MODULAR MULTIPURPOSE HYBRID SHIP DESIGN FOR HARBOUR AND WINDFARM SUPPORT VESSELS TO ACTUALISE ENVIRONMENTAL SUSTAINABILITY

Key Characteristics

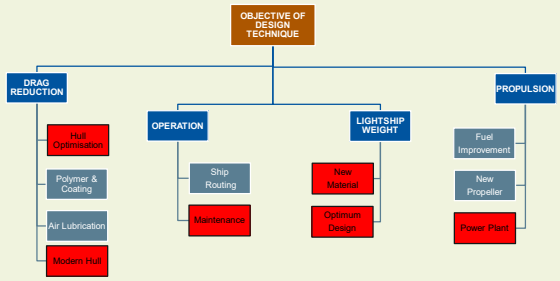
Designed to match the increased industry demand of windfarm support vessels and harbour crafts.
A vessel design with excellent sea-keeping characteristics of SWATH with resistance and emission characteristics of Planning Mono-Hull.
Emission standards that meet the European commitments to UNFCCC Copenhagen 2009 convection to reduce CO_2 emission by 40% by 2030.
Modular Design to reduce the cost of production with ability to adapt to length of 18-24m for three different types of vessel.

Motivation & Objectives

Today, the Maritime Industry faces two major concerns of Safety and Environmental sustainability. In the current market scenario the European Shipbuilding business is being predominantly governed by Windfarm, Harbour, Offshore Support Vessels and Yacht/Cruise/Pleasure Crafts, this idea focuses on design of a safe and eco-friendly common modular vessel that can cater to Windfarm, and Harbour Support Vessels mainly Pilot, Police/Custom Patrol Boats and Wind-farm Crew Transfer vessels for 18-24 m segment.

These vessel types are designed and operated with an intent to carry personnel at fastest possible time while ensuring safety and comfort of personnel on board, quintessentially during embarkation and disembarkation to/ from these crafts. Conventionally Planing Mono-Hulls are used for Pilot Boats, Police/Custom Patrol Boats and in latest trends Catamarans and/or SWATH (small water-plane area twin hulls) for wind-farm support vessels. For the intended operation, while planing mono-hulls provide high speed with very poor safety characteristics, the SWATH provides excellent safety/sea-keeping with very high resistance (emissions) and complex/high production cost/time.

The idea proposes the development of a hull form that can provide the excellent sea-keeping characteristics of SWATH vessels while being able to operate at speeds as per industry requirements keeping in mind the European Maritime Emission norms both in short and long term.

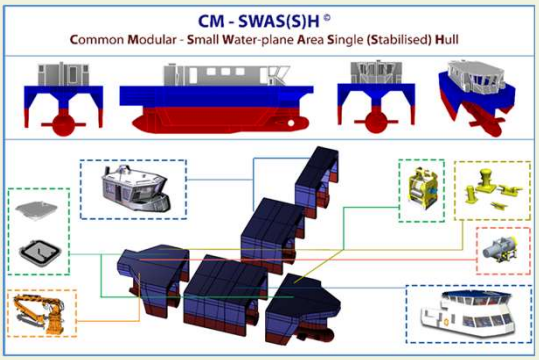


Methodology

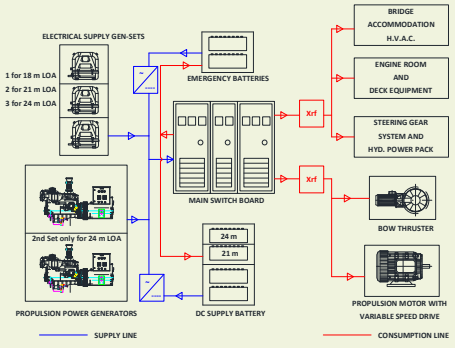
To ensure good safety and sea-keeping characteristics the project will use the concept of SWATH and develop a trimaran like Small Water-plane Area Single (Stabilized) Hull popularly termed as SWAS(S)H. Thus decreasing the wetted surface area and in-turn the resistance (emissions). While this solves the problem of safety and emission it raises the issues of practical implementation due to high cost of design and production.

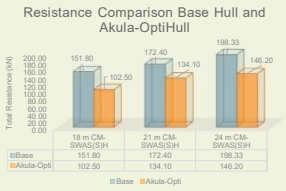
To further enhance the operational profile the Marine power plant is being installed with an Advanced Hybrid Diesel Electric AC-DC System keeping in mind the future compatibility for Battery powered vessel.

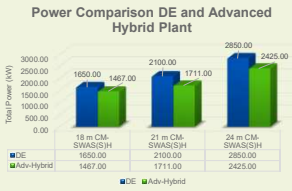
Environmental protection and Sustainability often treated synonymous are similar but not same. Sustainability, unlike protection is a multidimensional thought that focuses not only on technology but also on management factors. The economic slowdown has forced the maritime industry to provide an integrated solution, a design that not only reduces emissions but at the same time provides a practical solution that can be implemented in current volatile market. Hence the need of a design that will ease the complexity and time/cost of production as well, this gave birth to the idea of CM-SWAS(S)H, Common Modular - Small Water-plane Area Single (Stabilized) Hull.



Results







While all SWATH hulls operate in the range of 14-17 knots, the new hull designed to operate at 25knots presents comparable values of power requirement as Planing MonoHulls. This was achieved by using Multi-Objective optimisation of hull for resistance and designing a completely new form of Advanced Hybrid Diesel Electric Power Plant with ability to operate with both AC and DC power, this was done to ensure the future adaptability to battery powered operation. The figure on right indicates the layout of the plant. The design provided a range of 11-18% reduction in power consumption.

Research Outlook

Any work no matter how successful, always presents a scope of improvement. Since this is a new form of hull a concervative approch was used to design to structural elements of the hull. We know that all classification societies enable designer to prove the structural integrety by way of FEM analysis that can be accepted in special cases. The author proposes a FEM based structural optimisation to reduce the structual complexity and lightship weight at future work.

Team The Akula, Team Members(s) : Akula Nidarshan
E-Mail : n.akula@doct.ulg.ac.be

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