



# Modelling and Simulation in NATO with Focus on NCI Agency

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Workshop-Reihe: Perspektiven der Modellbildung und Simulation  
23<sup>rd</sup> – 24<sup>th</sup> January 2017



# Purpose

*Expose the various capabilities and application of  
Modelling and Simulation (M&S) within NATO*

# Content

- M&S capabilities in NATO
- Examples of M&S application in NATO
- Summary

# M&S Capabilities in NATO

- Range of M&S-related capabilities in NATO
  - Development and application of models and simulations within Operational Analysis (OA) teams to support decision making, including concept development
  - Use of simulation to support training and exercises, engineering, testing and procurement
- No significant effort in NATO on development of large-scale simulations in past 20 years
  - Primary focus on analysing lower intensity, crisis response operations rather than large-scale warfighting
- But recent regain of focus on use of wargaming and simulation models to analyse capabilities required by NATO in the changing security environment

# M&S Stakeholders in NATO

## Overview

### Strategic Commands



- Allied Command Transformation (ACT)



- Allied Command Operations (ACO)

### Agencies



- NATO Communications and Information (NCI) Agency



- Science and Technology Organization (STO)



### Centres of Excellence (COEs)

- M&S COE



# M&S Stakeholders in NATO

## Strategic Commands (ACT)

- Operational Analysis Branch
  - Analysis for Concepts, Experiments and Requirements
    - Limited M&S capacity but usage of modelling techniques
- Future Solutions Branch
  - Industry Engagement, Science & Technology, M&S Policy/Collaboration
    - Elicitation and analysis of M&S requirements, investigation of new technologies, and action plan on M&S in support of training
- Joint Warfare Centre (JWC) & Joint Force Training Centre (JFTC)
  - Command Post and Computer Assisted Exercises (CAX)
    - Simulation for CAX in NATO Response Force (NRF) certification

# M&S Stakeholders in NATO

## Strategic Commands (ACO)



- Operational Analysis (OA) staff embedded within ACO command structure
  - Conduct Operations Assessment at respective Command HQs
    - Limited M&S capacity (small teams)

# M&S Stakeholders in NATO

## Agencies (NCI Agency)

- Operational Analysis (OA) Service Line (SL)
  - Provide OA support to planners and decision makers within NATO and the Nations
    - Some M&S capacity, particularly applied to Defence Planning and support to operations
- Education and Training (E&T) Service Line (SL)
  - Provide advice and support on use and exploitation of M&S techniques in the context of training
    - Support NATO and national training entities with use of simulations
    - Capture requirements for M&S within C2 systems lifecycle phases



# M&S Stakeholders in NATO

## Agencies (STO)

- Centre for Maritime Research and Experimentation (CMRE)
  - Develop an architecture for interoperable, network enabled M&S
  - Investigate future of M&S in NATO (e.g. training and education, logistics, ...)
- Collaboration Support Office (CSO) / Panels
  - NATO Modelling and Simulation Group (NMSG)
    - Promote co-operation among Alliance bodies, NATO Nations and Partner Nations to maximise effective utilisation of M&S
  - System Analysis and Studies (SAS) Panel
    - Conduct studies and analyses of operational and technological nature
    - Promote exchange and development of methods and tools for OA
  - Human Factors and Medicine (HFM) Panel
    - Use M&S and related technologies for medical training purposes

# Examples of M&S Application in NATO

## What is the impact of new medical doctrine on requirements for Medical Evacuation?

- New doctrine to be used to identify medical-related capability requirements
- Assess impact of new doctrine to inform planners and decision makers



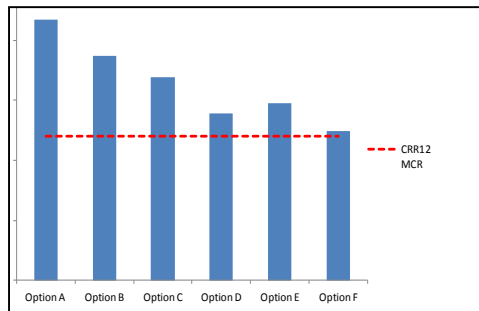
- SMEs review extant method and propose updates in line with new doctrine
  - Develop 6 options for capturing key aspects of new doctrine
- Develop Capability Assignment Logic (model)
  - Amount of capability required
- Implement in supporting tools
- Testbed agreed changes in sample of representative scenarios
- Compare against casualties observed in NATO operations (ISAF)
- Review outcome with SMEs and decide way forward

# 1 – Defence Planning: Impact Analysis

## Capability Requirements for MedEvac Helicopters

### So What

- Modelling techniques, including simulation, allowed to assess impact of new doctrine
  - Comparison against extant requirements identified based on previous doctrine and against data from operations
- Planners / decision makers used outcome of impact assessment to support their decision on implementation of new doctrine in NATO Defence Planning Process (NDPP)



## 2 – Resource Allocation

### Student Throughput and Resource Estimate Allocation Model

#### Problem

How to manage E-3A (AWACS) aircrew student training in effective manner?

