MINI-DASS (Mission-Informed Needed Information - Discoverable Available Sensing Sources): A New Mission & Means Framework Ontological Approach for ISR Missions… *the magic rabbits*

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2016 International C2 Research and Technology Symposium  
6-8 September 2016, London, UK
Outline

• Background and Context
• MINI-DASS Challenges: Dealing with Data & Information
• Implementation: Missions and Means Framework Model
• Developing an Ontology and Operators
• The Road Ahead
• Summary
Intelligence Products

Engage Sources

Plan - Pose questions, Hypothesize

Translate human intent to computer understanding

Disseminate

Collect Data – Discover, Filter, Contextualize, Extract

Situational Understanding

Decisions

Situational Understanding Representation

Process – Aggregate, Link, Correlate, Reason

Suitably render information for human understanding

Discover, Query

Potentially Relevant Data

Automatic queries, taskings based on results

Translate human intent to computer understanding

Answer questions, Hypothesize

Discover, Query

Potentially Relevant Data

Automatic queries, taskings based on results

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Answer questions, Hypothesize

Discover, Query

Potentially Relevant Data

Automatic queries, taskings based on results
Key Points of Representation

• **Information query must be tied to mission/task**
  – Machine understanding of needed information
  – Information requests technology agnostic

• **Discovery, availability & relevance of information sources**
  – Any source or container that can deliver information to consumer
    • Fusion engines
    • Information processing techniques (including PED)
    • Social media
    • Sensors
  – Includes policy, especially in coalition environment
  – Determination of mission relevancy of information

• **Need ability to match capability of means to mission capabilities required**
MINI-DASS Objective

- Provide an informational-based MMF with an ontology developed that will enable the optimal matching of information available from discoverable information sources (means) to the mission-relevant information needed (mission) to provide enhanced situational understanding to the decision maker.

- Domain: Limited to information sources and ISR operations that are at the edge including contested urban environments
  - Focus on coalition operations complicates effort
    - Assets more disparate
    - Policy issues
  - Process closed questions

- Goals
  - Common description of requested information and capabilities that can be provided by available information sources (common language)
  - Automated capability to enhance understanding in the domains of (1) the environment and (2) the threat
  - Framework and mechanism to describe capabilities required
  - Automated model of current mission/task building processes
The Tough Challenges

- **Mission/task builds**
  - Need to understand information needed
    - Stripped of assumed technology/information source
    - Convert to machine understanding
  - Need to determine information relevancy
    - Which sources have relevant information
    - What within-source information is relevant

- **Domain ontology**
  - Model complex, disparate and soft source capabilities
    - Fusion engines
    - PED processes
    - Social media
    - Video
    - Traditional low-power sensors
  - Information source discovery & accessibility

- **Determine “goodness” of information to satisfy mission needs**
  - *Value* of data: veracity, relevance, orthogonality
  - Qualitative measure acceptable
  - Must be objective
• Model is generic and mission-independent
• Levels applied to MINI-DASS
  o Level-4 represents the “acquire-the-needed-information” mission (verbs)
  o Level-3 represents how well the capabilities of the available information source means satisfy the mission needs; basis for determining optimality and “goodness” of the “matches” (adverbs)
  o Level-2 represents capabilities of the information source means that are available (nouns)
  o Level-1 is the interactions and effects which includes mission programming and information source updating (adjectives)
• Executing parties self-linked and crossed-linked through shared interactions and effects

• MMF model has levels connected by both explicit and implicit operators
  - Certain levels “talk” only to other levels
  - Level instantiation must follow a specific causal order

• Operators may change the state of levels
  - $O_{1,2}$ operator changes state of Level 2 means
  - $O_{2,3}$ operator changes state of Level 3 capabilities
  - $O_{2,3}$ and $O_{3,4}$ operators are key to MINI-DASS

**MINI-DASS is an multi-dimensional operations research optimization problem**
• MMF model is generic
  - Kinetic & ISR missions
• Level 2 (means) domain-specific
  – Ontologies have advantage of defining in advance exactly what each class of objects (MEANS) is and how it relates to all other objects within our domain of interest
  – Ontologies are classification systems, and in the process of building the ontology we must make *a priori* decisions as to what things belong together
• ISR assets for Level 2 MINI-DASS ontology
  - Social media
  - PED process
  - Fusion engine
  - Video
MINI-DASS MMF & Ontology Team

- Information source technical experts
- Ontology experts
- Operational experts
- Operational Research experts
The Road Ahead

Interactions
- OPFOR
- Own assets
- Coalition assets
Summary

- **Goal:** Provide an informational-based MMF that will enable optimal matching of information available from discoverable information sources (means) to the mission-relevant information needed (mission) to provide enhanced situational understanding to the decision maker.

- **Multi-dimensional operations research effort**

- **It’s a tough problem with numerous challenges**
  - Modeling sources with human-generated information
  - Finding the mission-relevant information
  - Determining “goodness” of information

- **No results yet**
  - MINI-DASS is a concept
  - Research just beginning

- **MMF model is generic; Level 2 ontology domain-specific**

*We are attempting something new that, if successful, could have a significant impact on military operations!*
Questions?