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Design of Phinisi Tourism for IKN-Balikpapan Bay Route

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Abstract

Balikpapan Bay connects Balikpapan City to the new capital city of the Republic of Indonesia (IKN). Currently, many community activities in Balikpapan Bay include crossing, loading, unloading, and fishing activities. Balikpapan Bay also offers an unforgettable water tourism experience with many intriguing attractions for all ages, such as water slides and diving. IKN is utilized in the development of marine transportation to create marine tourism potential in Balikpapan Bay. The purpose of this research project was to build a tourist phinisi ship that allows tourists from within and outside the country to spend their free time on board and enjoy the splendor of Balikpapan City and IKN with a cultural concept. Phinisi will be equipped with lodges, museums, cafes, and restaurants, depending on the design of the boat. The research stages included designing a general arrangement that produces data in the form of main dimensions, hull form coefficients, line plans, general arrangements, 3D designs, and interior rooms. A parentship approach was used in this study. The main dimensions obtained in concept design of Phinisi; loa = 55 m, B = 9 m, H = 5 m, T = 3.5 m, Vs = 9 Knots, Crew 11 people, passengers = 15 people. The Phinisi cultural concept provides a different approach to getting to know the local wisdom.

Keywords: Balikpapan Bay; Phinisi; Tourism; Parentship approach; IKN

1. INTRODUCTION

The Indonesian Capital City (IKN) was built not only to move the center of state administration but also with a greater goal of equitable development and economy. The development of IKN considers various sectors that can drive the regional economy, including tourism. We expect IKN to become the primary destination for tourists seeking a unique maritime experience; thanks to the provision of sea transportation services. In addition, it will make a significant contribution to local economic development and preservation of maritime cultural heritage. Comfortable accommodation options, access to the Kalimantan Cultural Museum, and the opportunity to enjoy the beauty of Balikpapan Bay are needed.

Balikpapan Bay is one of the places in East Kalimantan with many natural wealth potentials [1]. They are home to freshwater dolphins, which play an important role in the local food chain. Dolphin populations in Balikpapan Bay are threatened by various industrial activities. On the one hand, Balikpapan Bay offers interesting water tourism for all ages, such as water slides and diving, in addition to the dolphin tourism. In addition, IKN can be utilized by marine transportation developers to create marine tourism potential in Balikpapan Bay. Several tourism facilities have been provided, such as Phinisi, which is relatively small in shape and size. This Phinisi serves the Balikpapan Bay-Balang Island Bridge and Nusantara (IKN) shipping route on a round-trip basis. The fleet serves 40-60 passengers, including the crew of the ship. Several ship facilities are offered, such as bedrooms, cafeterias, and prayer rooms located on decks 1, 2, and 3 of the boat.

Referring to the regulations of tourist ships in Indonesia [2-5], namely, creating a safe and enjoyable tourist experience for tourists, the ship's facilities can still be developed to provide comfort for local and foreign tourists. Phinisi was chosen because it is a Motor Sailing Ship (KLM) of the cultural heritage of the archipelago. Phinisi operating in IKN can function as an icon and strengthen national identity. In addition, Phinisi is driven by engines and sails. This is in line with the vision of the capital city of Indonesia as a green city that shows the identity and diversity of Indonesia [6].

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The specific objectives of this study were to produce data in the form of main dimensions, hull form coefficients, lines plans, general arrangements, 3D designs, interior spaces, and scaled ship models. The urgency of this research is at an important and urgent level because the fleet currently available requires the development of comfort and safety services; therefore, it is necessary to design a Phinisi with comfortable accommodation, access to the Kalimantan cultural museum, and the opportunity to enjoy the beauty of Balikpapan Bay and accommodate the safety of sailing passengers and crew [7].

Various biota, including fish, algae, crustaceans, mollusks, ostracods, pteropods, foraminifera, and coral reefs, are found in the waters of Balikpapan Bay. Fish need coral reefs as an important part of their environment because they provide a place to eat and reproduce by laying eggs [8]. Coral reefs in Balikpapan Bay, are vulnerable to extinction. Data collected by the Kalimantan Coastal Foundation (Peka) show that the damage to coral reefs in Balikpapan Bay is very severe. As it is located in a closed bay, the coral reef in Balikpapan Bay is the most unique coral reef in Indonesia. The level of damage to coral reefs in Balikpapan Bay was recorded to be very severe. The coral reefs in this area are some of the most unique in Indonesia because of their relatively protected locations in bay waters [9].

