

# Dugout Canoes of Papua and New Guinea.

A. W. JEFFORD.

*Senior Mechanical Equipment Inspector D.A.S. F., Port Moresby.*

## Introduction.

SINCE the conclusion of the last world war the native people living in the coastal villages of Papua and New Guinea have become increasingly aware of the advantages of modern methods of boat building and mechanical means of boat propulsion.

The principal type of vessel is still the dug-out canoe, and although there are differences in construction between canoes built on the west coast of Papua and those built, say in New Ireland, the basic materials and methods of construction are the same—namely hollowed logs fitted with planks to give additional free board, bindings of vine, and round timbers for other supporting materials.

The building of these vessels was originally the work of those people living in coastal areas with access to the necessary raw materials, and who had the initiative and energy required to undertake such a task. Canoes were built as items of trade and were sailed along the coast and bartered for by coastal dwellers who lacked the raw materials and the skill to provide craft for themselves. To-day in the more settled areas the hollowed hulls only are traded and the building of the craft is undertaken by natives who have a sea-going background, and have also a knowledge of boat design and construction. They may also possess a knowledge of ship's carpentry and the use of modern hand and shop tools. To-day, whilst the native still clings to the use of hollowed logs to form the basic



Plate I.—Single canoe.



Plate II.—Single hull with outrigger.

part of a canoe he seeks modern refinements in construction and design which allow him to enjoy the comforts of civilization to which he is becoming rapidly accustomed. The advances made in canoe construction are quite striking but it is well to bear in mind the economic factors involved.

#### *Early types of canoes.*

Canoes range in size and length from ten feet to over 60 feet in length. The smallest, which are usually single hulled outrigger canoes as shown in Plate I may be used to ferry passengers and cargo from the shore to outlying canoes or in villages built over the water for transport to shore. Construction is simple and the materials primitive. The hull is open and with the exception of the outrigger has no other fittings. Propulsion is by means of a pole or paddle. Single canoes slightly larger in size carry a single sail and are steered by a steering oar. Such canoes also have a series of hatch covers over the dugout canoe and the crew and cargo is carried on the outrigger frame. These canoes are found in all coastal villages and

also far inland up the principal rivers and estuaries. Although of primitive construction they last for many years without any protection by paint or other form of preservative.

A single-hulled outrigger canoe is shown in Plate II. It is from the village of Maiwa, north of Yule Island on the central coast of Papua, and recently sailed nearly 100 miles along the coast to Port Moresby. The main hull measures 55 feet overall with an outrigger log 27 feet long and outrigger support poles 17 feet long. The deck of the craft upon which several people may live for lengthy periods is confined to the area above the hull. The roughly shaped timbers and methods of fastening are a common feature of this type of canoe.

The most common type of dugout canoe is that with two hulls, usually referred to as a *lakatoi*, although in the Motu language this signifies three hulls. Whilst the single hulled outrigger canoes were designed as vessels of war the multiple hulled vessels were evolved for the carriage of trade goods such as sago and pottery.

The twin hulls provide the basis for a stable platform upon which the native fisherman can build a shelter for his family, install a cooking fire or galley and have sufficient room for his nets and catch. The vessel is seaworthy, manoeuvrable, suitable for either shallow or deep water operations and may be conveniently beached without damage to the hulls. The twin hulled type of canoe lends itself to improvement by the use of modern methods of propulsion such as large canvas sails or outboard motors.

Finally, there are the three and four hulled canoes which in days gone by were the cargo ships of the Papuan coastal traders. The really large types are now rare but the three hulled vessel shown in Plate IV was seen recently at Port Moresby. Here again bush materials are used even to the decorative decks and rigging using palm fronds. The deck house is built by using the palm bark for the walls and thatching the roof with kunai grass and the rolled

up door is of palm fronds. The mid-section of the craft is occupied by the cooking and eating facilities. To the right of the table are the fishing nets hanging from the canvas sail support. On such a craft the owner and his family spend a large part of their lives. Fishing and the carriage of passengers and cargo provide their livelihood.

