



## **SERIES**

How to Command a Nuclear Submarine

## **EPISODES IN THIS SERIES**

4 sixty-minute episodes

## **EDUCATION SHEET EPISODE**

Episode 1

## **SCHOOL LEVEL**

Junior Secondary

Senior Secondary

## **EDUCATION DESCRIPTION: How to Command a Nuclear Submarine**

The Royal Navy's punishing "Perisher Course" is undoubtedly one of the world's toughest job interviews. Designed to single out individuals capable of commanding a nuclear submarine, the course subjects students to extreme stress as they face every possible scenario that a modern submarine may encounter. Revealing this top secret world for the first time in 30 years, the Royal Navy opens the hatches to chart the progress of five young officers putting their careers at stake. Success wins the highly prized command of a nuclear-powered submarine, failure brings an immediate end to a submarine career. Filmed on board HMS *Triumph* off Scotland's wild west coast, the documentary combines physics, engineering, mathematical equations and the workings of a nuclear submarine with real, live human drama.

## **TEACHER BACKGROUND INFORMATION**

In the early days, the British Admiralty regarded submarines as "underhand, unfair and damned un-English", but quickly changed their minds when they saw how effective these stealthy killing machines could be. Thanks to advanced technology and long-range weapons, subs are deadlier than ever.

*How to Command a Nuclear Submarine* presents a unique opportunity to enter the highly secret world of the some of the world's deadliest machines. Travel alongside five young officers in their bid to complete the Royal Navy's "Perisher Course" and qualify to command a nuclear submarine.

We join the men at Faslane Base on Scotland's west coast as they prepare to board the Trafalgar class submarine, 5000-tonne HMS *Triumph*. Crewed by 130 of the navy's finest, *Triumph* is a hunter-killer, armed with missiles and torpedoes able to strike targets 1600km away.

In this episode, the trainee captains are subjected to an "Eyes Only" exercise, in which they must use just a periscope and a stopwatch to calculate the distance and speed of opponents, diving the sub instantly if a ship comes dangerously close. This and other tests clearly demonstrate the men's different personalities and attributes, highlighting character traits that work for or against them.

We also learn how a nuclear reactor the size of a beer barrel powers two turbine engines, and how the submarine produces its own fresh water, oxygen and electricity, enabling it to remain submerged for up to 90 days.

Elements of human drama, the secrecy of naval submarines, nuclear physics and mathematics combine to create a masterful teaching tool. There is scope for further research and class discussion, particularly about the pros and cons of nuclear energy.

## **CURRICULUM POINTERS**

### **Junior Secondary Curriculum**

*The science curriculum provides opportunities for students to develop understandings about science and its processes, the scope of its contributions to our culture and society, and its applications in our daily lives. The science curriculum addresses the diverse needs of Australian students by providing them with scientific knowledge, understandings and skills to make informed and responsible personal, social, technological and environmental decisions that impact at the local, national and global levels and to participate, if they so wish, in science-rich careers.*

Australian Science K-10 Curriculum 2010: Rationale

### **Senior Secondary Curriculum**

*The study of physics provides students with an understanding of systems that is the basis of the development of technological applications. The interplay between concepts and technological and societal impacts is embodied in the history and philosophy of science and forms a continuum relating our past to our future.*

NSW Physics Stage 6 Syllabus Curriculum 2002: Rationale

## CURRICULUM OUTCOMES

### Junior Secondary

In undertaking these tasks, students of Science will:

- *Develop an interest in science and a curiosity and willingness to explore, ask questions and speculate about the changing world in which they live*
- *Develop an ability to communicate their scientific understandings and findings to a range of audiences, to justify their own ideas on the basis of evidence, and to evaluate and debate scientific arguments and claims whilst respecting alternative viewpoints and beliefs*
- *Develop an ability to solve problems and make informed, evidence-based decisions about current and future applications of science while taking into account moral, ethical and social implications.*

Australian Science K-10 Curriculum 2010: Aims

### Senior Secondary

In undertaking these tasks, students of Physics will develop knowledge and understanding of:

- the nature and practice of physics
- applications and uses of physics
- the implications of physics for society and the environment
- current issues, research and developments in physics
- energy
- waves

and develop further skills in:

- communicating information and understanding
- developing scientific thinking and problem-solving techniques.

NSW Physics Stage 6 Syllabus Curriculum 2002

## STUDENT LEARNING TASKS

### Junior Secondary

#### Task 1

Find a website to help you draw a floor plan of a nuclear submarine and label the following parts:

- Inner hull
- Outer hull
- Control room
- Sail
- Masts
- Nuclear reactor
- Engine room
- Rudder and controls
- Propellor
- Engines
- Fuel storage
- Torpedo room
- Manoeuvring room
- Launch gear
- Ballast and trim tanks
- Food stores
- Escape hatches
- Sonar sphere
- Messes (dining rooms)
- Cabins
- Bunks

Make sure you list which site or sites you used in drawing and labeling your plan.

#### Task 2

Do some research to find out about the introduction of nuclear propulsion to submarine construction:

- Who developed the first nuclear submarine?
- Where was he from?
- What was it called?
- When was it launched?
- What were its dimensions?
- What were three advantages it had over other types of submarine?
- Is it still in commission?

### **Task 3**

Write 100 words to describe the “Eyes Only” test that forms part of the “Perisher Course”. In your description, include vessels, equipment, a mathematical formula and two risks that are part of this test.

### **Task 4**

Write 100 words to describe how a nuclear-powered submarine differs from a conventional submarine.

### **Task 5**

Do you think nuclear warships should be allowed to visit Australian waters? Write a letter of about 150 words to Australia’s Minister for Defence in which you outline your opinion and reasoning on this matter.

## **STUDENT LEARNING TASKS**

### **Senior Secondary**

#### **Task 1**

Draw a diagram to show how nuclear marine propulsion works.

#### **Task 2**

List five advantages and five disadvantages of nuclear-powered submarines. Write a 50-word paragraph to sum up whether or not you believe the advantages of nuclear power outweighs the disadvantages in submarines.

#### **Task 3**

In about 150 words, explain what an “Eyes Only” exercise involves and the mathematical calculations required, including variables.

#### **Task 4**

Do some research to help explain, in about 75 words each, how the following are generated on nuclear-powered submarines:

- Forward and reverse thrust
- Electricity
- Fresh air
- Fresh water

#### **Task 5**

Describe in 200 words what becomes of the waste material generated by nuclear-powered submarines.