As a supporting city for IKN, Balikpapan City has promising marine tourism potential because of the beauty of the coral reefs and rows of white sand on the beach. Balikpapan Bay is popular tourist destination. Other tourist locations include Lamaru Beach, Benua Patra Beach, Manggar Segarsari Beach, Kemala Beach, Melawai Beach, and jet skis [10].

One type of tourist ship suitable for the waters of Kalimantan is the water bus [11-13]. In addition, traditional ships are still being used from generation to generation, one of which is phinisi. A classic Indonesian sailing ship with many sails, twin masts, a wooden hull, and a long, graceful bridge, uniting the past and present. Even today, many people use Phinisi, a masterpiece of Indonesian culture, and a typical traditional ship. The production of study and durable Phinisi began in the 18th century [14].

Adequate transportation is very important in the context of tourism, as it offers many advantages and enormous potential. Phinisi vehicles are used in marine tourism. The ship rented by its owner for tourism purposes can accommodate eight 20 passengers, making it suitable for travelers who want to see the natural beauty of the ocean in various locations. Traditional Phinisi currently have difficulty transporting commodities, because they are no longer able to compete efficiently. Initially intended to transport commodities, the use of ships in this capacity was gradually discontinued because of the low profits obtained. Thus, the conversion of Phinisi is more profitable [14].

Phinisi ship was chosen because it is a Motor Sailing Ship (KLM) of the cultural heritage of the archipelago. Phinisi operating in IKN and Balikpapan Bay can function as one of the icons and strengthen national identity. In addition, Phinisi is driven by engines and sails. This is in line with the vision of the capital city of Indonesia as a green city that shows the identity and diversity of Indonesia [15]. The advantages of the planned Phinisi over the existing Phinisi are that it has comfortable accommodation, access to the Kalimantan cultural museum is fulfilled because the ship's design adopts the concept of cultural tourism, and adequate safety and security so that passengers feel safer. The shape of the Phinisi hull is as follows [16-18].

The ship design research that we propose is of the phinisi type with a single hull and uses a parentship method that has not been carried out in previous research. In addition, the proposed design adopts ergonomic principles so that the crew and passengers feel safe and comfortable using the ship [19]. The Phinisi cultural concept provides a different approach to getting to know the local wisdom.

2. METHODS

In the world of ship design, the most widely and very popular spiral design is used. This method describes a calculation that is carried out repeatedly, starting with the needs submitted by the owner and then continuing to calculate and adjust the power, line planning, and other steps. This is because the initial assumptions prepared based on the owner's wishes cannot be fully implemented before all the possible solutions are explored. Therefore, this process requires the involvement of experienced designers to ensure optimal results, starting from the owner's request and continuing to calculate and adjust power, line planning, and other steps. This is because the initial assumptions prepared based on the owner's request cannot be fully implemented before all the possible solutions are explored. Therefore, this process requires experienced designers to ensure optimal results. The spiral design stages can be described as follows.

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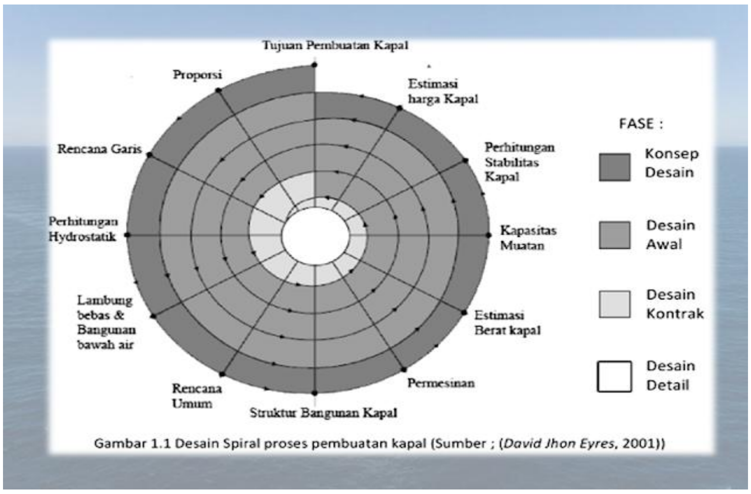

Gambar 1. Spiral Design on ship design proccess [20]

One of the key elements in the spiral design model is that, with each turn of the cycle, the number of available design options increases, increasing the level of complexity. The initial design stage begins with defining the purpose of the ship and the criteria expected by the owner, as shown in Figure 1. Next, the designer can compile a matrix that includes hundreds of design variations with various combinations of the length, width, draft, height, speed, and hull shape characteristics. The research method used was the parentship approach [21-25]. Stability aspects are also considered for safety during sailing [26]. Similarly, the distribution and position of the load [27] affect the load shift [28]. The parent- ship approach method uses one type of ship as the initial data. Furthermore, the main dimensions are modified according to needs by considering the design constraints for certain types and functions of the ship. This method minimizes design errors because it uses a comparison vessel that is already operational and technically feasible.

