# FAST TRIMARAN PASSENGER SHIPS FOR THE ARCHIPELAGO REGIONS

SEMINAR NASIONAL
ARCHIPELAGO ENGINEERING (ALE)

*"Inovasi Teknologi Pengembangan Wilayah Kelautan-Kepulauan Dalam Era Normal Baru"*

FAKULTAS TEKNIK
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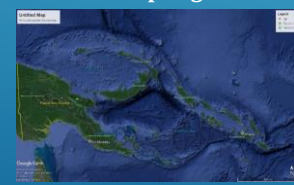
## 1. INTRODUCTION

- **Global marine transportation play an importance role in the archipelago regions to connect the islands → developing the nations**
- **The typical archipelago regions : many small islands with low passenger rate**

**Eastern Indonesia**

**Riau Archipelago**

**Philippine Archipelago**



**Solomon Archipelago**

- **Others …..**

## 1. INTRODUCTION

- The typical archipelago regions :
  - Low passenger rate due to small island residents,
  - Worse sea conditions with high waves and winds,
  - There a lot of marine accidents, uncomfortable ridings, seasickness, trip cancellation.
  - The need of fast passenger transport to reduce the travel time, etc.





## 1. INTRODUCTION

- The operation of monohull ships in the archipelago regions isrestricted for some reasons
- The existence of trimaran ships with certain advantages will helpfull
- The first modern trimaran was launched by British Navy, the research vessel RV Triton → embryo for the modern Trimaran ships

## 2. STATE OF THE ART

- 2.1 The Origin of Trimaran
- The design and names for the Trimaran components are derived from the original ***proa*** constructed by native ***Pacific Islanders***.
- The first Trimaran was built by indigenous ***Polynesians*** almost 4000 years ago.
- According to Definition (Wikipedia): A *Trimaran* is a ***multihull boat*** consisting of a ***main hull*** (***vaka***) and two smaller ***outrigger*** hulls (***amas***), attached to the main hull with lateral struts (***akas***).



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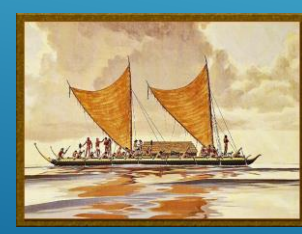
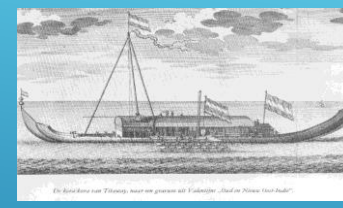
## 2. STATE OF THE ART

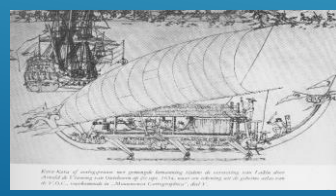
- 2.1 The Origin of Trimaran
- The ***Original Pacific Trimaran***.

## 2. STATE OF THE ART

- 2.1 The Origin of Trimaran
- The *Original Moluccas Trimaran*.
- Its name is Kora-Kora
- Function: transport passengers cargo, special task and marine combat





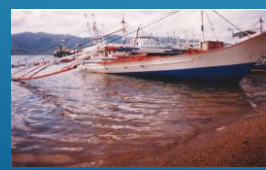




## 2. STATE OF THE ART

- 2.2 The Existing Traditional Trimaran
- The Indonesia Trimaran → Small fishing boats

- The Philippine fishing and leisure boats



## 2. STATE OF THE ART

- 2.3 The Existing Modern Trimaran
- Passenger-Car Ferry Trimaran

- Leisure Trimaran Vessels

- Others





## 2. STATE OF THE ART

- 2.3 *What is missing in the development of trimaran ships?.*

  → *fast Passenger Trimaran to operate in the Archipelago Regions".*

**The archipelago regions are selected for the reason:**

- The place where the traditional trimaran boats was born and operated
- The need of fast passenger transport (short travel time) in the archipelago regions
- Small payload due to the low-rate of travel passengers
- Worse sea conditions with high waves and wind in certain period
- The need high stability vessels with performance and good seaworthiness

## 3. THE APPLICATION OF PASSENGER TRIMARAN

### 3.1. The Design Concept

- The design procedures was fulfilled as requirements in ship standart ship design
- 2 options to overcome the worst sea condition in the archipelago region
  - The ships configurations are greater than the waves → but there is low payload → this is not feasible
  - *Small ship that run through the waves → Wave Piercing Trimaran*

    *The wave piercing trimaran can be performed in the big waves due to its low impact of wave pressures on the hull.*
- A design concept was introduced by the author which is *Small Waterplane Area-Wider Deck (SWA-WD).* This concept was introduced in order to reduce the resistance while the stability parameters are satisfy the rules
- Those concepts are used during design process !



