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The use of *matic* (automatic transmission of motorcycle) as catamaran boat engine to support economic activities in Ujung Pangkah, Gresik

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Absract. River is the only access to enter the pond area in Ujung Pangkah District, Gresik. The area is difficult to access due to the siltation of the river with only 50 cm depth. In addition, rent for traditional boat is expensive. This research developed a design of a small boat efficient enough to transport fish farmer from and to the pond area. Engine from motorcycle was used as it was easy to operate and economical use of fuel. The fundamental change for this design was a small double-hulled low-lane vessel. The motor matic engine was adjusted to a propeller to get maximum boost. The results showed that a ship with 3 meters length, 1.2 meters width and 1 m height, 2 persons in charge and speed of 7 knots, could use 150cc automatic motor engine by lowering engine rotation (RPM) from 7000 RPM to 4500 RPM using a Gear Box and 4-leaf B-Serries blades with a diameter of 14 cm.

1. Introduction
Gresik is located in the northern coast of East Java Province which has a large pond area of around 16,767.95 hectares. The main fishery production is milkfish and vaname shrimp. The main access to the pond area is from a nearby river with boat as the only mode of transportation. Traditional boats that exist today are only able to operate when the waters are in tidal conditions. When the water depth subsides (until only 50 cm), the boats cannot operate. This inhibits the daily activities of the farmers of the pond areas. This research aims to convert a *matic* (automatic transmission motorcyle) engine into boat propulsion for a small catamaran boat that can load two people and operate in the shallow pond area.

2. Methodology
The method used was the Parametric Design [1], which includes all design parameters to obtain the optimal ship design and function in accordance with the desired ship design objectives, namely a small catamaran boat with a *mati*c engine.

3. Result and Discussion
Shallow river waters have considerable influence on the performance of a vessel, the vessel will have greater obstacles and will face more difficult maneuver controls than when in deep water [2]. The

magnitude of catamaran resistance in shallow waters is greater than in deep waters or free waters due to the influence of sinkage and ship bank interaction effect.

3.1. Catamaran motorboat desain

Boats with double hulls have smaller ship resistance compared to single hull (monohull) boats [3]. Design parameters that must be fulfilled in this boat design were: having the ability to load two people; equipped with storage box supplies; has enough space to set up the motorcycle engines; crew position is similar as riding a motorcycle; and easy boat operation, as easy as people riding a motorcycle on the highway. The main size of the boat is 3 meters in length, 1.3 meters wide with a height of 0.95 meters. The general design of the boat are as follows:

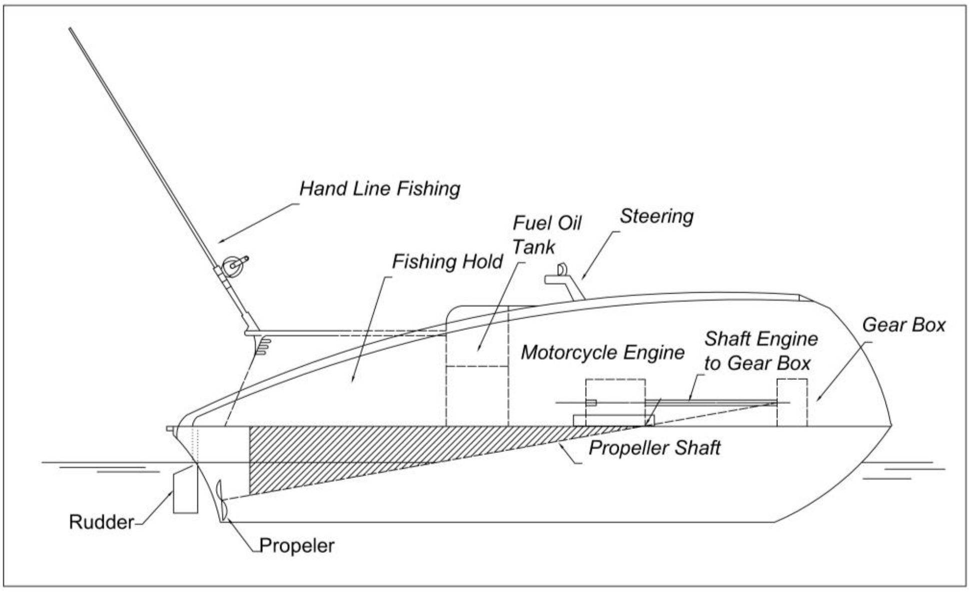

Figure 1. *Catamaran Motorboat* design.

