

# SUBS in Schools

Australia



## Level 3 - Spatial Design Project

### Design Brief & Virtual Reality Guide

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## **AUTHORISED AGENT**

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## Welcome

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The SUBS in Schools Spatial Design project challenges year 7 to 12 school students to design and build a virtual galley or berth environment for a submarine. The program aims to create an exciting and fun learning environment for students. If time permits, students are encouraged to go beyond the manual, be creative and innovative extending the process. Some of the problems students will face when designing a virtual environment will be similar to challenges faced by engineers building a full-scale submarine.

The program will expose students to 3D CAD/CAM packages, and virtual reality software as they consider the design alternatives and construction challenges with this project. The project focuses on helping students develop problem-solving skills and teamwork issues as they use their creativity and innovation to solve a real-world project.

It is an ideal design project for schools who do not have a significant Design and Technology workshop facility. This project requires minimal expense. Some schools do not have internal D&T classrooms capable of building a large-scale model of either an ROV or a submarine. This level of the competition will allow these schools to participate in a complex STEM program without being disadvantaged.

The task is to form a virtual design company, which will make a bid for the design of an accommodation space on board the Future Submarine Project. The students will have to build a virtual 3D model of the accommodation space (i.e. galley or sleeping quarters) and possibly a physical 3D model of their area and then present their design to a team of industry judges. The national winning teams may have the opportunity to undertake some high-level industry visits and possibly undertake overseas travel to represent Australia.

### See a Real Life Submarine

#### Sydney, NSW

Australian National Maritime Museum

- HMAS Onslow (tours available)



## Introduction

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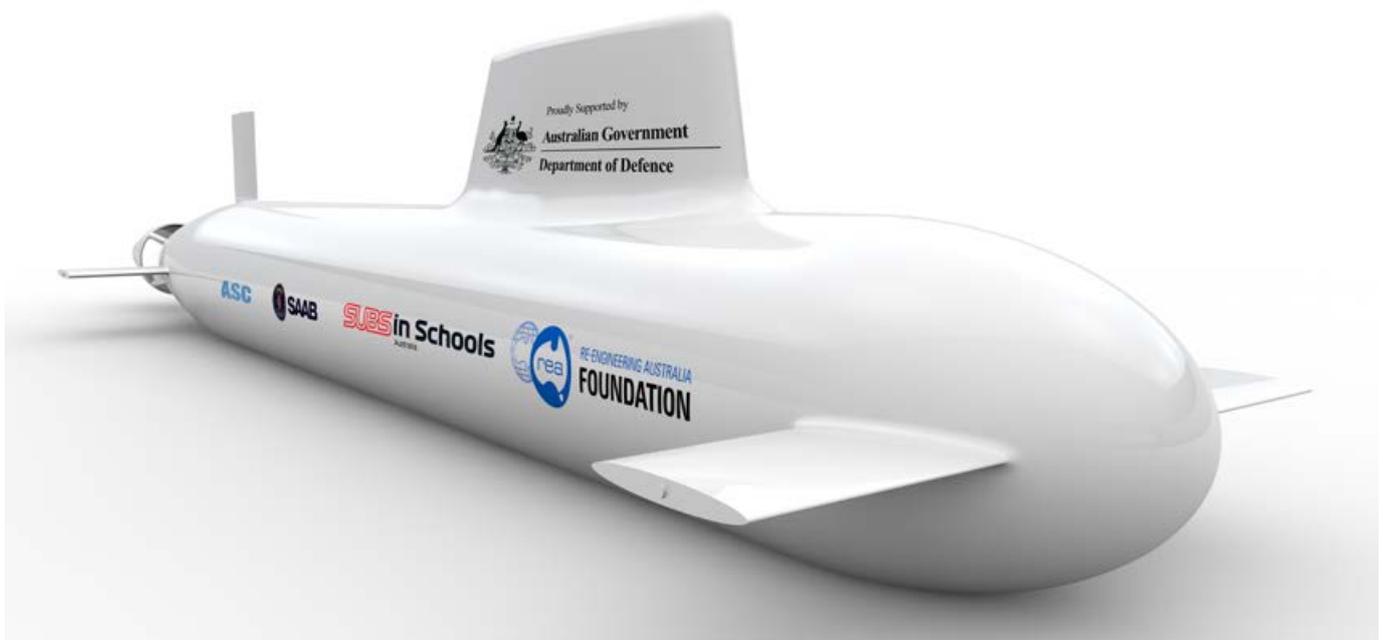
Australia is about to launch its next generation of combat submarine. You've seen a business opportunity and decide to start up a small business venture which includes a team of 3 to 5 members. You intend to design the internal galley (kitchen) or sleeping quarters (berth) within the submarine and present your design ideas to the acquisition team of the Naval Group who are designing Australia's next generation submarine.