FAST TRIMARAN PASSENGER SHIPS FOR THE ARCHIPELAGO REGIONS

## 3. THE APPLICATION OF PASSENGER TRIMARAN

### 3.2Advantages and Weakness of Trimaran.

*The advantages of Trimaran Ships are:*

- Longer and slender center and side hulls cause low resistance and to increase the performance of propulsion systems, increase speeds or low fuel consumption.
- Larger deck area to provide the spaces for passenger accommodations, cars, cargoes and special tasks.
- Better operation performance in calm and rough seas
- Higher initial transverse stability (GMT) due to the contribution of side hulls
- Better stability to operate at calm and rough seas.
- *Lower resistance in waves or low impact of wave pressures on the hull*

## 3. THE APPLICATION OF PASSENGER TRIMARAN

### 3.2Advantages and Weakness of Trimaran.

*The weakness Trimarans are described as follows*:

- Wider beam, larger transversal bending moment acting on the side hulls
- Greater WSA which contributes for greater frictional resistance and ship motions
- Wider beam which is difficult for docking and entering ports and narrow channels
- Narrow engine room which is difficult to arrange the main engine
- High construction cost at the same payload compared to its counterpart of monohull





## 3. THE APPLICATION OF PASSENGER TRIMARAN

### 3.3. Results of Design Trimaran Multi-Function

- Trimaran Multi-Function: Fishing Boats and Passenger Transport at restricted route, Material FRP, Dimension 2 GT and 4.5 GT, Hull form SWA-WD

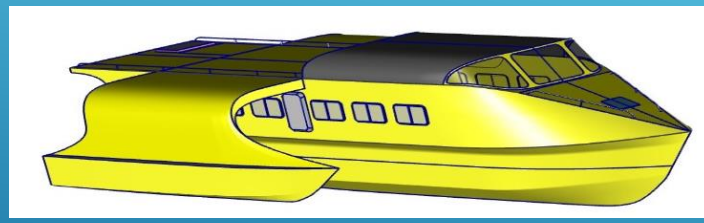
Table 1. The Parameters of Small Multipurpose Trimaran Fishing Boats

| No | Parameter of Vessel | 2 GT | 4.5 GT | Unit |
|---|---|---|---|---|
| 1 | Length overall, $L_{OA}$ | 9.80 | 10.84 | m |
| 2 | Beam, B | 0.80 | 0.90 | m |
| 3 | Beam maximum, $B_{max}$ | 1.10 | 1.10 | m |
| 4 | Breadth overall, $B_{OA}$ | 4.06 | 4.65 | m |
| 5 | Draft, d | 0.50 | 0.60 | m |
| 6 | Deck height, H | 0.85 | 0.90 | m |
| 7 | Payload | 0.80 | 1.20 | tons |
| 8 | Total weight | 2.87 | 4.02 | tons |
| 9 | Prime mover (out board) | 25 | 40 | hp |
| 10 | Service speed | 12.5 | 11 | knots |
| 11 | Autonomy | 50 | 50 | n.m |
| 12 | Passenger accomodation | Small deckhouse | Small deckhouse | |

## 3. THE APPLICATION OF PASSENGER TRIMARAN

### 3.4. Results of Design Trimaran Passenger Capacity 25 pax

- Passenger Trimaran, type Wave Piercing, Hull form SWA-WD, Material FRP



| | | | |
|---|---|---|---|
| Capacity | : 25 passengers | Crew | : 3 persons |
| Autonomy | :75 n.m | Service speed | : 15 to 20 knots |
| Service speed | : 15 – 20 knots | Hull material | : FRP |
| Propulsion power | : 160 to 200 hp (outboard engine) | | |
| Length Overall | : 11.12 m | Deck beam | : 2.24 m |
| Beam of waterline | : 1.50 m | | |
| Draft | : 0.60 m | Deck height | : 2.35 m |

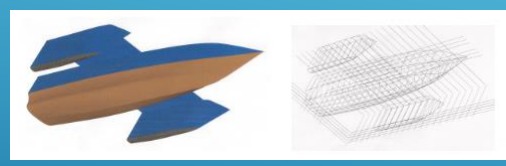




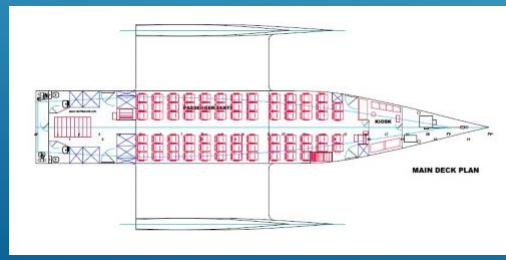
## 3. THE APPLICATION OF PASSENGER TRIMARAN