#### Context

- Represent all E-3A training courses
- Take into account
  - Real-life system constraints (shifts, capacities...)
  - Resource reliability (maintenance)
  - Interaction of multiple courses using shared resources
- Easy to use by non-OA practitioners
- Easy to interpret results

#### Approach

Simulation model (discrete event)  
Implemented in Simul8

#### Inputs (sample)

- Resources
  - Scheduled/unscheduled availability
  - Capacity (available seats for aircraft, simulators, ...)
  - Shift patterns (day time, Mon-Sun, ...)
- Students
  - Start dates
  - Individual attributes (language proficiency, experience, ...)
- Events
  - Durations
  - Associated resources, ...

- Plan, run and manage training more efficiently
  - Run multiple courses simultaneously
  - Select from list of events to develop courses
- Graphical display of student progress over time
- Course of actions comparison
  - Impact of resource reduction on course completion times
  - ‘What if’ analysis
  - Bottleneck identification
  - Predict student throughput

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# 3 – Collective Training and eXercise Application Services

- Applications for the trainers
  - Training Objective Development



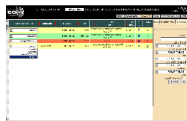
- Setting Development and Management



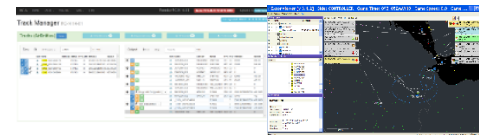
- Main Events List/Main Incidents List (MEL/MIL) and LIVEX Development and Management



- Joint and Air C2 Simulation: COTS/GOTS simulations made interoperable with NATO C2 Systems and combined with MEL/MIL

