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Analysis and Modeling of Joint Operational Command and Control in the Canadian Forces

by

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Outline

- Introduction: JCDS 21 Technology Demonstration
- Requirements Analysis of “Joint Staff” Business Processes
- Enterprise Architecture for C2 functions at the Joint Operational Level
- Plans for a Joint Operational Headquarters C2 Simulation

Introduction

- The objective of the JCDS 21 TD is to demonstrate a joint net-enabled collaborative environment to achieve decision superiority.
- This paper presents the requirements analysis that was performed for JCDS 21 to capture the enterprise architecture (EA) of the command and control (C2) functions in the Canadian Forces (CF) at the joint operational level.
- This requirements analysis guides the JCDS 21 experimentation campaign which is to predict the impact of JCDS 21 technologies and processes on the CF's C2 environments.
- This paper will also describe plans to develop a simulation for these C2 functions. The simulation of the processes for joint operational C2 in the CF will support the design and evaluation of the experiments.

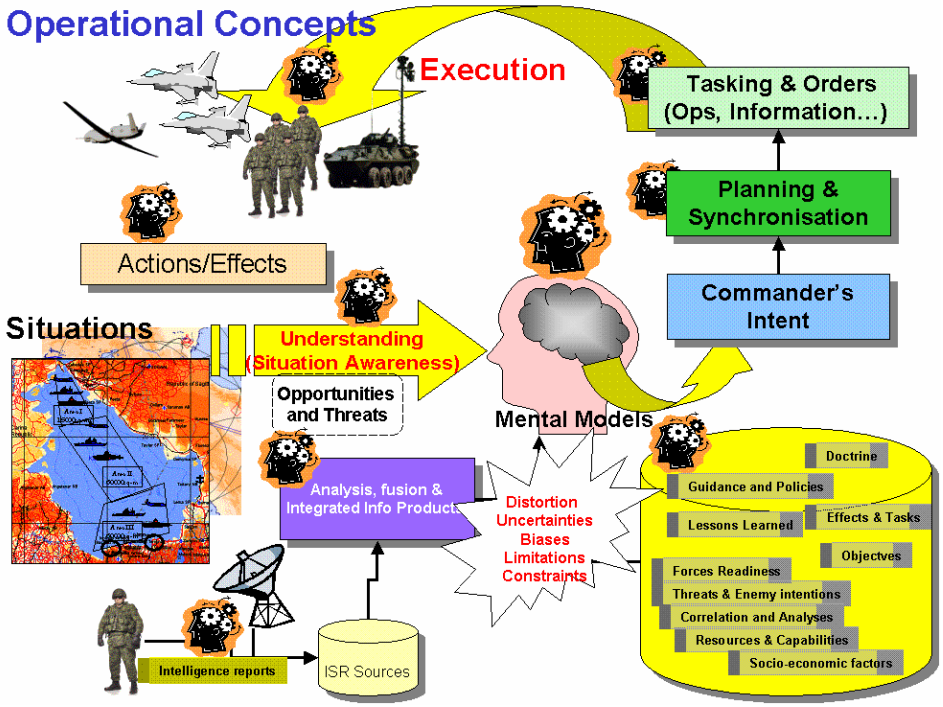
Joint Command Decision Support for the 21st Century

JCDS 21 TD:

- Technology Demonstration project for Canada Command (Domestic Operations)

- OBJECTIVE: to demonstrate a joint net-enabled collaborative environment to achieve decision superiority

- TASK: Develop operational and system requirements for a net-enabled collaborative environment to support strategic decision-making, within a joint, interagency, multi-national and public (JIMP) framework



Requirements Analysis Methodology

- Formal systems engineering processes should be employed for analysis and requirements capture
- Human engineering processes should be employed to identify the impact of human limitations and capabilities and provide specifications for the human interface requirements
- Review was performed and a set of cognitive analysis methods were identified. A final list of seven were selected.

Template used to characterize the different methodologies

- *Description* — briefly describes the method.
- *Inputs to the method* — describes the information that is input to the method or its sub-procedures.
- *Outputs from the method* — describes the outputs of the method or its sub-procedures.
- *When to use the method* — describes when in the project lifecycle the method or its sub-procedures can be or has been used.
- *Related tools and methods* — briefly describes tools available for use with the method and other closely related methods.
- *Resources required to use the method* — describes the level of effort required by practitioners and stakeholders who use the method.
- *Advantages of the method* — briefly states proposed advantages of the method in comparison to other related methods (where possible).
- *Issues related to the method* — describes reported problems, including disadvantages, of the method or its sub-procedures.
- *Applications of the method* — describes example projects where the method has been deployed.
- *Quality assurance considerations* — describes methods available to ensure reliability and validity of the method.
- *Relationship to system performance requirements* — describes the relationship of preliminary requirements gathering methodology to more in-depth systems requirements gathering.
- *Contacts* — lists some known developers and users of the method.
- *References* — provides references.
- *Bibliography and Websites* — provides other relevant resources.

Requirements gathering and analysis methods chosen for the analysis of joint, distributed and complex command situations

1. Mission Function Task Analysis (MFTA)
2. Cognitive Work Analysis (CWA)
3. Applied Cognitive Work Analysis (ACWA)
4. Hierarchical Goal Analysis (HGA)
5. Team Cognitive Task Analysis (Team CTA)
6. US Dept of Defense Architectural Framework (DoDAF)
7. Joint Application Design/Development (JAD)

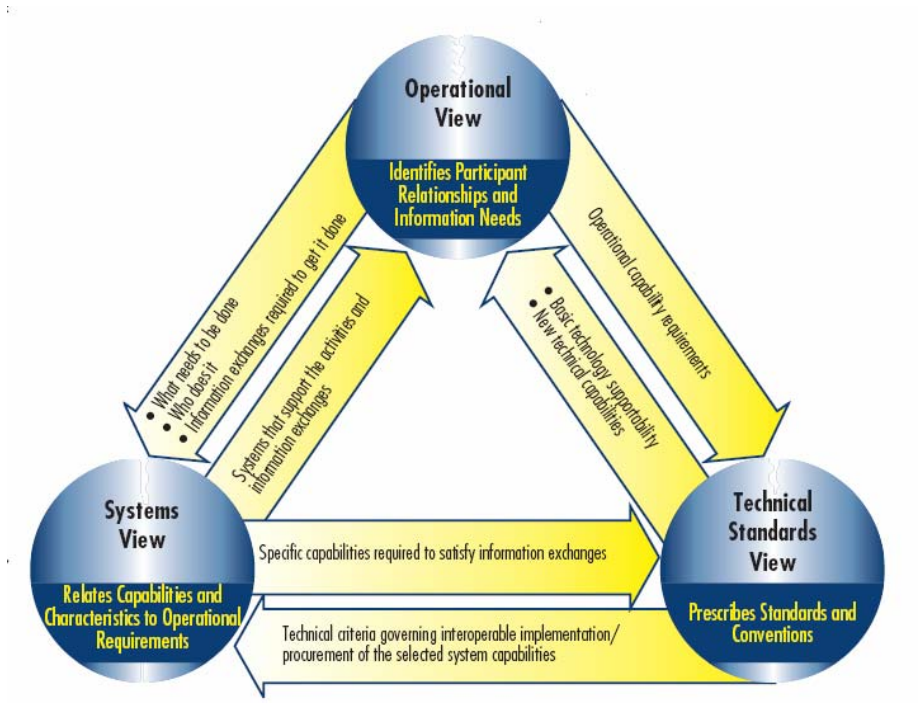
Resulting Strategy

- Two phase approach:
  - collect EA information based upon a systems engineering methodology; and
  - collect the human interface information based upon human engineering process methodologies.
- The EA information would be used to determine the overall objectives of the JCDS 21 project and support the development of a C2 simulation to model collaboration, information and intelligence analysis, and decision-making as workflow processes.
- The more detailed requirements analysis of the human interface information (cognitive analysis) for the JCDS 21 project is future work outside the scope of this paper.

