a side wave (Fig. 7).
- Capsize without the engine stopping was also reported. The boat went over very quickly due to the weight of water trapped between the bulwark and iceboxes on deck.
- One of the survivors reported that they had decided to anchor, but that the boat capsized shortly afterwards.
- In one case it was reported that the chain-rope connection to the rudder broke and with loss of steering the boat capsized when hit by a wave from the side.
- In one case it was reported that the top of the roof of the wheel house blew off prior to the capsize.

3.4 Survival of the Crew after the Capsize

None of the boats carried either life jackets for all crew members or a life buoy as required in accordance with the "Merchant Shipping Act". The few survivors from the boats reported that after the capsize, they found something floating in the sea, a plank, a loose hatch cover or similar and hung on to that through the night and were

eventually picked up by other boats or managed to swim ashore the next morning. One can just imagine the horror of this dark night with extreme wind, confused sea and torrential rain. One survivor was reported to have landed 30 hours after the capsized. In many cases there was only one survivor from a crew of 8 that could tell what had happened. One survivor reported that in his case 6 men out of an 8 man crew survived because they kept together during the night and managed to encourage each other. It is clear that most of the crews on the boats are good swimmers since they come from coastal villages. Nevertheless one can conclude that there were very few survivors from the boats that were lost in the cyclone.

3.5 Safety Regulations for Fishing Boats

Safety regulations for fishing boats are the responsibility of the Merchant Marine Department. The requirements are formulated in "The Merchant Shipping Act". The following paragraphs give the main points related to the size of fishing vessels based in Kakinada (below 25 Gross ton and fitted with engine of 50 hp or more):

- Definition: "Fishing vessel" means a ship fitted with mechanical means of propulsion which is exclusively engaged in sea fishing for profit.
- Certificates of Crew: One engineer duly certificated, designated "Engineer of fishing vessel". This means in practice that the person has gone through a 12 month course at the Fisheries Training Institute dealing with navigation, service of engines and the use of fishing gear. Since the vessels are below 25 Gross ton there is no requirement for a certified skipper. The Certificate of the Fisheries Training Institute is accepted as sufficient qualification for being a skipper on board the trawler as well as an engineer.
- Registration: Every new boat must be registered and undergo an inspection. The certificate of inspection shall among other things specify the safety equipment and appliances required to be carried on board and contain a statement to the effect that her hull, rigging, equipment and machinery are in good condition. A stability inclining test is done by a Naval Architect who issues a Stability Certificate.
- Renewal of Certificate of Inspection: Each year after issue of previous certificate.
- Safety Equipment: One lifejacket for every crew member. 2 Life buoys. 2 Fire extinguishers. 4 Fire buckets. 1 Sand box. 2 Anchors with rope. Navigation lights, red/green sidelights and white masthead light.
- Stability expressed in metacentric height (GM) is calculated by a Naval Architect based on an inclining test on a new boat. A "Stability Certificate" is then issued. From a number of these certificates for the "Sona" type of boat, it can be seen that, the GM varies between 0.78 m and 0.91 m which indicates a very good initial stability since the minimum required is $GM = 0.35$ m.

3.6 Observations Regarding Safety Regulations

A regulation is of little use if it is not enforced. Following survey of several fishing boats in Kakinada and interviews with boatowners and crew, the following conclusions can be deduced:

- The safety equipment is present during the inspection but removed afterwards and given to the next boat to be inspected. None of the boats therefore carry this

equipment when going fishing. Navigation lights are in most cases wrongly mounted and in many cases the bulb is missing.

- The crew has no confidence in the type of lifejackets that to date has been made in India. The lifejackets are of a model that were discarded 30 years ago in other countries with cotton cloth cover and cotton straps that will rot after a few years in a humid environment aboard a fishing boat and with the buoyancy material of kapok, which according to the crew will become waterlogged after a short time. A lifejacket of this type that had been utilised by the Fisheries Training Institute was demonstrated at the training course and the criticism proved justified: the cotton cover and the straps could easily be ripped apart. Since there exist modern life jackets with synthetic foam that will not become waterlogged and cover and straps made of a synthetic material that will not rot, the old type of life jacket should be banned. However, regardless of the quality of the safety equipment, it serves no purpose if the crew is not trained in the use of this equipment. The lifejacket has a number of straps that have to be tied in a certain way if it is to function well as a buoyancy aid, since it is especially important to avoid it sliding up into the face of the person. Even the instructors of the Fisheries Training Institute had difficulties in tying on the life jacket in the correct manner (Fig. 8). Doing this on a dark night with a cyclone approaching makes it even more improbable that the life jacket will be of any use unless the crew are properly drilled in tying the jacket on even blind-folded. This points to the main weakness of a life jacket compared with a buoyancy aid such as a life float, the use of which is immediately understood by the crew.
- The need for 4 firebuckets and a sand box seems outdated. 1 firebucket with lanyard or 2 firebuckets, if no firepump (deckwash) is fitted, should be adequate.
- Although the Stability Certificates of new "Sona" boats indicate a high initial stability it is not stated in which condition the vessel is tested, how much fuel and freshwater there is in the tanks and whether the ice boxes on deck are in position. When the iceboxes on deck are full they have a significant effect on the stability, especially on the smaller "Royya" type which does not carry iceboxes under deck (Fig. 9). The minimum GM = 0.35 m is an international criteria for fishing boats above 24 m in length that undergo a complete stability investigation including calculation of righting levers at various angles of heel. This criteria is certainly too low for the boats of the size we are dealing with since a complete stability check is not made. The criteria for minimum GM given in Ref. 3 under 4.2.3 should be used. A complete stability calculation should be made for a typical "Sona " trawler to judge the effect of water on deck following the recommendation in Attachment 3 of Ref. 4 . The high depth moulded in relation to the waterline beam on this type of boat, makes it vulnerable to weights on deck.

3.7 Vessel Construction

There are no rules or regulations in India regarding the construction of the size of fishing vessels based in Kakinada. The following observations were made of trawlers under construction in Kakinada, of the size described in section 3.1 above.

- The scantlings are below what is normally prescribed in scantling rules. The planking thickness is 25-26 mm while minimum plank thickness for this size of

boat (CUNO = 80) would normally be 30 mm. The frame distance, centre to centre, is 400 mm while normal distance should be 320 mm. The larger framespacing, together with the thinner planking, leads to a considerable weaker construction. **It seems that the plank thickness and the frame spacing have not been modified from the earlier 10 m "Royya" type of boat with a CUNO = 36 m³ even though the trawlers now are double the size with a CUNO = 80 m³.**

- The planking is fastened to the frames with ungalvanized steel screws of 6 mm diameter. It is extremely rare for this type of fastening is used in the construction of a wooden fishing boat. A screw is more expensive than a nail and takes more time to fasten. This practice seems to be limited to Kakinada. North of Visakhapatnam a trawler was observed under construction using hot dip galvanized round nails of 6.7 mm diameter.
- The frames are of adequate size, but the fastenings of the frames to the floors are considerably below accepted standards with only two 10 mm bolts on each side where four bolts would normally be required.
- Big gaps between the planks occur after a few years service and this requires massive caulking to stop the leak (Fig. 10). Although it is not possible to directly link the weak construction of the trawlers to the sinkings during the cyclone, it is clear that the present scantlings present a safety hazard.
- In many cases the hatch covers to the fish hold and to the rudder compartment cannot be fastened down in such a way that they will not be washed away by a wave breaking on the deck (Fig. 11). The height of the hatch coaming, which is recommended (Ref. 5) to be minimum 300 mm, is in most cases half this height or less. This also applies to the coaming height for doors into the wheelhouse where water will enter easily into the engine room.
- The scuppers in the bulwark (Fig 11) should be sufficiently large to prevent large quantities of water being trapped on deck. They have a combined area of about one third of what is recommended (Ref. 5).

4. Training Courses

4.1 Training Course for Boatowners and Crew

An invitation was given to the two boat owners associations in Kakinada to participate in this training course. The main objective was to create an awareness among the participants of the main causes leading to the disasters such as experienced during the cyclone and what can be effectively done to prevent the large loss of life. There was very active participation during this meeting and a very lively discussion regarding the points listed under 3.6 and 3.7 above. The boatowners agreed that some of the measures, such as a good lashing down system for the hatches and larger scuppers in the bulwark, would not cost much. Regarding scantlings they suggested that a demonstration boat be built incorporating the correct plank thickness, frame distance, plank fastenings and frame bolting, together with the other safety measures so that they would be able to see for themselves what this will mean in added expenditure.

Generally they would like to see safety equipment such as life jackets and life floats issued with a Government subsidy. Regarding the skipper taking the correct action when faced with a sudden storm, there were few suggestions as to how this could be done. Possibly a leaflet with illustrations and a short text in Telugu that could be fixed in the wheel house could give a few simple rules:

1. Close all hatchcovers and openings in the deckhouse.
2. Open any temporary closures of the scuppers in the bulwarks.
3. Secure all equipment on deck.
4. All crew members to carry life jackets.
5. Keep the bow up against the waves by going slowly forward.
6. Never try to run with the waves.