3. RESULTS AND DISCUSSION

3.1. Determine of Main Dimension of Phinisi

In this study, the phinisi "Fenides" operating in the watersways of Labuan Bajo was used as a parent ship.

Table 1. Particular of Phinisi Fenides

No	Item	Value	Units
1	LOA	41	meters
2	B	7.7	meters
3	T	2	meters
4	Vs	9	knots
5	Crew	22	people

Table 2. Particular of Phinisi Design

No	Item	Value	Units
1	LOA	55	meters
2	B	9	meters
3	T	3.5	meters
4	H	5	meters
5	Vs	9	knots
6	Crew	26	people

Table 3. Ratio and constrain of particular of Phinisi Design

No	Ratio	Value	Status
1	L/B	5	Acceptable for ship motion & velocity
2	L/H	9	Acceptable for longitudinal strength, resintance, and manouvering
3	B/H	1.8	Acceptable for Intac stability and damage stability

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No	Ratio	Value	Status
4	B/T	2.57	Acceptable for ship stability, resintance, and manouvering

To calculate the Froude Number (Fn), the following formula is used:

$$Fn = \frac{Vs}{\sqrt{g}.L} \quad (1)$$

where,
Fn = *Froud Number*
Vs = velocity (m/s)
g = acceleration (9.81 m/s^2)
L = length of waterline (m)

So, the Froude Number Phinisi value is 0.448.

Based on the obtained Froude number value, the next step was to calculate the ship coefficients. These coefficients included the block coefficient (Cb), midship coefficient (Cm), waterplane coefficient (Cwp), prismatic coefficient (Cp), volume displacement (∇), and displacement (Δ). The calculation of the coefficients contained in the Parametric Design book is as follows:

a. *Block coefficient* (Cb)

$$CB = -4.22 + 27.8\sqrt{Fn} - 39.1\ Fn + 46.6\ Fn^3 \quad (2)$$
$$= 0.562$$

b. *midship coefficient* (Cm)

$$Cm = 1.006 - 0.0056\ Cb\text{^}{-3.56} \quad (3)$$
$$= 0.86$$

c. *waterplan coefficient* (Cwp)

$$Cwp = Cb / (0.471 + 0.551\ Cb) \quad (4)$$
$$= 0.822$$

d. *prismatic coefficient* (Cp)

$$Cp = Cb/Cm \quad (5)$$
$$= 0.664$$

e. *volume displacement* (∇)

$$\nabla = L \times B \times T \times Cb \quad (6)$$
$$= 678.990\ m^3$$

f. *displacement* (Δ)

$$\Delta = \nabla \times 1.025 \quad (7)$$
$$= 696 \quad ton$$

3.2. Modeling of Phinisi Hull

The projection pattern of the body of the ship includes various cuts, such as a cross-section of the body of the ship (body plan), a longitudinal cut of the front or rear of the ship (sheer plan), a cut of the right or left side of the ship, and a horizontal cut of the ship's body at the waterline (half- breadth plan). The B-Spiline software was used to design the line plan. The following are the steps in creating a line plan using B-Spiline software:

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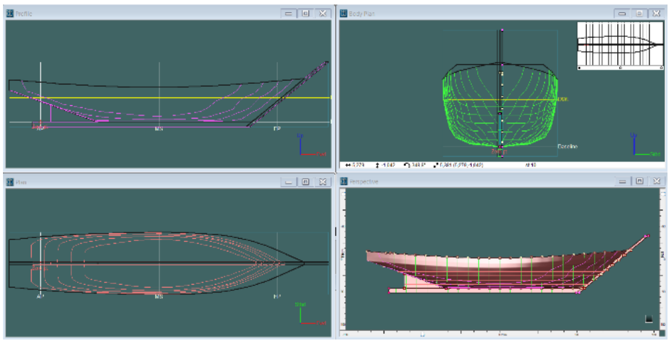

Figure 2. Phinisi hull of Design on Software B-Spiline Application

Figure 2 is then exported to a 2D CAD application so that it can be used as a reference for arranging the rooms and compartments planned for the Phinisi.

