BOBP/REP/54

Developing and Introducing a Beachlanding Craft

(on the east coast of India)

BOBP For Fisheries Development
BAY OF BENGAL PROGRAMME

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Small-Scale Fisherfolk Communities GCP/RAS/118/MUL

Developing and Introducing a Beachlanding Craft on the east coast of India

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This report reviews and analyzes the work of the Beachlanding Craft Development subproject of the Bay of Bengal Programme (BOBP). It briefly describes the development of these craft and their introduction on the east coast of India, analyzes their present status and discusses the results.

The report was prepared by a consultant with wide experience of fisheries in the Bay of Bengal region, on the basis of documentation on the subproject, published and unpublished, as well as impressions gathered during field visits to fishing centres in Andhra Pradesh and Orissa during August 1992. Assistance received by him in carrying out the field visits from Mr. S. B. Sarma of the Andhra Pradesh Directorate of Fisheries and information provided by fisheries officials, fishermen and boatyards are gratefully acknowledged.

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The Bay of Bengal Programme (BOBP) is a multi-agency regional fisheries programme which covers seven countries around the Bay of Bengal — Bangladesh, India, Indonesia, Malaysia, Maldives, Shri Lanka and Thailand. The Programme plays a catalytic and consultative role: it develops, demonstrates and promotes new techniques, technologies or ideas to help improve the conditions of small-scale fisherfolk communities in member-countries. The BOBP is sponsored by governments of Denmark, Sweden and the United Kingdom, by member-governments in the Bay of Bengal region and also by AGFUND (Arab Gulf Fund for United Nations Development Organizations) and UNDP (United Nations Development Programme). The main executing agency is the FAO (Food and Agriculture Organization of the United Nations).

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SUMMARY

The development of a new type of user-friendly and more efficient fishing craft for operation off open beaches was identified as an important component of technology development to help the participating countries of the Bay of Bengal Programme (BOBP) achieve their ultimate objectives of

- improving the standards of living and the quality of life of their small-scale fisherfolk, and
- increasing fish supplies.

With this in mind, a beachlanding craft (BLC) development project for the east coast of India was launched in 1979. Its immediate objective was to develop "fishing craft capable of operating satisfactorily, technically and economically, from surf beaches".

The development and trials of several prototype beachlanding craft during 1979-1984 resulted in two models – IND-20 and IND-25 -- being deemed suitable for commercial introduction.

Positive government interest during the development of the craft resulted in the introduction of over 300 of these craft between 1986 and 1992 through several government-sponsored credit schemes. About 50 more craft were introduced during the period without government assistance.

While the technical feasibility of the craft had been tested at the time when commercial introduction commenced, their economic viability was yet unproven. BOBP emphasized the need to continue the economic viability tests as well as the need for careful planning of their commercial introduction with special attention to :

- Careful selection of capable operators and suitable bases;
- Training; and
- Close monitoring and effective official support.

A considerable amount of development work continued to be carried out by BOBP even during the commercial introduction of the craft. This work included :

- The conduct of offshore fishing trials,
- Training;
- Transfer of FRP construction technology to boatyards, and
- Modifications to the engines, hulls and propulsion units.

There is a wide disparity in the relative present status of the two BLC types considered suitable, IND-20 and IND-25. Due to the manner of its utilization for fishing, as well as the attempt to operate it under a joint-responsibility system, the IND-25 is virtually non-operational in Tamil Nadu and Pondicherry. While better utilized in Orissa, it nevertheless has had only limited acceptance there. The IND-20, however, has become widely accepted, particularly in Andhra Pradesh and Orissa.

The present *de facto* locations of BLCs in Andhra Pradesh and Orissa are not the same as the locations they were originally introduced. Due to illicit transfers within Andhra Pradesh, as well as from Andhra Pradesh to Orissa, and seasonal migration along the Andhra Pradesh coast and from Andhra Pradesh to Orissa, the craft have tended to concentrate in a smaller number of fishing centres offering better prospects for fishing than the numerous locations originally targeted.

BLC now regularly operate in many areas of Andhra Pradesh and Orissa. The main fishing gear used are the large mesh driftnet and the drift longline. The BLC operations are mostly in waters of 50-70m depth, with a few craft operating in offshore waters. In some areas of Andhra Pradesh, operations are confined to inshore waters. Puri, in Orissa, has the largest concentration of BLC, and these have been landing large catches of Seer and, more recently, Shark. The performance of hulls has been generally satisfactory. Some engine problems encountered at first have since been

solved. Sails are used extensively by these BLC, but the modern rigs introduced by BOBP have not received wide acceptance.

