

# **2006 CCRTS:**

**The State of the Art and the State of the Practice**

## **Assessing C2 Program Capabilities**

**Paper no. C-123**

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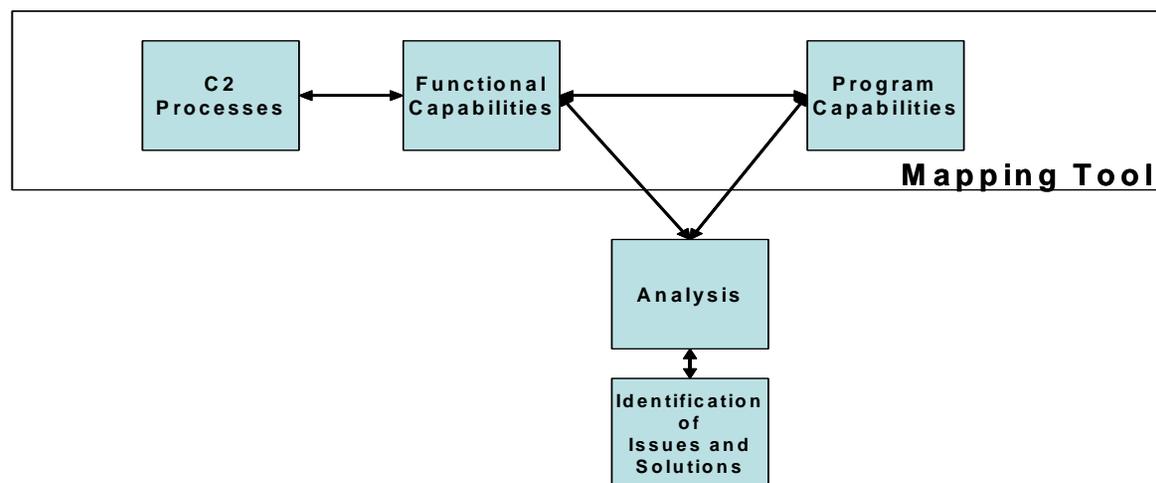
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# I. Introduction

- **MITRE's support to ASD(NII) C2 Programs Directorate:**
  - **Portfolio Management relating to the development, integration, convergence and synchronization of C2 programs across Services, Agencies, and Combatant Commands**
  - **Operating Hypothesis: C2 program capabilities supporting the same functionality are potentially similar**
  - **Scope: Developed and tested a methodology to compare 2 program's capabilities for their overlaps**

## II. Overview of Methodology



- Development of conceptual C2 definition based in **C2 Processes**
  - Evaluated Universal Joint Task List (UJTL) and Joint Integrated Activity Set (JIAS) as the candidate bases for C2 definition
- Development of **Functional Capabilities** vision
  - Used C2 and Net-Centric Environment JFCs as the basis for a C2 Functional Vision
- Mapping of **Program Capabilities** to Functional Capabilities
  - Assembled relevant program capabilities data from authoritatively confirmed documentation
    - - Focused foremost on CDD capabilities
- Conduct **Analysis** to identify potential gaps and overlaps
  - Used mapping tool to identify CDD-capability discrepancies
  - Analyzed discrepancies outside the model

# C2 Capabilities Vision Approach

- **C2 Joint Command and Control Functional Concepts (C2 JFCs) serve basis for C2 Capabilities Vision**
  
- **JFC C2 capabilities entered into a database mapping tool**
  - Linked to Joint Integrated Activity Set (JIAS) C2 processes
  - Used as basis for comparison with program capabilities in CDD
  
- **Joint Command and Control Functional Concept v1.0 (Final)**
  - Seven Basic C2 Capabilities
  - Eight Collaborative C2 Capabilities
  - 43 Capabilities at lowest level of indenture for this set
  
- **Net-Centric Environment (NCE) Joint Functional Concept v1.0 (April 2005)**
  - Seven Knowledge Capabilities
  - Fourteen Technical Capabilities
  - 82 Capabilities at lowest level of indenture for this set

**A total of 125 core functional capabilities compose a fixed C2 definition yardstick**

# Mapping Tier 1 Programs to Capabilities

- **Define Tier 1 program capabilities based on requirements documents (namely Capability Definition Document CDDs)**
  
- **Mapping tool to parse program capabilities and tie to JFC C2 capabilities**
  - 125 JFC C2 capabilities entered into database
    - Linked to JIAS C2 processes
    - Use as basis for comparison with program capabilities in CDD