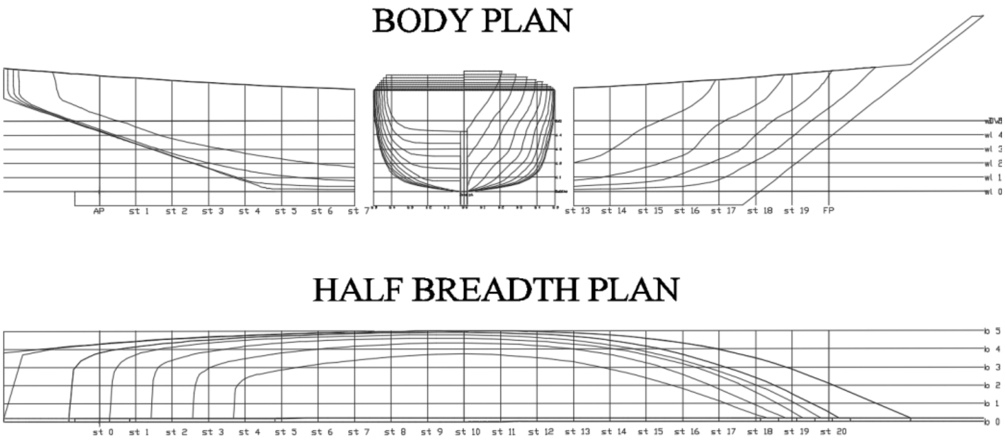

Figure 3. Lines plan of Phinisi

3.3. Ship Stability Analysis

The ship stability was calculated using the B-Spline Stability Enterprise software. The stability criteria applied are the criteria for the general category ships based on the IMO A.749(18) Chapter 3. Selecting several load case scenarios when phinisi is operating, namely; 1. When departing from the port with 100% full consumables; a 2. When traveling one-third of the route with 75% consumables, 3. When traveling on half the route with 50% consumables; 4. When arriving at the destination (arrival) with 10% consumables, the results of the phinisi stability data analysis are as follows:

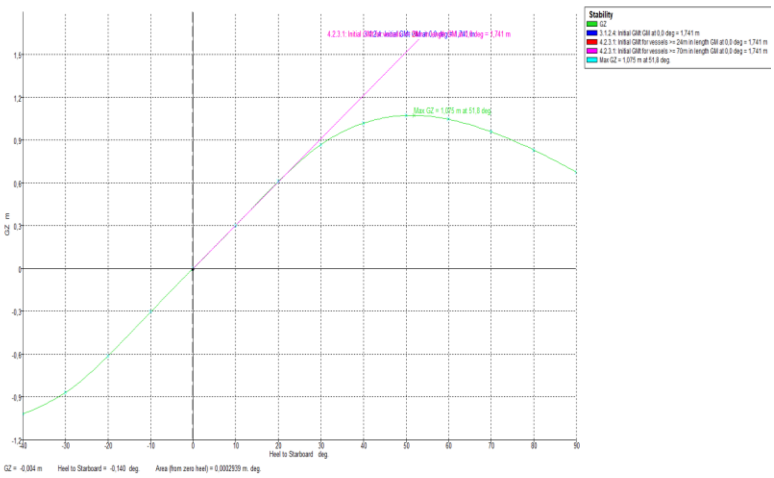

Figure 4. GZ curve of Phinisi

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Table 4. Loadcase scenario of Phinisi Design

GZ curve of Phinisi											
Loadcase operation	Area of under GZ $curve_{actual}$			Area of under GZ $curve_{IMO}$			GZ max. actual	GZ max. IMO	GM_{actual}	GM_{IMO}	status
	0-30	0-40	30-40	0-30	0-40	30-40					
	meters. radian						degree		meters		
100%	0.23	0.40	0.16	0.055	0.09	0.03	51.8	25	1.74	0.15	accept
75%	0.23	0.40	0.16	0.055	0.09	0.03	51.8	25	1.72	0.15	accept
50%	0.23	0.40	0.16	0.055	0.09	0.03	50.9	25	1.71	0.15	accept
10%	0.23	0.40	0.16	0.055	0.09	0.03	50.9	25	1.69	0.15	accept

3.4. Design of General Arragement of Phinisi and Calculating of Tonnage

The general plan of Phinisi includes an engine room, an accommodation room, and a cargo room. The main rooms are placed by considering their position in relation to the hull and superstructure, including the cargo room, engine room, room for crew and passengers, tanks (fuel, ballast, fresh water, etc.), and other rooms. At the same time, other important needs must also be considered, such as watertight bulkheads for each room, adequate stability, structure/construction, and provision of sufficient access. The general plan is gradually made through trials, tests, and adjustments to the appropriate space or size. The arrangement and placement of the space can refer to ships that have been built or operated with features similar to those of the design of the ship.