Information on BLC earnings is scarce. The Uppada (Andhra Pradesh) fishing trials in 1985-86 and the Thirumullaivasal (Tamil Nadu) fishing trials in 1989-91 showed annual net earnings of Rs.32,656 and Rs.22,596 respectively. Circumstantial evidence points to very high earnings by BLC operating from Puri.

The handling of the development process of the BLC by BOBP was thorough and systematic, with two notable exceptions:

- The lack of justification for development of the IND- 25; and
- Insufficient attention to the solution of the engine problems

In the commercial introduction of the BLC, no attention was paid to the selectivity criteria, suggested by BOBP, when choosing capable operators and suitable bases. The uniform distribution of the craft to fishermen's cooperative societies proved to be **counter-productive** and most of the craft became *de facto* individually owned. **The issue of cooperative ownership of craft needs to be reviewed and provision made for ownership by selected members who are enterprising fishermen.**

The attention given to training during the process of commercial introduction was too little and too late. More fishing demonstrations should also have been carried out as follow-up to the Uppada fishing trials.

The BLC has proven itself in surf-crossing and beachlanding and there is a consensus among fishermen that it is a safe and comfortable craft. While none of its beachlanding characteristics could be considered superfluous, they have, nevertheless, imposed a limit on the craft's size and, consequently, on its operational range. While the main complaint of the fishermen has been about engine defects, such defects have not led to any craft being abandoned or rendered inoperable. The engine problems were due to the engine installed by BOBP. But, then, BOBP had no alternative but to use these engines, and, considering the handicaps, their development to the present level is a considerable achievement.

Given that the BLC is, in general, a technically satisfactory fishing craft, its earnings will be determined by factors related to fishing gear, location and human skills. **It is obviously not a craft for everyman and has to be operated and manned selectively.**

The cost of the BLC places it beyond the reach of the informal credit market. It has, necessarily, to be financed for the small-scale fishermen through institutional credit. In the case of craft acquired through government-sponsored institutional credit schemes, the question of cost and affordability have not been a consideration for the beneficiary fishermen. Illegal transfers have had no relation to these factors. The really relevant issue with regard to capital cost has not been its quantum, but the 'bankability' of the craft – and that depends on its earnings. In order to rationalize its introduction and establish its bankability, state fisheries agencies should :

- Establish systematic monitoring of BLC operations;
- Formulate 'project reports' for financing BLC on the basis of such monitoring;
- Make appropriate changes in state-sponsored schemes to consider such reports;
- Ensure selectivity in further introductions;
- Aim at promoting the establishment of bank-financed credit schemes; and
- Establish appropriate credit supervision measures.

The majority of BLC are being used to harvest food fish resources further offshore. In some locations, new resources of Flyingfish, large pelagics and Shark are being exploited. Considering the small numbers and local concentration of the BLC off Tamil Nadu and Andhra Pradesh, a significant impact on the resources seems, so far, unlikely. The situation in Puri, however, appears to be different. The causes of the slump in catches of large pelagics since 1988-89 are unknown, but the decrease gives rise to concern. The recovery of the Puri season in 1991.92, with large and lucrative Shark catches, is likely to lead rapidly to excessive fishing effort on a very vulnerable resource. In spite of the resemblance of the Puri operations to the classic scenario which leads to overfishing, these operations are not being monitored. **Official action to monitor these operations is** an urgent **necessity.** Monitoring of the growing Shark fishery off the entire east coast also needs to be considered.

The proliferation of FRP construction technology on the east coast and commendable initiatives by boatyards in developing FRP craft, such as a FRP Nava and a FRP ***Teppa,*** are spin-offs from BLC development. Early action is needed to monitor quality of construction and to lay down quality standards for boatyards carrying out FRP construction.

Another spin-off is motorization of traditional craft, which has also begun to show an increasing trend. The operations of these craft, taken together with BLC operations, will from now on increase pressure on resources further offshore. Timely action should be taken to monitor these operations.

Other spin-offs from BLC development have been :

— The location of new, or less exploited, offshore resources;

— Use of new fishing methods;

— The diversification of fish marketing; and

— Use of the BOB Drive in the motorization of outrigger canoes in Shri Lanka and Indonesia.

The FRP nava which was first developed by the Andhra Pradesh Fisheries Corporation (APFC), one of the spin-offs of its work with BLC.

1. BACKGROUND

The Project Request (1977) of the FAO/SIDA project "Development of Small-Scale Fisheries in the Bay of Bengal"[1] identified the problem of the small-scale sector[2], with its acute need to improve the standard of living and the quality of life of fisherfolk in this sector, as "the biggest and most critical human problem in world fisheries". Although these fishermen contribute a very large proportion of the total fish production, their ***per capita*** production is very low, resulting in reduced income. This is the root cause of their poverty. The low level of their socio-economic conditions is also attributed to a combination of economic and technological considerations, such as low productivity, inefficient technology and weak institutional support.

