SUBMARINE TRAINING

SCS – SUBMARINE CONTROL SIMULATION

PASSION FOR **TECHNOLOGY.**

RHEINMETALL

HIGH FIDELITY STEERING STAND AND PLATFORM SYSTEMS

A PROFESSIONAL NAVY

NEEDS PROFESSIONAL TRAINING
USING PROFESSIONAL SIMULATION SYSTEMS

ENGINEERING TRAINING FOR SUBMARINES

Rheinmetall Defence is one of the largest German manufacturers of military simulation solutions for naval, land, air, joint and combined forces.

- With a broad portfolio of naval simulation solutions for generic, emulated, stimulated and onboard systems
- Turnkey supplier – from computer based training to full mission incl. courseware and infrastructural works
- More than 40 years' experience in high fidelity SCS modelling and simulation
- Competence in submarine and surface platforms and tactical training environments
- Proven ability to realise Naval Simulation Networking Enabled Capabilities (NEC) and simulation linking

SUBMARINE CONTROL SIMULATOR

INTRODUCTION

Today Navy's Submarine assets range from those with older designed platform engineering systems to the most modern with fully automated Engineering Monitoring and Control Systems (EMCS), including Air Independent Propulsion (AIP) for which Rheinmetall Defence has both the proven experience and capability to provide complete and a scalable range of simulation and training solutions.

SUBMARINE CONTROL SIMULATION – DEFINITION

Provision of a complete 'high fidelity' crew team training for:

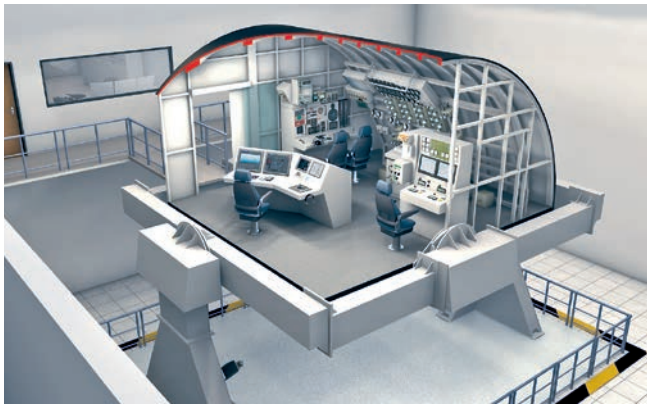
- Steering stand/autopilot, diving/surfacing, manoeuvring and platform engineering tasks of a submarine
- By substituting the actual submarine with mathematical, physical, hydrodynamic and engineering systems simulation modelling
- To simulate, emulate or stimulate Original Equipment Manufacturers' (OEM) actual systems

Thus:

- Complete manoeuvring and platform engineering systems training can be performed without needing the actual submarines saving costs
- Training of emergency and other situations not possible in reality
- Can be used for sea trial, technical, procedural and tactical tests

SYSTEM CONFIGURATION AND SCALABILITY APPROACH

A modular and scalable approach to Submarine Control Simulation (SCS) for all platform systems and sub-systems enables users a step-by-step selection and subsequent expansion of the submarine control simulator and its main system segments. Namely the required onboard systems and sub-systems to be trained, their respective trainee stations, Cabin (CAB) layout and Motion System (MOT). These segments and simulation solutions for their respective realisation can be configured for simulator realised from an entry level PC based classroom part task to team trainer, up to a full scale SCS.