Canoes of this size may use one or two sails and since the craft have no established fore or aft the alterations required to change sailing direction may be carried out simply by reversing the set of the sails and steering from the opposite end of the vessel. It is from such multi-hulled canoes that the double hulled vessels of to-day have developed and become widely used as native fishing boats.

An average sized double canoe requires two logs, some sixty feet in length and four feet in diameter. These must be dragged to the beach and set up for shaping and hollowing.



Plate III.—Three-hulled canoe showing hulls and deck house.



Plate IV.—Three-hulled canoe showing galley, fish nets, etc.

The deck and hull timbers must be obtained, and curved or bent roots or limbs rudely fashioned and fastened into position. Fronds of the Nipa Palm are used to render the deck side above the hull watertight and the whole structure is lashed together with vines or canes. Whilst methods and materials are of a primitive nature, a very seaworthy craft is produced. The cane lashings, for instance, shown in Plate VI, are extremely tough and durable and allow sufficient movement of the component parts of the canoe to work in a rough sea without giving way.

The fact that European clothing, cooking methods and appliances, and sanitation are becoming the rule, the training in modern methods of fishing, the construction of nets and use of nylon cords and lines have all contributed to improvements in canoe design. Study of the two canoes in Plate V shows that the hulls are basically the same but the layout and neat construction of the powered canoe indicate the advances made in canoe design by the native people.

### *Structural Modifications.*

Improvements in design bring with them a host of problems which have to be overcome and foremost among these is the need to effect improvements which add to the safety of the vessel and its crew. Initially the craft had a sound hull but rather flimsy fastenings. It was made from crude materials, but was light, manoeuvrable and seaworthy. The flexibility of construction was an asset; frequent bailing kept the craft above the water even in moderate seas. From this has evolved a fairly rigid flush-decked craft with well designed hatch covers to exclude sea water from pouring into the open hulls and a coaming around the deck. The vessel may be propelled by one or more outboard engines and steered by hand tiller and thus now has a fore and aft and must be guided from the one position. The location of the engine or engines is approximately a third of the length of the craft from the stern and situated between the two hulls. The trim of the craft must be tail heavy to keep the bows from diving below the swell of a wave. Should the craft be for

passengers and cargo, the weight should be kept toward the stern whilst a fishing boat requires plenty of room aft to allow for trolling and netting operations.

Much of the passenger cargo and food may be stored in the hull compartments. Here also are stored spare drums of fuel. The cooking fire must be considered, although generally it is placed to suit the convenience of the people on board and the prevailing weather conditions. A danger of fire always exists, but very few cases of damage by fire have been known. Fire extinguishers are carried on very few canoes and life belts are only seen on registered passenger carrying canoes. Plates III and VII show the dangers that exist with petrol operated engines when used under primitive conditions. Note also the hatch cover removed from the left hand hull in Plate VII. Daily running requires the use of the petrol container in the foreground whilst reserve supplies are held in the 44-gallon drum. To the rear of the drum may be seen the deck aperture in which the tiller is hung. Plate VIII shows two outboard engines

in position but tilted forward. The decking of this canoe leaves much to be desired. Plate IX shows a very neat well in which is fitted a 40 h.p. outboard engine. It will be noticed that in each case the engine is either at deck level or below. This is necessary to put the propeller well down below the surface of the water and also the deck joist provides a convenient member on which to secure the engine.

The design of dugout canoes imposes several obstacles to the fitting of inboard engines and propeller shafts. As may be seen from the illustrations the fitting of such engines would involve major modification to the design of the hull to provide a suitable bed for the engine and supports for the propeller shaft and bearings. The working of a canoe in a heavy swell could impose strain upon the propeller shaft and the engine. Several engine and propeller shaft arrangements have been suggested to power dugout canoes and the use of universal drive shaft connections has been offered both as a means of overcoming the excessive shaft angle and also to raise or lower the propeller as



Plate V.—Old and new double canoes.



