

Fiberglass Boat Repair Training on Meosbekwan Island, Ayau Islands, Raja Ampat

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Abstract

Meosbekwan Island is one of the outermost islands of Indonesia which is administratively located in the Raja Ampat district. Generally, the Meosbekwan people work as fishermen who use boats less than 12 meters in size as the main means of transportation. Most ships are made of Fiber-reinforced plastic (FRP) or Fiberglass-reinforced Polymer Composite Materials. The condition of the area, surrounded by coral reefs, so that many ships were damaged because they hit the reef. The ship repair process is very difficult, because the condition of the area is far from urban areas. In general, the ship repair process adjusts to the level of damage. On the island of Meosbekwan, the ship's damage to the lower hull was torn and porous. The use of appropriate repair standards, needs to be applied so that the ship provides a sense of security and comfort for users. The procedure for repairing a damaged fiberglass boat consists of removing the outer layer until a solid part is found, then filling the damaged part with a resin-catalyst alloy reinforced with fiberglass Woven Roven 600 and Chopped Strand Mat 450. The number and variety of layers are adjusted by reference. The repair method used is the Hand Lay Up method. During the activity, one of the boats was completed together with the fishing community of Meosbekwan Island.

Keywords : Meosbekwan island, Fiberglass Vessel, Fiberglass Polymer Composite Material.

INTRODUCTION

Community Service, as one of the tridarma of higher education, is a medium for educational institutions to implement and apply knowledge in their respective fields to the community. The higher education forum in the Sorong Raya area (DIKTISORAYA) organizes Community Service activities by establishing cooperation and sharing knowledge in the fields of fishing, machinery and processing with fishing communities in the Ayau Islands. The problems faced by the community are expected to be given concrete solutions through community service activities.

The Ayau Archipelago District consists of five islands, Abidon, Meosbekwan, Reni, and Rutum. On this occasion, community service activities, were carried out in the village of Meosbekwan. In general, the geographical location of Meosbekwan Island is at coordinates 0.4° 07' 04.9" South Latitude -131° 14' 04.57" East Longitude, is a small island with an area of 203,293 m² with an altitude of <3 meters above sea level. Meosbekwan Island is known for its potential marine resources in the waters area in the form of clusters of coral reefs which are located close to the coastline (about 2 miles). This cluster of coral reefs surrounds a small island, which is only about 1.2 km². With this cluster of coral reefs, the waters of Meosbekwan are rich in various types of fish corals, such as napoleons and groupers (Widayatun, 2002). Therefore, Meosbekwan Island is one of the coral reef tourism destinations. In addition, in these waters, you can find over 200 species of fish and around 122 types of coral reefs. In addition, these islands are found on the white sandy beach (sandy beaches) which is a nesting habitat for various species of sea turtles (Farid and Sryadi, 2001). Figures 1a and 1b show pictures of the

Ayau Islands and Meosbekwan Islands, respectively. With this geographical location, Meosbekwan Island has the availability of coastal and marine ecosystems that can support the local economy of the island community.

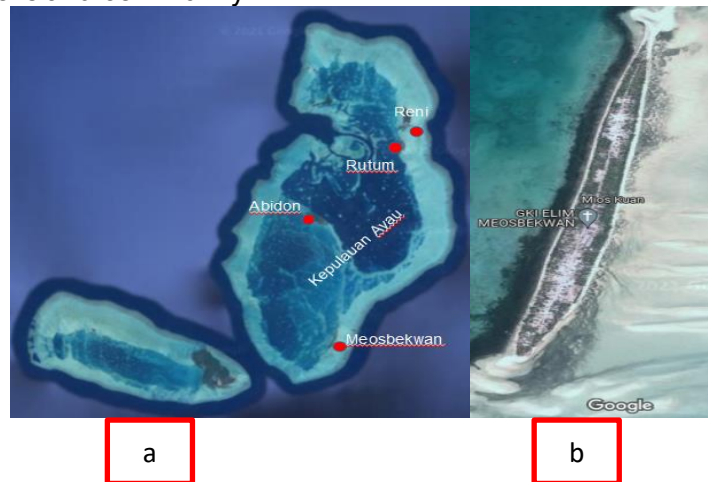


Figure 1. (a) Ayau Archipelago; and (b) Meosbekwan Island (map: google map)

Furthermore, as is the case with those on Bintan Island, Riau Archipelago Province (Jocom, 2022), most of the people of Meosbekwan Island depend on marine resources to meet their daily needs (Widayatun, 2002). To support the improvement of the local economy of the island community, the surrounding community utilizes a mode of transportation in the form of boats less than 12 m. Most of these ships are made from fiberglass-reinforced polymer composite materials. This material is very suitable if applied to ship less than 12 m. In the marine and fishery industry, composite materials made from fiber reinforcement, such as fiberglass, have proven to be very special and favorite in boat construction because they have the advantages of being chemically inert (both applied in general and marine environments), lightweight, potent, easy to print, and inexpensive. compete (Rezza, 2020-1).