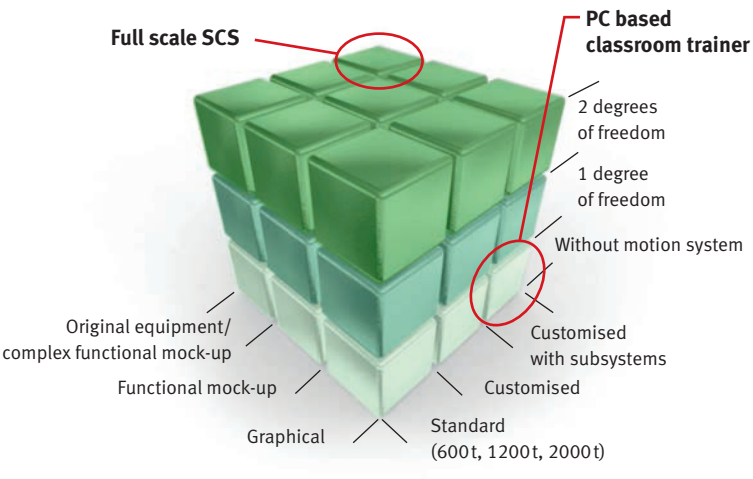


SUBMARINE CONTROL SIMULATION – CONFIGURATIONS

Trainee stations

Complex functional mock-up

3D virtual environment

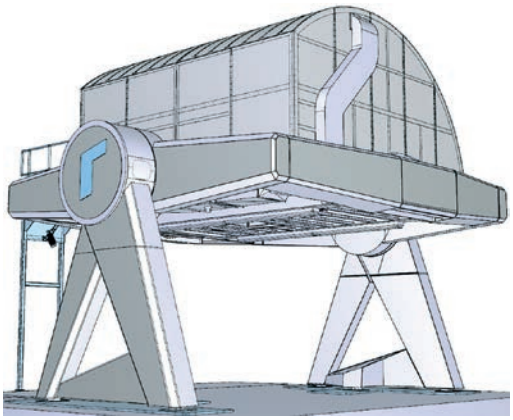


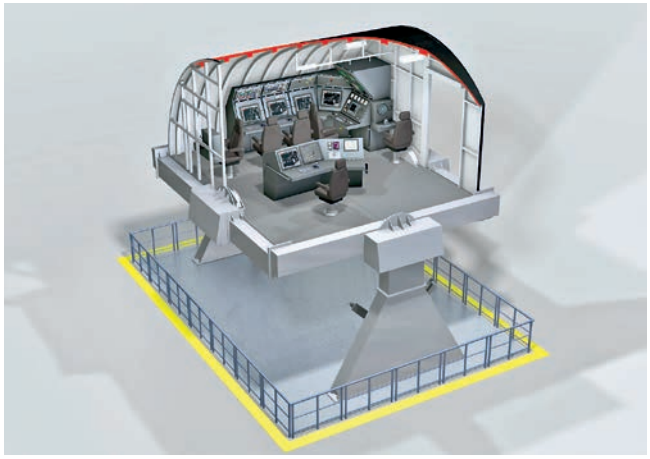
Motion system

Mathematical model

FULL SCALE SCS

A graphic and current example of a full scale SCS. The Motion (MOT) system is a 2 Degrees Of Freedom (DOF) safe, highly reliable and low maintenance electrically driven system. Despite the Motion system being 2 DOF to achieve up to between 45° and 60° of pitch and roll simultaneously, the submarine mathematical model is most accurately calculated to a 6 DOF solution.





PC BASED CLASSROOM TRAINER

Part task training and instructorless training

Two trainees and one instructor (sub-team training)

Several trainees and one instructor (team training)

Application

- On-board orientation
- Part task training
- Instructorless training
- Sub-team training
- Team training

Configuration

- PCs connected by TCP/IP network
- PCs can be dynamically assigned by instructor to specific applications

SYSTEMS, SUBSYSTEMS AND TRAINEE STATIONS

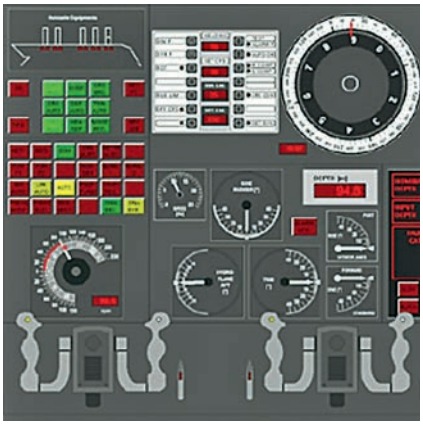
The SCS is designed to provide simulation for all onboard systems and sub-systems including:

- Steering stand (station)
- Air Water Management System (AWMS)
- Propulsion control
- Diesel engine
- Air Independent Propulsion (AIP)
- Snorkel and mast control
- Ballast systems
- Automated Engineering Monitoring and Control System (EMCS)
- Integrated Platform Management System (IPMS)

For each of these it is possible to use the following simulation approaches:

- Simulation, either graphical, functional mock-up or complex functional mock-up
- Emulation integrating Original Equipment Manufacturers (OEM) system software
- Stimulation of actual onboard OEM equipment

Steering stand alternatives



Graphical simulation

Functional mock-up

'Stimulated' original OEM equipment

Air Water Management System (AWMS) and Engineering Monitoring and Control System (EMCS) alternatives

