

University of Wales Trinity St David

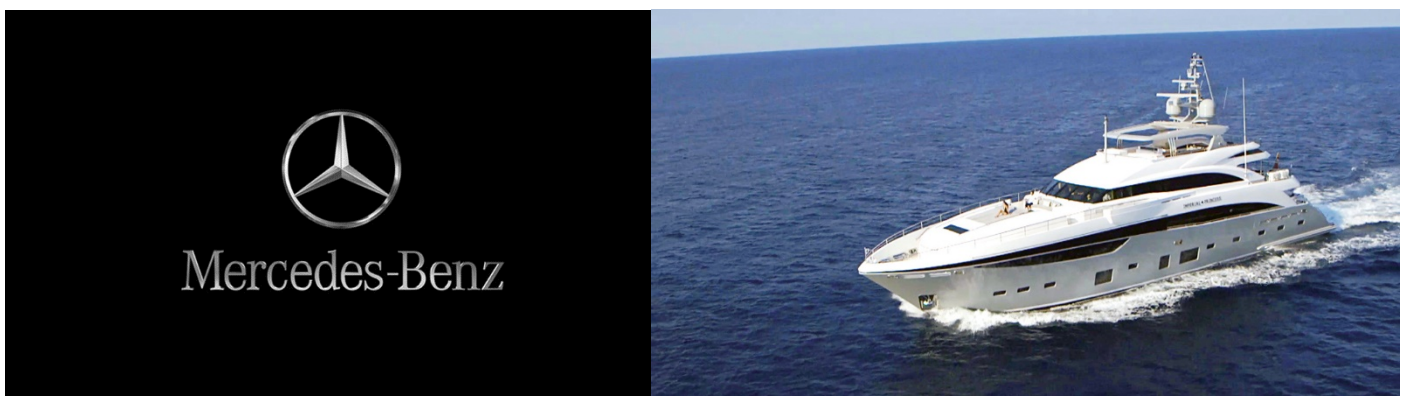
M6X02237 - Major Project: Design Research & Manifesto

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BA/MDES Automotive and Transport Design

Project Mercedes Sealife (SL2025)



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1) Introduction

I am designing a Mercedes inspired superyacht. The yacht will use renewable power in the design and sustainable technology to produce a new sustainable powerful yacht. This will be the first Mercedes Yacht, excluding the Mercedes racing team boats. This means the yachts styling will need to successfully capture the essence of Mercedes' brand vision, whilst creating this new original design of yacht that brings us into the future of yachting, as we advance into a new era.

2) Environmental Impact

"The most damaging greenhouse gas, carbon dioxide, is released into the atmosphere from the burning of fossil fuels. Factory emissions contribute greatly to the release of carbon dioxide into the atmosphere. Industry and electrical generating factories contribute slightly more than 50 percent of greenhouse gases."

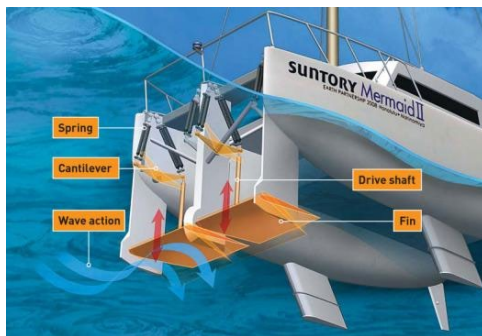
(Factories Environmental Impact, 2020)

The need for a sustainable future in yachts is clear as the burning of fossil fuels has proven the destruction to the planet, a new sustainable power source is required. I believe that by 2025 there will be a banning of diesel and petrol for yachts, this will bring a demand for these new advanced sustainable yachts that will use renewable technology to find innovative ways of powering yachts into the next decade.

The technology I have looked at using in the yacht is wave power, wind power, solar power as well as looking into the use of thermal energy. Other advancements in the sustainability of the yacht are the materials used and how natural fibre composites can be used for the hull of the yacht. There are different ways of being able to harvest the wave energy, one of the ways is an oscillating water column that will partially sit under the surface of the water, it has an integrated air chamber that funnels waves inside under the waterline, because of the oscillation the trapped water column continues to rise and fall, which in turn causes it to pressurise and depressurise pushing and pulling it through a turbine creating the energy. Another way to harvest energy from waves instead is a buoy system called the attenuator.