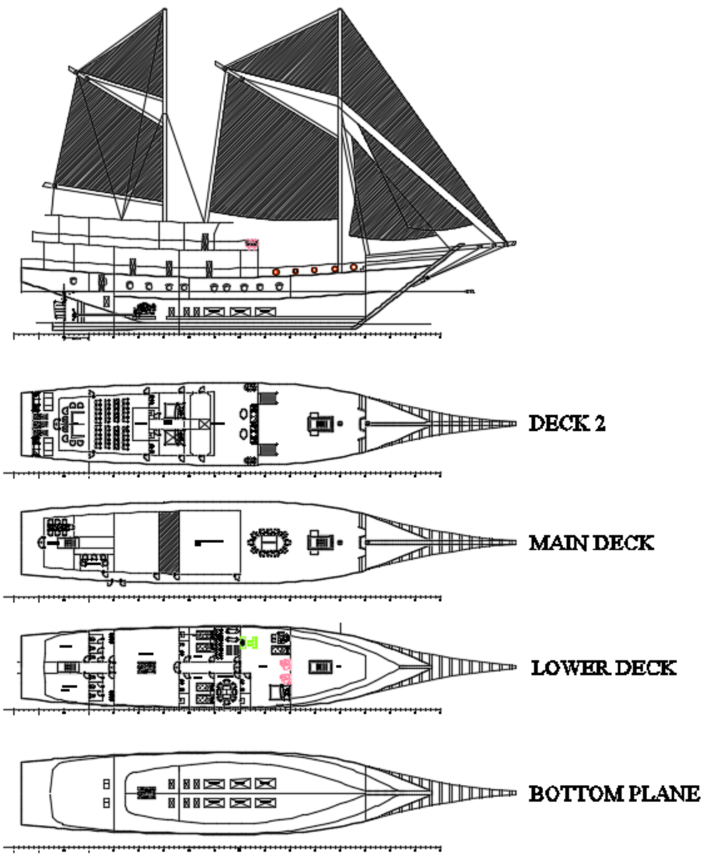

Figure 5. General arrangement of Phinisi

Figure 5 shows the layout of the compartments on each deck and the space of the Phinisi. The resistance and engine power were calculated through a ship model simulation using Maxsurf Resistance software, with a maximum speed of 10 knots in the test. The Wyman method was applied in this simulation, assuming an efficiency of 100%. The simulation results are as follows:

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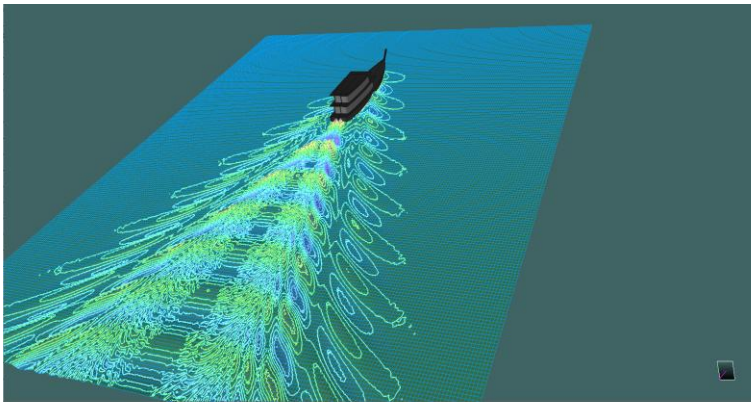

Figure 6. Calculate of Resistance total of Phinisi

Figure 6 shows the fluid flow interacting with the phinisi body, which provides flow pattern information with a numerical approach. The simulation results in Maxsurf Resistance show that at a service speed of 9 knots, the required power is 585.66 kW. After a correction for the local shipping area (inland waterway) of 15%, which results in an additional power of 87.85 kW, the total required engine power becomes 673.51 kW. To meet this requirement, the main engine specifications used for Phinisi are as follows.

Figure 7. Main engine of Phinisi

Table 5. Sprcification of main engine of Phinisi

No	item	value	units
1	powering	749	kW
2	length	3091	mm
3	Breadth	1305	mm
4	Depth	1882	mm
5	Dry mass	3880	kg
6	type	YANMAR 6EY17KW	

The Phinisi general plan describes the estimated weight information, which is divided into two, namely, LWT and DWT, as shown in Tables 6 and 7 below.