The improvement, development and application of appropriate existing or new fishery technology was identified as one component of the Project's immediate objectives of developing and demonstrating technologies for the ultimate purpose of assisting the countries participating in the Project to improve the standards of living and the quality of life of their small-scale fisherfolk and to increase supplies of fish.

Fishing vessel technology (FVT) was one of the target areas proposed in this connection. One subproject contemplated the development of a fishing craft for beach operations, which would

- be affordable to the small-scale fisherman,
- allow him to use more and new or improved fishing gear,
- ensure his safety and comfort,
- expand the fishing seasons, and
- increase his operational range,

thereby increasing his fishing efficiency, productivity and income, as well as the landings of the additional food fish resources that are available in some coastal and inshore waters.

When the project activities proposed under FVT were placed before the Third Meeting of the Advisory Committee of the Project (Chittagong, 1978), India evinced keen interest in the Beach Craft Development (BCD) project.

The BCD project was launched in 1979 with the objective of **"developing fishing craft capable of operating satisfactorily, technically and economically, from surf beaches".** (Gulbrandsen, 1979).

The Project was to be implemented on the east coast of India, where about 64,000 non-mechanized craft, of which 75 per cent ***were kattumaram/teppa***[3], were operating from 860 villages situated mainly by exposed beaches. The total fisherfolk population was about 560,000, of which 25 per cent were active fishermen (Anon, 1973-77 Census).

A complete replacement of the kattumaram was, however, neither intended nor considered possible. A separate and supplementary project to attempt their improvement and facilitate the supply of materials for their construction was launched at the same time. It was also **appreciated from the outset that a new type of craft would be considerably more expensive** than the traditional

1 From 1980, the Project was designated a programme — the Bay of Bengal Programme (BOBP).

2 There is no uniform definition of the small-scale fisheries sector in the region, but it excludes from its purview inland fisheries, fish culture activities and various forms of trawling (see Appendix B of the Report of the 2nd Advisory Committee Meeting, Madras 1977).

3 The remaining craft comprised masula or ***padavo*** (7%), nava (2%), canoes and vallam.

craft and that its viability would depend on increased earnings, through a combination of factors, such as

- type and quantity of fishing gear,
- number and duration of fishing trips,
- operational range, and
- price of fish.

2. HISTORY

The history of the BCD project covers two phases.

During the first phase, from 1979 to 1984, beachlanding craft (BLC) were developed and trials of several prototypes were carried out, resulting in two models being deemed suitable for commercial introduction by 1984.

Commercial introduction of the craft was carried out during the second phase, from 1985 to 1989. During this period and later, in fact, until 1992, considerable refinement of the technology, mainly in respect of the engine and propulsion system, but also in respect of the hull, continued to be carried out. Other BOBP activities during this period comprised :

- Technical and operational training;
- Transfer of technology to boatyards;
- Promotional activities in cooperation with the state and central government authorities;
- Offshore fishing trials; and
- Evaluation of the performance of the craft.

2.1 Development of the BLC

Beach landing craft development commenced in 1979 with the design of four intermediate motorized craft to meet the conditions of the east coast of India, viz. IND-10, IND-11, IND-13 and IND-14 (illustrated overleaf).

- IND-10 , a 7 m, decked craft of timber, was constructed in 1979. After initial trials in 1980, IND-10 was discarded as it proved too heavy to haul on to and off the beach.
- IND-11, a 7.4 m boat, with polystyrene blocks encased in a non-watertight framework, was based on the principle of the ***kattumaram.*** The prototype was constructed in 1979. Trials with IND-I 1 were conducted in Tamil Nadu and the craft was modified in 1982, on the buoyancy block principle. The new 7.2 m version, named the IND-21, was discontinued in 1984[4].

4 While the fishing trials of IND-21 were proceeding, a fishermen's cooperative society in Tamil Nadu placed an order for thirty IND-21s with a private boatbuilder under a Tamil Nadu Government 50 per cent subsidy scheme. The construction of the first five hulls was supervised by BOBP, which found the quality of wood and workmanship poor. The high cost of good timber, fasteners and polystyrene also became a matter of concern. It was, therefore, recommended that construction on the buoyancy block principle be abandoned, and no further development work was undertaken.

IND-10

IND-11

IND-13

IND-14

- **IND-13,** a 7.4 m decked craft of marine plywood was developed by 1980. The prototype, fitted with a 4.8 hp air-cooled diesel engine, underwent fishing trials from Uppada in October 1980 March 1983. These trials indicated that a BLC doing large mesh driftnet fishing would be economically feasible, but that a craft with more space for crew and storage of gear was needed.

