University of Warwick Submarine Team

The aim of our project is to design and create a working human powered submarine to be raced in the 2024 EISR competition in Gosport.

Submarine propulsion task

What we need from you is a proposal of an innovative but practical method of propulsion that will allow us to manoeuvre a winding track as fast as possible. Some ideas that you can work from are propulsion using multiple propellors or fins. We are looking for innovative but practical concepts which could be implemented in future iterations of the Warwick Submarine!

Areas of considerations should be:

1. How did you arrive at this solution?
    - Show your design process – Iterations, etc.
2. How will it be powered by the pilot?
    - Using pedals? What gearbox ratio? Using a diaphragm? What is the target rpm? Is this achievable?
3. What materials should be used?
    - Consider things such as corrosion resistance, durability, expected stresses, etc.
4. How would it be built and what changes would be needed to be made to the current submarine?
    - Consider manufacturing techniques – would it be 3D printed or machined? Etc.

Secondary Level Competition, ages 11-16:

For this competition you should research a method of propulsion and draw up an annotated design to help us understand the design. The more innovative the design the better! The design should show how the human inside is able to power it effectively and how the power goes to the method of propulsion.

Areas of considerations should be:

1. How did you arrive at this solution?
    - Show your design process – Research of past competitions (link to eISR & ISR below), Design Iterations, What is innovative about your design? Etc.
2. How will it be powered by the pilot?
    - Via pedals? What gearbox ratio? Using a diaphragm? What is the target rpm? Is this achievable?
3. What materials should be used and why?
4. Critical review of your final design and a conclusion.

To further help illustrate the design, 3D CAD could be used to help show off the design. Any CAD program can be used, but a suggested, user-friendly option (used at Warwick!) is Fusion 360 – An educational version can be downloaded for free from Autodesk's website when registering using any school email address.

- Link: https://www.autodesk.co.uk/campaigns/education/fusion-360

There are good tutorial videos and playlists on YouTube that might help you with learning the basics – but have a play!

If you have any questions about the technical details of the competition, please contact warwicksubmarineteam@warwick.ac.uk

Sixth-Form / College Level Competition, ages 16-19:

For this level of the competition, you should still design a propulsion system but also consider other factors that would affect the propulsion with the system. Examples of this are:
Fluid dynamics of the system
Is it cost effective?
How easy is it to remove and fix if it breaks?
What are the methods of manufacturing it?

Areas of considerations should be:

1. How did you arrive at this solution?
    - Show your design process - Research of past competitions (link to eISR & ISR below), Design Iterations, What is innovative about your design? Etc.
2. How will it be powered by the pilot?
    - Using pedals? What gearbox ratio? Using a diaphragm? What is the target rpm? Is this achievable?
3. What materials should be used?
    - Consider things such as corrosion resistance, durability, expected stresses – possibly using simulation, etc.
4. How would it be built and what changes would be needed to be made to the current submarine?
    - Consider manufacturing techniques – would it be 3D printed or machined? Why this method? Etc.
5. Critical review of your final design and a conclusion.

To further help illustrate the design, 3D CAD could be used to help show off the design. Any CAD program can be used, but a suggested, user-friendly option (used at Warwick!) is Fusion 360 – An educational version can be downloaded for free from Autodesk's website when registering using any school email address.