Plate VI.—Construction detail.

required. Such installations may require the fitting of two or more universal joints and the submersion of such joints in seawater would not

be a desirable feature. Another suggestion involves the fitting of a standard marine diesel engine and gearbox from which a universal jointed drive shaft extended to a series of vee pulleys set on an angle from the vertical. Immediately below the pulleys are the secondary pulleys attached to the propeller shaft which is set to place the propeller below the engine and forward of the gear box. The propeller in this instance cannot be raised or lowered. Variations of these ideas have been attempted by several amateur canoe builders but the installation of mounting brackets to support the propeller and shaft raises many problems with a craft such as is described. Such difficulties do not arise when fitting an outboard engine. These units are compact, easily installed and relatively simple to operate. Their objectionable features as far as the native owner is concerned are the high initial cost, the local maintenance difficulties and the high cost of operation. Also, being petrol fuelled, they have a low safety factor.

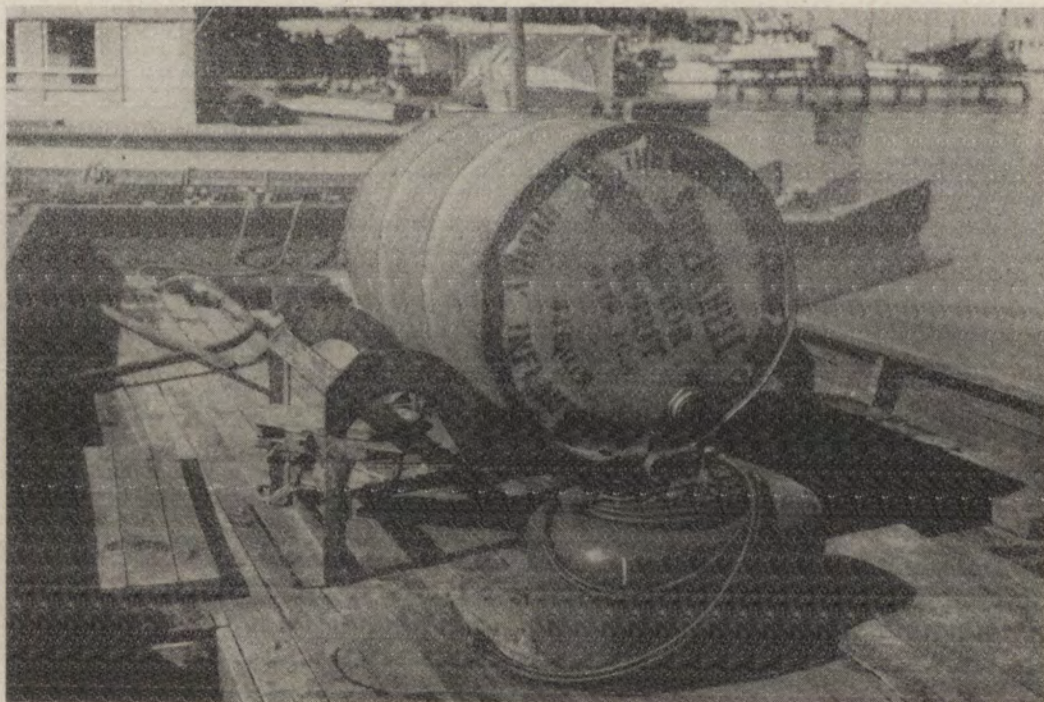


Plate VII.—Benzine, etc.