4.2 Training Course for Personnel from the Fisheries, the Mercantile Marine Department and Kakinada Port Office.

Unfortunately none of the invited representatives from the Merchant Marine Department in Vishakapatnam and the Kakinada Port Office were able to attend this evening course. It was therefore not possible to discuss important aspects of the "Merchant Shipping Act" and how it can be formulated and implemented to really improve the safety of the trawlers.

The other invited participants were from the Fisheries Training Institute (CFTI) and Fisheries Department in Kakinada. An overhead projector was used to illustrate the main aspects of safety at sea as given in Ref. 6. The main question raised was how the Fisheries Training Institute (FTI) can best teach their students the basic safety principles. The revised syllabus of the FTI dated 1978 contains a large number of subjects dealing with Fishing Gear Technology, Seamanship and Navigation, and Marine Engineering. The teaching of handling a boat in bad weather, life saving and fire fighting appliances are mentioned with three lines in a five page syllabus, which indicates that this is not given sufficient weight. The difficulties the instructors had in putting on a life jacket during the training course indicate further that sea safety is not sufficiently stressed during the one year course. The FTI training vessel essential for practical training is old and has to be considered unseaworthy since water on deck would go straight into the engine room through large ventilation openings. Hopefully the FTI will acquire a new training vessel sometime next year and this could be a possibility to demonstrate proper scantlings and safety measures and serve as an example to the trawler owners.

5. Lifefloat

5.1 Design and Construction

The idea of constructing a lifefloat locally came after the interview with the survivors of boats that had capsized during the cyclone. Most of them had found something floating in the sea to hang on to. In developed countries a lifefloat is not usually recommended because the sea temperature is so low that a person will only survive a short time in water. For vessels of the same size as the trawlers in Kakinada an inflatable liferaft with a cover to protect the occupants is required. The cost of such a

liferaft (Rs 75,000) and the need for annual servicing at an approved servicing station, makes this an unrealistic proposal for this size of fishing vessel in India.

The alternative is either a fixed liferaft which will support all its occupants out of the water or a lifefloat where the occupants are in the water but hang on to the lifefloat for support, especially for the ones who are not good swimmers. An 8 man liferaft with the surface area and buoyancy required by the 1995 Torremolinos International Convention for the Safety of Fishing Vessels (see References : No. 4) will need to be about 1.4 x 2.2 m in area and have a net buoyancy of 0.77 m³. There will be some problems in positioning this liferaft on the top of the wheel house. The second alternative, a lifefloat of 0.95 x 1.6 m would require a buoyancy of only 0.2 m³. It was considered that this was the most practical minimum alternative. A life float has the following advantages:

- Keeps the survivors together, which will boost the spirit.
- The orange colour makes it easier to spot from a search boat or an aeroplane.
- Two persons who might be weaker than the other can be supported inside the lifefloat.
- Can be fitted on the top of the wheelhouse in such a way that it will float free in case of a capsizing.
- The visible position on top of the wheel house makes it easy to control whether or not the boat is carrying it.
- Can be produced locally in Fibreglass Reinforced Plastic (FRP) requiring no maintenance, at an estimated price of Rs 7,000.

The prototype lifefloat was modelled on a U.S. Coast Guard approved model shown in Fig. 14. Inside the lifefloat there is a suspended net kept down by a stainless steel frame in order to reduce the drift of the empty float and to support the two weaker survivors. A plug and a mould for the two halves of the life float were made by a local FRP boatyard in Kakinada (Fig. 15 and 16). The completed prototype is shown on the top of the wheelhouse roof but without the supports which had not been completed (Fig.17).

5.2 Demonstration of the Lifefloat

The lifefloat was demonstrated at the fisheries harbour in Kakinada with many interested fishermen watching (Fig. 18). A volunteer crew first threw the life float in the water from the top of the wheelhouse and then jumped in. From comments received by boatowners and crew it was evident that they had much more faith in the life float than the life jackets that had been supplied previously. The demonstration showed that the crew had some difficulties in understanding the purpose of the rope on the outside intended as handgrips. The crew tended to want to hold on to the float itself which is difficult due to the smooth surface. The test showed that it would be better to mould fixed handgrips into the outer surface of the float and this is incorporated into the revised version (Annex 2).

6. Engine Installation in Nava

6.1 Specifications

The project document stipulates the order of 12 engines of 20 hp to be installed in large wooden Navas that can be used in the villages for rescuing seed collectors from the outer islands. A specification for engines and sterngear was prepared for tendering. Tenders were received from three suppliers and forwarded to the FAO Office in New Delhi.

After issuing the specification for the sterngear, it was discovered that some boats have started to use a type of sterngear that eliminates some of the major alignment problems associated with a conventional installation. This type of installation is shown in Fig. 19 and includes a thrust bearing and a double universal joint from a truck. It is a type of installation common on traditional boats in Orissa. The main advantage of this installation is that the alignment is not critical since the double universal joint can accommodate misalignment both in angle and height. The use of one universal joint is very common when installing engines into wooden Navas, but this will only cater for angular misalignment. The Navas must regularly be turned over for application of hot tar to the bottom (Fig.20) and the engines must be removed prior to this. Re-aligning the engine becomes problematic and it is clear from inspecting a large number of Navas that they all suffer from worn out and leaking stuffing boxes due to poor engine alignment. The consultant therefore recommends that the "Orissa installation" is used and specifications are given in Annex 3 together with a drawing in Annex 4. The cost of this installation should not be higher than that originally specified since a stainless steel propeller shaft of 30 mm diameter can be used instead of the 38 mm shaft originally specified, and shorter engine beds can be used.

6.2 Selection of Navas and Supervision of Installation

Only the larger size Nava in good condition should be selected for engine installation. It is essential that the project employs a National Consultant that can go to the villages and inspect the Navas before they are sent to Kakinada for installation of the engines by the supplier. The cost of transport to and from Kakinada is to be borne by the owner of the Nava. The consultant must inspect the installation of the engines to ensure good workmanship and perform sea trials before final acceptance of delivery from the engine supplier. The terms of reference for the National Consultant are given in Annex 5.

The National Consultant should, as soon as possible travel to Cuttack and Paradeep in Orissa to make contact with suppliers of the type of sterngear mentioned above in order to obtain information on cost and technical details. On behalf of the project, he should purchase a thrust bearing, prepare a detailed drawing of this and consider whether the thrust bearing together with the other components, can be made in Kakinada at the same price as supplied from Orissa. This would be a useful "transfer of technology" and make it easier for Nava fishermen in East Godaverri to get repairs done in the future.

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FIGURES

- Figure 1 Wooden Nava fitted with 20 hp diesel engine
- Figure 2 FRP open “Nava” with 16 hp diesel engine.
- Figure 3 Development in FRP construction
- Figure 4 FRP boat construction in Uppada
- Figure 5 12 m “Sona” type shrimp trawler with 100 hp diesel engine
- Figure 6 Trawler with iceboxes on deck
- Figure 7 Causes for capsizing
- Figure 8 Training course for staff from Fisheries Training Institute and Fisheries Department

- Figure 9 10 m “Royya” type of trawler with icebox on deck
- Figure 10 A leak in a five year old trawler is stopped by massive caulking
- Figure 11 A typical trawler with no means to clamp down the hatchcovers
- Figure 12 The rudder tiller is connected to the steering wheel by rope.
- Figure 13 Poor workmanship and frames of insufficient strength have caused considerable damage in FRP boat.

- Figure 14 The 8 – 10 man life float type approved by the U.S. Coast Guard
- Figure 15 Inserting polystyrene foam blocks into the half FRP shell of the prototype life float built in an FRP boatyard in Kakinada.
- Figure 16 Completed prototype of a 8 – 10 man life float
- Figure 17 The life float on top of the trawler wheelhouse
- Figure 18 Demonstration of prototype life float in the Kakinada Fisheries Harbour

- Figure 19 “Orissa” type sterngear with thrustbearing and double universal joints in a wooden Nava.

