Tenix Engineering Conference Paper
Philippine Coast Guard Search and Rescue Vessel

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Abstract. On the 20th June 2000 TSWA successfully delivered the First of Class 56-metre Search and Rescue vessel, BRP SAN JUAN to the Philippine Coast Guard. The delivery marks a significant milestone in the development of this TSWA indigenous design into a Project that dates back more than 10 years. The Coast Guard new construction Project started in circa 1989 when Ocean Shipyard, through a licensing agreement to Danyard, commenced discussions with the Philippine Coast Guard to supply vessels to the Osprey Class design. As a consequence of the closure of Ocean Shipyard in 1991, Tenix (then Transfield-ASI) was introduced to the Project. Following yet another near collapse of the Project in 1993, due to rising costs, TSWA proposed to develop an indigenous and more affordable design. A Contract was placed in May 1998 for the construction of two vessels, BRP SAN JUAN and DON EMILIO.

This paper provides an overview of the Project design philosophy, the application of the Det Norske Veritas High Speed Light Craft Rules, provides an insight into the principal design particulars and details of this First of Class vessel.

1. INTRODUCTION

The development of the new generation Philippine Coast Guard Search and Rescue vessel dates back more than 10 years. This new construction Project started during 1989 when the Western Australian based shipbuilding company, Ocean Shipyard, through a licensing agreement with the Danish shipyard Danyard, commenced discussions with the Philippine Coast Guard to supply vessels to the Osprey Class design.

As a consequence of the closure of Ocean Shipyard in 1991, the Tenix (then Transfield-ASI) shipyard was introduced to the Project. Following protracted discussions and yet another near collapse of the Project in 1993, due to rising costs, the now Tenix Shipbuilding WA proposed to the Coast Guard an alternative strategy to develop an indigenous and more affordable design. The 56 metre Search and Rescue Vessel became a reality when a Contract was placed in May 1998 for the design and construction of two vessels, which were to become BRP SAN JUAN and BRP DON EMILIO.

On the 20th June 2000 TSWA successfully delivered the First of Class 56-metre Search and Rescue vessel, BRP SAN JUAN to the Philippine Coast Guard. The delivery marked a significant milestone in the development of this class of vessel, which has now seen the launch and naming ceremony of the second vessel BRP DON EMILIO on 4 October 2000.

This paper provides an overview of the Project design philosophy, the application of the Det Norske Veritas High Speed Light Craft Rules, provides an insight into the principal design particulars and details of the First of Class vessel.

2. SHIP GENERAL REQUIREMENTS

The 56 metre Search and Rescue Vessel (SAR) was designed to be a purpose built Maritime Emergency vessel with capabilities to support;

- Recovery and Evacuation of survivors at sea, including jackstay transfer,
- Provide emergency medical operating facilities,
- Helicopter operations including on deck refueling,
- Maritime Pollution Control and containment,
- Alongside fire fighting facilities for adjacent ships, and
- Decompression and diving facilities, and

In addition the vessel was required to achieve the following principal requirements;

- Speed not less 24.5 knots,
- Range of 1000 nautical miles at 24 knots,
- Range of 2000 nautical miles at an economical speed of 15 knots,
- Crew accommodation of 38 personnel,
- Carry 390 survivors, and
- Flight deck structure capable of accepting a helicopter landing weight of 2600 kilograms.

2.1 Design Regulations

The vessel, including hull, machinery and equipment systems was designed in accordance to the regulations of Det Norske Veritas (DNV) Classification "Rules for Classification of High Speed and Light Craft " and with notation 1A1 HSLC Crew R1.

The following International Convention, Regulations and Standards were also applicable to the vessel:

- International Civil Aviation Organisation, ICAO
- International Convention for the Safety of Life at Sea (SOLAS) 1997 Consolidated Edition
- International Load Line Convention – 1966
- International Tonnage Convention – 1969
- International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) Annex. I (oil) & IV (sewage) with Amendments.
- Regulations of the flag state, Philippine Department of Transport and Commerce (DOTC).

2.2 Hull Form Development

The factors that are generally taken into consideration in the selection of the best hull form are the vessel's speed and powering in calm and rough water, ride quality, deck wetness, static and dynamic stability, maneuvering and ship motions. The initial design of the hull form for the SAR was developed based on a semi displacement hard chine form, flared forward in combination of built in spray rail to further improve vessel's performance. The selection of hard chine was based on considerations of produceability and ease of manufacture.

