



U.S. Army Research, Development and Engineering Command



***TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.***

## C3Grid Overview

DoD M&S Conference

10 March 2008

## Report Documentation Page

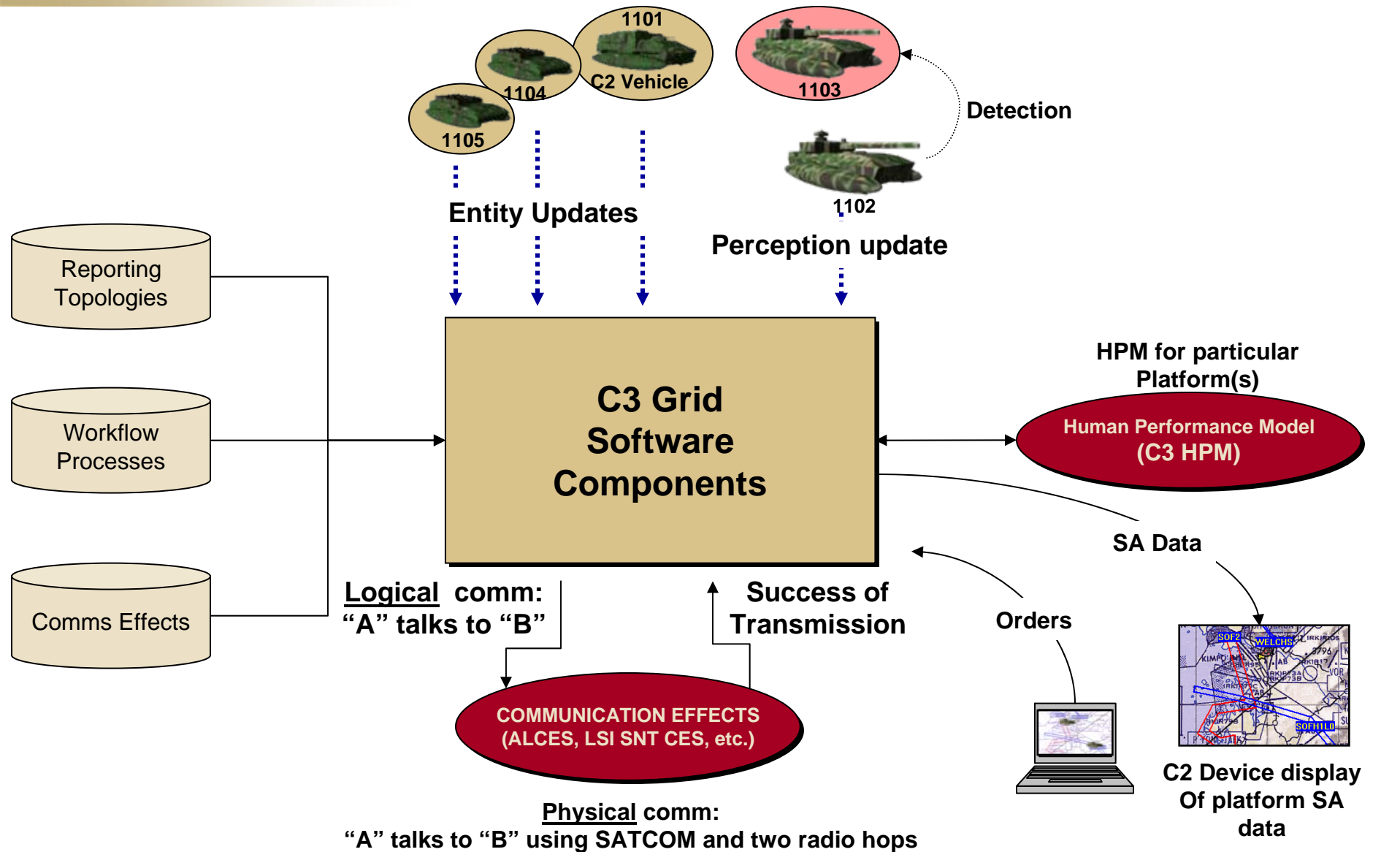
*Form Approved*  
*OMB No. 0704-0188*

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

|   |                                    |  |   |                                  |                                 |
|---|------------------------------------|--|---|----------------------------------|---------------------------------|
| 1. REPORT DATE<br><b>10 MAR 2008</b>  | 2. REPORT TYPE<br><b>N/A</b>       | 3. DATES COVERED<br>-                    |   |                                  |                                 |
| 4. TITLE AND SUBTITLE<br><b>C3Grid Overview</b>   |                                    | 5a. CONTRACT NUMBER                      |   |                                  |                                 |
|   |                                    | 5b. GRANT NUMBER                         |   |                                  |                                 |
|   |                                    | 5c. PROGRAM ELEMENT NUMBER               |   |                                  |                                 |
| 6. AUTHOR(S)  |                                    | 5d. PROJECT NUMBER                       |   |                                  |                                 |
|   |                                    | 5e. TASK NUMBER                          |   |                                  |                                 |
|   |                                    | 5f. WORK UNIT NUMBER                     |   |                                  |                                 |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br><b>U.S. Army Research, Development and Engineering Command</b>  |                                    | 8. PERFORMING ORGANIZATION REPORT NUMBER |   |                                  |                                 |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)   |                                    | 10. SPONSOR/MONITOR'S ACRONYM(S)         |   |                                  |                                 |
|   |                                    | 11. SPONSOR/MONITOR'S REPORT NUMBER(S)   |   |                                  |                                 |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT<br><b>Approved for public release, distribution unlimited</b>   |                                    |  |   |                                  |                                 |