- Figure 20 Wooden Nava turned upside down for application of hot tar



Fig.1 Wooden Nava fitted with 20 hp diesel engine



Fig.2 FRP open "Nava" with 16 hp diesel engine. Note that sail and leeboard are carried for use in case of engine breakdown



Fig. 3 Development in FRP construction. To the right is the 8.5 m beachlanding craft introduced by BOBP in 1985. To the left a recently constructed 10.7 m decked boat from Uppada, built with the same mould but expanded



Fig. 4. FRP Boat construction in Uppada. In this village there are five FRP boatyards



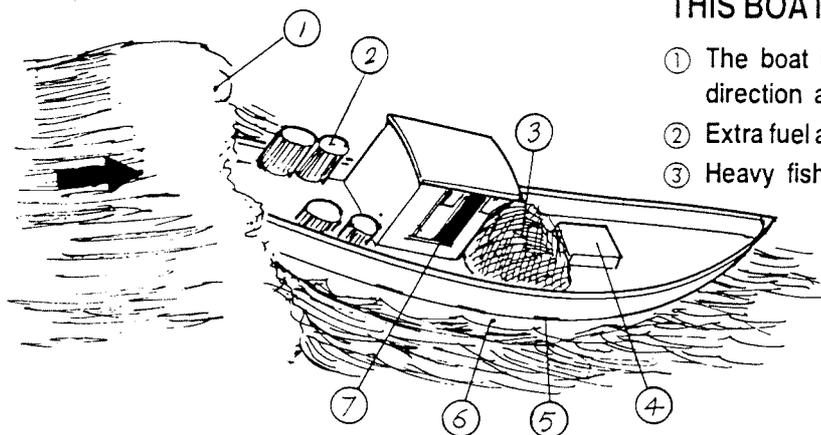
Fig. 5. 12 m "Sona" type shrimp trawler with 100 hp diesel engine



Fig. 6. Trawler with iceboxes on deck

CAPSIZAL

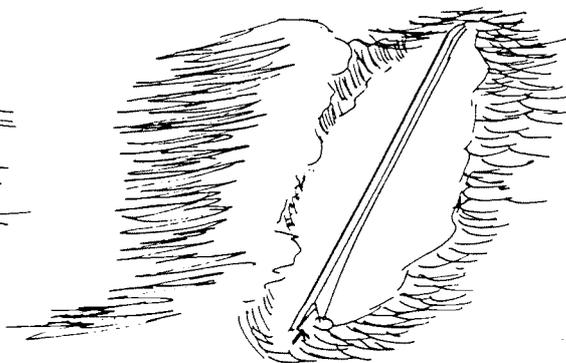
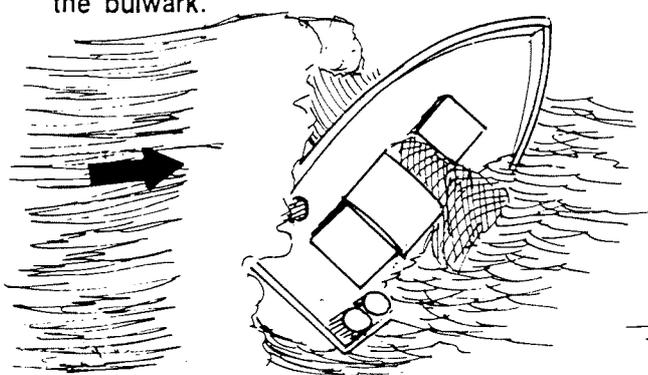
THIS BOAT IS IN DANGER OF CAPSIZING



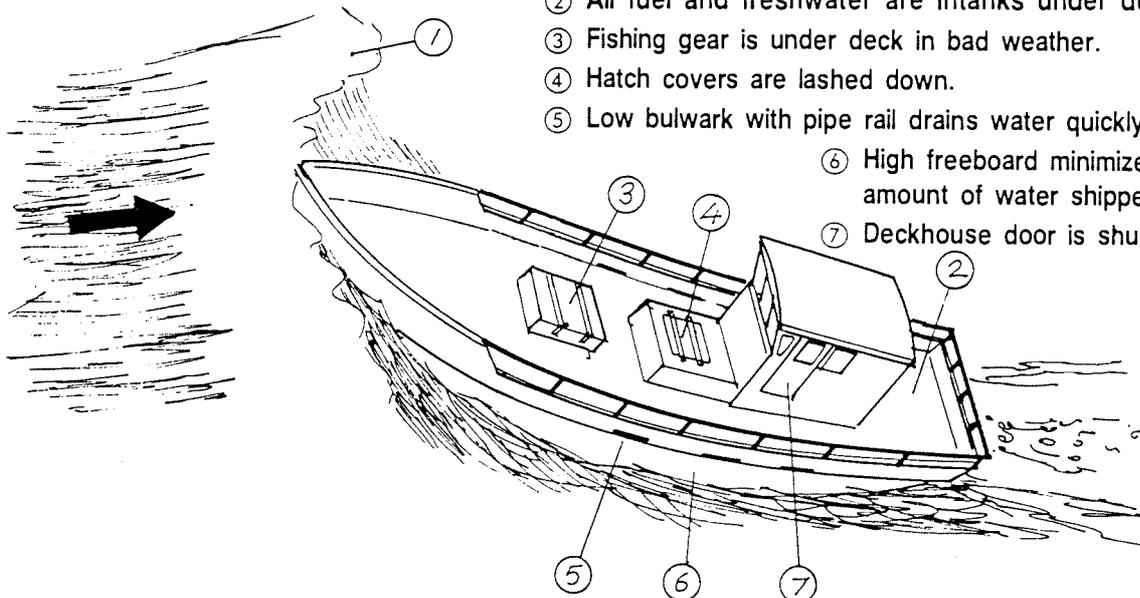
- ① The boat is going full speed in the same direction as the waves
- ② Extra fuel and fresh water are in drums on deck.
- ③ Heavy fishing gear is on deck.
- ④ Hatch covers are not lashed.
- ⑤ Freeing ports are small.
- ⑥ Freeboard is low.
- ⑦ Deckhouse door is open.

The boat is likely to be thrown broadside to the waves and the fishing gear and drums are likely to slide over the bulwark.

The boat is then likely to capsize with the next large wave.



THIS BOAT IS BETTER PREPARED AGAINST CAPSIZING



- ① The boat is going slowly against the waves.
- ② All fuel and freshwater are in tanks under deck.
- ③ Fishing gear is under deck in bad weather.
- ④ Hatch covers are lashed down.
- ⑤ Low bulwark with pipe rail drains water quickly.
- ⑥ High freeboard minimizes the amount of water shipped in.
- ⑦ Deckhouse door is shut.

Fig 7. Causes for capsize



Fig.8. Training course for staff from Fisheries Training Institute and Fisheries Department. Participants were asked to tie on a lifejacket. None were able to do it without further training.

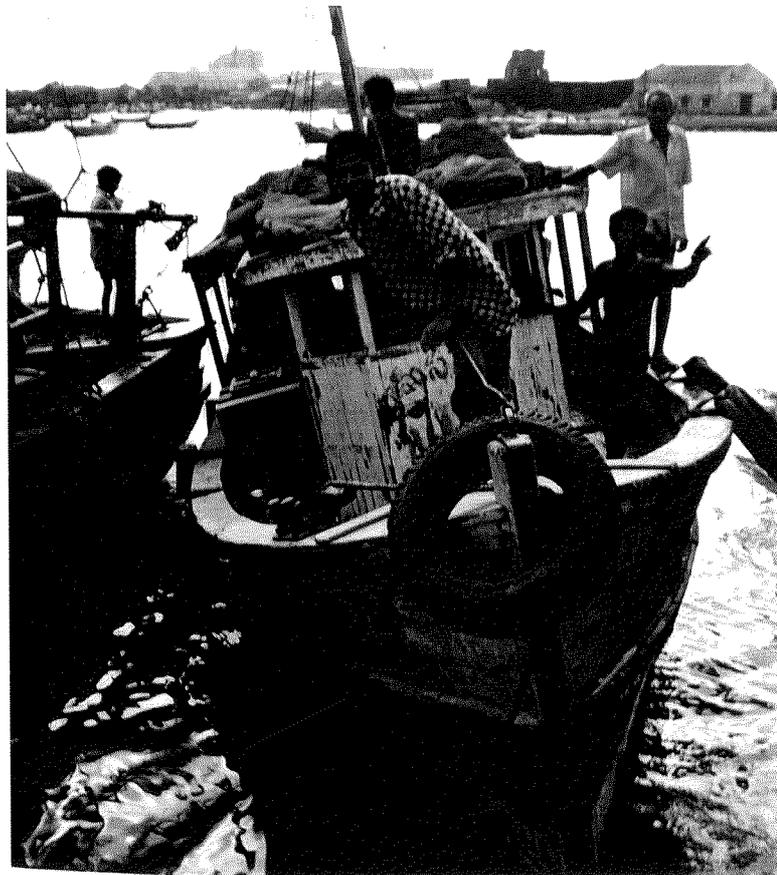


Fig.9. 10 m "Royya" type of trawler with icebox on deck. Angle of heel when arriving in port indicates low stability.