As a new company, you will need to structure your team. Each member needs a clear role, title and the same workload for the duration of the project. You'll need to create marketing material to start building awareness for your team. Your company image could be created through the development of logos, advertisement, media exposure, social media, marketing materials or social networking.

As you're new to the submarine industry, you'll need to get up to speed quickly and efficiently on the latest design trends. To help develop your ideas, you will need to form connections with existing industries. Industry connections will aid in progressing your thoughts and may even provide access to pre-existing knowledge that you otherwise might not find elsewhere. You will also need to develop an understanding of how many people make up the crew on board a submarine and how this crew may use different spaces on a submarine.

Your design will compete against many others so you will need to be very clear on what is going to set your design apart from the competition.

Making the pitch to the acquisition team will be critical in determining your success. Your presentation should highlight your progress through your project and why your proposal will be the most effective.



## Option 1 - Kitchen (Galley)

### Background information

The galley is a confined space used by 2-3 chefs to prepare, cook and plate food for a crew of 50-70 submariners. It's a cramped environment and any ideas which will improve the working environment will go a long way. The style of food cooked is typical of items you cook at home, i.e. burgers, lasagne, pasta, pizza.

A typical time that a submarine is at sea is six weeks so you will need to build in methods of storing and accessing six weeks worth of food for 50-70 people.

### Considerations

#### 1) Layout

This is one of the most important aspects of the design, as the cooks will be working in a confined space so you'll need to consider how they move about a kitchen and work together as a team.

- What is the flow/ process of preparing, cooking and serving food in a kitchen?
- Do chefs use stations in a kitchen to complete different tasks?
- How do the chefs access the raw ingredients, through to disposing of the food waste?

#### 2) Storage of food

Space is at a premium on board a submarine so a conventional home pantry might not be the solution. How do you bring a sense of structure and organisation to the storage of food?

- Where is the food stored?
- How is the food stored? Is there an order to access the ingredients?
- How do the chefs access food to begin cooking?

#### 3) Disposing of food waste/ rubbish

- How do you dispose of food waste?
- How do you consider minimising the space rubbish will take up on board a submarine?
- Will there be an odour from the rubbish you'll need to consider?

#### 4) Appliances

- Commercial appliances vs submarine kitchens, what's the difference?
- What type of stove top/ oven do you use? Natural gas, LPG, electric? What justification do you have for choosing this heat source?
- Size of appliances for efficiency vs size?
- What appliances do you need?

#### 5) Human Ergonomics

- How high do you make a bench top, or an oven, how deep a bench? All these type of considerations are related to human ergonomics.



## Option 2 - Sleeping Quarters (Berth)

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### Background information

The crew on an Australian submarine can vary from mission to mission. Sleeping 50 to 70 crew on a rotational basis in an Australian submarine is the norm. Some American nuclear submarines can sleep up to 160 submariners on board.

How can you design a space that can accommodate a fluctuating crew size, possibly allowing the space to be used for another purpose when not being used for sleeping.

### Considerations

#### 1) Use of space

In a submarine it is very difficult to have time to yourself. One of the only opportunities you have is in your bunk.

- Lower ranking crew may need to share beds at different times, meaning one crew member may be leaving as the next arrives to go to sleep. How could you assist in this transition?
- Can you sit up in bed or only lay down?
- How can you personalise the space?
- Can you incorporate an opportunity for them to sit? Lighting for reading without disturbing others?