Resulting Strategy (cont'd)

- Systems engineering phase
  - US Dept of Defense Architectural Framework (DoDAF)
- Human interface phase
  - Primarily Hierarchical Goal Analysis (HGA)
  - Also employed Joint Application Design/Development (JAD) for unit in early development

Enterprise Architectures

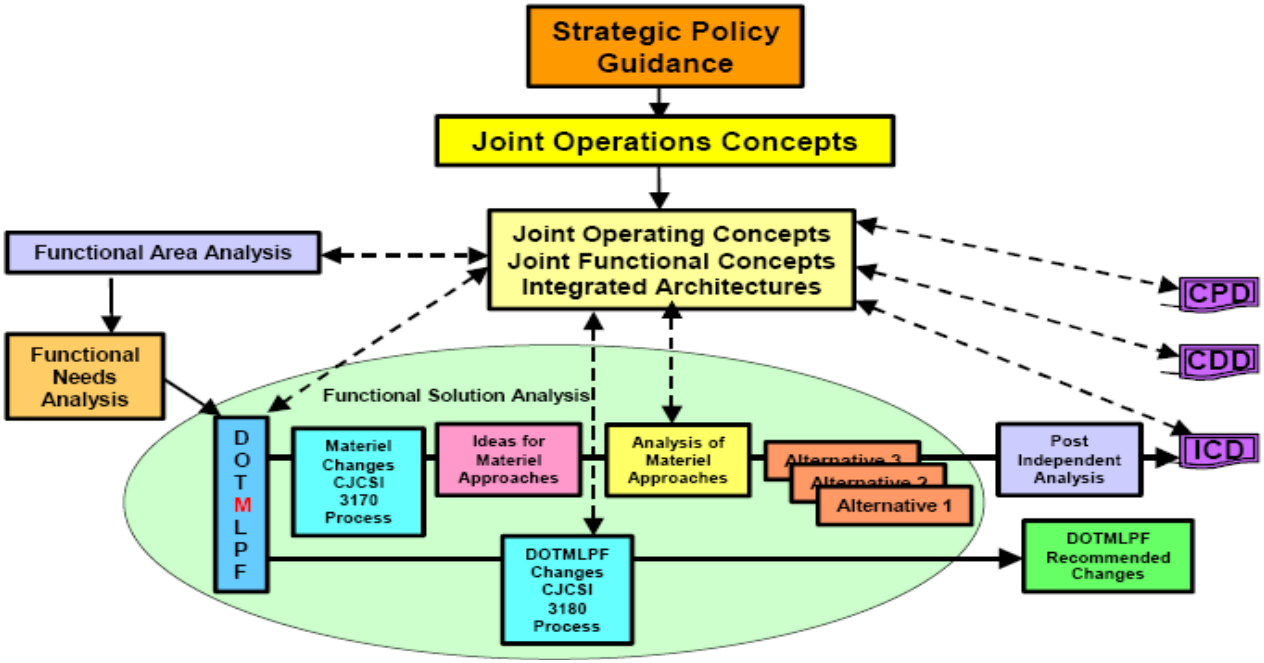


DoDAF illustrating relationships between OVs, SVs, and TVs.

Data Collection for Joint Operational C2

- Data Collection
  - Operational Documentation (Doctrine, CONOPS, SOPS, TTPs) and previous architecture work
  - Observation of relevant meetings
  - Interviews with selected operators
- Objective was to capture meeting independent information, providing insight to decision making and collaboration processes, technologies and infrastructure. Therefore:
  - a complexity matrix was created for decision making, problem solving and finding information; and
  - a complexity characterisation of collaboration was designed to complement the raw data collection.

Joint Capabilities Integration and Development System



JCIDS Capability Definition & Assessment Process

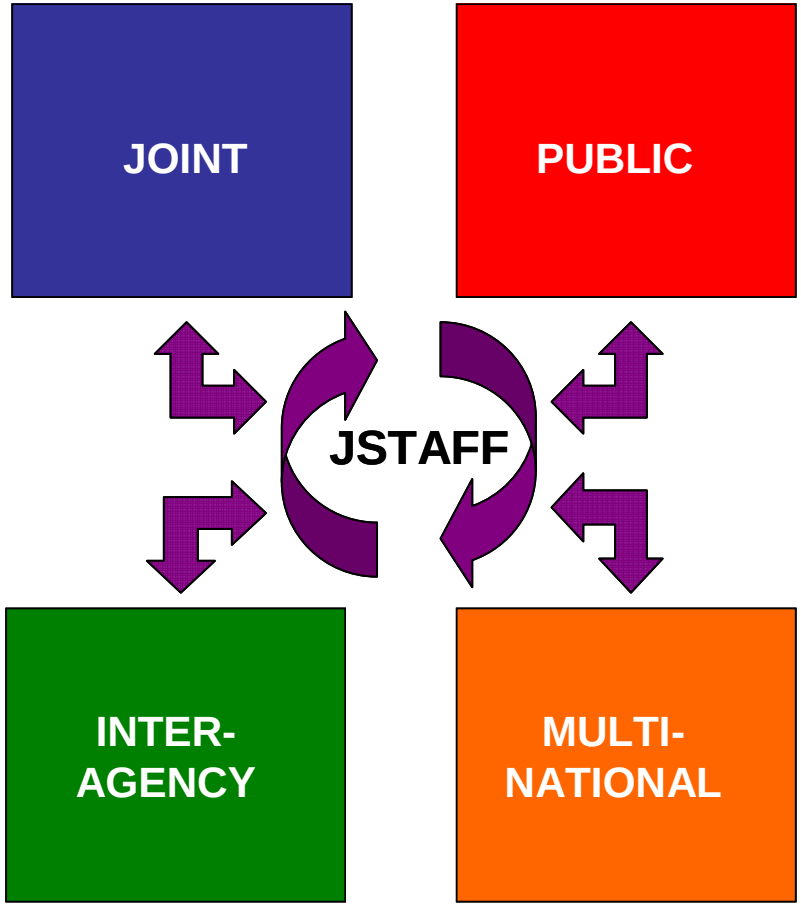
JIMP Environment Scenario

- The preparation of DoDAF architectural views was chosen as the analysis approach for requirements gathering for the JCDS 21 project problem space - decision-making within a joint, interagency, multi-national and public (JIMP) framework.
- It was used to provide a structure for the presentation of the analysis of the Canadian Incident Response Environment and the development of a scenario to illustrate multi-level collaborations and dynamic decision making.
- The mandate was to characterise complex situations resulting from terrorist activities and asymmetric threats, based on a review and analysis of emergency response plans and scenarios, Canadian Forces doctrine and Standard Operation Procedures (SOPs) and literature on asymmetric threat and terrorism.