Furthermore, the Ayau Islands are overgrown with coral reefs, including on the island of Meosbekwan. A large number of coral reefs, in fact, also harm the surrounding community, where many fishing boats are damaged due to accidentally crashing into coral reefs. As a result, many community vessels were unable to operate. With the location of the area far from the ship repair site and the lack of ship repair facilities, many community ships were left alone. To help the surrounding community in repairing ships, it is necessary to have concerns from several parties. In this case, Higher Education has the responsibility to contribute directly to reinforce the application of Science and Technology, as well as research-based social engineering. The contribution made by universities in the form of downstream research results will provide quality and quantity of fiber vessels. Especially for the people of the island of Meosbekwan.

In the Community Service program, fiberglass boat repairs have been done in many areas, including Bengkalis Waters (P. Pardi, 2017) and Bantaeng Regency (W. Mustafa, 2018). Previously, the most used wood as a material for shipbuilding. Finally, the availability of wood materials dwindled, and shipbuilding turned to fiber materials. In addition, the depreciation and maintenance costs incurred by wooden ships are also greater when compared to fiberglass ships (Anwar, 2012).

Then the material used in the manufacture or repair of ships is a composite material. Composite materials that have been extensively discussing in modern materials science are generally in the form of fiber, sheet, and particle-reinforced, or self-reinforcing polymer matrices, ceramic matrices, or metal matrix composites (R.-M. Wang, 2011). The use of composite materials is growing day by day. This is because of the specific strength they have. Figure 2.

shows the development use of composite materials based on characteristic strength. The use of fiberglass composite materials has long been introduced at the 1930s modern composites in the form of glass fiber reinforced resin FRP (Fibre-reinforced plastic) there was introduced. Ships and planes are made from this glass composite, commonly called fiberglass. Since the 1970s, the application of composites has increased widely due to the development of new fibers such as carbon, boron, and aramid and new composite systems with matrices made of metals and ceramics (A. K. Kaw, 2006).

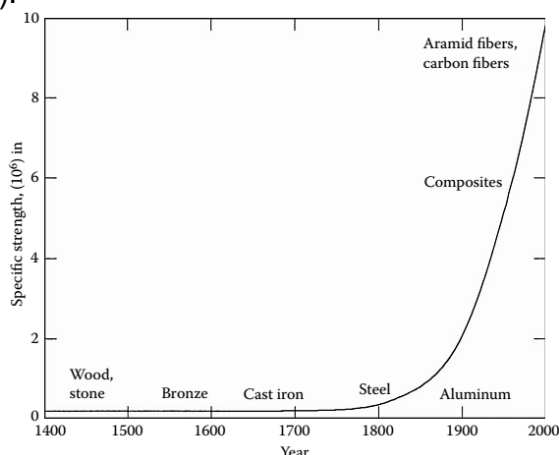


Figure 2. The development of the use of composite materials based on specific strength

Then in carrying out ship repair planning, first know the ship construction design. That is important because, in the construction, there are differences in the amount of coating in the manufacture. There are differences based on field applications. The design of the ship can be from two sides, the longitudinal construction and the transverse construction. Figures 3a and 3b show details of the longitudinal and transverse design, respectively.

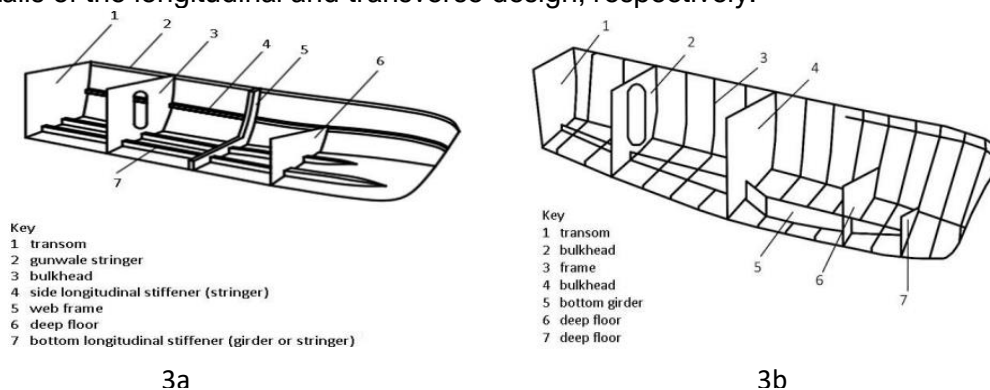


Figure 3. (a) Longitudinal Construction and (b) Transverse Construction (photo: BKI 2020)