The preliminary hull lines and power prediction were developed in house using the hydrostatics software Maxsurf and then later sent to the Maritime Research Institute in the Netherlands (MARIN) for review. This initial MARIN review confirmed the predicted vessel performance based upon the size and speed of this vessel. Predicted and actual results of the vessel performance are shown at Figure 1.

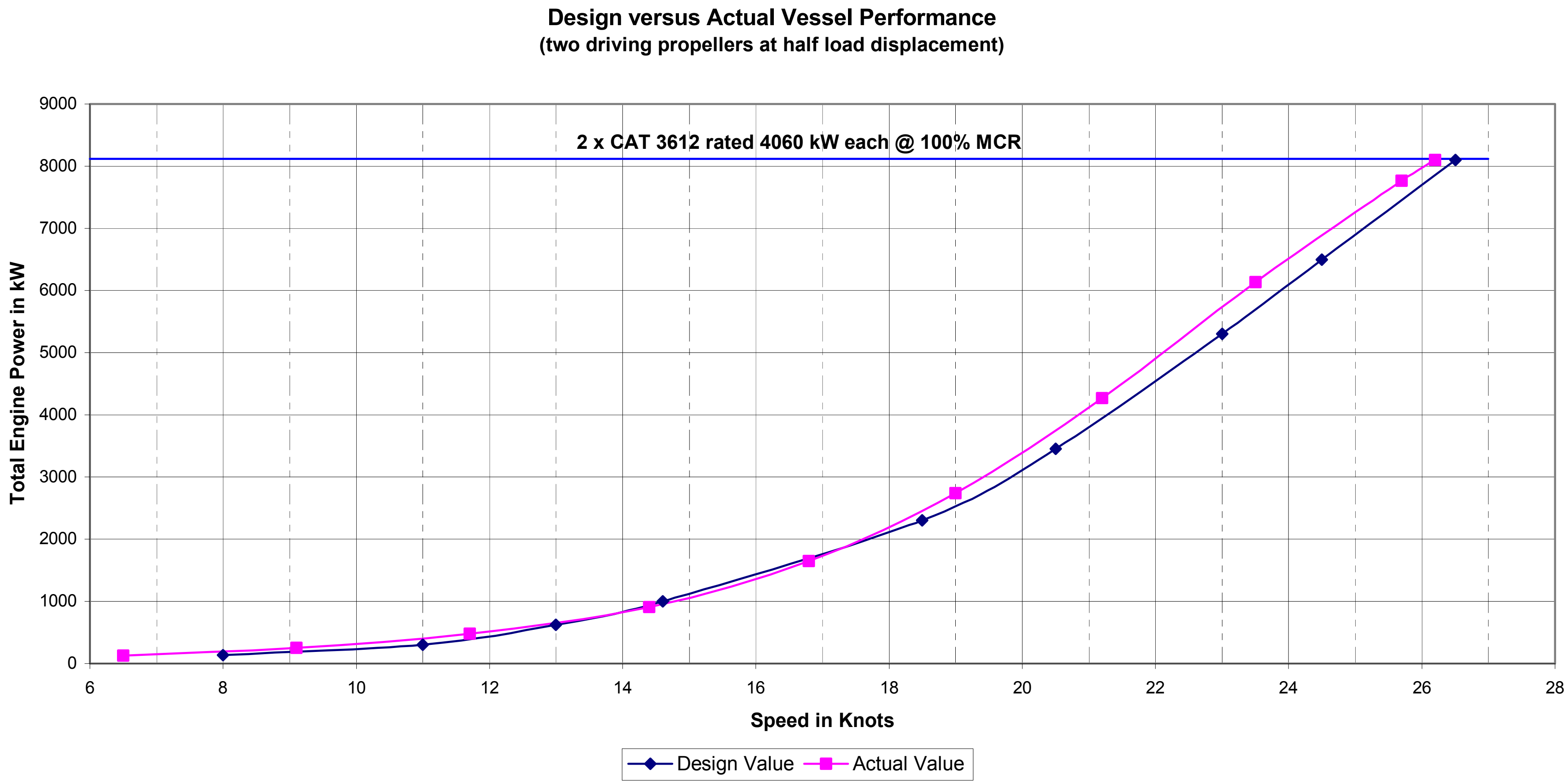

Figure 1. Design versus Actual Vessel Performance

2.3 Seakeeping

The vessel's seakeeping characteristics were predicted using the linear strip theory program “Seakeeper”. Due to the nature and type of vessel, the seakeeping characteristics were expected to be good and were evaluated against the International Standard for the Evaluation of Human Exposure to Whole Body Vibration (ISO 2631/3). In addition extrapolation of previous model test data was undertaken by MARIN on behalf of TSWA to ensure that the confidence levels of the predictions were high.