Applying an Architecture Based Approach – DoDAF Views

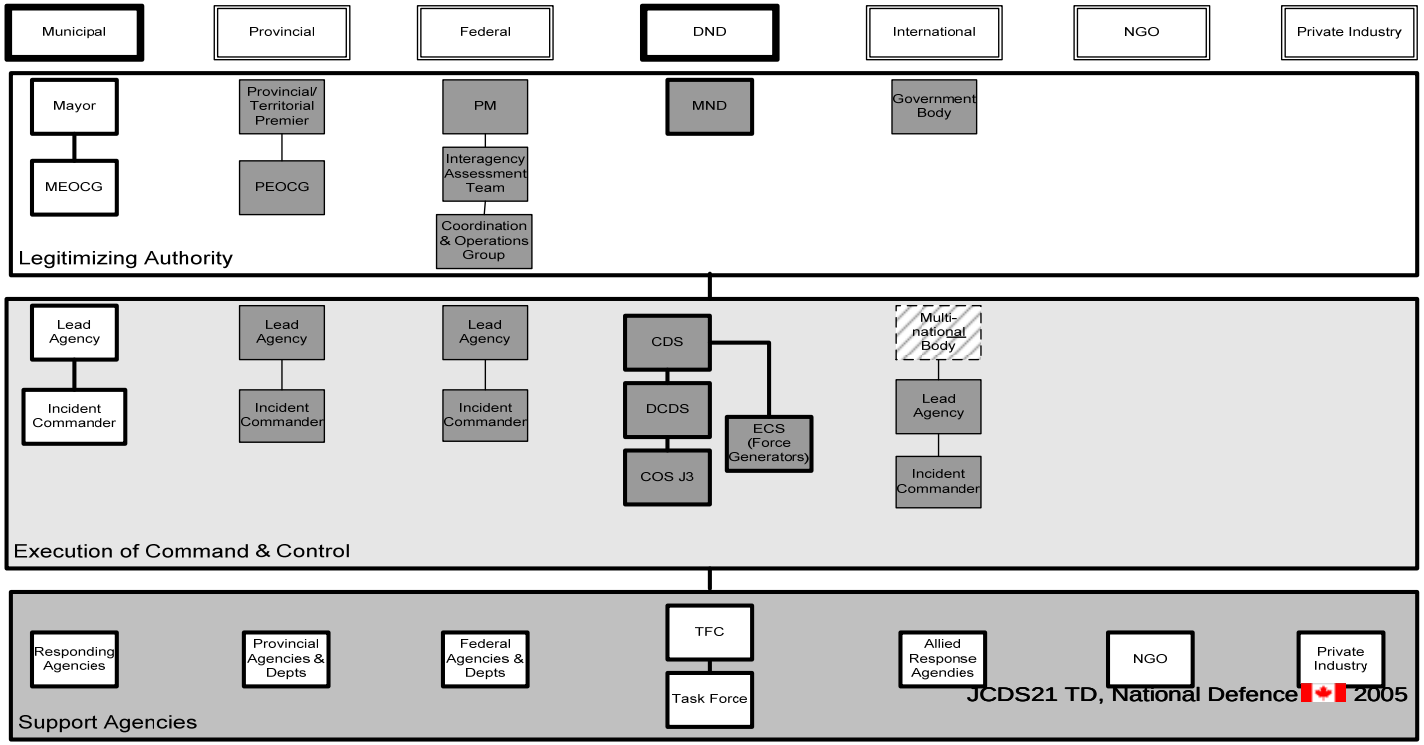
- Operational View 1: High-Level Operational Concept Graphic
- Operational View 4: Organisational Relationships Chart
- Operational View 2: Operational Node Connectivity Description
- Operational View 5: Operational Activity Model