- **IND-14,** a 7.2 m twin hull craft of marine plywood, was developed in 1980. The prototype was fitted with a kerosene-fuelled outboard motor, whereas in the other three craft diesel aircooled inboard engines had been used. The twin hull configuration of IND-14 exposed the bridge and crew to the full impact of the waves, and control during the critical beachlanding period was inadequate due to the difficulty of operating the twin-rudder assembly and manipulating the engine.

While trials with IND-13 were going on, a new 8.4 m plywood BLC, IND-18, was designed and started operations in Kerala in 1981 5. This craft, fitted with an 8 hp diesel air-cooled engine, was similar in most respects to the IND-13 except for the extra length.

IND-18

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5 This craft was designed and constructed for use in Kerala under a separate UNDP-funded project

The combined experience with IND-13 and IND-18 resulted in the IND-20, which was essentially a FRP version of the IND-18. The IND-20 underwent trials in Madras in 1982 and, subsequently, at the request of the state government of Andhra Pradesh, six craft were supplied for trials in three villages during 1983-84 [6].

These developments, together with the catch and cost data collected during the period of trials, led to the production of IND-20 for commercial introduction.

In the meantime, the IND-23 and the IND-24, with aluminium hulls, were also designed. Prototypes were constructed and tested, but these craft, though found in initial trials to be excellent surf-crossing and beachlanding craft, were not developed further as the correct grade and temper of aluminium alloy was not locally available.

The IND-11 had in 1980 been considered well-suited for surf-beach operations. It had the added advantage of being readily accepted by kattumaram fishermen. The IND-21, which was described in 1982 as the final design of this size and type of craft, was also acceptable to the kattumaram fishermen. But it suffered a setback due to structural defects. This prompted the new design of a FRP craft of similar capacity. The resulting design was the 6.7m IND-25 which was seen as "perhaps the smallest possible motorized BLC", a viable alternative to IND-21 and more suitable than the IND-20 for *kattumaram* fishermen. Construction of this craft commenced in early 1984 and, following trials in Tamil Nadu, was recommended for introduction.

IND-21

6 The IND-20 went through three modifications: IND-20A had a modified hull incorporating wider stern sections and a flatter run. In IND-20 B, the working deck was lowered to provide better crew safety and comfort. In IND-20 C, a 9 hp VST Shakti freshwater-cooled engine with a 2:1 reduction gear was installed. The craft supplied to Andhra Pradesh comprised three IND-20s and three IND-20As.

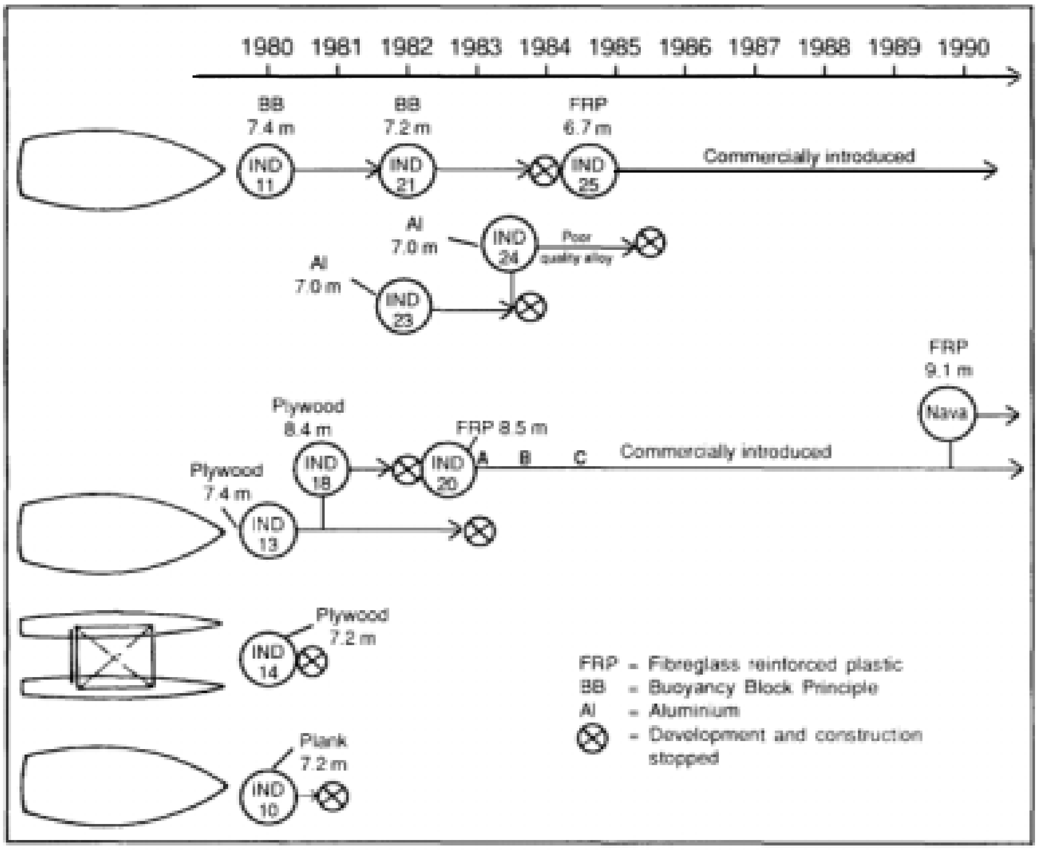
IND-24 crossing surf.