Fig. 10. A leak in a five year old trawler is stopped by massive caulking. The large gaps between the planks are caused by weak construction



Fig. 11. This is a typical trawler with no means to clamp down the hatchcovers. Drainage openings (scuppers) in the bulwark are about one third the size recommended by international guidelines



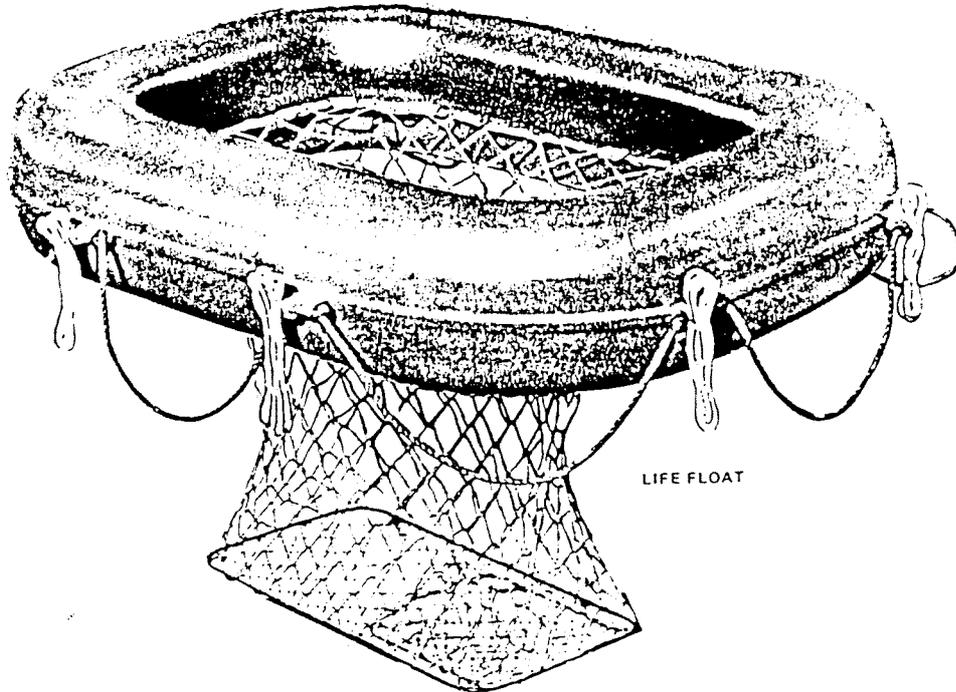
Fig.12. The rudder tiller is connected to the steering wheel by rope. No proper rudder stops. This is not acceptable on a 12 m trawler. Breaking of this rope was the cause for the loss of at least one trawler during the cyclone.



Fig.13. Poor workmanship and frames of insufficient strength have caused considerable damage in this FRP boat, only two years old

PLASTIC LIFE FLOATS

UNITED STATES COAST GUARD APPROVED
 Manufactured under the strict supervision of the U.S.C.G.
 International Orange in color.



	MODEL	PERSON CAPACITY	APP. LENGTH	APP. WIDTH	SEC. DIAM.	SHIP WT.	U.S.C.G. APPROVAL NO.
LIFE FLOATS	1206	6	50"	36"	8 1/2"	23	160.027/79/0
	1208	8	51"	37"	9"	25	160.027/75/0
	1210	10	63"	37"	9"	30	160.027/76/0
	1212	12	78"	37"	9"	38	160.027/80/0
	1215	15	64"	48"	12 1/2"	50	160.027/77/0
	1222	22	100"	48"	12 1/2"	70	160.027/78/0

The following U.S. Coast Guard Requirements are included in the price on all life floats.

1. All rafts must have four 2" wide bands of Type II retroreflective material as shown in sketch.
2. All rafts will have a Float-Free Link, a 100 ft. Painter (Line) of 1,500 lb. breaking strength and a Float-Free Wire Link, manufactured to U.S. Coast Guard specifications.
3. A provision must be made to fake the painter in such a way that it runs out freely when the raft floats away from a sinking vessel.

The purpose of the Float-Free Link is to eliminate the possibility of the rafts floating away from a sinking vessel, out of reach of the survivors.

The painter being 100 ft. long holds the raft in the vicinity and if the vessel sinks beyond 100 ft. the link breaks. Also the 100 ft. line is an aid to any survivors.

- ✓ Tough resilient vinyl surface — easily boarded, comfortable in the water — no hard surfaces.
- ✓ Light weight yet easily exceeds the most severe U.S.C.G. tests. Ease of handling is one of our most valued features.
- ✓ Less storage space required for equal raft capacity compare dimensions . . . you'll be amazed!
- ✓ No exposed metal hardware — all becketts secured inside the float body.
- ✓ Double webbing, sunlight or weather never reaches supporting becketts.
- ✓ Solid closed-cell plastic throughout; bullet hole would have only a minimal effect on buoyancy. Will not rot or mildew.

MODEL NO.	CAPACITY	PRICES	
		LIST	OURS
1206	6 Man	\$508.95	\$382.43
1208	8 Man	588.95	441.68
1210	10 Man	778.95	584.18
1212	12 Man	868.95	651.67
1215	15 Man	1038.95	779.17
1222	22 Man	1360.95	1020.66



Fig. 14. The 8 - 10 man life float was modeled on this type approved by the U.S. Coast Guard



Fig. 15 Inserting polystyrene foam blocks into the half FRP shell of the prototype life float built in an FRP boatyard in Kakinada



Fig. 16. Completed prototype of a 8 –10 man life float. The central bag will support two crewmembers who are old or not good swimmers. The bag will also slow down the drift of the life float when it is empty. The rope on the outside will be replaced by fixed handgrips in the next version.

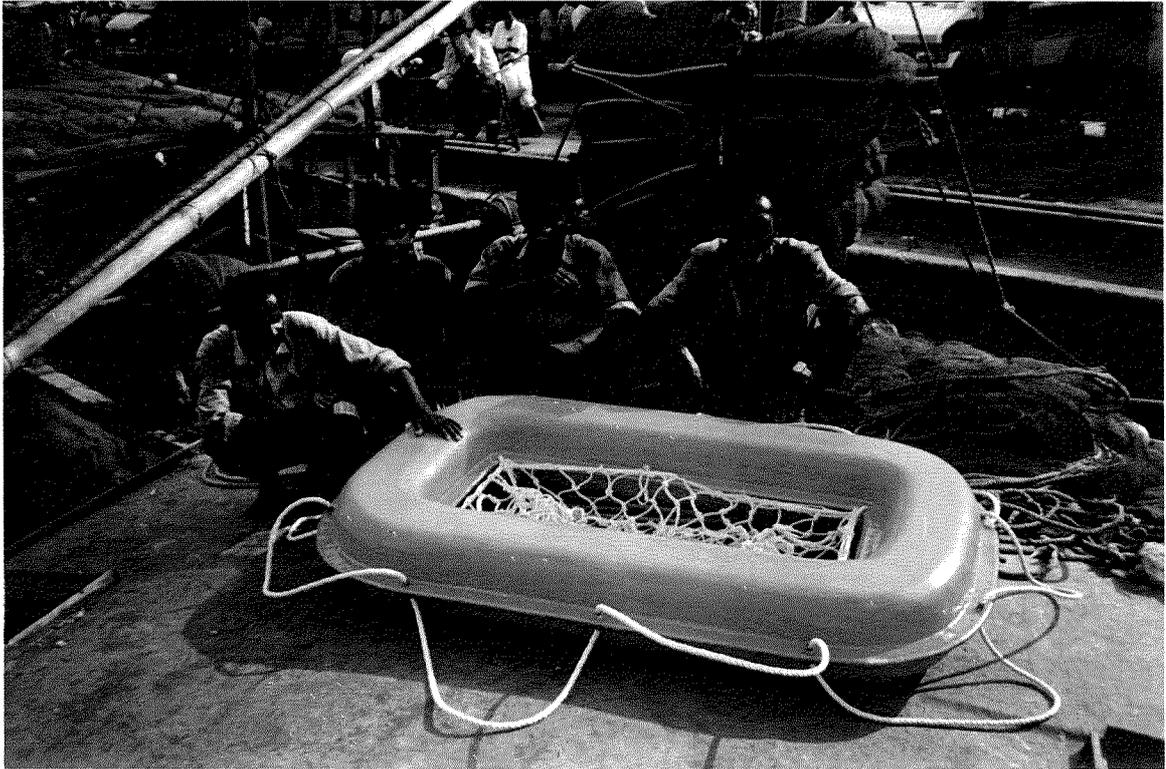


Fig. 17. The life float on top of the trawler wheelhouse. Special support brackets will later be fitted to the wheelhouse roof