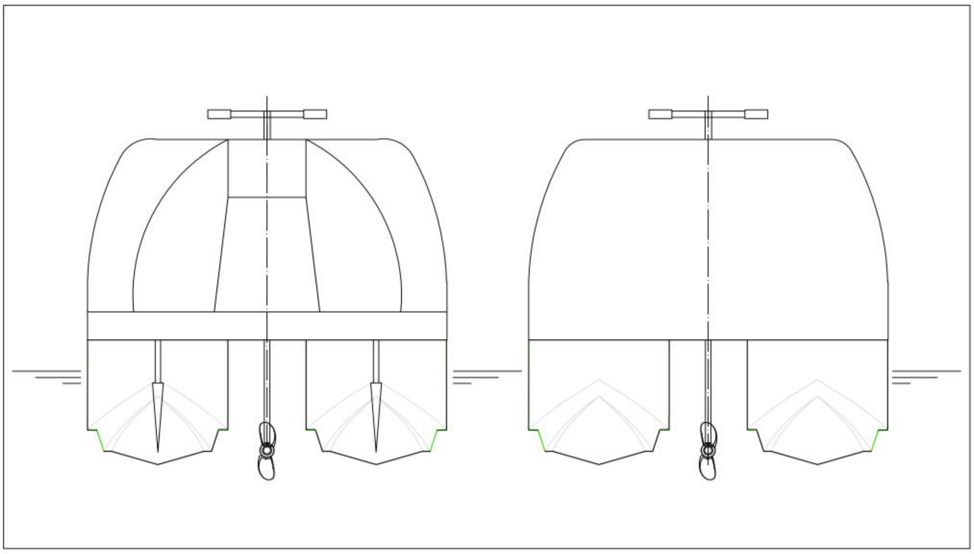

Figure 2. *Catamaran Motorboat* desain from back and front view.

The boat was designed to operate in limited waters (not seas) and for no more than one day of operation. The fuel provided does not exceed the capacity of the motorcycle tank placed between the seats and the steering wheel.

The hydrostatic calculations of ships with 0.25 meter boat load are:

Displacement	: 0.43 ton
Volume (displaced)	: 0.42 m^3
Draft Amidships	: 0.25 m
Immersed depth	: 0.25 m
WL Length	: 2.918 m
Beam max extents on WL	: 1.299 m
Wetted Area	: 4.263 m^2
Max sect. area	: 0.188 m^2
Waterpl. Area	: 2.205 m^2
Prismatic coeff. (Cp)	: 0.769
Block coeff. (Cb)	: 0.444

Based on these hydrostatic calculations, for a boat load of 0.25 meters, the boat's displacement is 0.43 tons. Thus, if the weight of the boat and machinery system is 0.23 tons, then it can be loaded with 0.20 tons which is enough to load two people with fuel and supplies.

3.2. Catamaran Motorboat resistance calculation

According to Lammeren and Vossers [4], ship resistance is influenced by the ship's hull, speed and reynold number. Resistance components consist of friction resistance, wave making resistance and air resistance. The calculation of boat resistance by using the numerical method is by modeling the vessel then calculated by approaching the calculation of resistance with the slender body method. The results of the calculation of resistance are as follows:

Table 1. The relationship between speed and ship resistance.

Velocity (knots)	Resistance (kilo Newton)	Power (HP)
3	0.1	0.532
4	0.2	1.006
5	0.2	1.352
6	0.4	3.031
7	0.5	4.923
8	0.6	6.287
9	0.6	7.148
10	0.6	7.84

By using a 50 % propeller efficiency with a vessel speed of 8 knots, the boat resistance was 0.6 kilo Newton or 6.3 HP. Considering that the model operates in calm waters, while the vessel will be operated in free waters, it is necessary to add 15 % to the vessel's resistance to 7.245 HP. This is needed because the driving engine works only on average 85 % of the Maximum Continuous Rating (0.85 MCR), then there is an additional 15 % resistance to 8.33 HP. Additionally, due to the influence of the gear box and friction on the propulsion system which is around 15 %, the total boat resistance at 8 Knot velocity is 9.58 HP.

