# SUB COURSE C: BUILD YOUR OWN BOAT
## Designing, Building, And Operating Unmanned Surface Vehicle

A ship is a complex vehicle operated in water where she is required to remain operable and survive with high durability in a rapidly changing environment while still performing her functions well according to the mission she was made. In the era of technology and communication, the task of humans increasingly helped by the presence of robot technology. A robot is a set of mechanical devices that can perform physical tasks, either with human control or using programs that have been created. This technology has begun to enter the field of naval architecture in which one of them is Unmanned Surface Vehicle (USV). USV is a vehicle that operate on the surface of the water (watercraft) without a crew and controlled manually or autonomously via the Ground Control Station (GCS).

USVs are the natural progression for today's marine industry and also the future for maritime operations. These unmanned and autonomous vehicles provide the ideal platform for services that currently rely on manpower heavy solutions. Rather than be constrained by traditional warfare areas and disciplines, USV's can be employed in various scenarios to do the dangerous, dull and dirty work with greater efficiency. The dull parts such as border surveillance can be done by USV's with greater persistence and lower cost from traditional methods. The dangerous part such as mine warfare clearance can save lives.

In CommTECH Camp Insight 2020, we will take you to understand and build your own ship prototype. The highlights in this subjects is that you will learn how to design, build, and operate your own ship. In addition, you will be invited to see the development of other type of vessels created by students in our department, i.e solar boats. These boats have won multiple prestigious championships, both national and international wide This program is designed to suit bachelors, masters or doctoral students with or without specific knowledge in naval architecture field. This camp will bring new knowledge, inspiring insights, fun, rewarding, and life-changing experiences to you.

Level : Bachelors, masters, or doctoral students with or without specific background in naval architecture.

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Synopsis of the course :

**Topic 1 : Introduction to Unmanned Surface Vehicle (USV)**

Unmanned surface vehicles (USV) or autonomous surface vehicles (ASV) are vehicles that operate on the surface of the water (watercraft) without a crew. USVs are valuable in oceanography, as they are more capable than moored or drifting weather buoys, but far cheaper than the equivalent weather ships and research vessels, and more flexible than commercial-ship contributions. This topic will focus on what is unmanned surface vehicles, their missions, their unique features, as well as ship design process that include Archimedes theory, Lines Plan, General Arrangement, and ship production process. This material will be required when the participants create a ship prototype in accordance with the design that has been determined.

**Topic 2 : Making Ship Prototype**

A ship prototype is a first, typical or preliminary model of the ship (in the size of a model), from which other forms are developed or copied, prior to mass-produced. Participants are required to understand the making process of ship prototypes platform as well as the process of ship printing using fiber materials. This topic will focus on making ship prototypes based on the Lines Plan drawing produced by ship hull modeller softwares.

**Topic 3 : Ship Propulsion and Control System**

The propulsion system is a system that allows the USV to move and maneuver properly. In this course, the USV propulsion system include motor, rudder, and propeller. Meanwhile, an autopilot system is a system that allows USV to move and maneuver according to GPS navigation and compass. This topic is arranged so that later the participants will be able to assemble and test the ship propulsion system and ship control system with manual control using remote control.

**Topic 4 : USV Technology**

The system controls the vehicle through the following operating modes: (a) manual assisted: remote manual control by means of joystick/keyboard of the vehicle heading and thrust; and (b) autonomous mode by giving commands such as waypoint, through Ground Control Station (GCS). USV can process the movement and observation data and then send it to GCS in real time through wireless communication system. This topic will discuss the details of the USV autopilot system in autonomous mode, how it works, and also the application.

**Topic 5 : USV Position and Direction**

The position and direction of the USV can be determined based on GPS sensors and compass. GPS is used to determine the location of the USV, while in order to know the direction of the wind sensors compass is used. This movement can be monitored in real time through the monitor screen. GPS and compass data will be delivered to monitor screen using microcontroller transferred with transmitter wirelessly. This topic will cover the details of how GPS sensors and compass work.