IND-20, with water-cooled engine BOB Drive

IND-25, with air-cooled engine BOB Drive

Thus, by the end of the first phase (1984), the BLCs finally developed for commercial introduction were IND-20 and IND-25. A flowchart showing the development process is given in Figure 1. The former was considered to be suitable mainly for the *nava* fishermen of Andhra Pradesh, and the latter for the *kattumaram* fishermen of Orissa, Tamil Nadu and Pondicherry.

Fig. 1. Development **of beachianding craft**



2.2 *Development of engine*

The development of the BLC involved special arrangements for the installation of the engines.

From the outset, the engine was installed in a pivoting watertight box fitted in a well which was provided in the boat. The stern tube, propeller and rudder were part of the installation and the lifting of the rudder stock caused the propeller and rudder to retract. This system was used in all boats during the first development phase.

The choice of the engines to be used was determined by such technical considerations as type of fuel, weight and cooling system. But the prevailing import restrictions also played an important part in determining the engine : **any engine used had necessarily to be one produced in India.**

During the first development phase, a 4.8 hp Greaves Lombardini air-cooled diesel engine was used. It was found to be underpowered, unreliable under actual operating conditions and incapable of standing up to extended use. The second generation craft were, therefore, fitted with a VST AD8V 8 hp diesel air-cooled engine which effectively had a built-in 2:1 reduction, as the power take-off was from the crankshaft. This engine also had various problems, the most serious of which was overheating due to its installation in a watertight box, Improvements on it had to be made from time to time.

2.3 *Introduction of the BLC*

The second phase of the project was the introduction of the craft on the east coast of India.

DISTRIBUTION

The IND-20 and IND-25 BLC developed during the first phase were commercially introduced during 1985-89 through several credit programmes, viz. a Hire Purchase Scheme (HPS), the National Cooperative Development Corporation Scheme (NCDC) and the District Rural Development Agency Scheme (DRDA). The NCDC and DRDA schemes provide for subsidies. The terms and conditions of the schemes are outlined in Appendix II.

Even before the BLC were deemed to be ready for commercial introduction, the Central Government, as well as the State Governments of Tamil Nadu and Andhra Pradesh, showed positive interest in the commercial introduction of the craft.

In 1984 the Central government announced a decision to introduce 90 BLC. Later, at a meeting on BLC introduction in Madras (November 1985), a Central Government decision to introduce 330 BLC during the Seventh Five-Year Plan (1985-90) was announced.

The scheme became operational in 1986 and was channelled through the apex cooperative body, NCDC. In terms of the guidelines given to NCDC under the scheme, its benefits were "to flow to the members of viable fishermen cooperative societies". The scheme provided for a 50 per cent subsidy of the cost of the fishing craft. Only genuine cooperatives, with local, active fishermen as members, were to be selected for allotment of BLC. According to the guidelines given by NCDC to the State governments, each cooperative was to receive a maximum of five BLC.

Over 350 BLC (both IND-20 and IND-25) were distributed under the various schemes during 1986-1991. Table 1 shows how many BLC are operating as a result of these schemes in the different states (and Pondicherry Union Territory) on India's east coast.

Table 1 : Distribution of beachlanding craft on credit (1986-1991).

state :	*Tamil Nadu*	*Pondicherry*	*Andhra Pradesh*	*Orissa*	Total
Year					
1986	3	3	22	6	34
1987	18	4	44	20	86
1990	18	4	181	62	265
1991'	18	4	254	82	358
% share	5	l	71	23	100

* Includes BLC ordered but yet (August 1992) to be delivered (22 in the APFC boatyard, Kakinada, and 15 in Mechem boatyard, Bhubaneshwar, Orissa.)

Table 2 gives the distribution of the BLC under the various credit schemes.

Table 2 : Schemewise distribution of BLC

Scheme	*Stale*	*% Share*
NCDC	Andhra Pradesh	76
	Tamil Nadu	
	Orissa	
HPS & DRDA	Andhra Pradesh	24

In addition to these craft, a much smaller number of BLC were purchased without government assistance – 52 IND-20s had been purchased upto August 1992, according to available figures, and there were a further 15 IND-20s on order at two boatyards in Puri.[8].