“Attenuator: This device acts in a similar way to the buoy system, with multiple floating segments connected to each other and oriented perpendicular to the waves. The relative oscillation of the floating segments converts the energy from incoming waves driving hydraulic pumps to generate electricity”
(Marine Composite Review 2020, reference 37)

Mork, G.; Barstow, S.; Kabuth, A.; Pontes, M.T. Assessing the Global Wave Energy Potential. In *Proceedings of the 29th International Conference on Ocean, Offshore and Arctic Engineering*, Shanghai, China, 6–11 June 2010; Volume 3, pp. 447–454



(Figure 1)

This technology is like what was used in the Suntory Mermaid ii, and by having buoys on the side pods of my design it will be able to generate wave power from both side pods on the side of the yacht. Wave power is much more suitable than solar, and wind as it is easier to collect data to find out when tidal currents are best, as well as tidal currents being more consistent than wind and solar. The turbines under the water need to be able to withstand high stress from water pressure as well as a harsh corrosive environment, this means the blades need a material that has a high tensile strength as well as having a high corrosion resistance. The material to use is CFRP, by using carbon fibre it is a higher cost of material per blade, however the material is much more suitable for the conditions it will be exposed to. Both wind power and solar power can be added to the yacht, such as solar panels on the roof, as well as turbines on board the yacht collecting wind power.

(Marine Composite Review 2020)

3) Aesthetics

The yachts I designed take inspiration from the classy stylish Mercedes design vision, as well as looking at sea creatures and merging these sea forms into the classy styling of the yachts. The shape of one of my yacht designs looks at the fins on sharks and sailfish and uses these shapes to create a flowing and natural looking yacht. The fin concept idea is a design that has not

been seen in yachts and how it overlaps the other panels at the edge has this flowing smooth natural look. The yacht also takes inspiration from natural forms created at sea, such as the ripple effect and using this form to create a superstructure that has a ripple effect see through roof. Focusing on Mercedes design language the speed form concepts playing with shapes from Mercedes vents as well as parts from the interior to create a modern looking superstructure design. The gill idea based on the interior feature in a Mercedes C class, I aggressive gill concept I have redesigned this part into the canopy structure as has a simple but clean and smart look to the design, this is because the shape was too extreme which would cause problems for maritime engineers as well as it looked too sharp than flowing of the design. The yacht will take inspiration from Mercedes colour schemes and style in the yacht. A black and dark grey classy main colour will keep the luxury and classy look. With an accent of turquoise green, the Mercedes racing team colour and is a colour linked with eco-friendly, therefore a renewable electric yacht this colour scheme will flow nicely.

4) Interior Features

The yacht is 30m long, with a draft of 2m and a beam of 6m. The yacht has 4 levels on board. The flybridge deck at the top with the canopy that retracts into the roof for a slick shape when in performance mode, on the flybridge there is the Wheelhouse for the captain to control the yacht, as well as the sky lounge before the open decking. On the main deck this will have the kitchens, dining area as well as a couple of guest cabins on this deck. And then on the lower deck has crew cabins, captains' cabin and the other two guest cabins. On the Lowest floor is the engine room, where the generators, battery pack and motors are found.

(Crew roles on yachts 2020, pontoonopedia)

5) Materials and Manufacturing

The materials I looked at using was linen fibre composites in the hull of the yacht, this is because they can come from quick growing flax plants. These linen fibres are great for making a composite to be used in the hull as it can form a lightweight as well as strong composite. Basalt fibres are the next material that can be made into a composite for the hull of the yacht, Basalt fibre is a great material for this use because of its properties. The material is environmental resistant and has exceptionally good wave absorption and wave penetrating properties, this is important for the hull of the yacht as it will be exposed to the elements all

the time. Other properties making basalt fibre a better choice than carbon is that it has a higher oxidation resistance, as well as a higher shear strength and compression strength. Even though Basalt fibre composite will not be as light as carbon fibre, it still has a great strength to weight ratio.

(Basalt properties, 2020)

The structure of the yacht will be made from aluminium, this material is commonly used for the structures in yachts as it has a high corrosion resistance, which is always beneficial in a vehicle exposed to the natural elements. As well as aluminium having a great strength to weight ratio, which as a lightweight material already makes it suitable for the structure of the yacht.