Operational View 1: High-Level Operational Concept Graphic



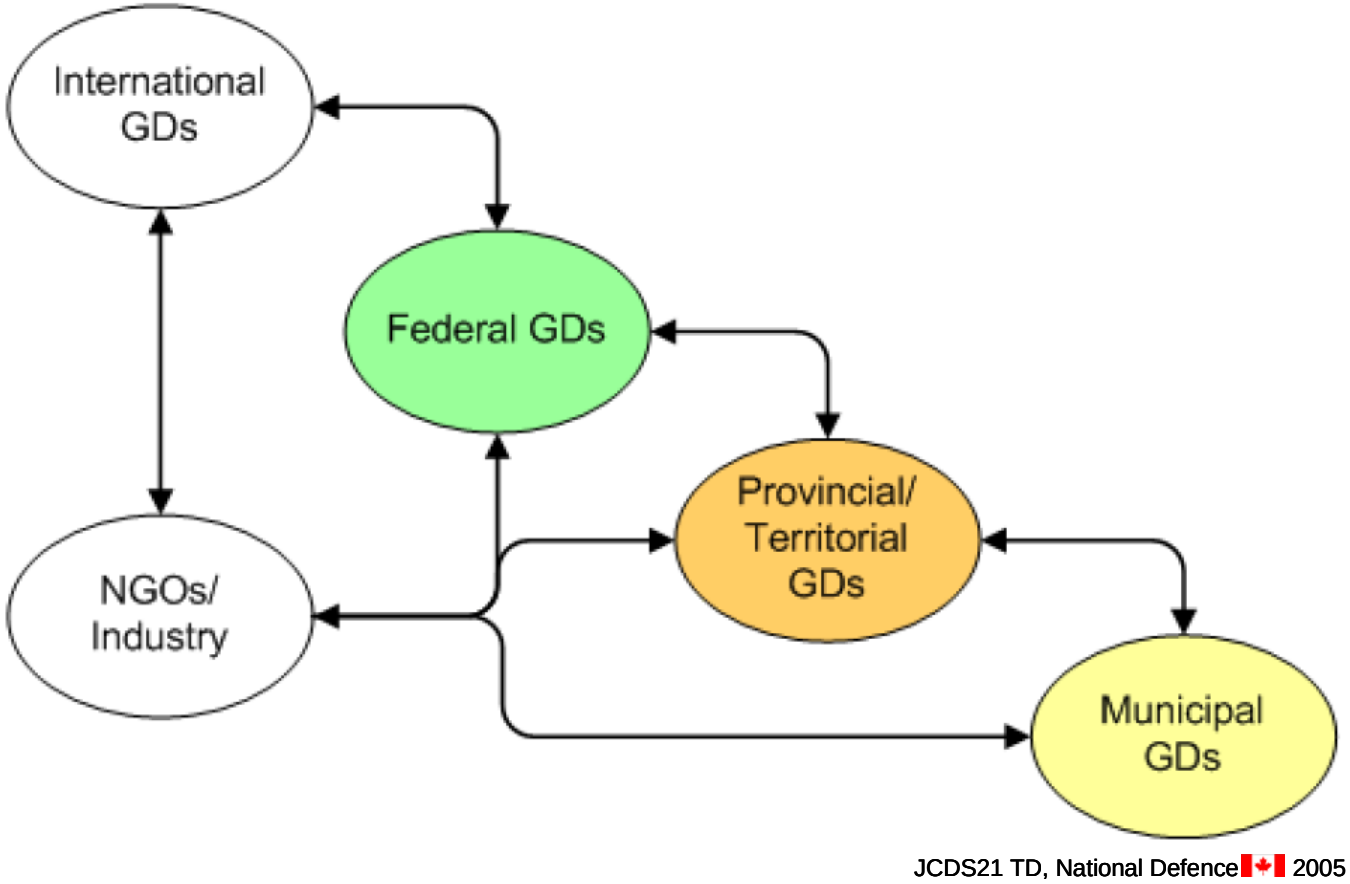
JCDS21 TD, National Defence 2005

Operational View 4: Organisational Relationships Chart



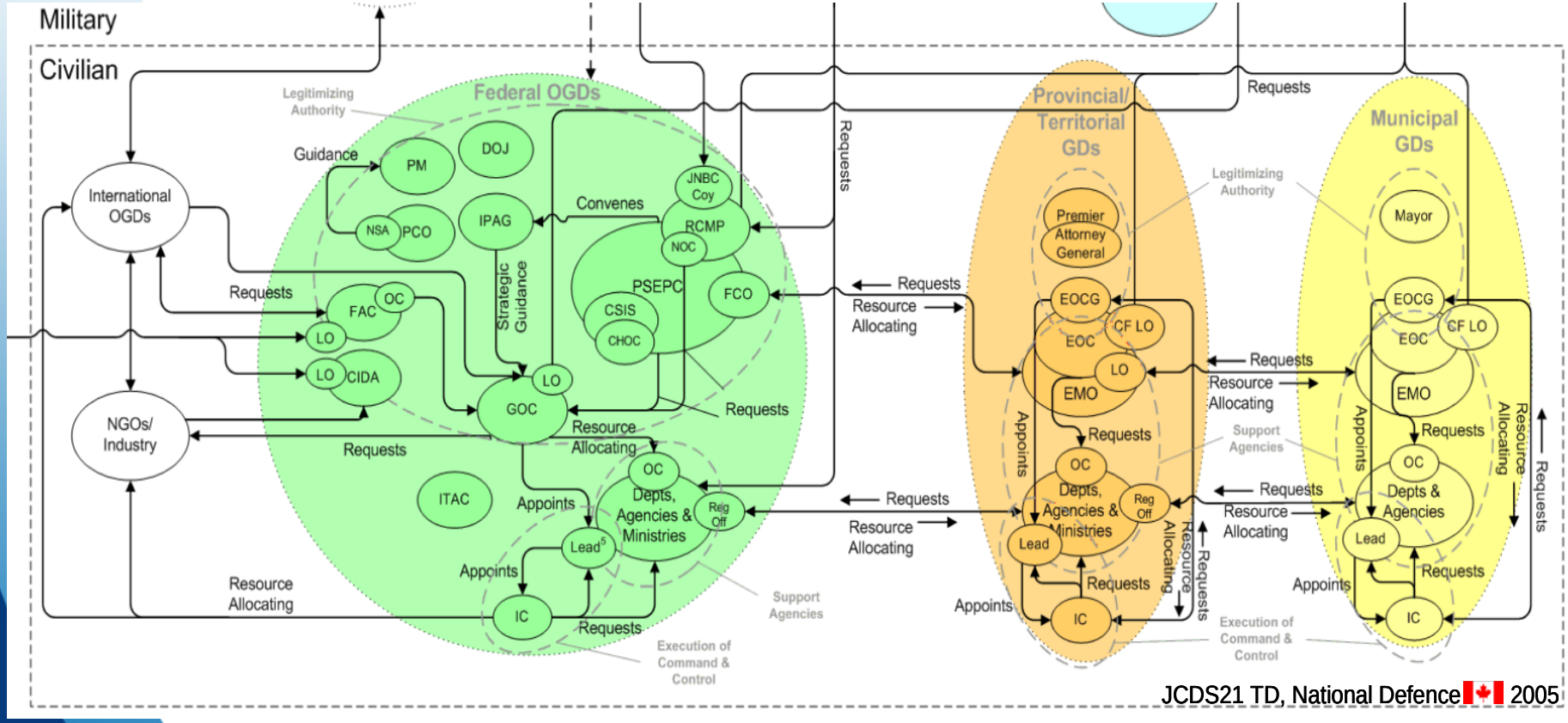
OV-4.4: DND Highlighted as a Federal Agency During Locally Contained Domestic Incident