Table 6. Breakdown weight of DWT of Phinisi

No	Total weight of DWT		
	Item	Value	Unit
1	weight crew & provision	5.5	Tons
2	weight of Fresh Water	0.723	Tons
3	weight of Fuel Oil	10	Tons
4	weight passenger & provision	2.2	Tons
5	weight of lubricant oil	0.440	Tons
Total		18.863	Tons

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Table 7. Breakdown weight of LWT of Phinisi

No	Total weight of LWT		
	Item LWT	value	unit
1	Hull weight	483.234	tons
2	deck weight	47.98	tons
3	Anchor	1.32	tons
4	Navigation equipment	0.1	tons
5	lifejackets	0.024	tons
6	lifebouy	0.007	tons
7	Construction estim.	137.057	tons
10	machinery system	3.88	tons
11	generator	2.88	tons
Total		676.482	tons

The tonnage value, or total volume, of the watertight enclosed space of the ship, including the spaces above and below the main deck. Calculated based on the government regulation of the Minister of Transportation Number PM 8 of 2013 concerning the method of measuring domestic ships.
Calculation of enclosed space above deck (V1) and enclosed space below main deck (V2):

Deck 1
Area = $182\ m^2$
Depth = 3 m
Volume = $700\ m^3$

Deck 2
Area = $145.15\ m^2$
Depth = 3 m
Volume = $499.87\ m^3$

$$V1 = V\ deck\ 1 + V\ deck\ 2 = 700 + 499.87 = 1199.87\ m^3 \quad (8)$$

$$V2 = L \times B \times H \times f = 40.1 \times 9 \times 5 \times 0.5 = 902.94\ m^3 \quad (9)$$

The total volume of the enclosed space above the main deck is V1 = $1199.87\ m^3$, whereas the volume of the enclosed space below the main deck reaches V2 = $902.94\ m^3$.

$$GT = 0.25 \times V \quad (10)$$

where

$$V = V1 + V2 \quad (11)$$

and than,

$$GT = 0.25 \times V = 526 \approx GT$$

$$NT = 0.30 \times GT = 0.30 \times 526 = 158 \approx NT \quad (12)$$

3.5. Design 3D of Phinisi

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Here is the result of the three-dimensional modeling of a Phinisi complete with several rooms and compartments that are typical of Kalimantan culture. The basic concept was inspired by the general plan design of Phinisi. A 3D image is shoween in Figure 8-13.

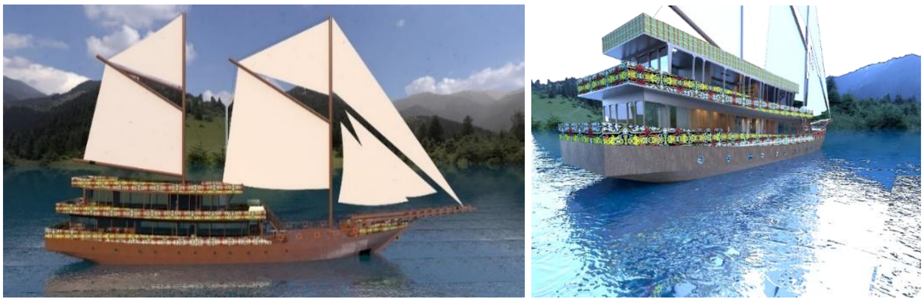

Figure 8. 3D of over all of Phinisi

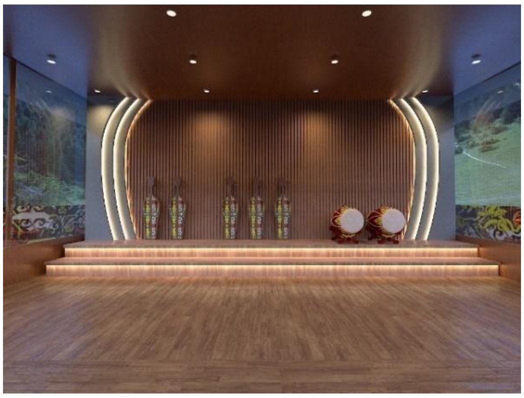

Figure 9. 3D of Borneo Musical Instruments Room of Phinisi

Figure 9 show in The Borneo Musical Instruments Room was located on the main deck. With a room area of 45,941.2 m². This fairly large room provides comfort for tourists to see traditional musical instruments originating in Kalimantan. One of the facilities provided is a musical instrument called "sampe."

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Figure 10. 3D of Kalimantan Cultural Exhibition Room of Phinisi

Figure 10 show in The Cultural Exhibition Room has an area of 32,673.8 m², located on the main deck. The room was designed with the aim of tourists getting to know more about Kalimantan culture, such as traditional weapons, shields, and paintings.

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Figure 11. 3D of Mini theatre Room of Phinisi

Figure present of the mini theater room was designed with an area of 42,4872 m² located on the second deck. The room is intended for staging films or traditional cultural arts performances so that tourists can better understand the Kalimantan culture.