# III. Matrix Mapping Tool (MMT)

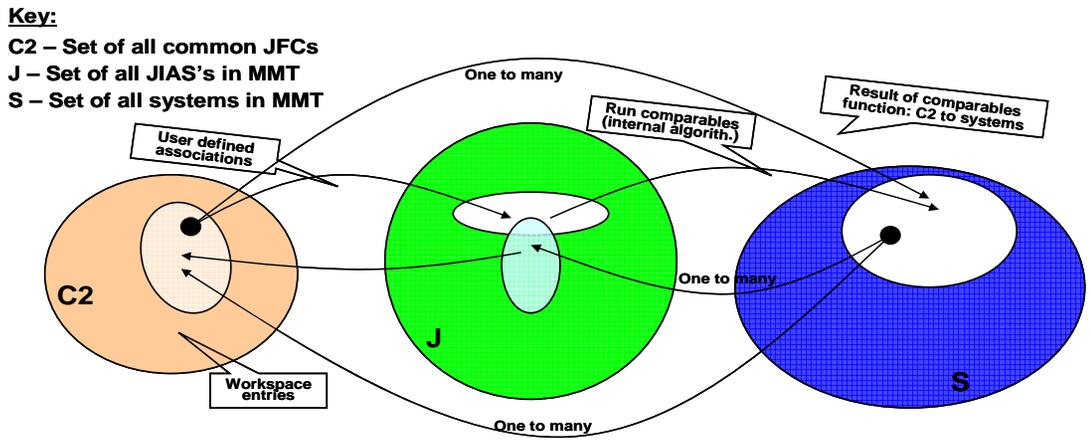


Exhibit B.1

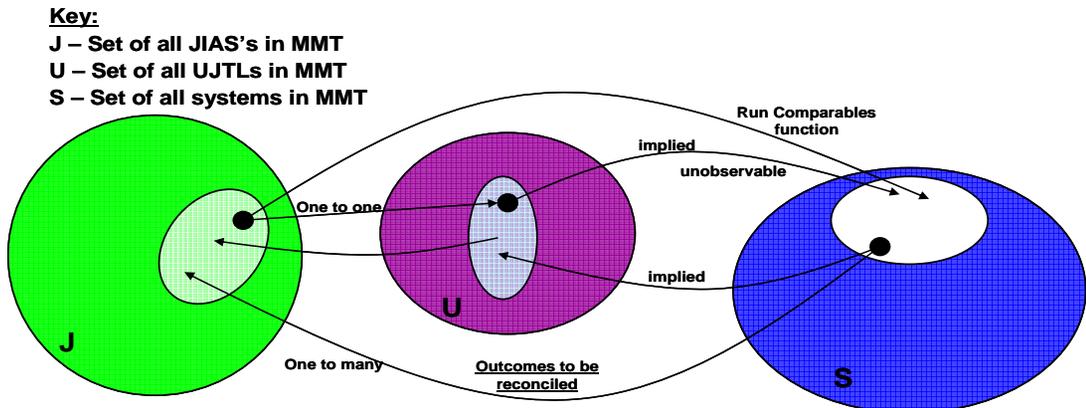
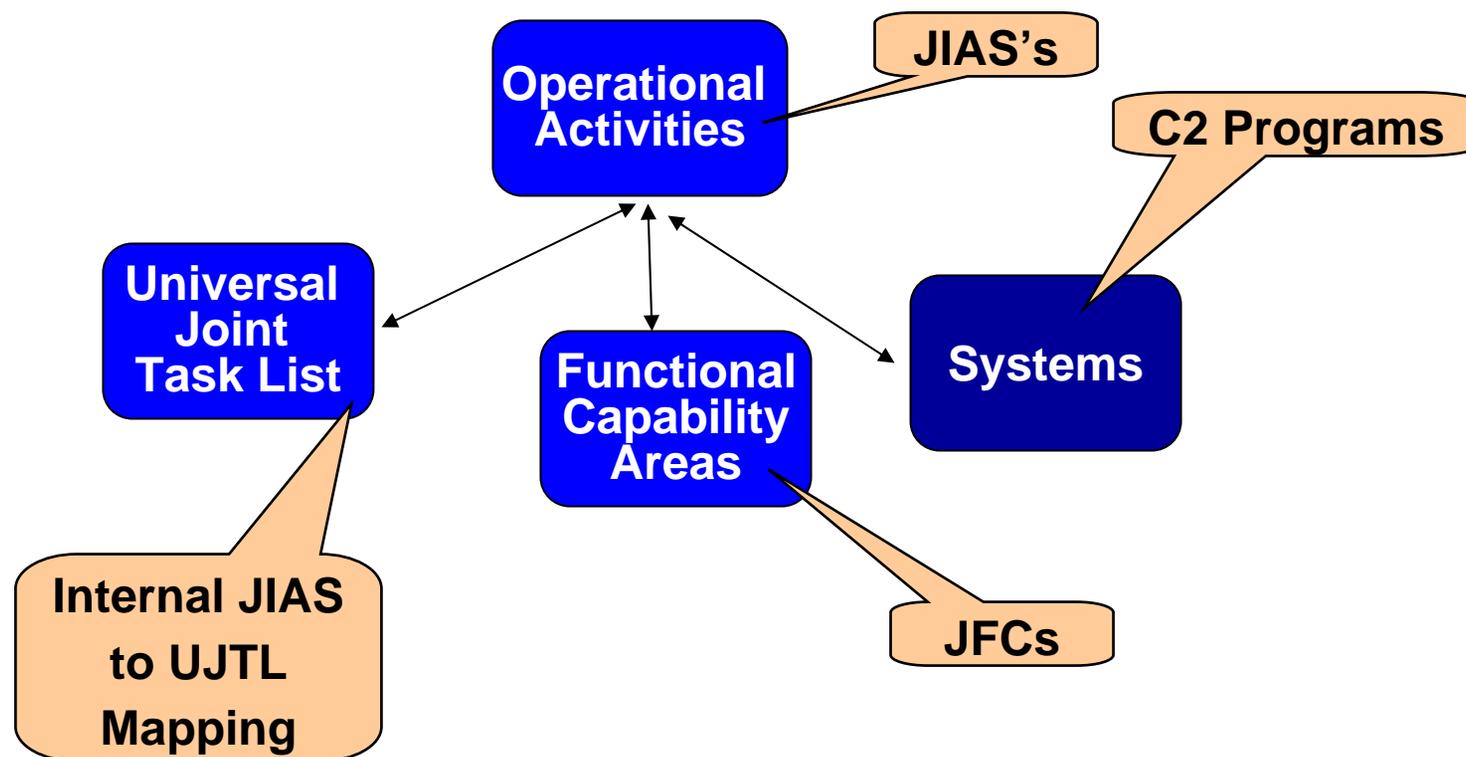