Operational View 2: Operational Node Connectivity Description



OV-2.1 Top Level Relationships

Operational View 2: Operational Node Connectivity Description

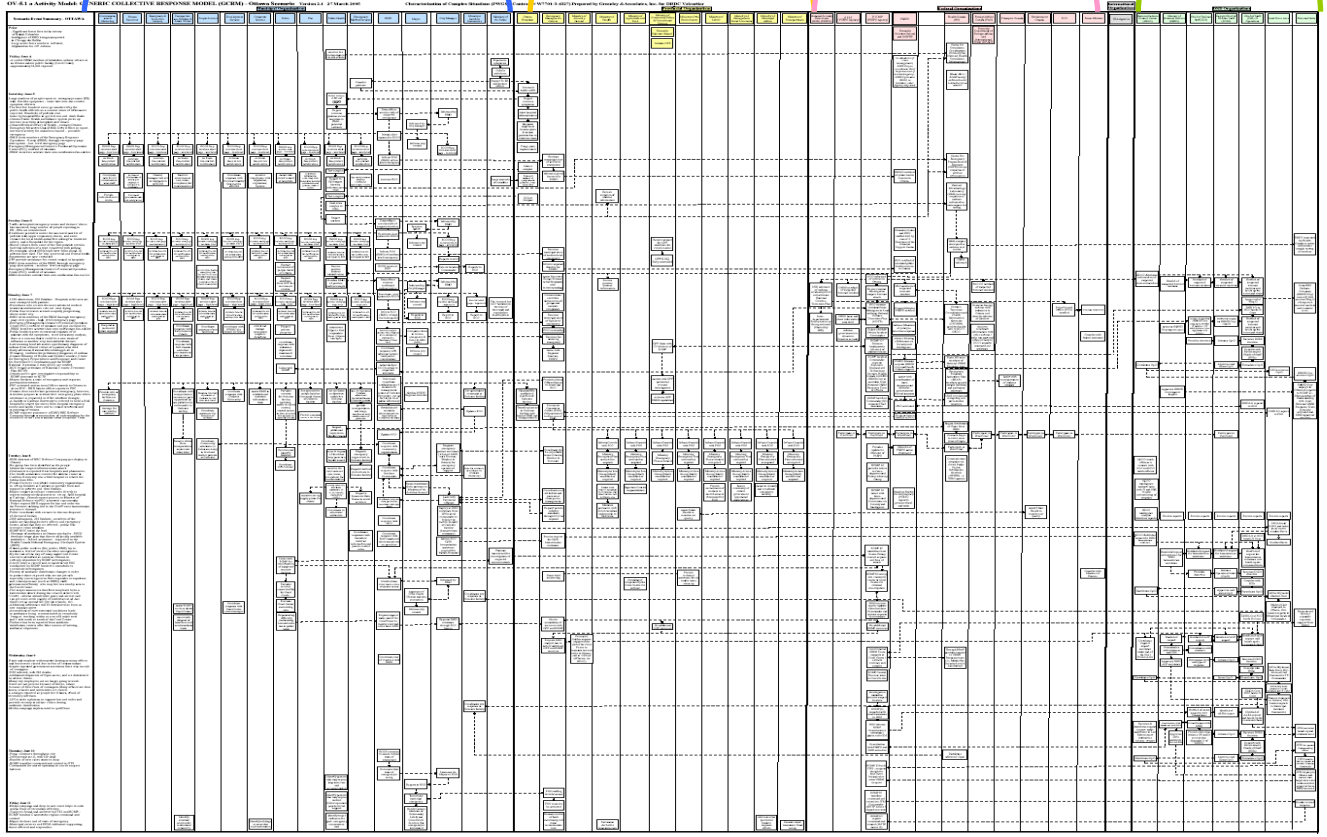


OV-2.3a Second Level of Decomposition – Tasking/Resource Allocation *OGDs*

Operational View 5: Operational Activity Model

Municipal | Provincial | Federal | DND

Scenario details



JCDS21 TD, National Defence 2005

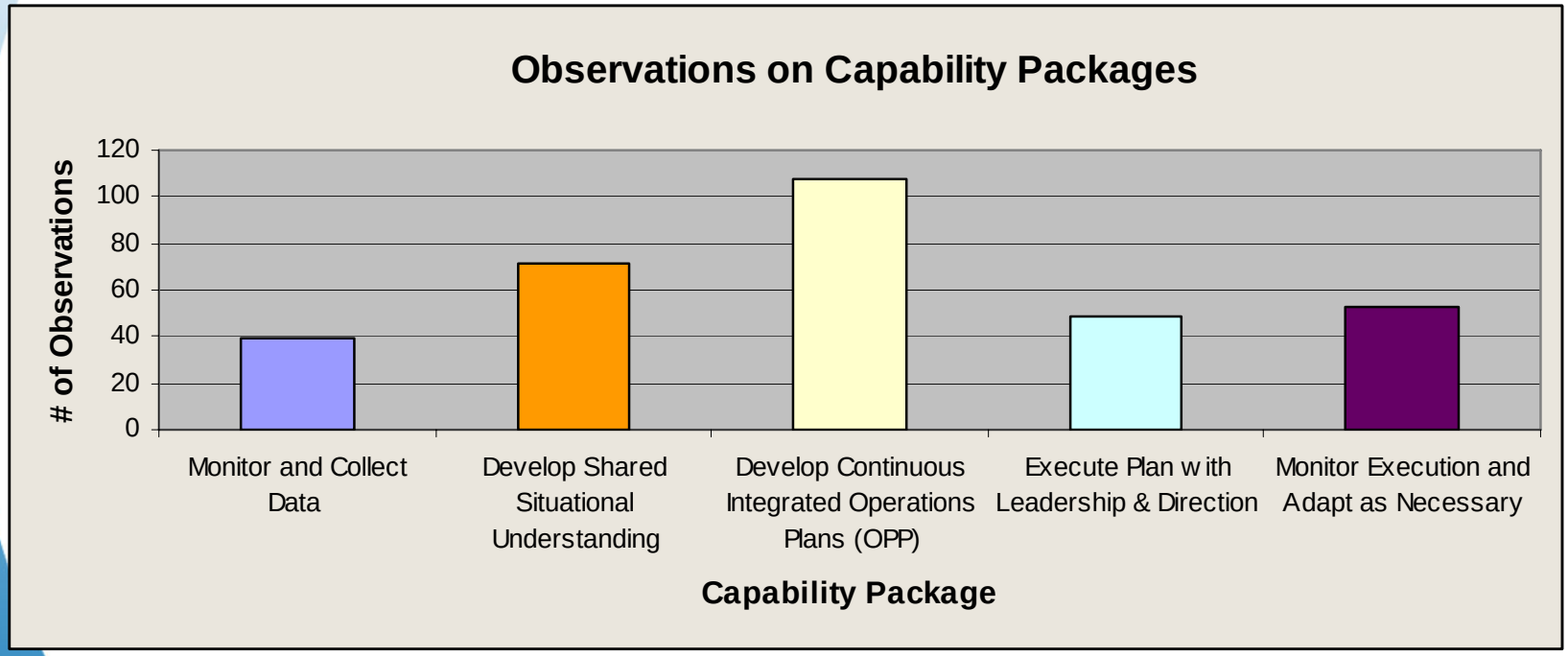
OV-5.1a High-Level Activity Models – Ottawa Scenario

Functional Area Analysis (FAA)

The following high-level Capability Packages were identified as essential to the Joint Operational command structure achieving a net-enabled collaborative environment to support decision-making:

1. Monitor and collect data
2. Develop shared situational understanding
3. Develop continuous integrated operations plans (OPP)
4. Execute plan with leadership and direction
5. Monitor execution and adapt as necessary

FAA Capability Packages for Joint Operational C2



Data Characterization: Three Classes

- Influences on the staff's ability to perform functions;
- Issues that shape the staff's environment; and
- Areas that are impacted by the influences and issues listed above.

Observed Influences on the Joint Operational Staff's ability to perform functions within the Capability Packages

- Doctrine, tactics and procedures
- Coalition partners/OGDs/NGOs etc.
- Government of Canada
- Strategic guidance
- Operational level activities
- Individual experience and knowledge
- Tactical level activities
- Mission location/host country
- Public opinion
- Media
- Knowledge management

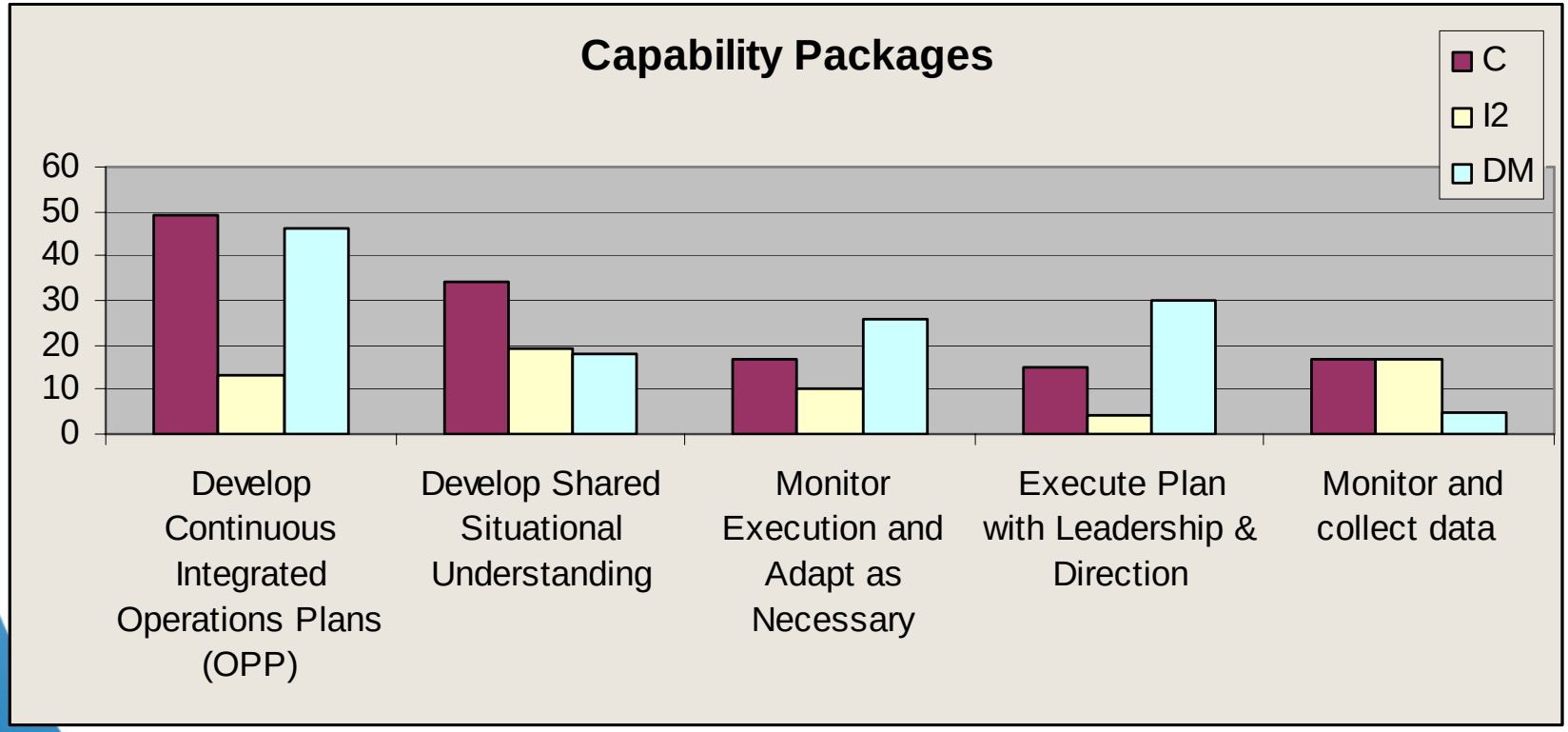
Observed Issues that shape the Joint Operational Staff's environment while executing within the Capability Packages

- Sharing Info
- Processes
- Policy/Legislation
- Environment (influenced by mission location, public opinion, individuals (i.e., leadership style), and media)
- Finance

Areas impacted by the 'Observed Influences' and 'Observed Issues'

- Constraint management
- Functional activities
- Multi departmental linkages
- Resource management

Relationship of the Capability Packages to Decision Making, Collaboration and Information and Intelligence Analysis



Functional Needs Analysis (FNA)

- The FNA uses the capability packages to represent the future “to be” state as determined by strategic priorities.
- The FNA for the requirements analysis team of the JCDS 21 project was developed in a collaborative manner involving all of the JCDS 21 project teams in a series of activities that involved:
  - **the presentation of the data collection results including the FAA**
  - **input from CF stakeholders on transformation and on information and intelligence fusion**
  - **teleconference working sessions**
- Requirements for each of the project teams were discussed in the context of the data collection findings and the results of the FNA activities were combined in tabular format identifying gaps pertinent to the focus of each of the JCDS 21 project teams.
- The relevance of these gaps to the FAA capability packages was mapped in order to provide a guideline to each of the groups as to which are relevant and to what degree for their focus areas.

