



Naval Combat Systems Engineering Course

Resume of Course Topics

Introduction to Systems Engineering – Lecture by Industry

An overview of Systems Engineering thinking and its application. This gives an insight of why we use Systems Engineering practices for Combat Systems and will involve multiple examples from System Engineering projects from around the world. The lecturers will involve the delegates in discussion and exercises; they will also cover any Combat System issues that are raised.

What is a Combat System? – Lecture by a serving RN Officer

An overview of the current Combat System equipment's, what function they perform and how they work together, including roles of the different types of ship and how this affects the equipment fit. The Naval Combat System Integration & Support Service will be covered; how does it benefit the MoD, what services does it provide?

Combat System Scenario – Lecture by Industry

This lecture will display the recorded video output from a realistic simulated scenario run in the T23 Shore Integration Facility. The operators screen will be presented as the scenario (engagement) develops. The functions of the Combat System will then be described during the various stages of the engagement. This scenario sets the context for the course and will be referenced in some of the other lectures during the week.

Use of the Combat System - Lecture by Industry

An insight in to an operations room of a warship and how the training, management, understanding and use of combat system equipment influence the successful outcome of engagements with an enemy. Lessons learnt from past conflicts are also discussed.

Standards, Data Management and Integration + Networks – Lecture by Industry

The System Integration regime that supports the Combat System with unified Fleet-wide Integration Policies & Procedures – backed by relatively simple Networking Standards. The 'staged' versus the 'big-bang' approach to system testing & integration. Also covers system and contractual relationships, shore and ship based integration and the pros and cons of each.

Combat System Component Architecture – Lecture by Industry

This will describe what a component based architecture is and enable an understanding of why we need component based architectures. There will also be an exercise to create your own Component based architecture.

Requirements Engineering - Lecture by Industry

The importance of Requirements Engineering as a discipline. Understanding stakeholders. Requirement writing & analysis. Requirements Management. Smart Requirements. Dealing with constraints from legacy equipment, designated technology, standards and corporate knowledge. Introducing the framework for System of Systems integration.

Safety - Lecture by MoD.

Policy on MoD Ship & Equipment Safety Management, the complex regulatory framework and current MoD safety concerns. During the presentation many examples are shown of where safety has failed in the past and how this has shaped the current policies in place.

Maritime Integration Support Centre Tour – Demonstration by Industry

Tour to explain and show how the T45 / QEC Maritime Integration Support Centre supports the Royal Navy. The value of using this facility versus RN vessels is discussed. Also how this facility can be utilised for urgent operational defect (OPDEF) rectification is explained.

Warship Alignment – Lecture by MoD (Ret'd)

Describes why mechanical alignment is important and how systems are aligned, and what it means to the combat system if the ship is incorrectly aligned. There are also a couple of practical demonstrations to get the delegates thinking about Datum's, Tilt, and cumulative errors. Electrical and electronic alignment is also covered.

Royal Naval Communications - Lecture by Industry

An overview of communications in the Royal Navy and how these systems co-operate with Combat Systems. It will cover current use of communication equipment, how interoperability is achieved and how COTS is now part of the communications world. Current problems and issues are covered. A brief is given on the future of Royal Navy communications.

Ground Truth Acquisition & Playback System (GTAPS) - Demonstration by Industry

GTAPS is a man portable recording unit that can be used in a variety of land and sea based locations to obtain a high quality ground truth. The demonstration will cover how GTAPS is used and what are the benefits to the Combat System of using it.

Geospatial Errors – Lecture by Industry

The need to address these errors including how research projects are focusing in this area. Sources of error and how to express them. Current practice. Standards and the need for meta-data (data to describe data). A very complex subject presented in a comprehensible manner.

Warship Vulnerability Reduction - Lecture by MoD

The need to reduce warship vulnerability. Current threats. Damage mechanisms. Vulnerability assessment and reduction measures. An Anti-Air Warfare system example shows how overall system vulnerabilities can be reduced by careful design and how this applies to Combat Systems.

Submarine Common Combat System Initiative – Lecture by MoD

This is a programme to tackle the whole life costs of submarine combat systems. This lecture will explain how COTS components are used and how this programme is enabling a migration towards open architecture combat systems. It will also explain how the use of virtual machines has benefited the programme.

Human Factors Integration - Lecture by Industry

The rationale for Human Factors Integration and the HFI approach within UK Defence procurement. Human Computer Interaction within combat and ship platform systems. Task analysis. Implementation issues such as workstation design, stress and hazards, vision and lighting, controls and the importance of Style Guides. It will also cover Human Factors analysis to help identify issues and risks.