### 3.4. Results of Design Trimaran Passenger Capacity 75 pax

- Passenger Trimaran, type Wave Piercing, Hull form SWA-WD, Material Aluminum

- 

  Lines Plan

- 


  Generall Arrangement

## 3. THE APPLICATION OF PASSENGER TRIMARAN

### 3.4. Results of Design Trimaran Passenger Capacity 75 pax

- Passenger Trimaran, type Wave Piercing, Hull form SWA-WD, Material Aluminum

**Design Specifications**

*A. Principal Dimensions*

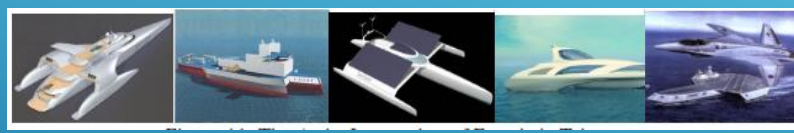
| | | | |
|---|---|---|---|
| • Length Overall $L_{OA}$ | : 27.23 m | Breadth maximum $B_{max}$ | : 12.38 m |
| • Breadth of WL (CH)$B_{WL}$ | : 3.60 m | Breadth of Deck (CH) $B_{deck}$ | : 4.37 m |
| • Draft (centre hull) T | : 1.20 m | Deck height H | : 2.40 m |
| • Length of outriggers $L_{out}$ | : 11.84 m | Breadth of outriggers $B_{out}$ | : 0.70 m |
| • Engine type | : MAN V12-1360 CRM | Quantity | : 2 units |
| • Engine output | : 1360 hp (1000 kW) | Service speed | : 30 knot |
| • Capacity of passenger | : 75 passengers | Number of crews | : 5 |
| • Maximum distance | : 150 nautical mile | | |
| • Classifications | : Bureau Veritas | Framing system | : Longitudinal |
| • Hull material | : Marine Aluminium Alloy (ALU 5083-H312 (S&P) | | |





## 4. FUTURE APPLICATION OF TRIMARAN VESELS

- Some applications of future works include mega-yacht, aircraft carrier, workboat (OSH = Oil Spill Harvester) and solar powered boat



- Potential application in Archipelago Regions including: tourist boat, patrol boat, hospital ships , etc.

- An intensive research work is executing by the author and his team concerning the trimaran Patrol Boat

## 4. FUTURE APPLICATION OF TRIMARAN VESELS

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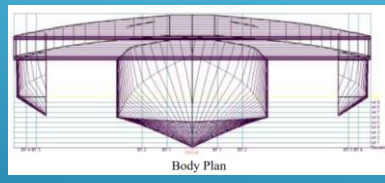
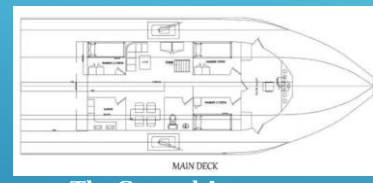



The Lines Plan




The General Arrangement

The configuration of the boat are:

| | | | |
|---|---|---|---|
| • Length overall, $L_{OA}$ | : 18.40 m | Breadth main hull, $B_{MH}$ | : 3.00 m |
| • Maximum beam, $B_{max}$ | : 7.00 m | Draft, T | : 1.00 m |
| • Deck height, H | : 2.50 m | Speed, Vs (optional) | : 25 knots |
| • Operation range | : Central Moluccas water | | |





## 5. CONCLUSION AND RECOMMENDATION

### 5.1 Conclusion

- The contribution of passenger trimaran ships is still not exist in the archipelago regions. The effort have been made by the author and his research team by introducing some particular ship configurations.
- The design concept of *Wave Piercing Trimaran* and hullform of Small Waterplane Area-Wider Deck (SWA-WD) was introduce by the author in design process. However, some future works should be performed to validate the design concept for future application.
- The design process ended-up the real trimarans multi-function that had been operated. Meanwhile, three trimaran ships has been developed with design blue print for the next building process. The design specification are provided for three passenger trimarans.

## 5. CONCLUSION AND RECOMMENDATION

### 5.2 Recommendation

- It is recommended that the results of design concept should be tested in the towing tank in order to validate several design parameters before preparing for ship building.
- The results of preliminary concept design of SWA-WD and Wave Piercing Trimaran were the first step of the whole design project. It still need more efforts, time, financial contribution to complete the project.





## 4. PENUTUP

# THANK YOU FOR YOUR ATTENTION

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