Development of a Simulation Environment

Developing a modelling and simulation capability that supports the broad range of operating concepts and stakeholders requires an integrated approach that includes:

- A method for describing operating concepts and capabilities that is common for all stakeholders
- A common architectural information base that enables future conceptual capabilities to be described in the context of the existing architecture
- A method for expressing capabilities in a dynamic simulation that provides traceability to operators' concepts
- A consistent metrics framework for C2 capabilities for indicating the degree to which performance objectives may be achieved in the simulation and the scenario
- Models for net-centric services in a service-oriented architecture

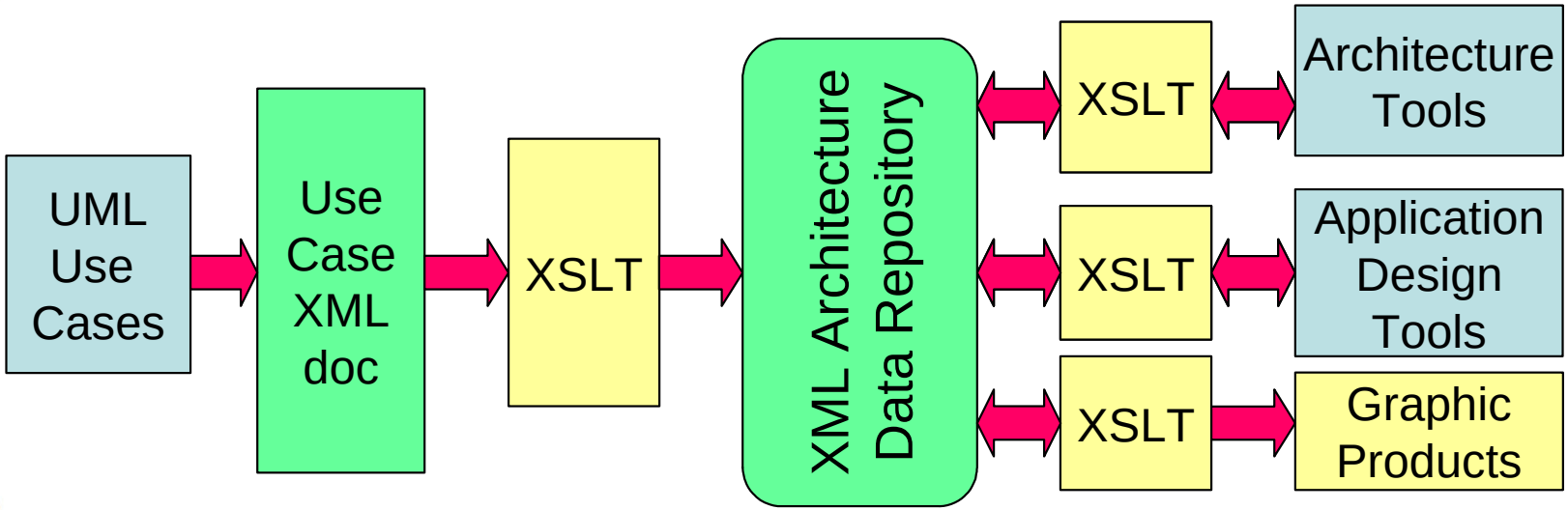
Joint Operational HQ C2 Simulation

- The objective is to model the Canada Command Joint Staff process – to establish a baseline simulation
- The C2 simulation will depict collaboration, information & intelligence analysis, and decision making model work flow processes
- It be used to explore the impact of introducing JCDS21 technologies and processes
- Complements Interagency study at Canadian Forces Experimentation Centre (CFEC)

Methodology

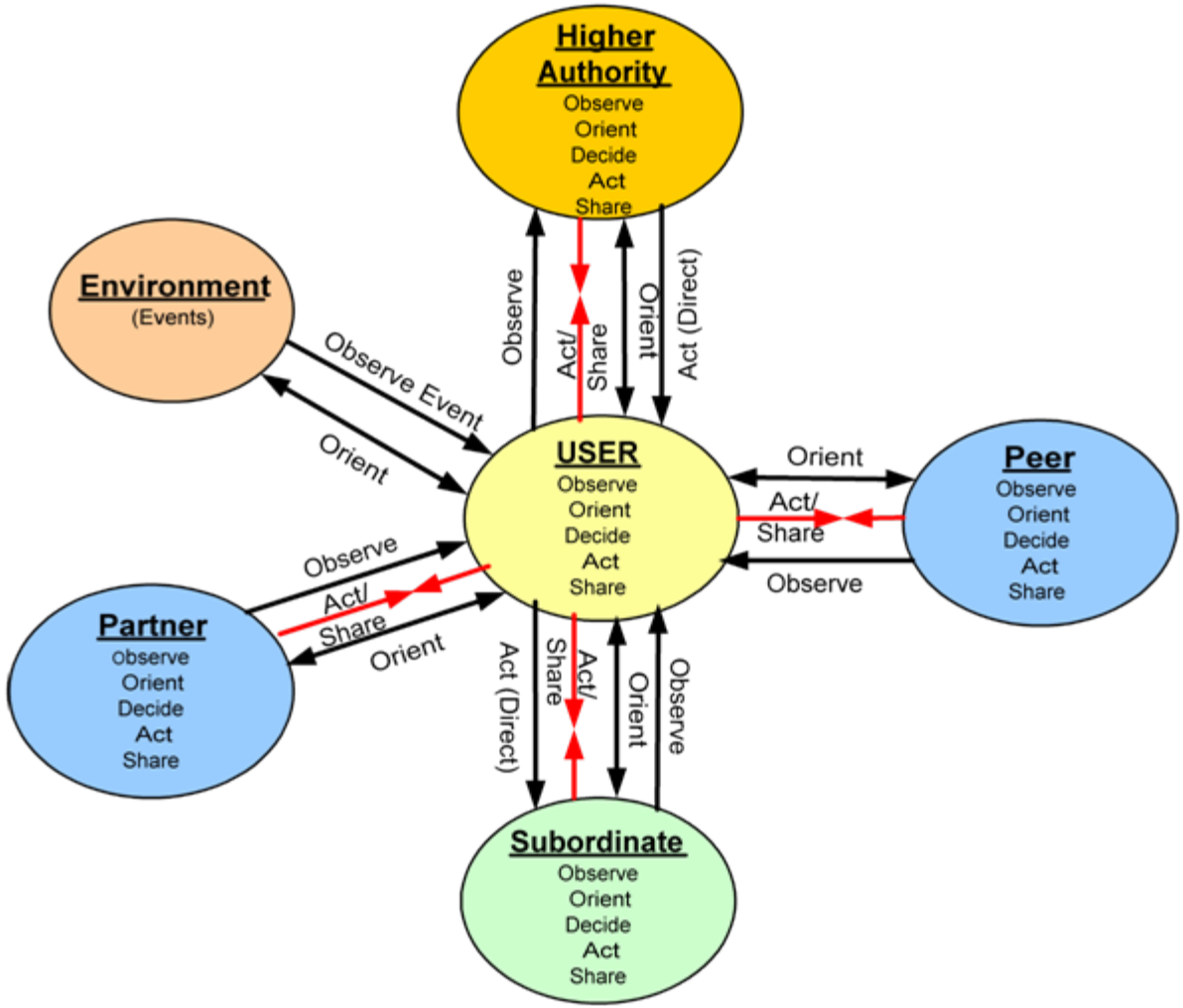
- Develop “Use Cases” to capture data (actors, activities, information entities, business rules)
  - Operator friendly software (*CaseComplete*)
- Exploit “Use Cases” and XML export functionality to develop self documenting UML models
- Develop process models
  - Initial “golden thread” Proof of Concept
  - G2/ReThink
- Eventually link executable architectures to simulation models

Common Capability Definition Method



XML Transformation

Dynamic Executable Architectures



Common Operational Architecture

Data Capture: Actors, Activities and Business Rules

Actor - RCMP Criminal Intelligence Director CID - Emergency Response

RCMP Criminal Intelligence Director CID - Emergency Response

Name: RCMP Criminal Intelligence Director CID - Emergency Response

Description: CID provides a national program for the management of criminal information and intelligence which a organized, serious or national security dimension in Canada, or internationally as it affects Canada.

