# OCD & CONOPS

## in Capability Development

## A Course Over Five Days

Presented by Mr Robert Halligan FIE Aust CPEng




The course is an immersion into the development of military capability, with a focus on problem definition, Operational Concept Description (OCD - how the capability, and each element of its solution, will be used), and concept of operations (CONOPS - how the military outcome is to be achieved).

This updated version of the course includes several more examples of military capability development work products, as a consistent set for a single military capability need and solution. The course content is easily transferable in application to any substantial business system, public infrastructure system, or other large undertaking involving people and technology as a part of the solution.

### Who should attend this course?

- military capability developers
- systems engineers and requirements managers working on military programs
- program and project managers for development of military capability, and parts thereof.
- counterparts in major infrastructure projects

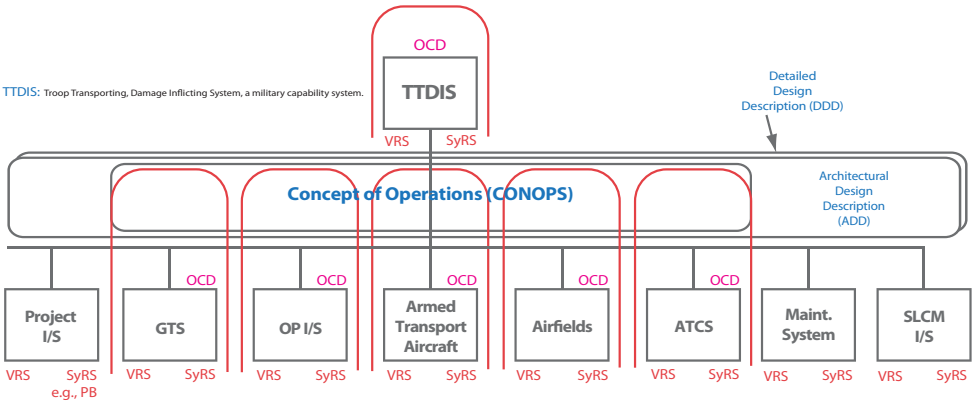
*"The OCD and CONOPS course has been very helpful. We are regularly applying what we have learned"*

delegate, CSIR DPSS, South Africa

*"The knowledge that Robert has is fantastic. His patience in ensuring the students comprehend the material is very good."*

delegate, Saab Systems, Australia

### REQUIREMENTS/OCD/CONOPS RELATIONSHIPS




ADD: Architectural Design Description. An ADD describes the concept of the solution to meet ALL of the requirements of the TTDIS.

CONOPS: Concept of Operations. A CONOPS describes the concept of the solution to meet the subset of the requirements of the TTDIS that are directly use-related. Also called an Operational Solution Description (OSD).

DDD: Detailed Design Description. A DDD describes the design to meet ALL of the requirements of the TTDIS. The description is at a level of detail that is implementable, e.g. sufficient to contract for, and/or design and develop, or otherwise acquire, each element of solution at the physical level shown. The DDD incorporates the set of SyRSs for the set of system elements, together with instructions for configuration of the set of elements into a whole solution.

OCD: Operational Concept Description. An OCD is a system (subsystem, etc)-centric description of the users of the system, the intended uses of that system, how it is intended the system be used, and the external conditions during which the system will be used. The OCD describes the context within which the problem definition (requirements, MOEs, goals and value relationships) exists, i.e. the purpose of the system. Also called a Concept of Use (CONUSE).

VRS: Verification Requirements Specification. Specification of the qualities of evidence required that each requirement has been satisfied.

SyRS: System Requirements Specification. A SyRS specifies the required characteristics of the item, together with goals (if any) for that item.

PB: Project Brief. The Project Brief is the SRS for the Project System (here shown as Project Infrastructure).

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This course is recognised by Engineers Australia for CPD purposes (40 Hours)

This course is certified by ECSA for 5 points (ref. INCOSE 13/003/15)

Attendance at public courses and on-site delivery in Australia may be eligible for SADI funding.


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# OCD & CONOPS in Capability Development

## Course Outline

PROJECT PERFORMANCE INTERNATIONAL

### 1. Concepts and Definitions

- defining the problem, and developing a complete solution
- life cycle basis of problem definition & solution
- example requirements and MOE's relating to a capability
- example physical levels of solution definition relating to a capability
- definition: problem
- problem description definitions
  - definition: requirement/threshold
  - definition: measure of effectiveness
  - definition: measure of performance
  - definition: target/goal/objective
  - definition: value (effectiveness) model
  - definition: operational effectiveness
  - definition: requirement importance
- definition: requirements specification
- concepts related to problem description
  - definition: need
  - definition: want
  - definition: desire
  - definition: intent
  - definition: expectation
  - definition: constraint
- definition: OCD – operational concept description/CONUSE – concept of use
- definition: solution
- definition: solution description
- definition: architecture
- definition: architectural design description
- definition: architectural framework
- definition: CONOPS – concept of operation(s)/OSD – operational solution description
- definition: detailed design
- definition: stakeholder
- definition: verification
- definition: verification requirement
- definition: verification requirements specification
- definition: validation

### 2. General Concepts of Problem Solving

- problem definition
- emergence
- divergence
- convergence
- systems thinking

### 3. Relationships Between Requirements Document, OCD, Architectural Design Description, CONOPS

- a system solution
- systems of systems

### 4. Types of Requirements

- eight basic types
- *workshop 1 - categorizing requirements for a capability by type*