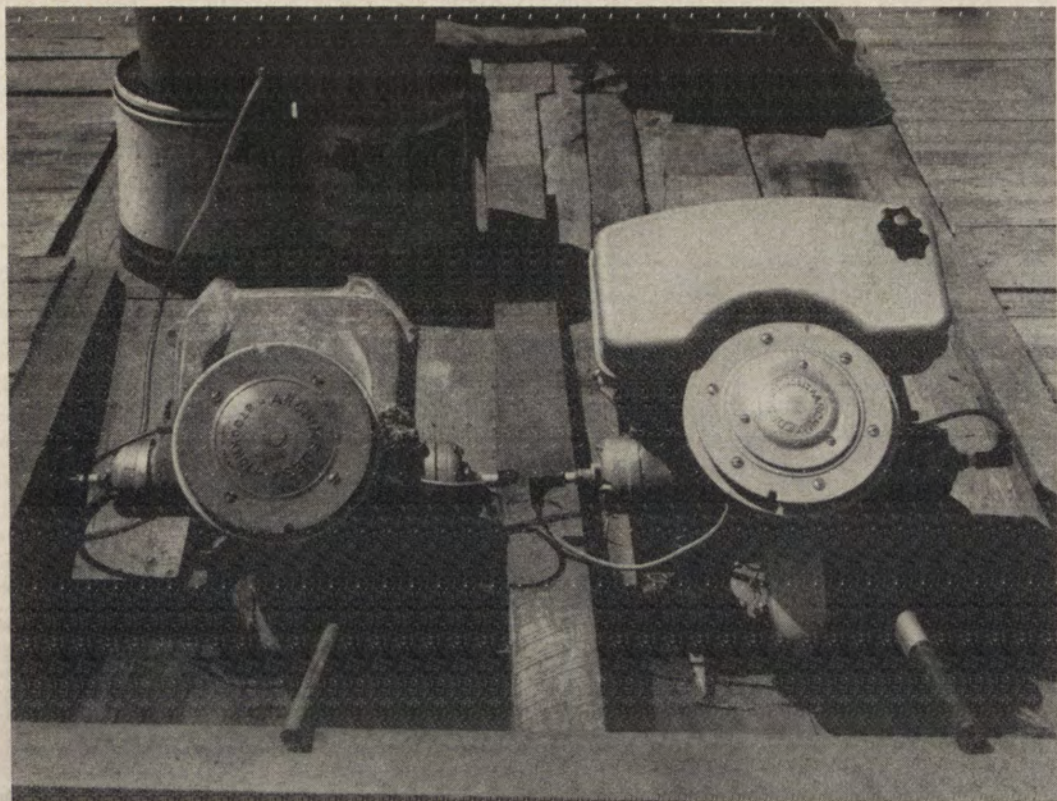


Plate VIII.—Twin engines.

### *Power Driven Canoe.*

A good example of native workmanship may be seen in the double hulled power driven canoe known as the "Logohu" or "Bird of Paradise", shown in Plate X. This vessel has an overall length of 53 feet and a beam of 9 feet. The hulls have an average diameter of 4 feet and the depth inside the hull is 2 feet 11 inches. The power unit, a 40 h.p. engine, is shown in Plate IX. The speed of the craft is about 8 knots with a crew of three and twenty-five passengers or  $3\frac{1}{2}$  tons of cargo. The position of the engine is 17 feet from the stern and in this position the propeller is always in deep water irrespective of the angle at which the canoe may ride. The tiller is plainly visible and the bow extension of the deck is an interesting feature. As usual, cargo, stores and fuel are stowed in the hull compartments. Some protection from the weather is provided for passengers

and crew by canvas awnings. This vessel carries fire extinguishers and sufficient life jackets for passengers and crew.

While the design of the "Logohu" bears little resemblance to the traditional native canoe, it is interesting to note that the lines of the vessel follow the pattern introduced by the artisans from the Gulf of Papua. The lines are severe and angles quite sharply defined. The "chine" type of construction has been developed for ease of construction above the water level.

Canoes built east of Hood Point, towards Samarai, have more graceful and sweeping lines. The curve of the bows and stern is very pleasing to the eye and the moulding of the coamings heightens this effect. The "Nepuvai", Plate XI, has an overall length of 49 feet and a beam of 10 feet. The mast carries a single sail. Two 12 h.p. outboard engines are installed.

The appearance of the canoe indicates that the native builder can produce vessels possessing seaworthy qualities and pleasing appearance. This canoe is used to carry fish for sale at the local market (visible in the background). These examples of the improvements that are possible by using the dugout hulls clearly show the adaptability of the native shipwright. The use of machine tools and dressed, selected timbers properly prepared and fitted, display the advantages shown in Plate V.