Goals:

- National Security Investigations Branch NSIB - is responsible for the assessment and monitoring security. (UC-CIE395)
- National Operations Centre NOC - provides a fully secure and integrated command and control during critical incident situations (UC-CIE396)
- Critical Incident Program CIP - is responsible for dealing with issues across the country relating t crisis negotiation and major case management. (UC-CIE393)
- Public Order Program POP - works to support RCMP Divisions in their public order responsibiliti public order issues, setting standards and establishing quality assurance and risk assessment

Related Documents: Path or URL

Enter URL

http://www.rcmp-grc.gc.ca/crimint/ci_aboutcid_e.htm

Notes: (Click here to create a new note)

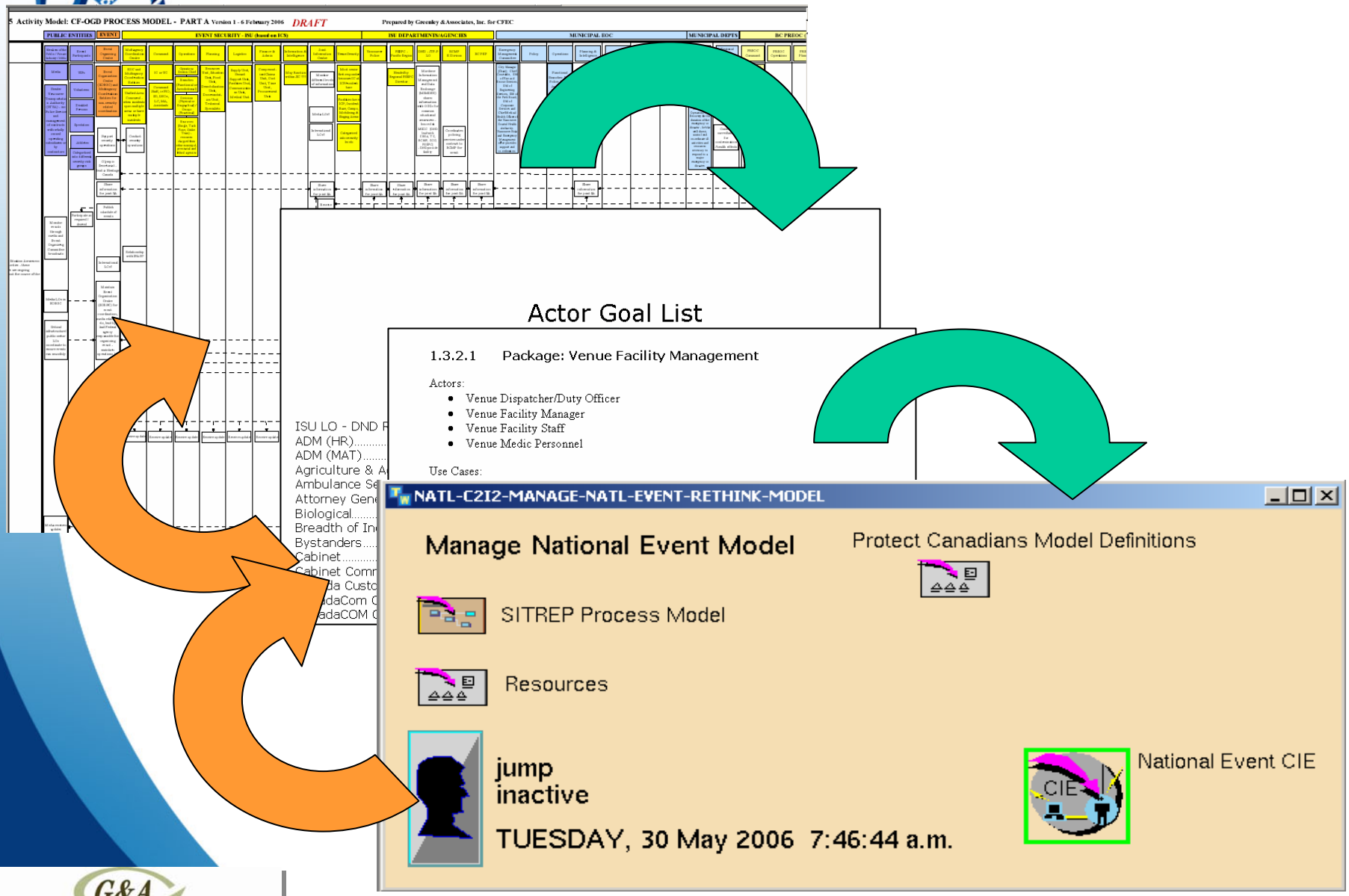
Owning Package: RCMP - National Emergency Response

Start | Microsoft Outlo... | June 8 present... | Business Devel... | WinZip Compre... | Agenda - CFEC... | OGD-C