Exhibit B.2

MMT purpose is to facilitate cross organization collaboration and reuse, in support of capabilities-based planning, analysis, and acquisition. MMT is a database with supporting software that documents relationships between warfighting activities, the UJTLs, JIAS's, systems, ACTDs, roadmaps, and capability areas. It allows for a common set of reusable data to support functional & operational analysis for capability gaps, and other studies where it is necessary to understand the relationships across the dimensions listed above.

# III. MMT Data Dimensions and Mappings Applicable to Our C2-Programs Application



# JFCs Entered into MMT up to 4 Levels of Indenture

The screenshot displays the MMT 3.0.02 Beta interface. On the left, a tree view shows the hierarchy of JFCs under 'User Workspace'. On the right, a detailed view of a selected JFC is shown.

Field	Value
Number	3.1.1
Name	Understand Higher Headquarter's Plans and Orders
Description	The commander's initial information may only be the purpose of the operation as assigned by higher headquarters, or it might include higher headquarters' plans, orders, estimates, and Intelligence Preparation of the Battlespace (IPB) products. Ref: MCWP 5-1, Marine Corps Planning Process A process designed to establish a clear understanding of the purpose of the operation and desired end state established by higher authority. It may also involve a review of the commander's assessment of the adversary commander's intent and an assessment of where and how much risk is acceptable during the operation. Ref: Force Application Architecture
Interested Functional Areas	C2, FA
UJTL Counterpart	OP 5.3.1 Conduct Operational Mission Analysis.