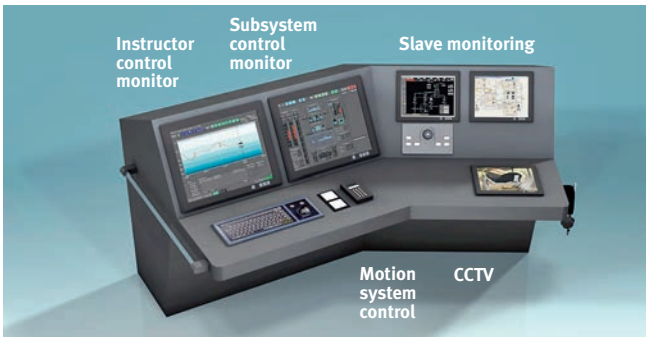
Functional mock-up AWMS

'Stimulated' original OEM equipment

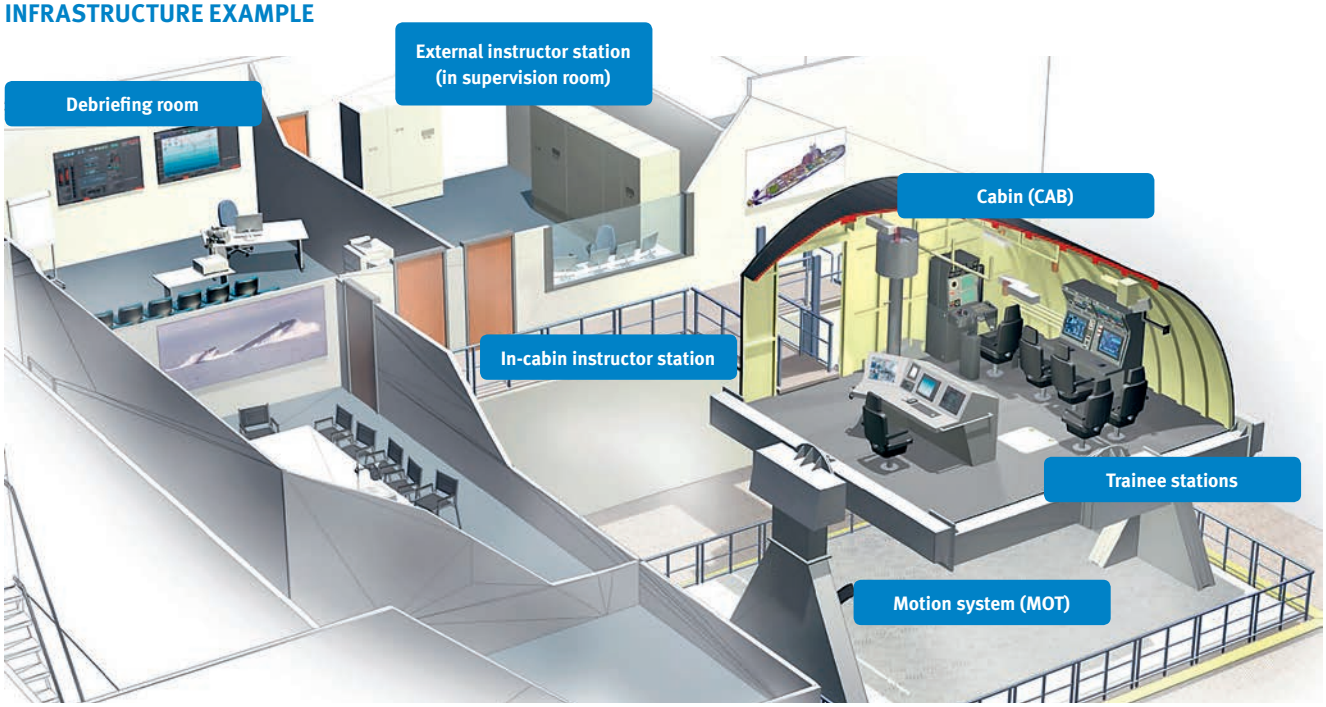
INSTRUCTOR STATION

The main functionalities of the Instructor station include:

- Simulator control and monitoring
- Observation, recording and assessment of trainee performance
- Submarine system and sub system control
- Display of simulator, system and subsystem status
- Setting of malfunctions



INFRASTRUCTURE EXAMPLE



CUSTOMERS BENEFITS FROM SUBMARINE CONTROL SIMULATION (SCS)

- Modular expandability enabling access to high fidelity simulation of submarine engineering systems and subsystems training in a multi-stage budget-dependent conceptual approach
- Stimulation, emulation or simulation of real OEM platform systems, automation and subsystems is possible
- System saleability from entry level part task individual operator training to comprehensive training for an entire submarine engineering and technical team
- Flexible configuration of the simulation in order to train at various skill levels with different onboard systems
- Future-proof system approach

KEY CHARACTERISTICS OF SCS

- User-defined solution taking into account the required modelling quality and depth, the necessary hardware effort and the layout of the motion system
- Linking and or networking via standard interfaces with other simulators (e.g. Submarine Command Team Trainer (SCTT)) for tactical submarine operations training
- Availability of expansion for 3D virtual environment submarine simulation with interactive local operation and dynamic feedback to the simulation system
- Synchronised recording of all relevant system data, voice communication, CCTV and monitor images for subsequent analysis and debriefing; restart of exercise at freely selectable starting points
- Proven capability and experience with a significant number of systems and upgrades supplied over the last 40 years

Rheinmetall Electronics GmbH
Brüggeweg 54
28309 Bremen
Germany

simulation@rheinmetall.com
www.rheinmetall-simulation.com