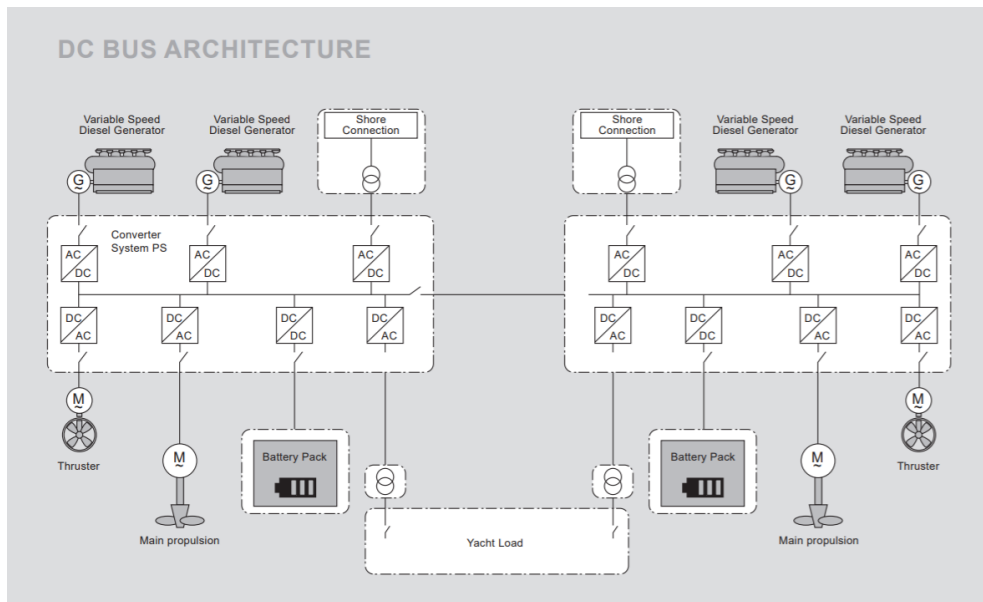
To manufacture the hull, the use of 3D printing is becoming more easily available for use in manufacturing. By printing the hull structure with a natural fibre composite, it produces little to no waste and is a more cost-effective method than carbon fibre. Also, by using a natural fibre it is a more sustainable material to be used, with similar properties to carbon fibre with this material still being lightweight. The 3D printer would be able to print up to sizes of 100ft and so my yacht's hull would be able to use this technology. This method of production is suitable as it is a faster and more economical method of manufacturing yachts, meaning this is a more sustainable way of manufacturing the yacht.

(3D printing in yacht building, 2019)

6) Performance

The yacht will use the NIDEC AIS power management system that is used in the Nidec Wider 165, this all-electric power management system has a 544kw battery pack with x4 350kw generators, x2 531kw electric motors and x2 70kw thrusters. The power management system allows the yacht to travel in four modes,

(Wider 165 Technical specs, 2020)



(Figure 2)

Nidec use diesel generators, however, to find a more sustainable way, I looked at replacements such as using fuel cells, which can generate electricity through chemical reactions. The alternative I found that is more sustainable is using biomass generators as it uses sustainable plant sources as the fuel. The renewable energy sources will then be used to top up the battery, so that it has a constant source of energy from renewable power and then uses the generators when battery is low.

(Diesel Generator Alternatives, 2020)

By utilising this system already used it has been proven to work for the Nidec 165, it should comfortably and efficiently power a smaller and more lightweight superyacht. The NIDEC AIS power management system will require somewhere to store the renewable energy from the renewable technology on board. This allows the solar power, wind power and wave power to be able to store the energy for when its needed in use. The power of my yacht will be around 30,000hp to be able to power the superyacht at comfortable speeds, as well as having enough power for it to go into performance mode. The yachts weight will be less than the Wider 165 as it is 20m shorter, as well as my hull being made using natural fibre composites, the overall weight of my yacht will be around 350 gross tons. I then used a formula to calculate the speed of the yacht, using $1.4 \times (\text{square root of waterline length in ft})$ $1.4 \times (\text{square root } 80) = 12.5$ knots.

(Yacht Formula 2020, severn-boating)

7) Target Market

My target client for this design is a 40-year-old multiple businessowner. He owns many houses, jets, cars, boats. This means the interest in a new vehicle such as a superyacht would appeal. The yacht would incorporate technology on board and gadgets that interest the client, who has a strong interest in technology and the development of future gadgets, with their wealth always being able to have the latest technology on the market.

The client will use the yacht around Southern Europe in the Mediterranean ocean, the yacht is a comfortable size for the many ports found in the Southern Europe region, with most of the rich and luxury bringing their superyachts to these locations.

8) Conclusion

In conclusion my yacht has looked at advancements in technology to improve the future of yachting and move it into the renewable power era. My yacht can create a new type of superyachts, with this being the first fully 100% electric powered superyacht. The design of my yacht I will look at continuing is the fin shaped hull design; this is because the whole design flows and fits into the natural look of the ocean. The design is innovative and is not seen in other designs amongst the yachts already on the market. My design will continue being developed, where I will find ways of incorporating this technology into the design features of my yacht.

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MAJOR PROJECT: PRODUCT DESIGN SPECIFICATION

BA/MDes Automotive & Transport Design

Module:	M6X02237 – Major Project: Design Research & Manifesto
Project Title:	Project Mercedes SL2025 (SeaLife)
Student Name:	Harry Cuthbert

Design Parameter:	Description:
Target Customer	40yr old wealthy businessman
Aesthetics	Black and grey classy look, with accent turquoise from racing team and renewable energy colour scheme
Ergonomics	Gadgets and technology in design for client's ease of use on board
Size	Length - 30m Beam – 6m Draft – 4m
Performance	Uses Nidec ASI power management system
Environment	Sustainable materials Sustainable Technology
Prod'n Quantity	One off design – Custom made features for client
Manufacturing Properties	3D printed structures – using natural fibre composites
Materials Properties	High corrosion resistant (weathering), high strength to weight ratio, lightweight
Target Product Cost	£20 million
Launch Date	2025
Sustainability	Using the PMS system that can run with zero emissions Renewable power for technology on board