Level 1: C2 JFC

Level 2

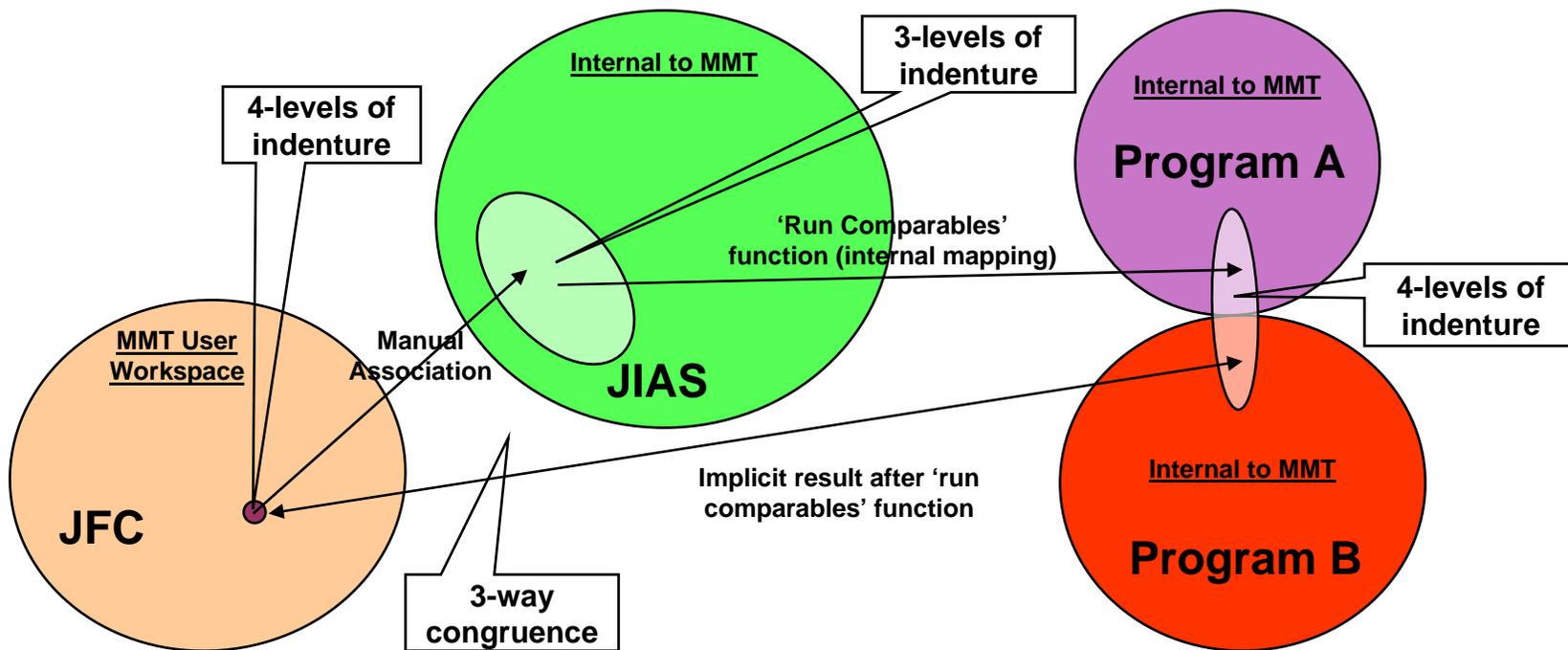
Level 3

Level 4

# Program CDD-Capability mapping to JFCs

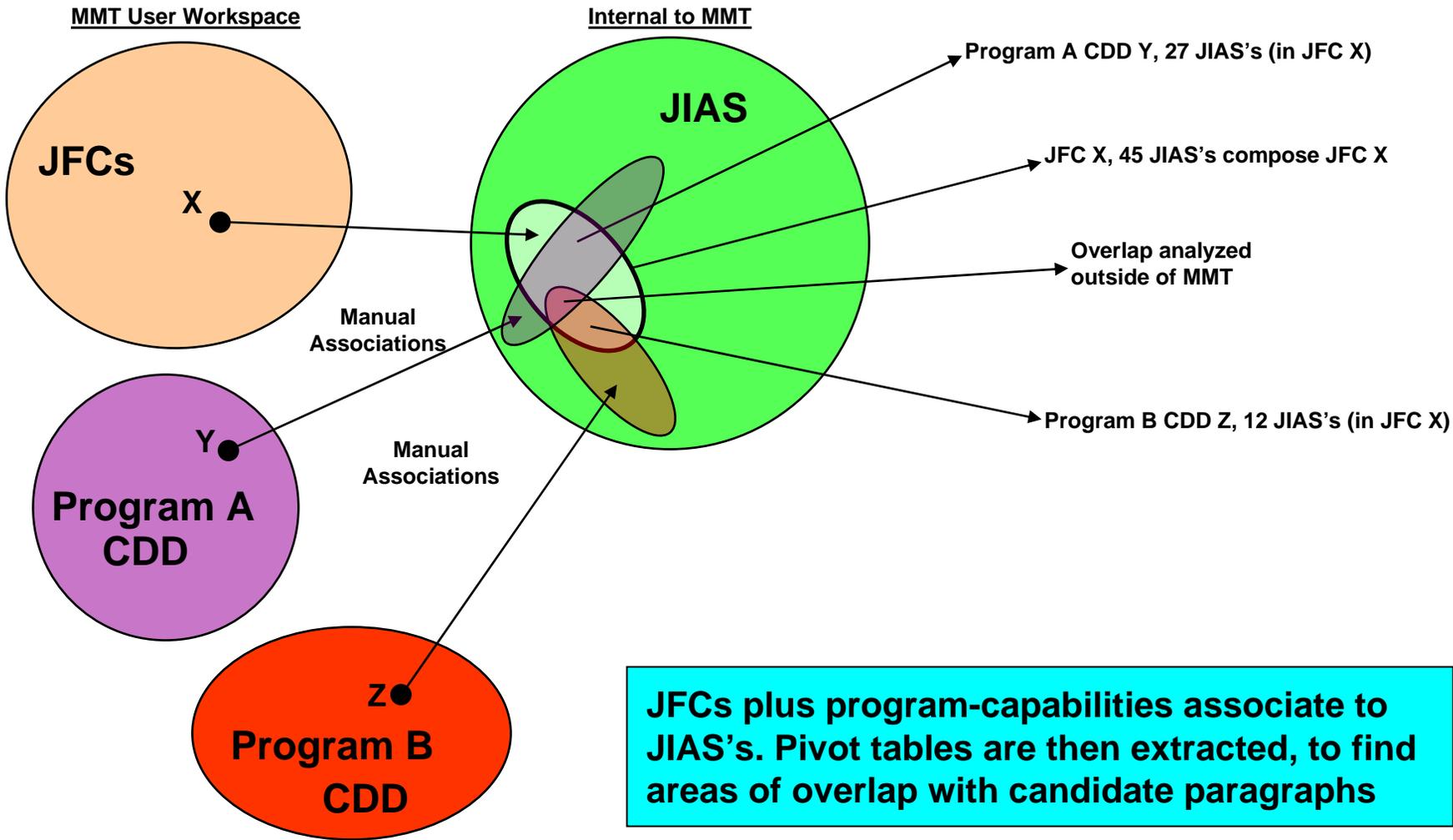
Functional Capabilities	Program CDD Capabilities	Program A CDD capabilities			Program B CDD capabilities			
		1	2	...	1	2	3	...
<b>C2 JFC Capabilities</b>								
	Basic							
	-							
	-							
	Collaborative							
	-							
	-							
<b>NCE Capabilities</b>								
	Knowledge-based							
	-							
	-							
	Technical-based							
	-							
	-							

# Initial approach with MMT Modifications



**Map C2 CDD-capabilities for Programs A&B to JIAS set, followed by algorithm modifications for congruence back to JFCs**

# IV. Approach to Developing the Methodology (using MMT w/ cross referencing tables)



JFCs plus program-capabilities associate to JIAS's. Pivot tables are then extracted, to find areas of overlap with candidate paragraphs

# 'Show Comparables' vs. 'Cross Reference' Functions

- **Initial approach was to link JFC via JIAS associations to CDD capabilities instantiated as 'Systems' in MMT**
  - Use 'show comparables' function to derive list of associated capabilities
  - This method currently does not support UJTL associations
  
- **Newly developed MMT 'cross-reference' function**
  - Correlates information in two dimensions instead of developing a single associated list by JFC
  - Appears more flexible in terms of alternate mapping for cross program capability comparisons
    - E.g. Comparing program capabilities without JFCs

# V. Analysis

- **Programs A & B satisfy different missions but share similar functionality**
- **MMT identified relevant functional C2 areas of potential overlap**
- **MMT is not an effective/efficient means to identifying paragraphs**
  - **Wheat vs. Chaff Issue**
- **MMT Identified Four Primary Areas Overlap**
  - **Intelligence**
  - **Courses of Action (COA)**
  - **Situational Awareness (SA)**
  - **Information Assurance**
- **Analysis of these four areas required reading recent CDD's (for both programs) and being on lookout for overlaps in these four primary areas**
  - **Subject matter Expert (SME) understanding was required for recording paragraphs with capability overlap**

# VI. Conclusion and Lessons Learned

## ■ Bottom line observations

- **Going too high a level of abstraction (indenture) does not yield enough specificity to engender overlaps among programs**
  - **Efficient but ineffective**
  