Whilst improvements in the design of the canoes show satisfactory progress, one of the main features to receive little investigation is the mechanical propulsion of such craft. Of the outboard engines there is a very limited choice in the Territory. What are available are high speed units designed principally for craft used for aquatic sports and game fishing. As such, they are a luxury item imposed by necessity upon the owners of native-built canoes. No one has yet determined the horse-power require-

ments and the most economic speed at which the average sized double canoe should be operated. Recent inquiries by the Fisheries Division of the Administration indicate a speed of eight to ten knots. This figure is doubtful, as these vessels are capable of much higher speeds under sail only.

#### *Future Investigations.*

It is intended that while further modifications to canoe construction will be followed, investigations will also be conducted to ascertain the power requirements of such craft. To this end a 40 ft. double-hulled canoe is to be fitted with one (or, if necessary, two) 8 h.p. industrial model diesel engines which will drive by individual vee belts and pulleys, an outboard type shaft and propeller. Each will have forward and reverse gearing, and the engine operating at 1,600 r.p.m. will drive a propeller of 330 mm. diameter and 304 mm. pitch at 750 r.p.m. It is proposed to load the canoe to pre-determined

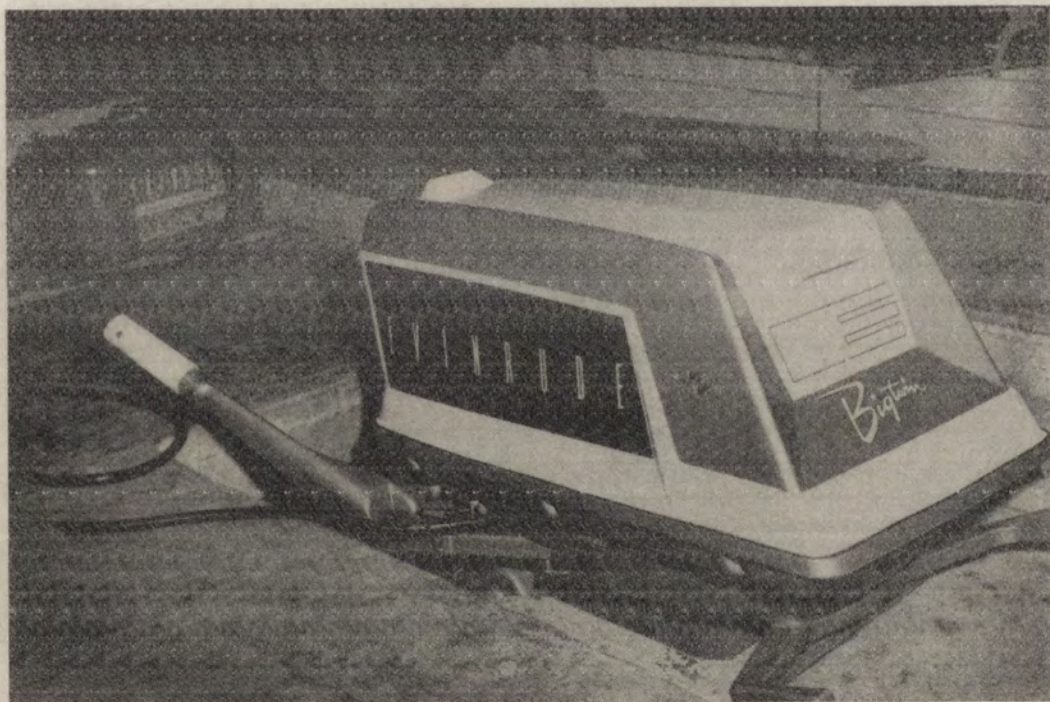


Plate IX.—Neat well, fitted with 40 h.p. outboard engine.