7 It is understood that the Planning Commission had proposed introduction of 800 · 1000 BLC during the Seventh Plan, but was not able to obtain approval for the programme.

8 Figures were obtained from the APFC boatyard, Kakinada, and boatyards in Puri during field visits to Andhra Pradesh and Orissa. Nystrom et al, after field visits in March/April 1990, gave a figure of 25 BLC purchased without government assistance. Turner and Mathew implied that there were none on order (January 1991).

BLCs being built at the APFC boatyard in Kakinada

Of the BLC distributed under credit schemes, about 75 per cent were IND-20s. Over 70 per cent of the total number originally distributed were to Andhra Pradesh, 23 per cent to Orissa, 5 per cent to Tamil Nadu and 1 per cent to Pondicherry (Table 1). This pattern of distribution, however, does not accurately reflect the actual operational areas of the craft; migration and illicit transfers, especially between Andhra Pradesh and Orissa, tend to change the distribution pattern.

Although under the NCDC scheme, the BLC were distributed to fishermen's cooperatives, in actual practice the responsibility for each craft differed from State to State. In general, in Tamil Nadu, groups were responsible. In the other States, the cooperatives, after formally taking delivery of the craft, allocated them to individual members. This practice followed different norms in Orissa and Andhra Pradesh. In the former, the highest bidder in an auction or the winner of a lottery obtained the craft. In the latter, the operator was identified on the basis of a consensus of the members. In some cases, the beneficiary had to make an outright payment of Rs. 30,000/- to the cooperative before assuming control of the craft.

In actual practice, there were many instances where the craft were transferred illicitly by the beneficiaries, on an 'internal hire basis', to individuals in another village or in another State. The latter made a lump sum payment and undertook to pay the monthly instalment due on the boat — an undertaking generally honoured only in the breach.

DISTRIBUTION CRITERIA

In connection with the commercial introduction of BLC, BOBP suggested in 1984 that the respective roles of BOBP and the government fisheries agencies might be as follows :

> "... At the stage when the boats were sold, their technical feasibility had been tested, however, not their economic viability which depends on factors such as durability of the hull material and the engine, availability of repair workshops and mechanics, availability of fish resources

within the potential area of operation, use of suitable and sufficient gear and, finally, on working patterns and forms of social organization among traditional fishermen used only to non-motorized fishing.

"The economic viability tests need to be continued and will be carried out by the craft owners (Departments of Fisheries, Andhra Pradesh and Orissa) and private fishermen (Tamil Nadu). BOBP will only play the role of adviser in regard to quantity and type of fishing gear and in regard to craft repairs to be undertaken. BOBP, however, will not have the role of supervisor in fishing trials and use of gear."

BOBP also suggested to the government agencies that appropriate consideration be given to the following factors while formulating and implementing the schemes for commercial introduction of the BLC :

- The need for the craft to achieve high levels of productivity and earnings, to be economically viable, considering the fact that their capital cost as well as their operating cost, due to the use of engines, was higher than those of the craft they were replacing.

  The fishing trials carried out by BOBP had shown that their viability depended on their operation by fishermen who had the capacity to locate/operate in more distant fishing grounds, who were used to carrying adequate quantities of fishing gear and employing diversified fishing methods, and fishing for the higher priced varieties of food fish.

- As fishing of the type specified was not being carried out in every fishing centre, it was important to make a judicious selection of the fishing centres in which the boats would be introduced.

- An important criterion in the selection of fishing centres was the accessibility of repair facilities, particularly for the engines, as the loss of fishing days due to lack of such facilities would affect the economic viability of the craft.

- With regard to training, the main requirement was for training of some government officers, at the technical level, in maintenance and repair of the engine, so that they could supervise implementation of the schemes in the field. Some fishermen/mechanics drawn from the centres in which boats were introduced should also be given similar training.

- In order to achieve a successful introduction of the BLC, careful planning and preparation was called for and needed to be accompanied by close monitoring and effective support from the authorities concerned.

PERFORMANCE EVALUATION

A study was initiated in 1984 on performance evaluation of BLC and was completed in 1985 (Drewes, 1985). The report suggested that it might be advisable for Government to initially subsidize the investment costs for a limited number of BLC. This would enable Government to observe the earnings, performance and acceptance of the BLC on a wider scale before promoting a full-scale introduction of the craft through bank loans.

The participants in two workshops conducted in 1985 in connection with this evaluation also expressed concern over the heavy exploitation of inshore resources, the need for craft to fish further offshore and stressed the need to obtain better knowledge of the offshore pelagic resources.

FISHING TRIALS

Offshore' fishing trials with BLC were started in 1985. The trials were systematically carried out from a few fishing centres, including Uppada and Thirumullaivasal.