- **Going to a deeper level of indenture is more useful for uncovering overlaps, but unwieldy growth in data, as programs are introduced; limits MTT for C2-programs portfolio management**
  - **Effective but inefficient**
  - **Limits ability to do gap analysis**
    - **Assuming gap analysis considers all relevant C2 programs**
  - **Operates solely in the capabilities-dimension when other dimensions as risk, cost and schedule also factor into decision making**

Topic	Pro's	Con's
Gap/Overlap Identification	MMT focuses on general areas of potential overlap reducing the volume of data to be analyzed	To ensure quality of results, program SME involvement is needed to perform the mappings. MMT may not be capable of identifying all areas of overlap.
Gap/Overlap Validation	MMT as a tool is technically correct from an accounting standpoint	SME review and analysis of the identified functional areas is required
Net-centricity	MMT can support list of net-centric functions, associations to JIAS supported	Careful deliberation to V&V (CDD-capability) associations to net-centric functions needed
Scalable	MMT is effective for program comparison's, providing the MMT database can be manipulated	Level of complexity and adding programs quickly overwhelms database and analyst's ability to find gaps/overlaps
Automation	Opportunities to enhance tool development such as standardized file importing	MMT is heavy on user entry of CDD requirements and deliberating associations
P3I	MMT may be better structured to automate and select queries for gaps/overlaps, to include importing of CDD files	MMT not structured to handle multidimensional frameworks such as temporal-schedule and cost, or risk domains
Experience/User Friendly	MMT can be quickly learned	Significant tedious data entry

## Conclusion & Lessons Learned (summary)

## VII. Recommendations (near-term)

### ■ C2 and NCE JFCs

- Reasonably depict top-level required C2 Capabilities
- Recommend going on record to solidify authoritative set of required functional capabilities (all 125)

### ■ CDDs

- Focus more on developing a common understanding of user needs without need for interpretation
- Exploit common JCIDS process for describing capabilities
  - FAA, FNA, FSA, JCD, CDD

### ■ MMT as a tool for ASD(NII)

- Explore another tool for managing entire C2-programs portfolio
  - Allows for assessing gaps, in addition to overlaps
- Explore way to integrate cost/schedule/risk dimensions
  - Supplements capabilities assessment
  - Integrative portfolio management aligned to cost & budgeting aspects

# Future Recommendations

- **Leverage Capability Based Assessment (CBA) for C2 via C2 Functional Capability Board (FCB)**
  - **Joint Capabilities Document (JCD) - The JCD identifies a set of capabilities that support a defined mission area utilizing associated Family of Joint Future Concepts, CONOPS or Unified Command Plan-assigned missions.**
  - **CJCSI 3170.01E Document**
  
- **Leverage Net-Centric FCB efforts with respect to implementation of the DoD Net-Centric Data Strategy**

## VIII. References and Cited Literature

- Dahmann, Judith, Kristen Baldwin, Dennis Bergin, Ajay Choudhary, Ana Dubon, Gary Eiserman, “Matrix Mapping Tool (MMT)” white paper OUSD AT&L/Defense Systems Washington DC 20301-3090, 2005.
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- Davis, Paul K: “Analytic Architecture for Capabilities-Based Planning, Mission-System Analysis, and Transformation,” p. 74, RAND, Santa Monica, CA, 2002. Also available online: <http://www.rand.org/publications/MR/MR1513/MR1513.pdf>.
- USD AT&L: “The Defense Acquisition System,” Directive Number 5000.1, Department of Defense, May 2003.
- USD AT&L: “Operation of the Defense Acquisition System,” Instruction Number 5000.2, Department of Defense, May 2003.

# Other Findings (backup)

- **CDD extracts may not explicitly call out net-centric requirements**
  - NCE JFC ‘overlaps’ are more indicative of net-centric operations than functional duplication
- **‘Show Comparables’ vs ‘Cross-reference’**
  - ‘Show Comparables’ provides a list of programs/systems related to a single JFC
  - ‘Cross Reference’ provides a matrix of JFCs vs. Program Capabilities using data within the MMT user workspace
- **Comparisons based on mappings to UJTL or JFC could obviate the need to use JIAS**
- **Parent JFC can not be fully realized using JIAS elements to 4 levels**
  - There are a few level 4 JFCs that do not map to JIAS
  - Some do not map well
- **Complex interpretations will be required to determine gap/non-gap & overlap/non-overlap**