#### 2) Storage of personal items

- How do you give a crew member an area to store personal items?
- This may include a photo of the family, an area to store jewelery/ watches, books/Kindle/iPad.
- Storage of spare linen/ pillows
- Entertainment
- Modular space
- How can you utilise the space more efficiently? Can you remove bedding for a spot to read or play video games.

#### 3) Human Ergonomics

With a growing number of women entering the submarine work force how do you accommodate the differences?

- How do you allow men and women to coexist in a confined space but have privacy when changing clothing, showering, going to the bathroom and sleeping?



## Objectives

### 1. Model of Chosen Environment

#### 1.1 Produce 3D Model of the Space

Produce a 3D CAD model of your chosen space. The model should allow for presentation as an interactive walk-through. You may use any 3D CAD software package, however, a recommended software package for this project would be Sketch-Up.

The model must be produced in a way to exhibit the entire space and allow an interactive walk through. The virtual model may be assisted through the use of virtual reality goggles. Depending upon the complexity and in-depth approach you take with the virtual model you may opt to have a physical scale model to assist in the explanation of your design.

A significant component of any product development process is the development of a 3D model. It is from a 3D model that many design decisions are made. A 3D model can also be a very useful component of the sales process.

Sketch-Up is available for download from the following web page. This website also provides curriculum materials and tutorials specifically designed for students and the classroom. Students will be able to download a version of Sketch-Up for use at home to help develop their skills.

<https://www.sketchup.com/education/sketchup-for-schools>

Students will be required to bring their 3D CAD model on a memory stick or on their computer to the competition.

Virtual Reality hardware will be available at the competition for the students to use. The students will be able to upload and walk through their models.

If schools would like to implement their own Virtual Reality (VR) environments REA can facilitate the equipment specification and access to software which would allow the school to undertake VR within the school.

The system which will be provided for the students to use during the competition will be based on IrisVR software & tools.

It is not a requirement of this challenge that students need to have a understanding of the complexities and use of the VR technology. We will have people available on the day of the competition to help transfer the model into the VR equipment.

#### 1.2 Scale Model

If you choose to produce a physical 3D model of the virtual design it should be at 1:20 scale. The scale model should be used to assist your virtual model in explaining your innovative elements. The scale model **MAY** exhibit elements of your designs or be a complete assembly of your environment. It is open to your discretion for you to choose the best way to exhibit your designs. If you feel your virtual model is intuitive and descriptive enough you **MAY** choose not to produce a scale model to assist your sales pitch. A scale model is optional.

### 2. Project Portfolio



To streamline the judging of team Portfolios, teams **MUST** structure this as two separate documents as follows:

Enterprise - including a focus on your team and your virtual company

Engineering - including your design and its unique strategic advantages.

Portfolio Design elements will be assessed throughout the entire team Portfolio.

A team's Portfolio tells the story of the team's journey including the knowledge and skills they have acquired along the way. It is also a useful tool for selling the team's capabilities and the design of their space.

A portfolio is a professional business document. Attention to detail is paramount. Most importantly, teams need to read the Portfolio judging information within ARTICLE C6 of the SUBS in Schools Australian Competition Regulations and the relevant scorecards contained within this document to ensure that all areas of the assessment process are addressed within the context of the Portfolio.

### 3. Trade Booth

Produce a trade booth – usually a 2m (w) x 1m (D) x 2.4m (H) expo style booth aimed at selling your virtual company's products to the Department of Defence. This will include the development of their company uniforms.

Within this space teams apply their marketing and branding material.

#### Assessment

The judges will assess a team's ability to market their design primarily within their Trade Display. Specific areas to be highlighted within the trade display are addressed in ARTICLE C7 of the SUBS in Schools Australian Competition Regulations and the relevant scorecards contained within this document.

#### Who Needs to Attend?

All team members must be present for the Trade Display judging



#### 4. Verbal Presentation

Teams will be required to deliver an oral presentation of their design to the Judges. The submission must last longer than ten (10) minutes. Teams must bring a laptop with any slide-show or other multimedia files that form part of the presentation. Teams should have available VGA and HDMI cables to connect to a data projector/TV monitor.