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9 The area 0-50 m depth is considered the coastal, or inshore zone, and the area 50-100 m depth the offshore zone. The deep sea zone is considered to be over 100 m depth.

The Uppada trials[10] showed that the BLC (IND-20) was capable of fishing in offshore waters upto 35 nautical miles. The achievement of 193 fishing trips and a 23 per cent rate of return on investment with a prototype engine installation indicated economic viability. Catch performance and profitability could be further improved with better organization and refinements to the propulsion unit. The limited carrying capacity of the boat and the limitations of the crew shelter indicated that offshore operations should be restricted to four months in a year.

In the Thirumullaivasal trials,[11] commercial fishing was carried out 15-35 nautical miles from the shore by an IND-20, using diversified fishing gear, comprising driftnets, drift longlines, gillnets and trolling lines, and targeting large pelagics and Flyingfish. Most of the operations were carried out at the edge of the continental shelf or beyond. The 364 fishing trips over two years yielded a catch of 40 t and a 12.7 per cent rate of return on investment. The trials provided evidence of the availability of lightly exploited large pelagic and larger Flyingfish resources in the offshore area which could partially be exploited by BLC. They also demonstrated the need for diversified fishing gear to exploit the resources economically.

TRAINING

As a result of the high incidence of engine problems encountered within the first six months in most of the BLC commercially introduced in the various east coast states, BOBP began to appreciate by 1985 that the technical support provided by the state fisheries agencies for repairs and maintenance was inadequate. It was felt that intensive training of fishermen was essential and that engine spare parts should be readily available always.

At a meeting with the BOBP staff in late 1986, state fisheries officials requested assistance in their training programmes.

The first BOBP training course had been already held at Gopalpuri (Orissa) in April 1986 — for two trainers and ten NCDC beneficiaries, who received instruction in BLC operation, with special attention to engine and craft maintenance. The two trainers, both from Andhra Pradesh, were to be based at training institutes, in Machilipatnam and Kakinada, which had invested in training equipment.

Similar courses held in 1987 led to the finding that institutional training was not appropriate as far as fishermen were concerned and that on-the-beach courses would be more effective. It was also concluded that the training content and material needed to be revamped, due to the low level of literacy among fishermen.

The first on-the-beach training was conducted in August 1989 as a ‘pilot training programme’ in Puri, Orissa. Further training was provided at three Andhra Pradesh fishing centres for 90 fishermen and 14 fisheries officers, in Tamil Nadu for 15 fishermen and three fisheries officers and in Orissa for 60 fishermen and four fisheries officers.

The conclusion reached after these training programmes was that the training of officers was of doubtful value. Most of them lacked the technical knowledge necessary to conduct training on their own. Furthermore, there were frequent transfers of such officers to non-marine sectors. It was therefore concluded that it was desirable to involve NGOs and private mechanics in the training programmes.

Suitable NGOs could not be identified, but in Andhra Pradesh and Orissa a number of private mechanics were trained on-the-beach in the maintenance of the engine and the liftable propulsion system. This was followed by further training in the workshops of the engine manufacturer (VST) in Bangalore. VST also provided training in their workshops for mechanics employed by their dealers.

10 August 1985 to July 1986.

11 February 1989 to January 1991.

FRP TECHNOLOGY

When beachlanding craft development commenced in 1979, FRP craft construction in India was limited to a few boatyards. While a few fishing craft, particularly small trawlers, had been constructed, the material had not been widely accepted in the small-scale fisheries sector.

The development of the two final BLC prototypes and the choice of FRP as the construction material was followed by the transfer of FRP technology to local boatyards by BOBP. This took various forms and, inter *alia,* included the following :

- Initial training at the BOBP boatyard in Royapuram, Madras, of the Assistant Manager and two boat-builders of the APFC boatyard, Kakinada;
- Technical support to the same boatyard in establishing a FRP boatbuilding division, guidance in procurement and inventory practices, and supply of an IND-20 mould and plug with on-the-job training in mould-making and moulding;
- Supply of plugs and moulds to three private boatyards in Orissa and one in Pondicherry;
- Provision of technical advice and training in the construction of engine boxes and propulsion units for boatyards constructing BLC; and
- Construction supervision of BLC under commercial construction

HULL, ENGINE AND PROPULSION UNIT

Development work on the hull construction, engine and propulsion unit for the BLC continued to be carried out by BOBP even during the commerical introduction of the craft.