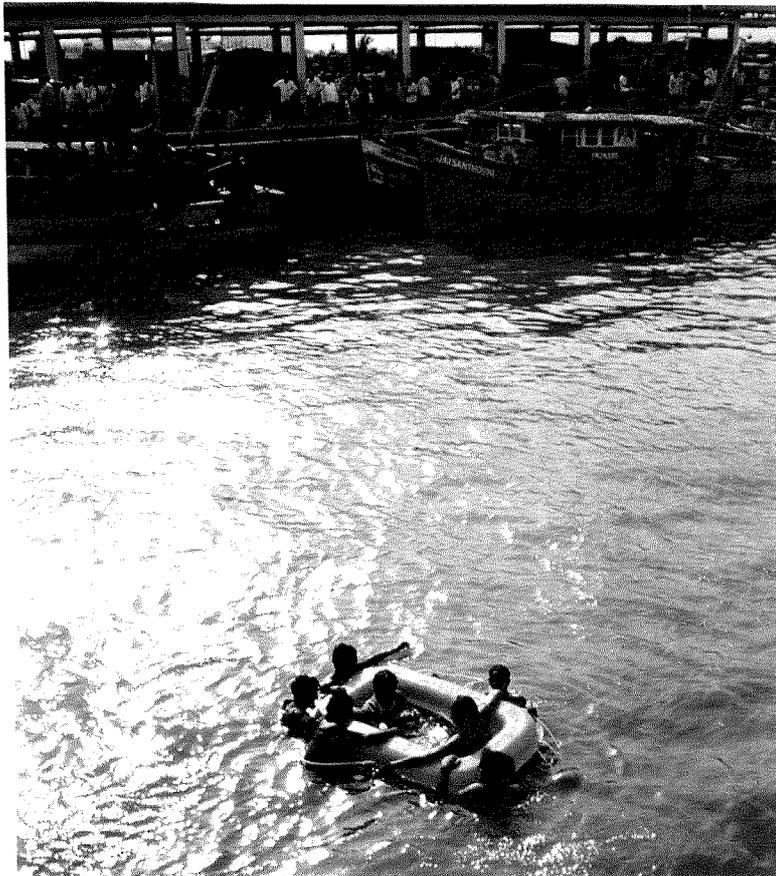


Fig. 18. Demonstration of prototype life float in the Kakinada Fisheries Harbour

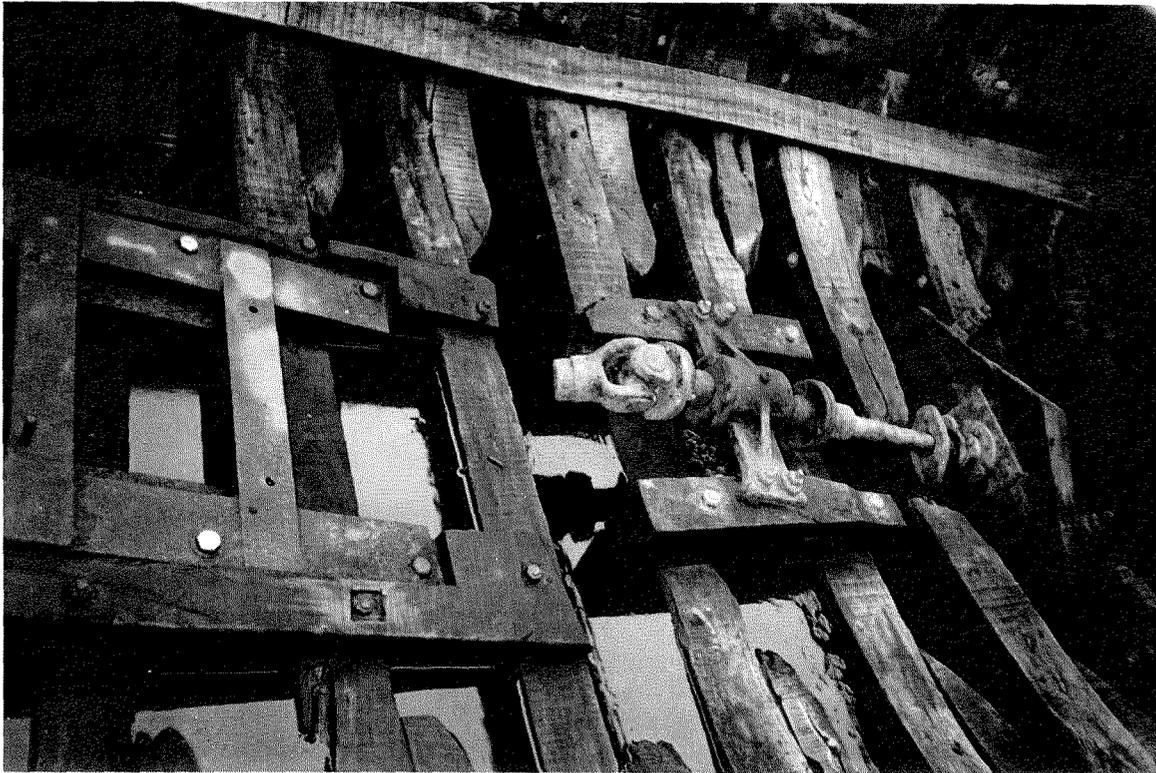


Fig. 19. "Orissa" type sterngear with thrustbearing and double universal joints in a wooden Nava. The engine can be reinstalled without alignment problems



Fig. 20. The wooden Navas must regularly be turned upside down for application of hot tar to prevent attack from marine borers

Itinerary and Persons Met

Itinerary

	Arrival	Departure Kristiansand
	2.6.98	
Rome	2.6.98	3.6.98
New Delhi	4.6.98	7.6.98
Bhubaneshwar-Puri	7.6.98	9.6.98
Kakinada	9.6.98	14.6.98
Visakhapatnam	14.6.98	16.6.98
Kakinada	16.6.98	29.6.98
Madras	30.6.98	2.7.98

Persons met

New Delhi

Sunil Sud	Joint Secretary Fisheries, Department of Agriculture and Co-operation, GOI
Y.S. Yadava	Fisheries Development Commissioner. Dept. of Agriculture and Co-operation, GOI
Renuka Taimni	Programme Assistant, FAO

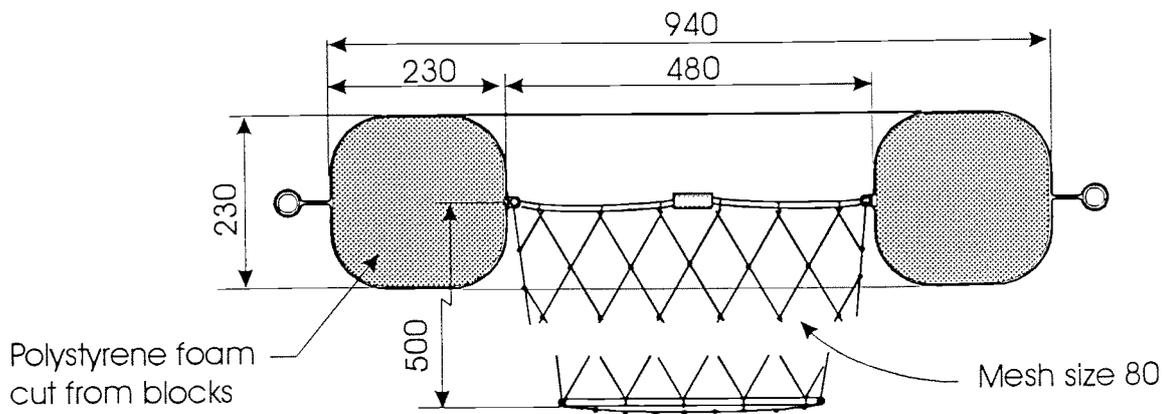
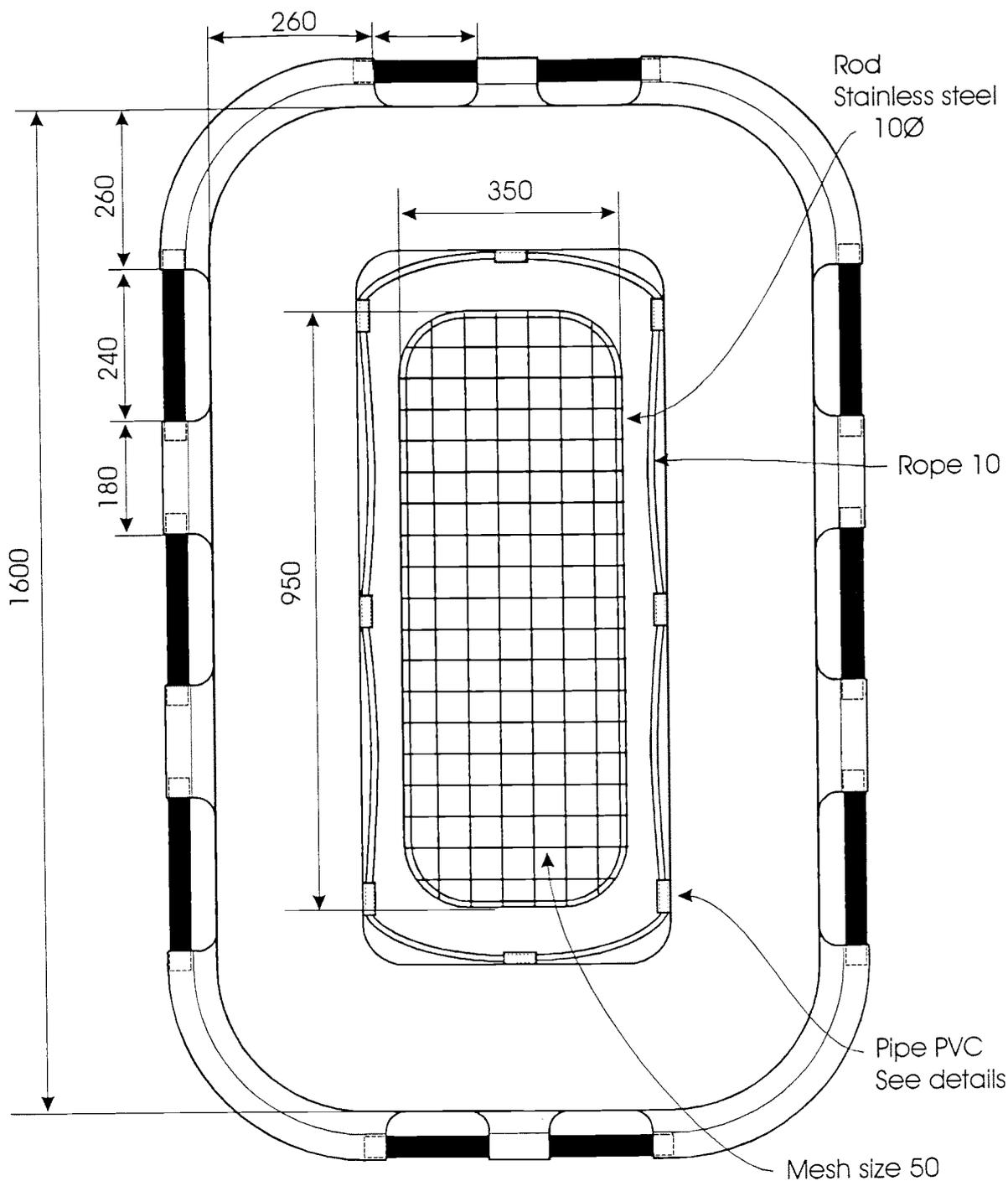
Kakinada