In fabricating or repairing fiberglass boats, it is necessary to pay attention to the lamination technique. If constructed with poor laminating, the laminate may still look good on the surface but will result in poor quality and up to half the life of the ship or even less. Conversely, if the lamination technique is correct, it will produce good quality (Anmarkrud, 2009) (McVeagh, 2010). There are two methods for repairing ships made from FRP (Fibre-reinforced plastic), namely the Hand Lay Up and Casting methods. The Hand Lay Up method is a manual fiber lamination process, which is the first method of making composites. The Hand Lay Up method is more emphasized for making products that are simple and only require one side to have a smooth surface.

Based on the evidence in the field, Community Service activities as one of the three pillars of higher education. It is a medium for educational institutions to implement and apply knowledge in their respective fields to society. The higher education forum in the Sorong Raya area (DIKTISORAYA) organizes community service activities on the island of Meosbekwan. The

Community Service Program is in the form of repairing boats made of fiberglass on the island. This activity is expected to provide enrichment of knowledge and technical work methods for repairing boats made of fiberglass for fishing communities on Meosbekwan Island.

METHOD

Time and Place

Community Service activities, with the topic of fiberglass boat repair training for fishing communities on Meosbekwan Island, Raja Ampat were carried out on October 11, 2021. The activities, were carried out by an integrated team at the DIKTISORAYA forum through the provision of materials and fiberglass boat repair practices carried out on Meosbekwan Island.

Tools and Materials

Equipment and materials used in this activity include; Chopped Strand Mat 450 (CSM 450); Woven Roving 600 (WR 600); Yukalac resin 157; catalyst; aerosil; Talc Powder; Wax; advanced; Dipper; Capi; sandpaper; cloth gloves; Face mask; thinners; Cutting Grinding Wheels; ruler; and Brush. Figure 4. shows pictures of the tools and materials used in activities on the island of Meosbekwan. Then the theoretical material given to the participants, namely the introduction of tools and materials and various methods of repairing fiberglass boats and the results that have been carried out by several industries that have implemented these methods. The practice of introducing fiberglass boat repairs technically involves presenters (lecturers) from the DIKTISORAYA forum and cadets from the Fisheries Mechanization study program.

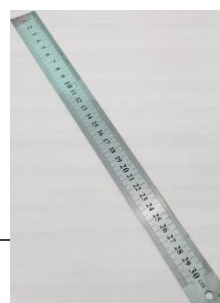


Figure 4. Pictures of tools and materials used
Stages of Activity Implementation

In Community Service activities, the ship repair method used is the Hand Lay Up method. This method is a method commonly used in repairing fiberglass boats. In this activity, the community is taught to practice this patching technique correctly. The communities are allowed to learn to use this technique. Figure 5. shows the flowchart of ship repair training using the Hand Lay Up method.