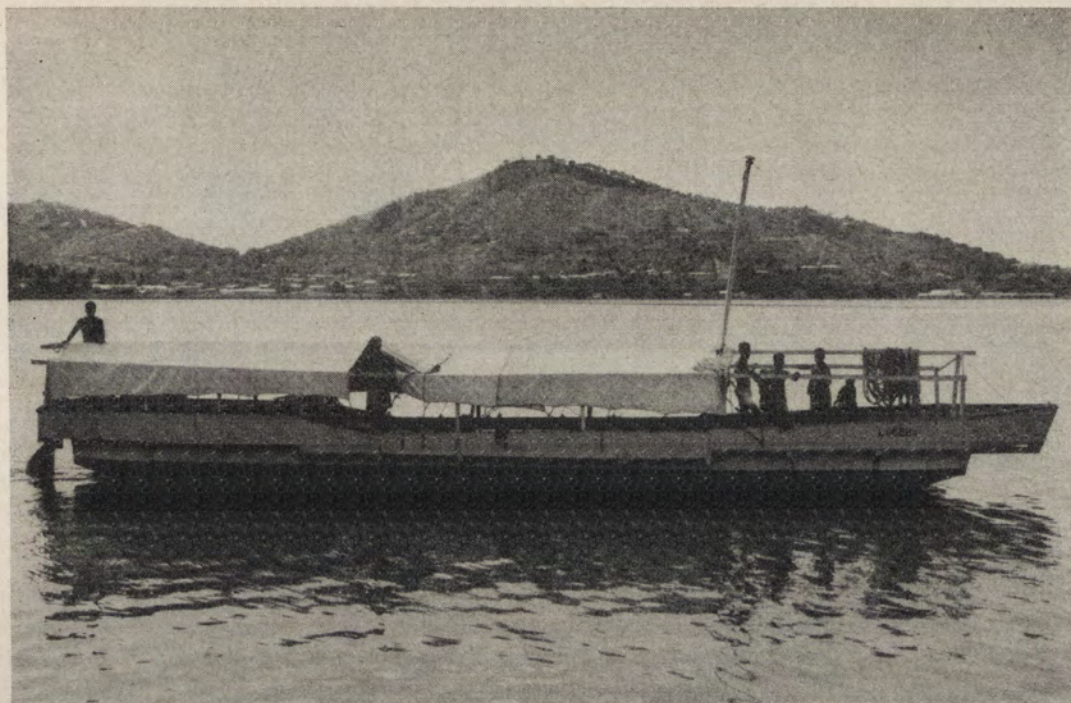


Plate X.—"Logohu".

specifications and with the use of different pulley and propeller sizes and combinations, carry out sea trials. By so doing, it is anticipated that some idea of the speed requirements of the canoe may be determined. The initial cost of the unit is very low in comparison with the petrol motors now in use and the operating and maintenance costs will also be of economic interest. The engine may, of course, be used for other purposes whilst the canoe is idle, and could also run a small generator to provide electric light if required.

#### *Conclusion.*

It appears that future improvements must be made to construction of the hull. At the moment such logs as are required for a double canoe are worth between £10 and £15 at the stump. These logs could contain over 2,000 super feet of milled timber worth £120. It may be possible to build a similar hull by using plywood, or

laminated construction using 46-inch sheets and marine glue. The use of fibreglass or other modern coverings may also have applications. However, the economics of such developments require careful investigation and the cost of material for two hulls 45 feet long would be about £150. The training of native artisans in the use of these materials would be important.

There are many catamaran types of craft available today, the plans of which might well be taken into account. Should such developments take place, they may again lead to changes in the coastal natives' mode of living as such craft would in the first instance not have the size to accommodate the families who normally live on board.

Further improvements must be made to develop better rudder control and to accommodate the power unit. Training of qualified engineers is also required on a large scale to



Plate XI.—"Nepuvai".

deal with engine maintenance and repair. But whatever improvements are made, the important fact is that the craft is, and will be for a long time to come, the means of livelihood for a big proportion of the coastal dwellers of Papua and New Guinea.

#### ACKNOWLEDGEMENTS.

The author wishes to thank Dr. Rapson and officers of the Fisheries Division, Mr. B. Morris of the Division of Information and Extension Services, and Mr. Q. Anthony of the Department of Native Affairs, for the assistance given in the preparation of this article.