Y.S. Yadava	Fisheries Development Commissioner. Dept. of Agriculture and Co-operation, GOI
P. Rosenegger	FAOR
Renuka Taimni	Programme Assistant, FAO
C.H. Krishna Murthy	National Project Director, Joint Director DOF AP.
B.V.Raghavulu	RDD Fisheries
P.Calvert	FAO Project Consultant/Team leader
P.Raghu Ram	National Consultant, Radio Communication
Baburao Vemagiri	Marine Engineer
P. Gangadharam	Manager, Sri Ayyappa Boat Builders
K. Subramanyam	Port Officer, Kakinada
Penmadi Dharma Rao	President, The Mechanised Fishing Boat Owners Welfare Association
Ch. Srinivasa Rao	Fisheries Development Officer
Karunakarao	Asst. Inspector of Fisheries
J. Ranga Rao	Marine Engineer DOF
Koteswara Kolli	Manager, Kolli Fibres

Visakhapatnam

P.K. Majumder	S.I.C. Mercantile Marine Department
Chandra Sekhara Rao	Engineer and Ship Surveyor, Mercantile Marine Dept.
P. Maheswara Rao	General Secretary, A.P. Mechanised Fishing Boat Operators Association
Omprakash Shetty	A.S.Molobhoy and Sons, Lifesaving equipment
M.R.Reddy	FRP Boatbuilder

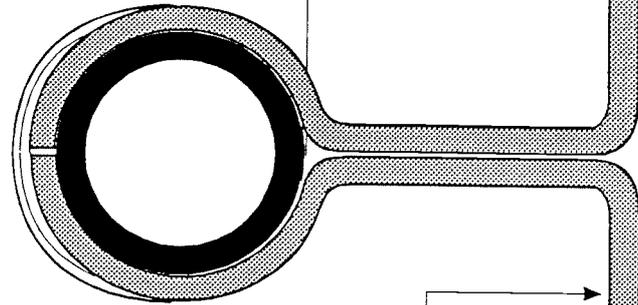
Design of Life Float



NOTE: ALL ROPES MUST BE OF U-V (sunlight) RESISTANT MATERIAL

SCALE = 1 : 10	10 Men Lifefloat	Design number	Drawing number
DESIGN : O.Gulbrandsen		IND - 30	1
Grimstad, Aug. - 98	GENERAL ARRANGEMENT		

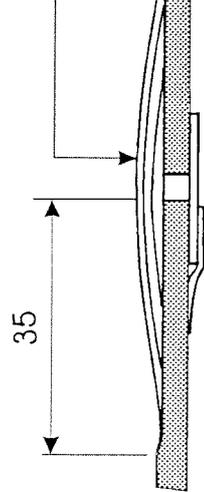
2 x 450 g/m² CSM
Remove gelcoat



3 x 450 g/m² CSM

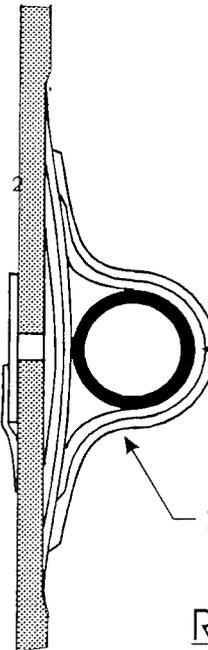
JOINT 1

3 x 450 g/m² CSM
Remove gelcoat



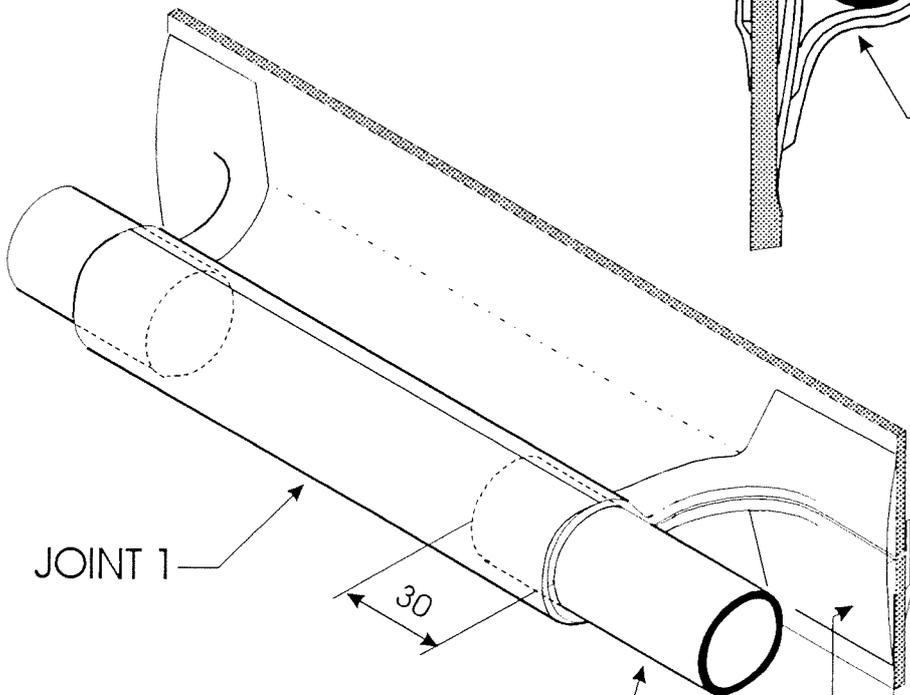
JOINT 2

Strip of premoulded
1 x 450 g/m² CSM
20 wide fixed with tabs
of CSM



Pipe PVC
OD = 16
ID = 12.8
Length = 50

2 x 450 g/m² CSM
Rope fixation
on inside of raft



High density polyethylene HDPE black pipe
Diameter outside = 32
Diameter inside = maximum 25 (thick wall)

JOINT 2

SCALE = 1 : 1	10 men Lifefloat	Design number	Drawing number
DESIGN : O. Gulbrandsen		IND - 30	2
Grimstad, Aug. 1998	DETAILS		

Engine Specification

Quantity: 12 Units consisting of:

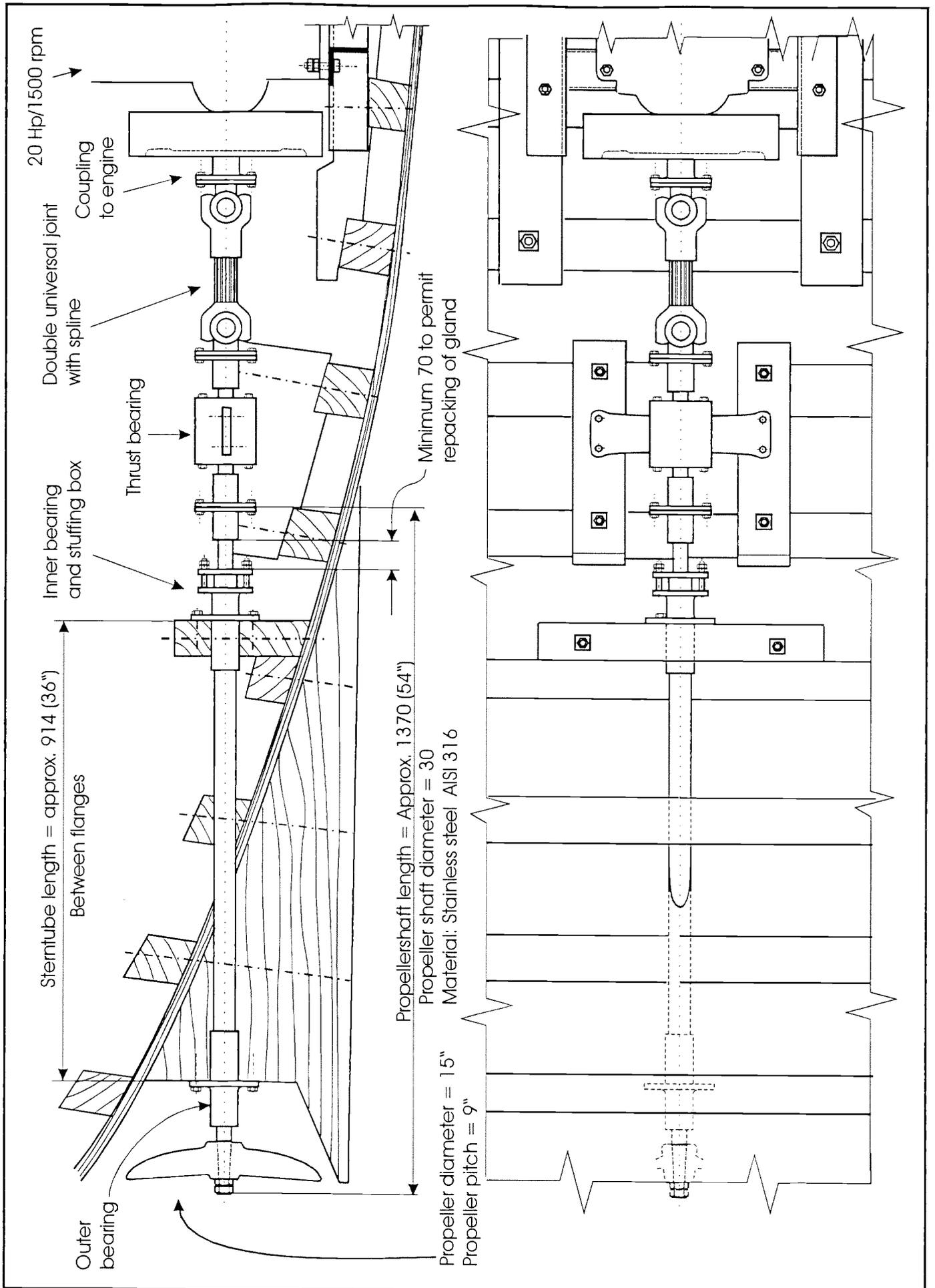
Diesel engine, 2 cylinder, developing 16 –20 hp per I. S. 10001-1981 at 1500-1800 rpm. Seawater cooling by scoop behind the propeller. Handstarting. Fitted with fueltank of minimum 10 litre.

Stern gear and equipment according to drawing IND-31, Number 1-3 including:

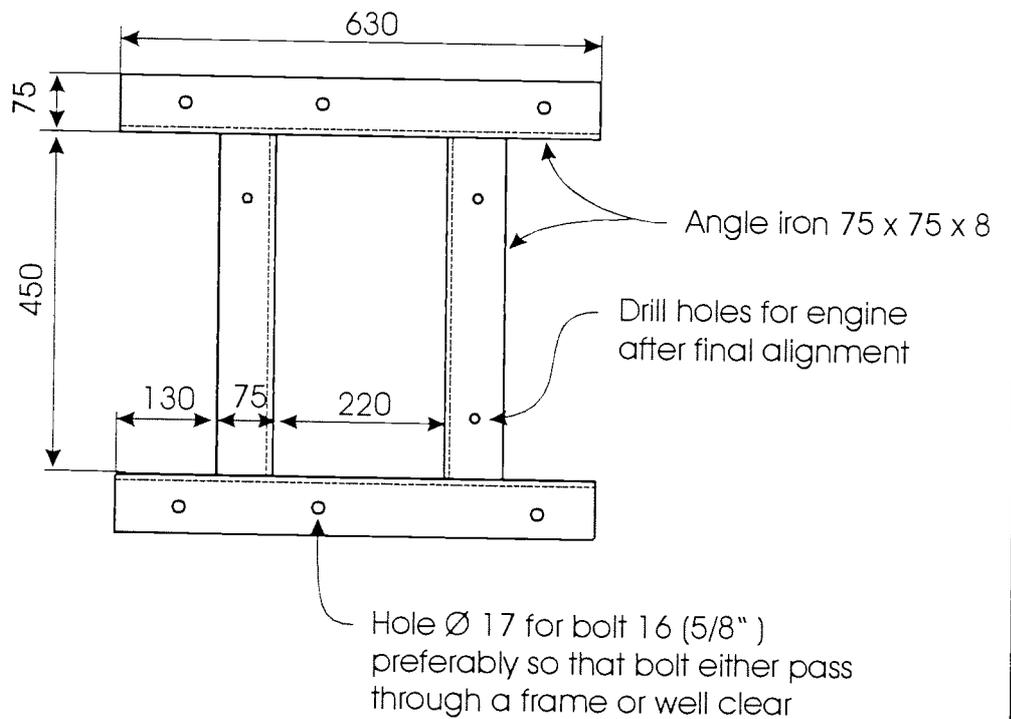
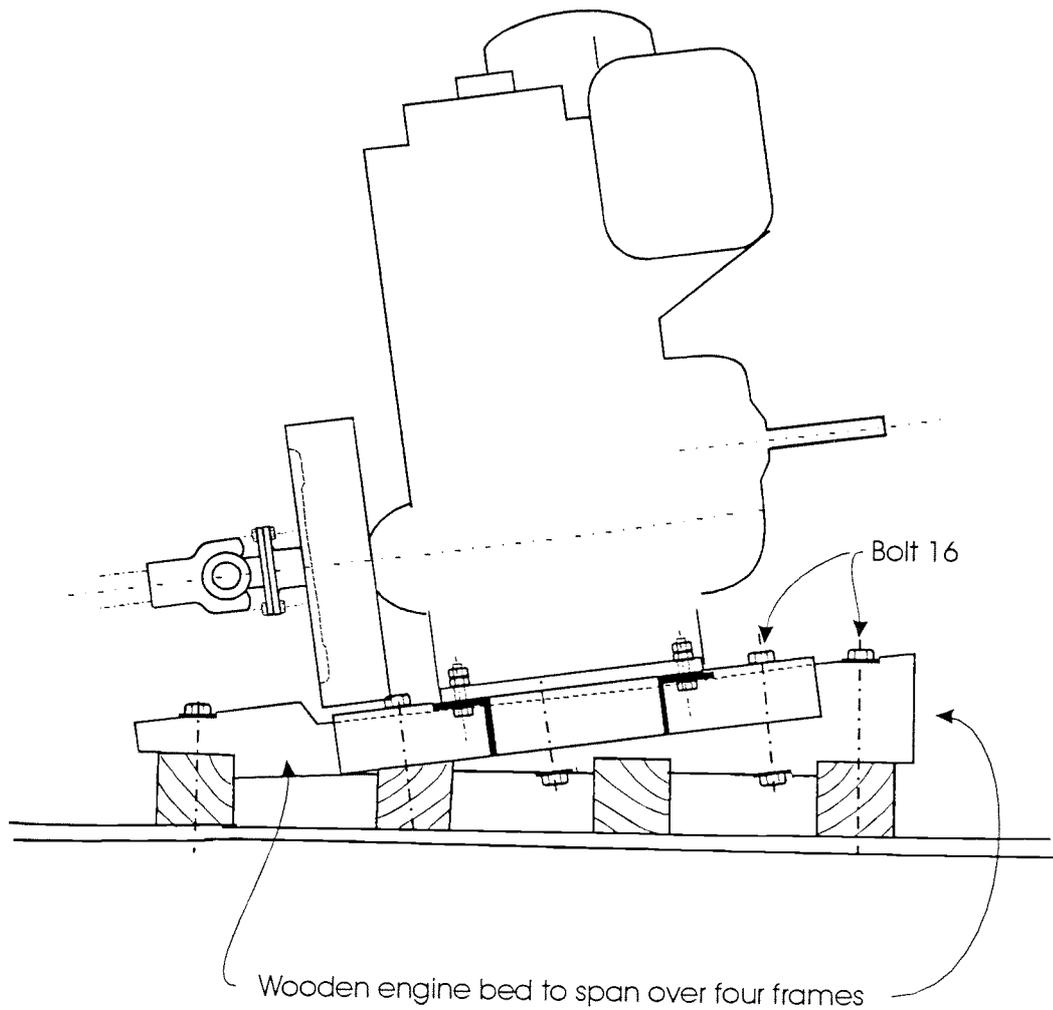
1. Propellershaft, stainless steel – AISI 316. Diameter = 30 mm. Minimum length = 1370mm (54”). With taper and keyway for fitting to thrustbearing and propeller. Keys of stainless steel AISI 316.
2. Propeller, 3-blade, bronze. Diameter and pitch to be specified by the supplier.
3. Sterntube, brass, with outer and inner rubber or wooden bearings. Inside stuffing box with gland packing.
4. Spare gland packing. Length = 1.0 m.
5. Thrust bearing of similar type as presently used..
6. Double universal joint with spline of similar type as presently used.
7. Couplings of steel between engine/universal joints, universal joints/thrustbearing and thrustbearing/propellershaft. All connecting bolts and nuts of stainless steel.
8. Water scoop behind the propeller with through hull fitting made of galvanized water pipe. Reinforced plastic hose from water scoop to engine.
9. Exhaust pipe of galvanized water pipe fittings of inside diameter minimum the same as engine manifold exhaust outlet. Fitted with water injection by cooling water from the engine for sound dampening.
10. Welded steel engine base for fitting to wooden engine bears.
11. Engine bearers of hard, heavy wood, 125 mm (5”) wide of length sufficient to fit over 4 frames. Holding down bolts of 16 mm (5/8”) hot dip galvanized with large washers through each frame.
12. Wooden skeg of 125 mm (5”) width, fastened to inside frames with 16 mm (5/8”) U-bolts. Faired for good flow of water to propeller.
13. Rudder of welded steel, liftable for shallow water operation.