### 5. The Quality of Requirements

- requirements quality attributes

### 6. Requirements Analysis for the Capability: OCD and SyRS Content

- purpose of requirements analysis and its relationship to OCD
- relationship to CONOPS
- requirements analysis (capture & validation) methodology
- context analysis, and relationship to OCD
- *workshop 2 - context analysis for a capability*
- states & modes analysis, and relationship to OCD
- *workshop 3 - states and modes for a capability*
- parsing analysis, and relationship to OCD
- *workshop 4 – parsing analysis*
- functional analysis, and relationship to OCD
- *workshop 5 - functional analysis for a capability*
- rest of scenario analysis, and relationship to OCD
- ERA analysis, and relationship to OCD
- out-of-range analysis, and relationship to OCD
- value analysis, and relationship to OCD
- *workshop 6 – building a capability system value (system effectiveness) model*
- operational effectiveness
- operational effectiveness versus overall effectiveness
- extracting information for an OCD and requirements document from users (and others)

### 7. Operational Concept Description (OCD) for the Capability

#### 7.1 Content and Purpose of an OCD

- users and uses of an OCD, in detail
- types of OCD
- principles regarding content
- use cases, mission profiles, scenarios and the OCD
- how does support relate to an OCD?
- relationship of the OCD to the requirements document
- OCD standards and guides
  - Operational Concept Documents, DID DI-MCCR-80023, SDD Documentation Set – Data Item Descriptions for DoD-STD-2167, U.S.A. Department of Defense, 1985
  - Concept Data Item Description, SMA-DID-P100, NASA Product Specification Document Standard, Release 4.3, 1989
  - ANSI/AIAA G-043-1992, Guide for the Preparation of Operational Concept Documents, 1992
  - Operational Concept Description (OCD), DID DI-IPSC-81430, Data Item Descriptions for MIL-STD-498, U.S.A. Department of Defense, 1994
  - IEEE Standard 1362, IEEE Guide for Information Technology – System Definition – Concept of Operations Document, 1998
  - ACC Instruction 10-650, Development and Use of Concepts of Operations, U.S. Department of the Air Force, 1998
  - Guide for the Preparation of Operational Concept Documents, ANSI/INCOSE/AIAA, G-043:2012
  - PPI's OCD/CONUSE DID
  - who should prepare an OCD
  - timing of preparation of an OCD versus requirements document

#### 7.2 Preparing an OCD

- characteristics of a good OCD
- *workshop 7: review of sample OCD's*
- *workshop 8: preparing a basic OCD*
- pitfalls in OCD preparation
- *workshop 9: review of an OCD for a military aircraft system*
- use of graphics in OCD's
- level of detail in the OCD
- design content – when, and when not?
- makeup of an OCD development team
- the role of users
- beyond the basic OCD
- extending OCD's to other stakeholders
- pitfalls in preparing OCD's

### 8. CONOPS/OPERATIONAL SOLUTION DESCRIPTION

#### 8.1 Content and Purpose of a CONOPS

#### 8.2 Relationship of CONOPS to Overall Solution

#### 8.3 Styles of Solution Development

- the solution domain: key concepts, relationships, and work products
- *workshop 10 – principles of CONOPS development*
- waterfall, incremental, evolutionary and spiral capability development approaches
- *workshop 11 – capability solution development strategies*

#### 8.4 Concepts of Architecture – Physical and Logical, in CONOPS Development

- physical architecture (structural view) – basic concepts
- the role of technology and innovation
- techniques for stimulating innovation in solution development
- use of design driver requirements
- perspiration engineering: configuration items
- criteria for selecting configuration items
- relationship of CI definition to future system integration
- *workshop 12 – physical conceptualization of capability solution*
- logical architecture – basic concepts of model-based architecting
- logical architecture related to physical architecture
- useful forms of logical representation – functional, state-based, mathematical, …
- model-based design in practice

#### 8.5 Functional Modeling in CONOPS Development

- functional modeling in CONOPS development – how to do it
- functional analysis/architecture process
- item flow and control flow
- coupling, cohesion, connectivity
- unallocatable and allocatable functions
- pitfalls in defining functions
- *workshop 13 – a simple functional solution*
- *workshop 14 – physical and functional solution*
- FMECA in functional solution
- performance thread analysis
- SysML, and alternative languages incorporating behavior modeling
- other functional modeling languages
- software tools supporting functional and physical solution
- pitfalls in functional solution development

#### 8.6 Return to Physical Solution Development in CONOPS Development

- facilities, procedures, people, and other types of solution element
- some common pitfalls in developing CONOPS
- adding the detail to the solution
- solution creates requirements – the duality of requirements and solution
- interface engineering
- evolution of interfaces in solutions having levels of structure
- interface requirements specifications versus interface design descriptions
- some common pitfalls in interface engineering

#### 8.7 Decision Making in CONOPS Development

- solution development for feasibility
- solution development for effectiveness: approach to solution optimization
  - the role of MOE's and goals
  - using a value (system effectiveness) model
  - taking account of risk relating to goals
  - taking account of risk relating to satisfaction of requirements
  - event-based uncertainty
  - risk-aversion
  - *workshop 15 – using a value (system effectiveness) model in developing solution for a capability problem*
  - cost/capability, return on investment and like concepts
  - iterative optimization of solution – an effective methodology
  - software tools supporting CONOPS decision making
  - common pitfalls in CONOPS development

#### 8.8 CONOPS Document

- CONOPS Template
- Example CONOPS

### 9. Development of Requirements and Requirements Specifications for Elements of Solution

### 10. Summary and Key Points

- action plan

### 11. References and Recommended Reading

The training is consistent with a systems approach to problem solving, as advocated by defense administrations worldwide. This interdisciplinary, collaborative approach to the engineering of system solutions (of any type) aims to capture stakeholder needs and objectives and to transform these into a description of a holistic, life cycle balanced system solution. The solution must satisfy the minimum requirements of the stakeholders, and optimize overall solution effectiveness according to the values of the stakeholders. Fundamental to the approach are the integration of risk and opportunity aspects into the capability development.