The output of the model tests, TSWA prediction and full scale results are shown at Figure 2. The data presented is based upon a vessel service speed of 18 knots, in head seas of 3.0 metres (significant wave height) with a wave period of 7 seconds, which equates to approximately Sea State 5.

2.4 Buoyancy, Stability and Subdivision

The vessel was designed to comply with the requirements of the Det Norske Veritas (DNV) and the loading conditions specified by the Philippine DOTC.

As a consequence of the intervention boat, whose launching arrangements are through the stern of the vessel this opening in the hull was considered, for calculation purposes, to be weathertight only and allowances were therefore made for the aft region of the vessel to be made watertight. This factor was considered in the vessel stability assessments along with the vessel carrying the specified number of survivors.

2.5 Structures

The vessel design is of an all welded construction, with hull being constructed Grade 250 steel and the superstructure (including flight deck) being aluminium alloy. Additionally the stern door arrangement was constructed of aluminium alloy in order to reduce its weight.

The longitudinal frames or stringers were supported by transverse web frames and bulkheads. The web frames and bulkheads were designed to absorb appropriate hull loads determined by the Classification Society.

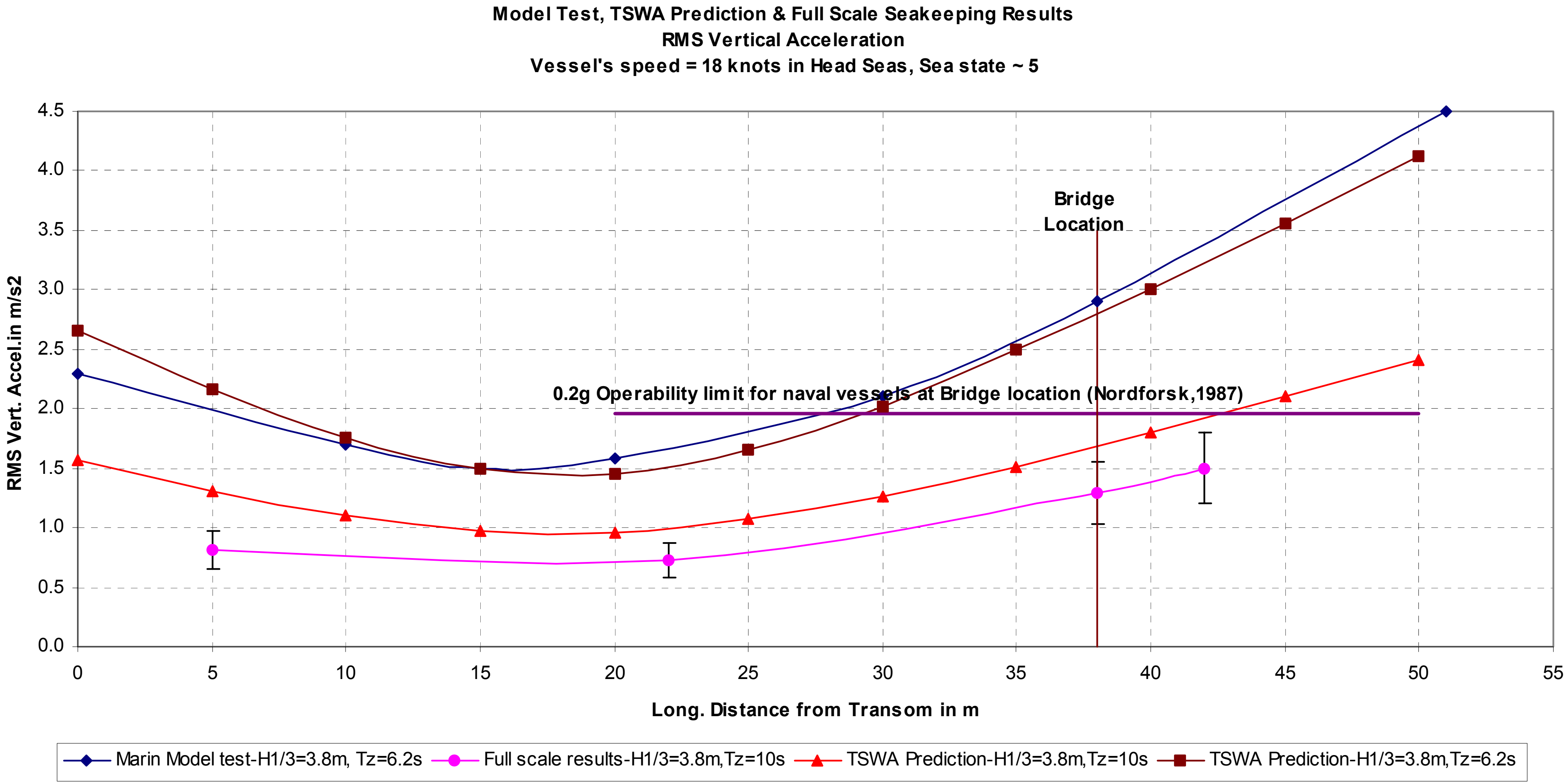

Figure 2. Vessel Seakeeping Performance

2.6 Main Propulsion System

Taking into account the running fuel cost, capital and through life costs, two medium speed engines were included in the design, each engine is resiliently mounted with a flexible coupling connecting the flywheel to a clutchable reduction gearbox. The gearbox is hard mounted with a horizontally offset output driving a shaft line connected to a controllable pitch propeller. Each propulsion train and ancillary systems are capable of operating independently.

In addition the port reduction gearbox provides a power take-off connection for the fire monitor pump which are used for the alongside firefighting capability. Figure 3 provides a view of the Main Machinery Room.

2.6.1 Main Engines

Make/Model: Caterpillar 3612 (4060 bkW @ 1000 RPM)

2.6.2 Gearbox

Make/Model: Reintjes, LAF 3445 (ration 2.515:1)

2.6.3 CPP

Make/Model: acbLips 4 bladed (Hub 4D710D)

2.7 Auxiliary Diesel Generator Plants

The electrical power for ship’s services is produced by two (2) generating sets of 260 ekW each and are located in the forward area of the engine room. The design allows for the complete electric power demand to be supplied with only one generator.