The cost of the installation into the wooden nava is the responsibility of the Supplier and will be executed under the supervision by the FAO National Consultant Marine Engineer.

Design of Engine Installation in Nava

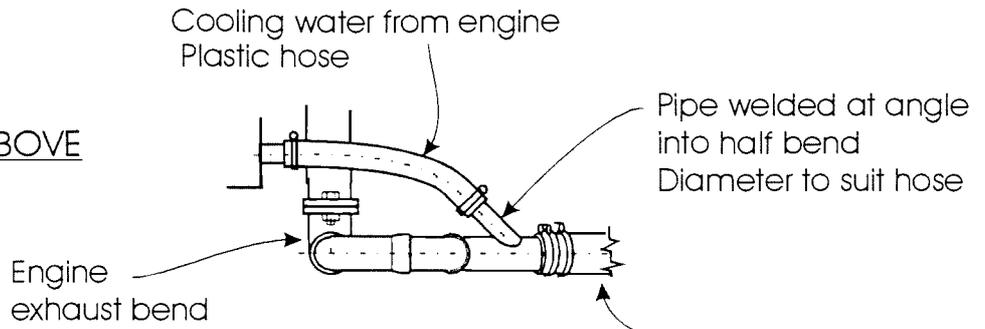


SCALE = 1 : 10	Engine installation in Nava	Design number	Drawing number
DESIGN : O. Gulbrandsen		IND - 31	1
Grimstad, Aug, 1998	GENERAL ARRANGEMENT		

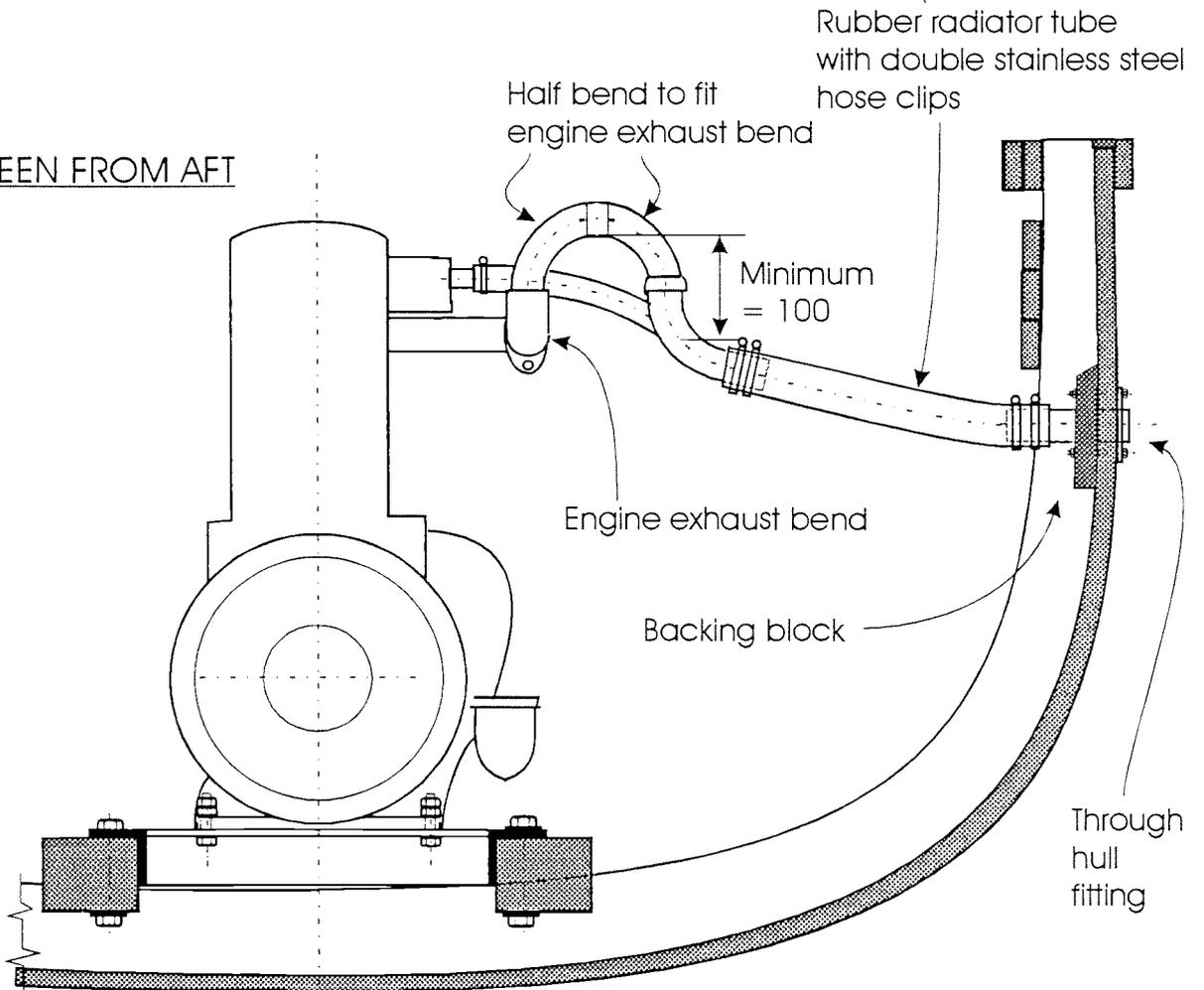


SCALE = 1 : 10	Engine installation in Nava	Design number	Drawing number
DESIGN : O. Gulbrandsen		IND - 31	2
Grimstad, Aug. 1998	ENGINE BED		

SEEN FROM ABOVE

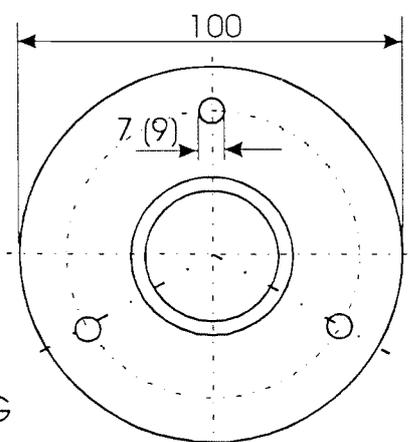
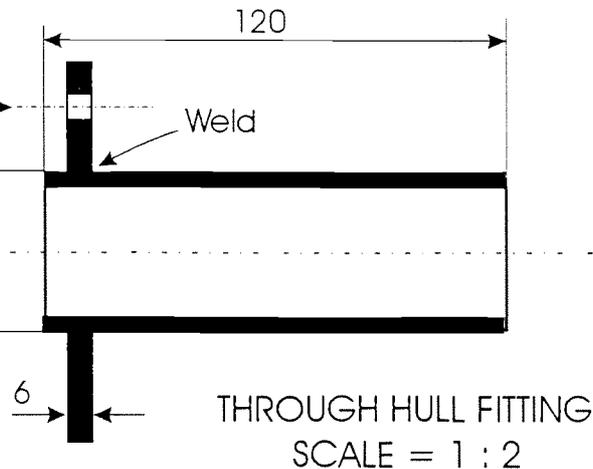


SEEN FROM AFT



Stainless steel bolt
M 6 x 70
Alternative
Galv. M 8 x 70

To suit
rubber hose



SCALE = 1 : 2, 1 : 10

DESIGN : O. Gulbrandsen

Grimstad, Aug. 1998

Engine Installation in Nava

WET EXHAUST SYSTEM

Design number

IND - 31

Drawing number

3

NATIONAL CONSULTANT – MARINE ENGINEER

TERMS OF REFERENCE

In collaboration with the team leader and the project staff, the Consultant will assist in the selection of 12 large size wooden navas suitable for installation of diesel engines. He will ensure that only new engines and equipment according to the revised specification by the Consultant Naval Architect are delivered to the project. He will supervise the installation and alignment of the engines and the sterngear to be executed by the engine Supplier.

Duration : two months