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3.3. Selection of motor drive

The selection of the driving engine must take into account reductions to the main engine power was caused by several factors including the efficiency of the hull and propulsion efficiency [5]. The power requirement of the engine to drive the ship at 8 knots is 9.58 HP, so the recalculation for the selected engine specifications are as follows:

1. Brand = Honda
   Type = Vario 150 CC
   Power = 12.6 HP
2. Brand = Yamaha
   Type = Mio 115 CC
   Power = 8.35 HP

Thus, to achieve a minimum speed of 8 knots, the engine used was a motorcyle engine with 12.6 HP power. While an engine with 8.35 HP power will produce a boat speed of less than 8 knots. More precisely, by using a 12.6 HP power engine, the catamaran motorboat will be able to run at a speed of 10 Knots. While using the 8.35 HP engine power, the boat will be able to run at the speed of 7 Knots [6]. Once the machine built, it was placed in the boat (figure 3.).

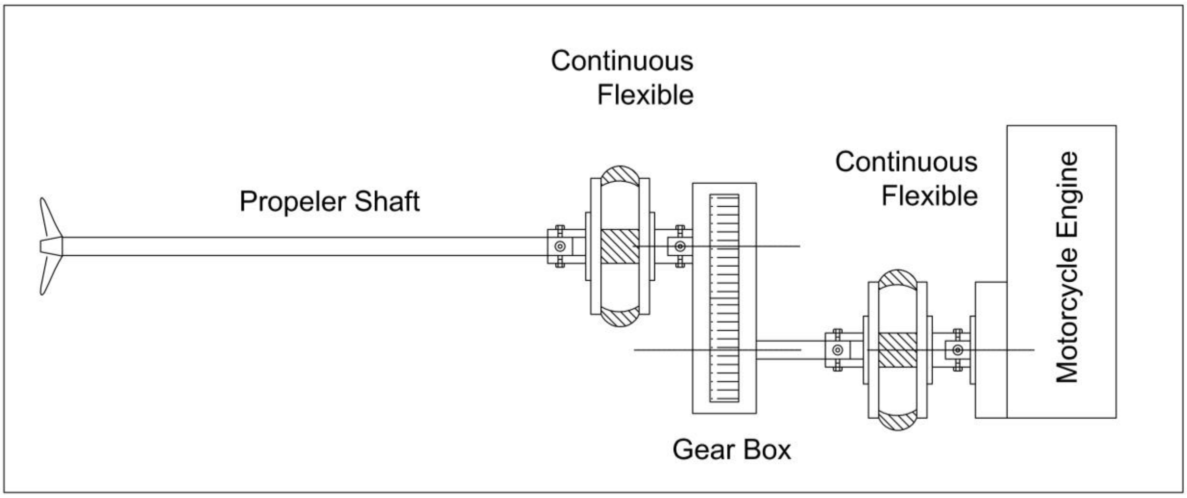

Figure 3. Setting the motor engine as catamaran motor boat driving force.

3.4. *Catamaran Motorboat production*

Overall, the production process can be done on a traditional boat with fairly simple technology. Fiber material was chosen because of its ease of production. The main material needed was 9 mm and 25 mm plywood for mold formation. Laminating materials include resin, mat layer and roving, talc powder, catalyst and pigment dye. The main equipment needed were brushes, cutting machines, and drills. Completely built catamaran motorboat are shown in figure 4 – 7.

Figure 4. *Catamaran Motorboat* (side view).

Figure 5. *Catamaran Motorboat* (back view).

Figure 6. Aperture to engine room.

Figure 7. *Catamaran Motorboat* (front view).

3.5. Sea trial Catamaran Motorboat

Trials were carried out to ensure the catamaran motorboat can operate properly (figure 8.). The sea trial results are as follows:

1. The speed of the boat only reaches 4 knots, less than the planning design that reached 8 knots.
2. When maneuvering the boat for the O test, it is capable to rotate with a diameter of 8 meters.

Figure 8. Trial in pond area

4. Conclusion

The catamaran motor boat with matic motorcycle engine speed only 4 knots as result. The development of design and engine sistems will be continue to get better performance and speed.

5. Reference

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