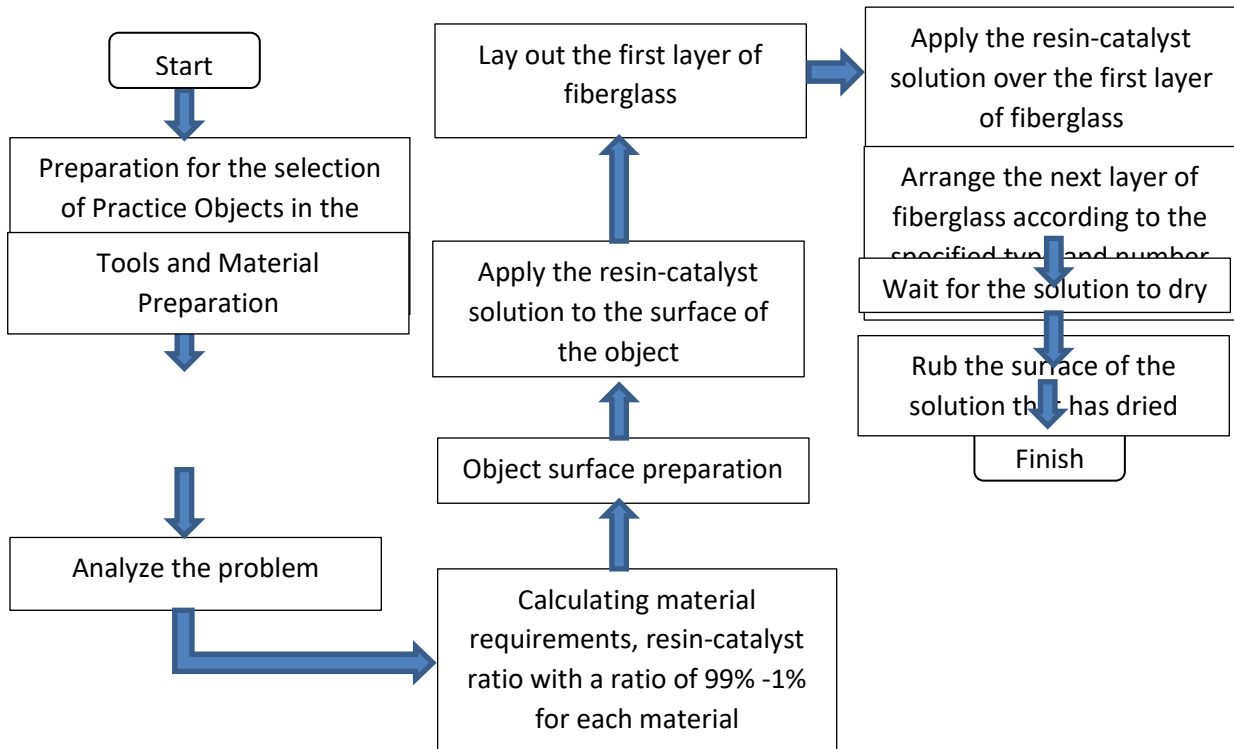


Figure 5. Ship repair process flowchart using the Hand Lay Up method

The most important thing is to see the problem at hand first. In this activity, the cases encountered were on the right and left lower hull. The right lower hull suffered severe damage, namely experiencing a hole in the loss of material. The lower left hull only experienced a slight scratch. Figures 6a and 6b show the process of opening the outermost layer of material that was badly damaged on the right lower hull and left lower hull, respectively.



Figure 6. a) Damage to the right lower hull; b) Damage to the left lower hull

Then for the number and arrangement of laminations used in the implementation of Community Service (PkM) on Meosbekwan Island, there is a difference in the number and lamination layout based on the level of damage to the ship handled. When viewed from the case, the lower left hull suffered pretty bad damage compared to the right lower hull. Based on this case, for the lower left hull, get the number and arrangement of laminations as much as five. As for the right lower hull, the number and lamination layout are four. The number and lamination layout has four and five layers, as shown in Tables 1 and 2 (Rezza, 2020-2).

Table 1. Laminate arrangement of four layers of fiberglass reinforced composite material

No.	Description	Laminate Arrangement
1.	Orde	
	Lamination:	
	Lamination 1	CSM 45
	Lamination 2	CSM 450
	Lamination 3	WR 600
	Lamination 4	CSM 450

Table 2. Laminate arrangement of five layers of fiberglass-reinforced composite material

No.	Description	Laminate Arrangement
1.	Orde	
	Lamination:	
	Lamination 1	CSM 45
	Lamination 2	CSM 450
	Lamination 3	WR 600
	Lamination 4	CSM 450
	Lamination 5	CSM 450

RESULTS AND DISCUSSION

Community Service activities in the village of Moesbekwan began with a trip to the Moesbekwan village using a fiberglass boat made by the Sorong Maritime and Fisheries Polytechnic. The journey to the villages takes approximately thirty minutes. The travel time is quite long because the island of Meosbekwan is surrounded by major coral reefs. Therefore, to be able to pass through. It the ship must find a way to avoid coral reefs. Figure 7. shows the team's preparations for heading to Meosbekwan village.



Figure 7. Preparation for the Community Service location in Meosbekwan village

Arriving at the village of Meosbekwan, all the teams arranged the location of the activities. The opening activity began with remarks from the head of the Community Service activity, followed by an introductory session from each team. After that, proceed with the division of groups. On this occasion, the theme of the activities carried out was fiberglass boat repair. This fiberglass boat repair activity aims to socialize ways or methods of repairing damaged fiberglass boats due to accidentally hitting rocks and the materials used. At the initial opportunity of the action, fiberglass boat repair activities began by socializing the methods and materials to the surrounding community. Figure 8. shows the socialization of methods and materials in repairing fiberglass boats to the people of the Meosbekwan village.