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Diagrams/Context

Course Layout

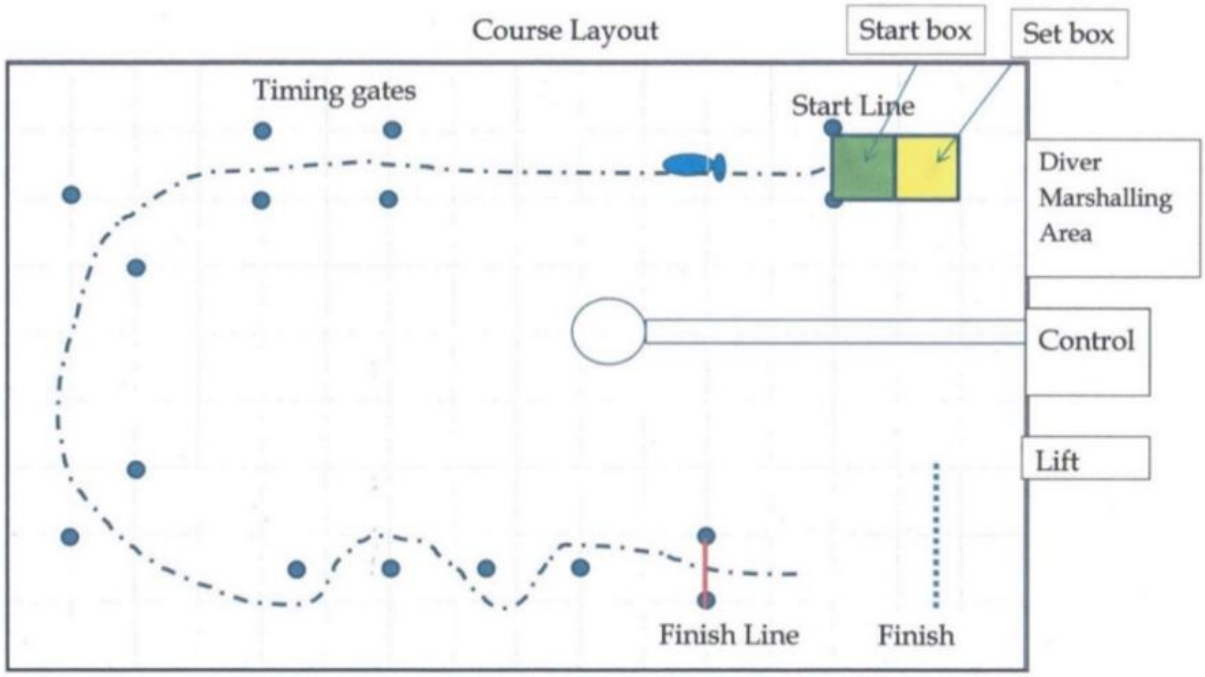

Figure 1 - eISR Slalom Course Layout

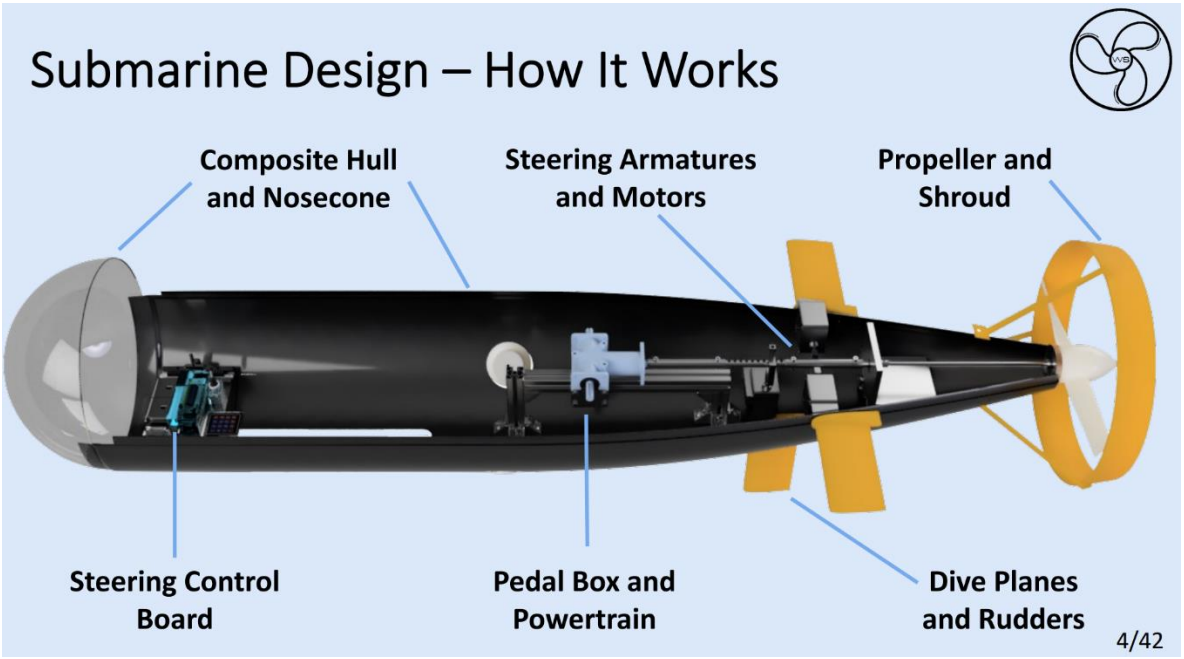

Figure 2 – Basic layout diagram of the submarine
(CAN BE CHANGED TO SUIT YOUR IDEAS – this is just for context)

Major changes currently being implemented for this year's competition (For inspiration)

1. Yaw dive planes are removed in favour of using a push-pull cable to rotate propellor left and right (without a shroud) by utilising a pivoting propellor mount, shown in figure 3, and a universal joint in the drive shaft. This was done for greater efficiency in tight cornering as dive planes require water flow to function effectively.

Figure 3 - How the push-pull cable (actuated by the pilots control stick) turns the propellor

2. Pitch is being electronically controlled via servos and electronics (this was developed previously but not successfully implemented).

Competition Information / Rules

- eISR rulebook
  - https://www.subrace.eu/assets/rules/eISR24-Rulebook.pdf
  - Make sure your solution adheres to the competition rules
- eISR Homepage
  - https://www.subrace.eu/
  - Could look at what past teams have used
- *ISR Homepage*
  - *https://internationalsubmarineraces.org/17th-isr/*
  - *(Not the focus of this project – this is the drag race version of the European international submarine races (eISR) but does show more examples of human powered submarines. This was the competition which the current submarine was previously designed for)*