Maritime Composite Training System (MCTS) & Bridge Navigation Trainer - Demonstrations by serving RN Officers at HMS Collingwood.

A visit to see Operations Room training and how it is undertaken in the MCTS facility. Delegates will gain an appreciation of how modern computing techniques revolutionise the Royal Navy's 'Team Training'. Delegates will also visit the Bridge Navigation Trainer to see it in operation. How does the Navy train its navigators today, how do they use the equipment procured? There may be opportunity for delegates to experience a 'navigation scenario' if there are no students being trained at the time of the visit! (Note: visits are dependent on operational priorities.)

Autonomous Systems – Lecture by Industry

What are autonomous systems? Why is the MoD starting to focus on these systems? Insight into where these systems could be applied. What are the implications for Combat System Engineering? The Unmanned Warrior exercise is explained.

Shared Infrastructure – Lecture by industry

This lecture discusses the benefits and reasons for the MoD to migrate Combat Systems to a Shared Infrastructure for surface platforms. It covers the use of virtualisation, the shared Network Infrastructure and explains the Shared Computing Environment and shared storage. A view will also be given of the MoD roadmap to virtualisation and Shared Infrastructure.

Supportability Engineering – Lecture by serving RN officer

This provides an understanding of why Supportability Engineering is important to the success of a project. The cost of Development and Manufacture is just the tip of the iceberg. Through the Support Solutions Envelope, and now Defence Lines of Development, MoD is trying to influence the acquisition of new equipment's to ensure they are affordable and supportable through-life.

Combat System Evolution + T26 Global Combat Ship – Lecture by Industry

What will Combat Systems look in the future? How is the T26 Combat System shaping up, how will it be integrated? What are the challenges that are faced by the MoD's Maritime Combat Systems Group over the next few years? All these questions will be answered by the lecture.

Shore Integration Facility Tour – Demonstration by Industry

How the T23 / LPX Shore Integration Facility supports the Royal Navy. The value of using this facility versus RN vessels is discussed. Also how this facility can be utilised for urgent operational defect (OPDEF) rectification is explained.

Electromagnetic Environmental Effects (E3) in Naval Environments– Lecture by Industry

The E3 environment. Electro –Magnetic Compatibility (EMC), Mutual Interference (MI), Electro-Magnetic Pulse (EMP) protection – including an overview of Tempest & Spectrum Management. Prediction and measurement tools. Who to ask for further advice and support plus lessons learnt are also covered.

Integrated Sensing in Support of Situational Awareness – Lecture by Dstl

This will be tackled from a Situational Awareness perspective to address Situational Awareness gaps and how they may be filled. This will pull together fusion aspects, system engineering and sensor aspects. This is a leading edge lecture explaining some of the research projects that Dstl are currently working on.

Maritime Force Capability Assurance – Lecture by Industry

What is Maritime Force Capability Assurance (MFCA) and why is it important? How is it measured over the force? What are the benefits of a good tactical picture? What are the benefits of MFCA to the military? These and many more questions will be answered by this lecture. There is also a syndicate exercise which will engage the delegates.

QEC Combat System – Lecture by 2 serving RN Officer's

Delegates will be asked to proffer a design for the QEC Combat System; putting into practice what they have learnt during the week. This will then be compared to the actual design giving an understanding of the Queen Elizabeth Class Combat System. How some of the integration issues were resolved are also covered. The Aircraft / Ship interface will also be explained.

Combat System Change Management & Fleet Minor Trials – Lecture by MoD

The Change Impact Assessment Process and how it's used within Combat System change management for configuration control. Why it is required and the benefit to the MoD. Other processes concerned with configuration management are also discussed. The Fleet Minor Trial process will also be explained.

Engineering the Combat System & Closing Remarks – Lecture by a Senior serving RN Officer

This will join up all the themes throughout the course and present a view on how valuable the information and techniques learnt are for those involved in the Maritime Combat System Enterprise. It will discuss the role of the Combat System Design Authority. Finally an insight into the challenges for Maritime Combat Systems in the future followed by some closing remarks.

Throughout the course, delegate networking is actively encouraged during the day; this is supplemented by two evening activities. There is a relaxed evening meal in the hotel on the first night, plus a visit to a Royal Naval Wardroom for a formal dinner later in the week.