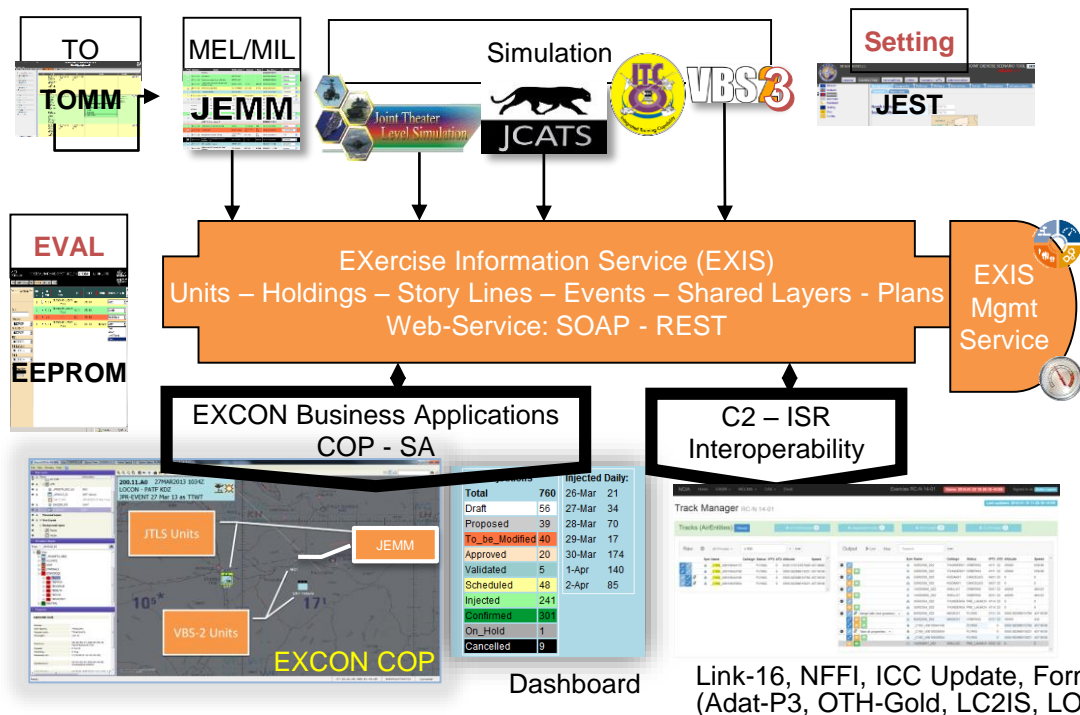


- Exercise Evaluation



Supporting Deliberate and Traceable Collective Training and Exercises

# 3 – Collective Training and eXercise Interoperable Application Architecture



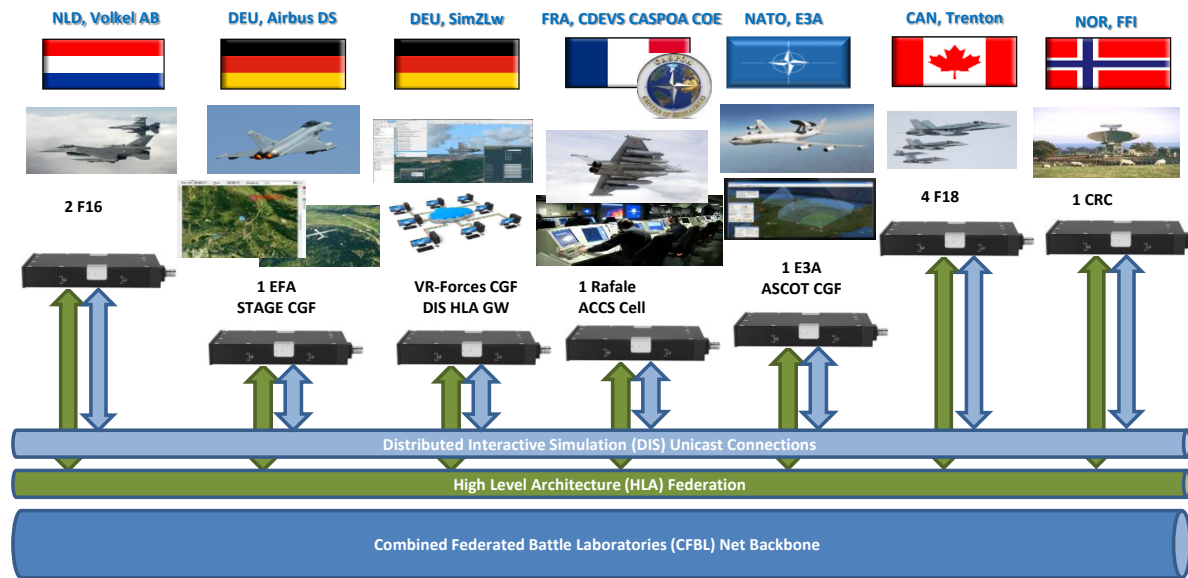
Open Architecture with Published and Maintained Practical Specification



# 4 – Mission Training

## Mission Training through Distributed Simulation (MTDS)

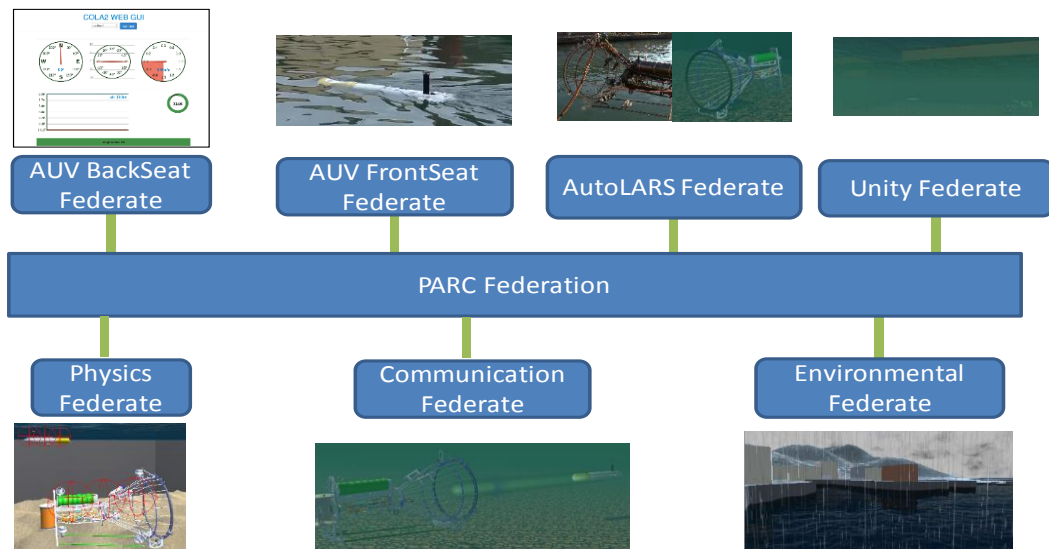
NATO nations have a common need for training of air combined and joint collective tactical training, referred to in NATO as Mission Training through Distributed Simulation. MTDS has achieved a level of maturity which makes it feasible for NATO to implement a persistent capability to support operational readiness.



# 5 – M&S at CMRE

- Persistent Autonomous Reconfigurable Capability (PARC)
  - Live and Virtual Simulation
  - HW and SW in the loop for Test Bed and Concept Development & Experimentation

## PARC Federation



# Upcoming M&S Work

- SAS Research Task Group on Course of Action (CoA) Analysis in the 21<sup>st</sup> Century
  - Objectives
    - Improve CoA analysis to enhance NATO and national defence and operations planning
    - Establish state of campaign analysis models and wargaming within NATO and the nations, identify shortfalls, implement short-term corrective measures and identify longer term actions
  - Study co-led by Canada and NCI Agency, including participation from ACT, ACO and a number of nations
  - Timeline: Jan 2017 – Dec 2019

# Summary

- M&S capability is available and applied in NATO by:
  - The OA / scientific community to support decision makers
  - The training community to support training and exercises
- Limited effort on development of large-scale simulations in past 20 years
- Recent regain of interest in modelling and simulations to analyse capabilities required in changing security environment
- Investment required to build up analytical capacity for development of models and simulations suited to problems that decision makers are currently confronted with

# Questions ?

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