During the offshore fishing trials, the overheating of the AD8V 8 hp air-cooled engine, on long trips 20-30 nm. offshore, was a problem serious enough to make it necessary to consider an alternative water-cooled engine. The engine selected was the 10 hp VST Shakti freshwater-cooled horizontal cylinder engine, originally produced for a tiller tractor. The use of this engine required a 2: 1 reduction gearbox and a water pump with keel cooling system. The engine proved satisfactory in trials when used with an imported gearbox and water pump. But as the use of imported components was not practical, the engine manufacturer turned out local versions of these items. The quality, however, was inferior and eventually, therefore, the idea of a reverse gearbox was shelved. Nevertheless, a reliable reduction gearbox had been developed.

The water pump was also a source of complaint for some time in BLC fitted with the watercooled engine. A satisfactory water pump assembly was, however, eventually developed.

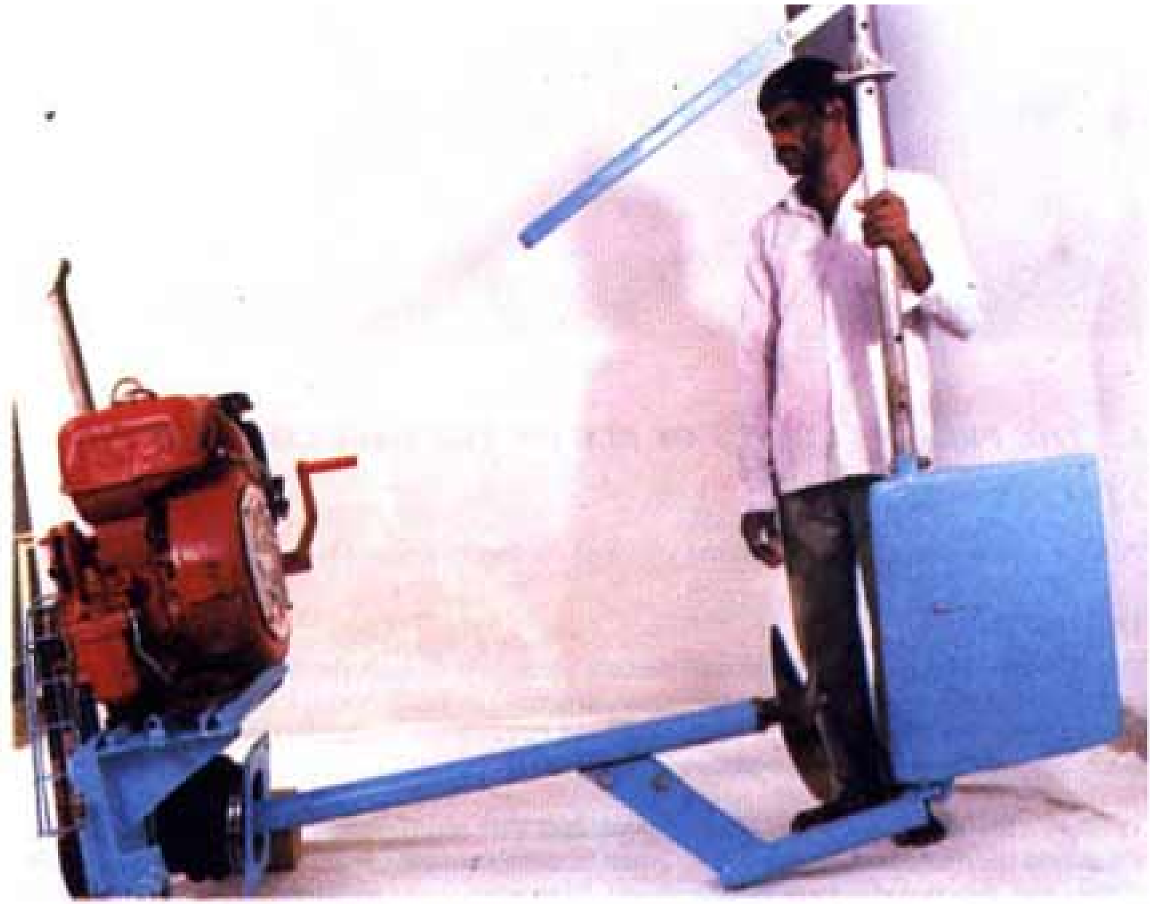
Experience with the engine installed in a pivoting watertight box fitted in a well – the so-called **Box Drive** used in all BLC – revealed such attendant disadvantages as :

- Overheating in air-cooled engines;
- Restricted access for maintenance; and
- Too much of space being occupied by the well and the box.

This prompted BOBP to look for alternatives and resulted in the design in 1989 of the **BOB Drive,** which combines a rubber bellows with a pivoting engine installation, thus eliminating the box and the well. It also permits the engine to be turned round by using a V-belt transmission system which ensures a 2:l reduction. The result has been :

- considerable saving in space and weight,
- increase in speed, and
- elimination of the disadvantages of the Box Drive.

The Box Drive



The BOB Drive