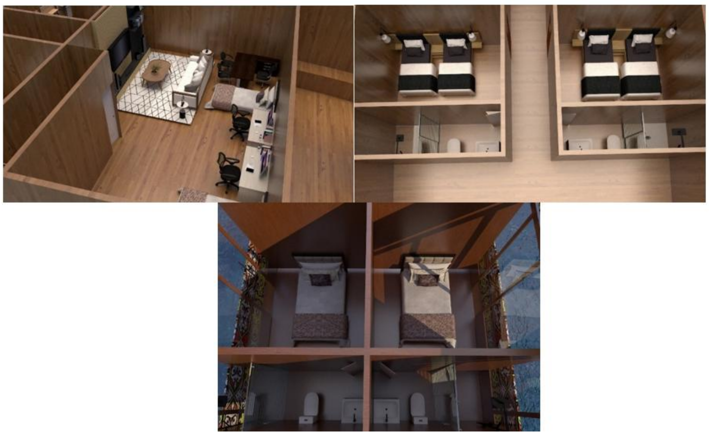

Figure 12. 3D of Cabin/sleeping Room of Phinisi

Figure 12 present of Cabin rooms are distributed in several deck sections, such as the lower and second decks. The size was adjusted to its class, which was designed to be as comfortable as possible. The sizes include 47.3121 m², 14.6101 m², and 10.7979 m². Their function is a resting place.

Figure 13. 3D of Lodging and Cafetaria Room of Phinisi

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Figure 13 show in Lodging and the cafeteria are functionally distributed in several rooms, such as the camera, dining, and café rooms. Their function is to make tourists more comfortable.

4. CONCLUSION

Using the main data of the parentship the design main dimensions of Phinisi were obtained through the follows Overall Length (LOA) 55 m; width (B) 9.00 m; height (H) 5.00 m; draft (T) 3.5 m; velocity (Vs): 9 knots; crew and passengers 26 people. Based on the results of the stability of the Phinisi tourist at all load case scenarios accepted for operation based on the IMO. The total resistance of the Phinisi tourist resistance was 126.5 kN. Requires 756 kW of powering machinery for operation.

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REFERENCES

[1] Bappeda Kota Balikpapan, *Sistem Informasi Pembangunan Daerah* (SIPD), 2015.
[2] Presiden Republik Indonesia, *Undang-Undang No. 17 Tahun 2008 tentang Pelayaran,* 2008.
[3] Kementrian Perhubungan, *Peraturan Menteri Perhubungan No. PM 7 Tahun 2019 tentang Keselamatan Pelayaran,* 2019.
[4] Kementrial Lingkungan Hidup dan Kehutanan, *Peraturan Menteri Lingkungan Hidup dan Kehutanan No. P.20/MENLHK/SETJEN/KUM.1/6/2018 tentang Pengelolaan Wilayah Pesisir dan Lautan*, 2018.
[5] Gubernur Kaltim, Peraturan Daerah Khusus di Beberapa Wilayah Wisata, 2022.
[6] Dirjen Hubla Kementrian Perhubungan, *Focus Group Discussion (FGD) dengan tema Penyediaan Kapal Pinisi untuk Mendukung Pariwisata di Wilayah Ibu Kota Nusantara (IKN)*, 2024.
[7] IMO, *Safety Of Life At Sea (SOLAS)*. 1974
[8] S. Hardwinarto dan Kelompok Kerja Erosi, Sedimentasi, *Kajian Erosi dan Sedimentasi pada DAS Teluk Balikpapan Kalimantan Timur*, 2002.
[9] Hendar, “Yuk, Kita Jaga Kelestarian Terumbu Karang Unik di Teluk Balikpapan”, mongabay, [online] avalaible: https://www.mongabay.co.id/2014/11/01/yuk-kita-jaga-kelestarian-terumbu-karang-unik-di-teluk-balikpapan/ [diakses 01 Juni 2025]
[10] C. Paino, *Peta usulan revisi RTRW 2011-2031 setelah ada perluasan KIK. Sumber peta: Pemerintah Kota Balikpapan*, 2016.
[11] Alamsyah, M. D. Nugroho, “Design of Catamaran Ship as Inland Waterways Transportation Mode in Samarinda,” Wave: Jurnal Ilmiah Teknologi Maritim, Vol. 12, no. 1, pp. 43-52, 2018.
[12] Alamsyah, B. F. Birana, “The General Arragement Catamarans Ship of Glass Bottom Type for Vacation Tools at Derawan Islands of Berau Regency East Kalimantan,” JURNAL SAINTIS, vol. 19, no.2, pp. 41-50, Nov 2019.
[13] Alamsyah, W. Setiawan, T. Hidayat, A. Alifantio, “Design of Water Ambulance for Inland Waterways of Regency East Kalimantan,” in Iconit, pp. 84-93, September 2019.
[14] A. F. Fadillah, B. K. Ibrahim, S. Manullang, “Desain Kapal Wisata Jenis Pinisi di Perairan Indonesia Timur,” Jurnal Manajemen Transportasi & Logistik (JMTRANSLOG), vol. 7, no. 1, pp. 49-58, Apr 2020.
[15] M. Azis, “Nikmati Serunya Wisata Bahari Kapal Pinisi, Telusuri Teluk Balikpapan dan Melihat Kilang Minyak”, inews, 06 Agustus 2022, [online]. Available : https://balikpapan.inews.id/read/139779/nikmati-serunya-wisata-bahari-kapal-pinisi-telusuri-teluk-balikpapan-dan-melihat-kilang-minyak [diakses: 01 Juni 2025]