Model Browser

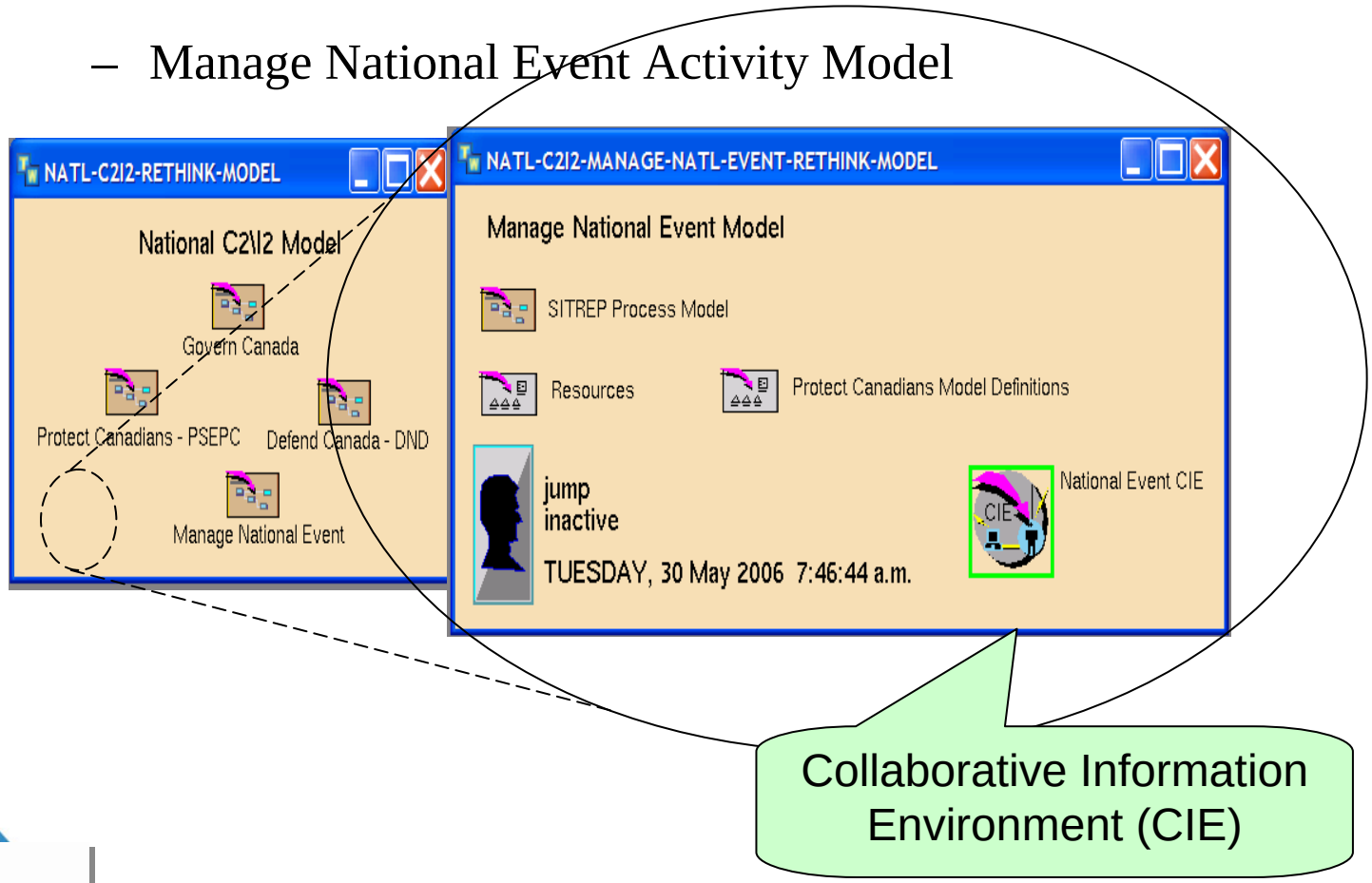
- Govern Canada for National Security and Public Safety
- Defend Canada
- Protect Canadians (Public Safety & Security and Emergency Response)
- Manage Major Event Operations
  - Event Command
  - Integrated Security Unit
    - Integrated Security Command Centre (ISCC)
      - ISU Commander - RCMP
      - Integrated Security Command Centre (ISCC)
      - ISU Incident Command
      - ISU Multi-Agency Security Committee
      - ISU LO - Municipal Police
      - ISU LO - Regional PSEPC
      - ISU LO - DND RJTF
      - ISU LO - PREOC
      - ISU Liaison Officer
      - Oversee Event Security
      - Maintain Event Security Situational Awareness (Observe)
      - Assess Event Security Threat/Identify COAs (Orient)
      - Determine Event Security COA (Decide)
      - Plan Event Security (Plan)
      - Direct Event Security (Act)
      - Report Event Security (Plan)
      - Inform Others of Event Security (Share Information)
      - ISU Joint Information Group
      - ISU Operations Section
        - ISU Operations Section
        - Maintain ISU Operational Situational Awareness
        - Process ISU support requests (supplies. equipment, personnel)
        - Direct ISU Response
      - ISU Planning Section
      - ISU Information and Intelligence Section
      - ISU Finance/Administration
      - ISU Logistics Section
- Incident Dimensions

From Architecture to Simulation



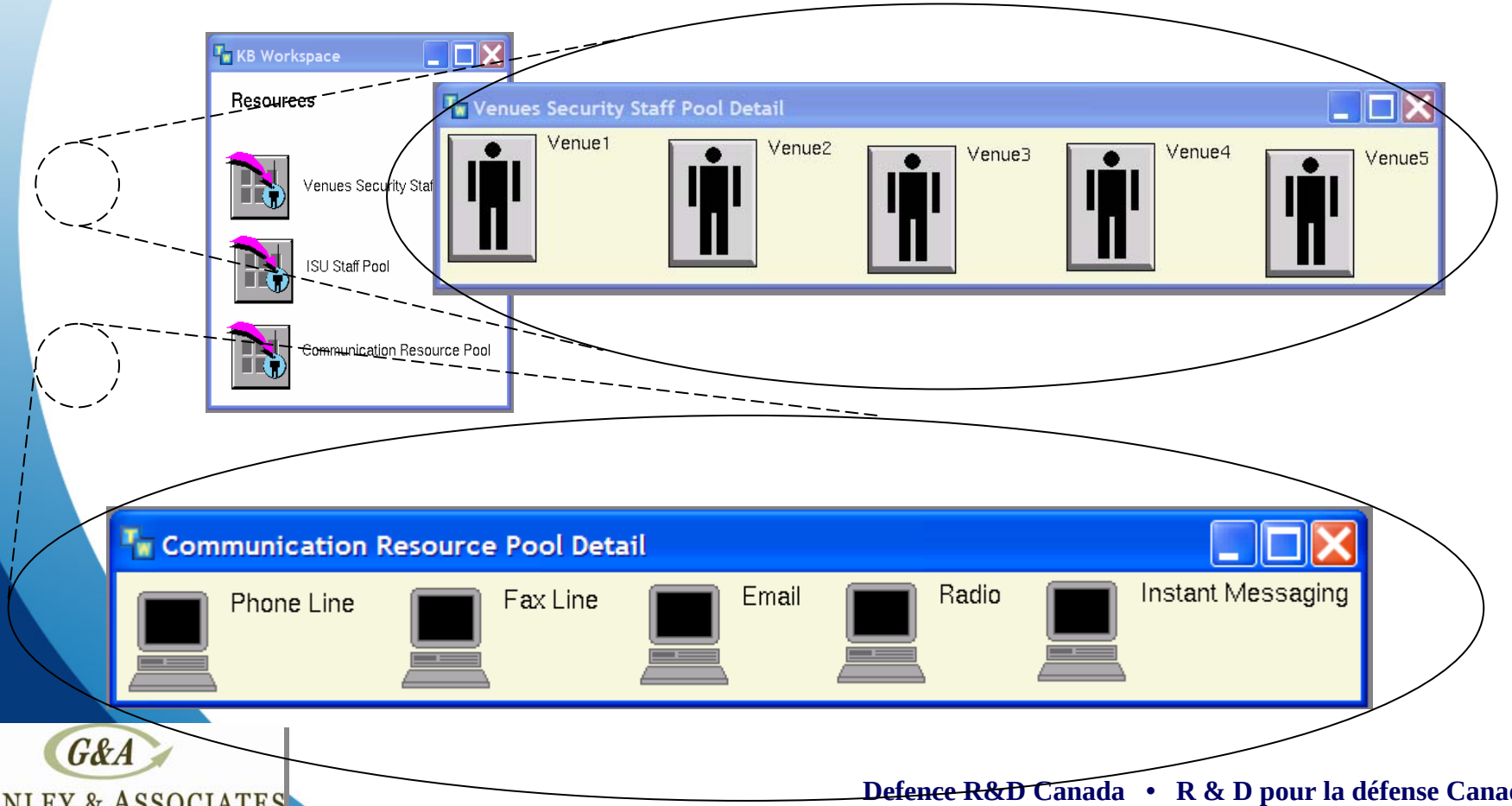
G2/ReThink Model - SITREP

- National C2\I2 Model
  - Manage National Event Activity Model



G2/ReThink Model - SITREP

- SITREP Process Resources



Conclusion

- The new Joint Operational Headquarters of the CF will reflect elements of the complex C2 environment analysed in this study. Therefore the requirements analysis and architecture products that have been developed can be applied to this new structure.
- The influences, issues and areas of impact on the Capability Packages defined in the requirements analysis helped to focus the JCDS 21 scientists in the conduct of the FNA.
- The development of a high level view of the military enterprise architecture has identified relevant business processes enabling the application of methodologies that can be used for providing in-depth requirements gathering and the analysis of the cognitive processes involved in command and control.
- This work has also provided the information required for the development of a simulation that will support the JCDS 21 project's experimentation campaign.

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