##### Assessment

Teams will be assessed on both their delivery technique and the content of their presentation. Teams should refer to information within the ARTICLE C8 of the SUBS in Schools Australian Competition Regulations and the relevant scorecards contained within this document.

##### Who Needs to Attend?

All team members must be present and contribute to the Verbal Presentation.

##### Team Preparation

Each team is required to prepare an oral presentation. Teams need to have all presentation resources tested and ready to go before entering the room. Most importantly, teams should read the oral presentation judging scorecard carefully to ensure their presentation features all elements and content that the verbal presentation judges will be scoring.

##### Judging Process / Procedure

Teams will be given 5 minutes at the start of their presentation to set-up and test their laptop and any other presentation resources. The team will inform the judges when they are ready to begin. At the conclusion of the team's presentation, the judges may choose to provide some feedback or ask any clarifying questions they feel necessary.

##### Verbal Presentation Judging Provisions.

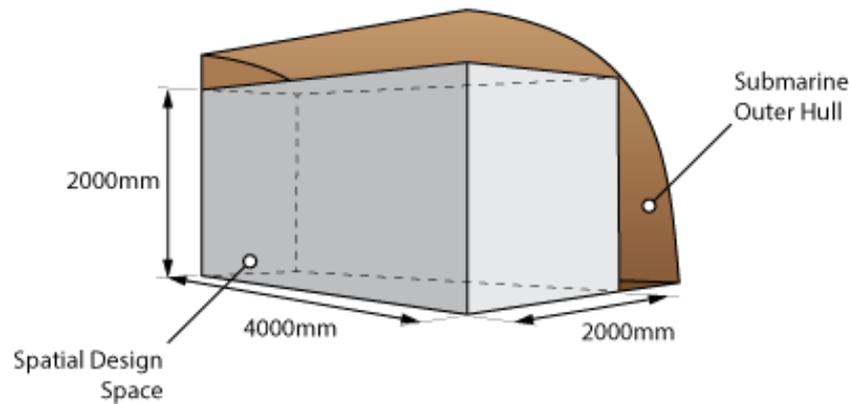
A meeting room, where the team will deliver their presentation will be made available. This space will include a data projector and screen or large TV monitor. Multimedia sound systems may not always be available, and teams may have to bring portable speakers. If possible, these will be in fixed positions but usually with sufficient cable length to allow teams some freedom for choosing where they wish to locate their laptop. A single table will also be made available with its use and location in the presentation space being optional.



## General Regulations

### R5.1 Overall Size

The completed assembly must fit within the dimensions shown. All design features and elements **MUST** stay within the constraints of this space.



### R5.2 Passage Size

The passage width **MUST** be no less than 600mm in width and no less than 1800mm tall, to allow crew to pass in and out.

### R5.3 Berth

The regulations for berth are only applicable if you are working on the berth design brief.

#### T5.3.1 Crew Capacity

You **MUST** provide an area for rest and relaxation for a rotational crew of 24. The crew are on 12 hour rotations, 12 hours at work, 12 hours sleeping/relaxing.

#### T5.3.2 Berth Operational Requirements

The berth **MUST** have an area large enough for a 95% male to sleep comfortably. The crew **MUST** be able to securely store personal items and change the bed sheets quickly for crew change over.

### R5.4 Galley

The regulations for galley are only applicable if you are working on the galley design brief.

#### T5.4.1 Crew Details

The submarine can acquire a crew up to 60 submariners. A typical voyage on board the craft is 6 weeks. The crew consume 4 meals a day, breakfast, lunch, dinner and supper. You **MUST** cater for the entire duration of the expedition.

#### T5.4.2 Chef Details

There are 2 chefs in the galley at one time. You **MUST** accommodate for multiple chefs in the galley environment.

#### T5.4.3 Kitchen Operational Requirements

The galley **MUST** be capable of storing food, preparing food, cooking food. This **MAY** be completed via a number of methods. Human ergonomics **MUST** be considered as you design these spaces.



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