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[16] F. Mahmuddin, A. Fitriadhy, S. Dewa, "Motions Analysis of a Phinisi Ship Hull with New Strip Method," International Journal Of Engineering And Science Applications, vol. 2, no.1, pp. 91-7, Feb 2016.

[17] A. Dianiswara, A.N. Hasmi, Alamsyah, L. P. Adyani, "Kajian Gerakan Roll Kapal Pinisi dengan Bilge Keel," Inovtek Polbeng, vol. 10, no.2, pp. 152-7, Nov 2020.

[18] Alamsyah, M.U. Pawarah, A. Dianiswara, "Kajian Kebutuhan Material Pada Konstruksi Lambung Kapal Phinisi," Jurnal Penelitian Enjiniring vol.25, no.1, pp. 77-84, 2021.

[19] W.M. Napitu, P. Manik, Kiryanto, "Studi Perancangan Bus Air Tipe Katamaran Kapasitas 100 Orang Penumpang Untuk Menunjang Pariwisata Di Danau Toba," Jurnal Teknik Perkapalan, vol.6, no.1, 2018.

[20] D.J. Eyres and G.J. Bruce, *Ship construction*. Butterworth-Heinemann, 2012 Jun 26.

[21] T.M. Van Bruinessen, J.J. Hopman, F.E. Smulders," Improved models in the design of complex specials: Success or failure?," InIMDC 2012: 11th International Marine Design Conference, Glasgow, UK, 11-14 June 2012.

[22] J.H. Evans,"Basic design concepts," Journal of the American Society for Naval Engineers, vol.71, no.4, pp.671-8, Nov 1959.

[23] F. Mistree, W.F. Smith, B. Bras, J.K. Allen, D. Muster," Decision-based design: a contemporary paradigm for ship design," Transactions, Society of Naval Architects and Marine Engineers, vol. 98, pp.565-97, Nov 1990.

[24] S.E. Hirdaris, W. Bai, D. Dessi, A. Ergin, X. Gu, O.A. Hermundstad, R. Huijsmans, K. Iijima, U.D. Nielsen, J. Parunov, N. Fonseca," Loads for use in the design of ships and offshore structures," Ocean engineering, vol. 78, pp. 131-74, Mar 2014.

[25] C. Vossen, R. Kleppe, S. R. Hjørungnes," Ship Design and System Integration," Available from: https://www.researchgate.net/publication/273026917_Ship_Design_and_System_Integration [accessed Feb 16 2025].

[26] Alamsyah, Z. Zulkarnaen, Suardi, "The Stability Analyze of KM. Rejeki Baru Kharisma of Tarakan–Tanjung Selor Route," TEKNIK, vol. 42, no.1, pp.52-62, 2021.

[27] Alamsyah Suardi, W. Setiawan, M. U. Pawara, Nurbaya, Hariyono, D. Paroka, A. Ardianti, "An Estimation Method for the Overthrowing Moment of Vehicles on the Car Deck of the Ro-Ro Ferry", Eng. Technol. Appl. Sci. Res., vol. 15, no. 1, pp. 19303–19309, Feb. 2025.

[28] Alamsyah Suardi, A. D. Rahmat, Nurbaya, W. Setiawan, M. A. Hakiki, R. Abdillah, M. U. Pawara, Hariyono, D. Paroka, A. Ardianti, A. D. Noegraha, "Uncomplicated Evaluation of Vehicle Tie-Downs Safety Factor on Ro-Ro Ferry Affected by Lateral and Vertical Acceleration Forces from Beam Sea", Journal of Advanced Research in Applied Mechanics, vol. 137, no.1, pp. 109-121, Jan. 2026.

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