Figure 8. Socialization activities on methods and materials in repairing fiberglass boats

After completing these activities, practical activities continued with repairing fiberglass boats. Figure 9. shows the process In the repair stage, starting with measuring the area of damage and marking it so that it is more effective and efficient in using materials. Then, the damaged layer is scraped using a grinder so that patch, the damaged part is not left behind. After that, rub the surface using sandpaper to make it easy to patch. Cut the fiberglass material and measure the resin catalyst as needed. Then, Patch the damaged part and wait for it to dry. After that, do caulking to produce a neat surface. In this opportunity, the caulking process could not done because the putty material was behind on Campus.



Figure 9. Fiberglass boat repair process; a) Measuring the area of damage; b) Looking for a hard surface; c) File the damaged surface; d) Measuring material requirements; e) Mixing ingredients; and e) Patching process

The repair results show that the patch material sticks well. Figure 10 shows the results of fiberglass boat patches. It appears that the patch results are perfectly covered. The results of these patches should be followed by a caulking process to produce a neater and denser surface. On this occasion, Community Service activities in Meosbekwan village only improved. The number of layers of material is also strong enough to withstand the blows of seawater. However, in that case, it should be followed by repairs to the inside of the ship. It is because, in this case, the damage to the boat was very serious. So it needs to be strengthened with deep patches. And for the process of repairing the inside of the boat on this occasion has not been carried out due to the limited time given. Therefore, on this occasion, only external patching was carried out.



Figure 10. Results of fiberglass boat patches

After Tim completed the repairs, they continued a group photo session and distribution of materials to the surrounding community. Figure 11. shows a group photo session and distribution of practice materials. After the fiberglass boat repair activity, and served lunch with the local community. The luncheon was done specially, with big skipjack tuna served to the team.



a



b

Figure 11. a) group photo session; and b) distribution of practical materials

Then the activity was closed by filling out the activity satisfaction survey. The team really hopes that this activity will benefit the local community. Figure 12. shows results of a survey on satisfaction with community service activities on the island of Meosbekwan, Ayau Archipelago.

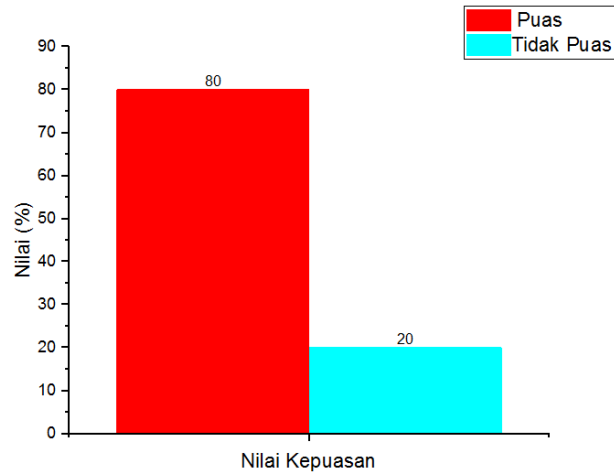


Figure 12. Results of a survey on satisfaction with community service activities on the island of Meosbekwan, Ayau Archipelago.

The survey results show that, during Community Service activities on the island of Meosbekwan, Kep. Ayau gives satisfaction to the surrounding community because the community is helpful by the knowledge provided about ship patching techniques using the Hand Lay Up method. What's more, the team from DIKTISORAYA was the first to stop by the island to conduct in-person training. Some people are dissatisfied with this activity because the time given is insufficient. The remaining time will later be used by the community to consult directly with lecturers and instructors to maximize fiberglass ship repair training activities.

CONCLUSIONS AND RECOMMENDATIONS

All activities went well and were according to plan. The community enthusiastically participated in this activity, from greeting to closing. According to the community, for the first time, the Hand Lay Up method was known by the surrounding community. This method is commonly used on ships made of FRP (Fibre-reinforced plastic). The provision of training is very appropriate because previously, if the boat was damaged, the ship was left just like that until the ship was completely damaged. This activity is also very appropriate, and the DIKTISORAYA team is the first group to organize activities for the surrounding community. They hope that this activity will continue so that it can be beneficial to the surrounding community.

Then based on the survey conducted, the time given by the coordinator of the DIKTISORAYA team was lacking, so there was a ship missed repair process. The community hopes. In the future, they will give additional time so that activities can run well again.

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