An emergency generator of 105 ekW, located on the main deck aft is to supply power all essential services in case of failure of the main generating sets. This generator unlike the main generator sets is air cooled and configured for automatic start up on loss of the ships main electrical power.

Figure 3 Main Machinery Room

2.8 Firefighting System

All necessary portable fire-fighting appliances are installed as required by the Classification Society requirements. The main engine room is protected with a carbon dioxide extinguishing system. Aqueous Film Forming Foam (AFFF) is provided for protection of the flight deck via a fixed foam tank and proportioners.

The alongside fire fighting capability is provided by a main reduction gearbox driven pump (600 cubic metres per hour) supplying two (2) fire monitors mounted on the aft end of the bridge deck, (Figure 4). Each monitor is capable of providing a seawater throw of 110 meters at a rate of 300 cubic metres per hour. These monitors can be operated remotely from the bridge or via a wandering lead from the bridge wings. The operation permits one monitor to provide a fog spray, to protect the vessel itself and the other providing a jet spray directed to the adjacent vessel on fire.

Figure 4 Fire Monitors

2.9 Lifesaving System

All necessary portable life saving appliances are installed as required by the Classification Society requirements for the protection of the ships crew. In addition to account for the vessel role this allowance has been increased to include;

- Four (4) 25 person SOLAS inflatable life rafts,
- Six (6) 65 person open reversible life rafts,
- One (1) rapid intervention boat, 6.5 metres long with a speed in excess of 25 knots and a range of 85 nautical miles, (Figure 5)
- Four (4) Rigid Hull inflatable boats, 4.5 metres long, and
- One (1) Twinlock Decompression Chamber, consisting of a two (2) berth inner lock and medical outer lock.

Due to the nature and role of the vessel a separate survivor's area has been included into the vessel arrangement, (Figure 6). This compartment provides for the decompression chamber, medical reception, operating theatre and seating in an open plan arrangement.

Figure 5 Rapid Intervention Boat

Figure 6 Survivors Area

3. MAIN CHARACTERISTICS

The vessel as designed provides the principal particulars that are detailed below. A depiction of the completed vessel, San Juan is shown at Figure 7 and Don Emilio at Figure 8.

Length Overall:	56.0 metres
Length Waterline:	55.3 metres
Beam:	10.55 metres
Draft Moulded:	2.5 metres
Maximum Deadweight:	650 tonne
Complement:	38 crew

Figure 7 San Juan prior to launch

Figure 8 Don Emilio moving to Ship-lift