| 13. SUPPLEMENTARY NOTES<br><b>2008 DoD M&amp;S (Modeling and Simulation) Conference Presentations held in Orlando, Florida on March 10 - 14, 2008, The original document contains color images.</b> |                                    |  |   |                                  |                                 |
| 14. ABSTRACT  |                                    |  |   |                                  |                                 |
| 15. SUBJECT TERMS   |                                    |  |   |                                  |                                 |
| 16. SECURITY CLASSIFICATION OF:   |                                    |  | 17. LIMITATION OF ABSTRACT<br><b>UU</b> | 18. NUMBER OF PAGES<br><b>19</b> | 19a. NAME OF RESPONSIBLE PERSON |
| a. REPORT<br><b>unclassified</b>  | b. ABSTRACT<br><b>unclassified</b> | c. THIS PAGE<br><b>unclassified</b>      |   |                                  |                                 |

- The real world Army is organized into well defined hierarchies with roles and responsibilities articulated and understood.
- Communication in the real world occurs over real equipment. It is well defined with a purpose and an intended effect.
- Decisions are made based on information and understanding – situational awareness
- The C3Grid enables MATREX to simulate information age operational realities – the force structure and information flows that are the challenges of the future Army concept
- The fidelity of the C3Grid and the services associated with the C3Grid impacts the degree to which the simulated world replicates the real world.
- The degree to which the real world and the simulated world can interoperate depends on the ability of each to impact the other; i.e., their ability to communicate with each other.

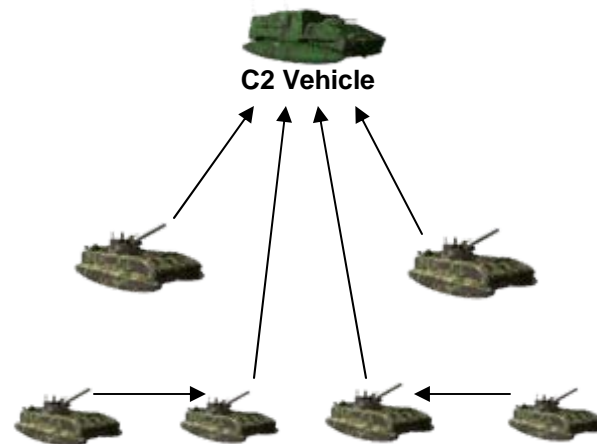
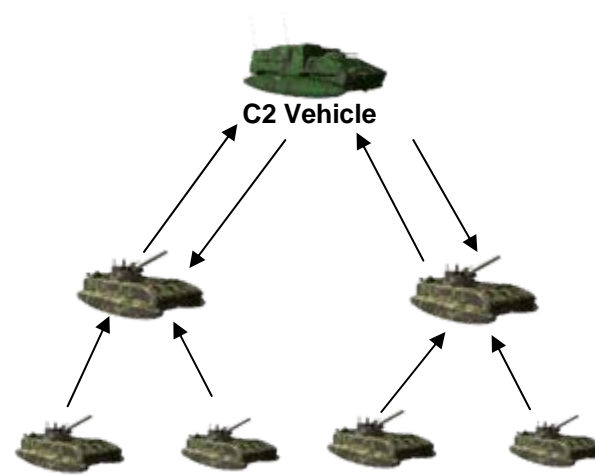
- Provides robust highly parametric C4ISR modeling capability for Network Centric Warfare (NCW) that enables the use of existing combat simulations to support Army transformation.
- Creates and allows representation of information flow topologies unique to message type, decision points and data processes.
- Interface for management of the Common Operating Picture (COP) for the force structure according to information flow using blue/red deconfliction, target correlation, aggregation and information dissemination.
- Interfaces for integration of external services including communication effects, fusion, human performance modeling and Command & Control devices.





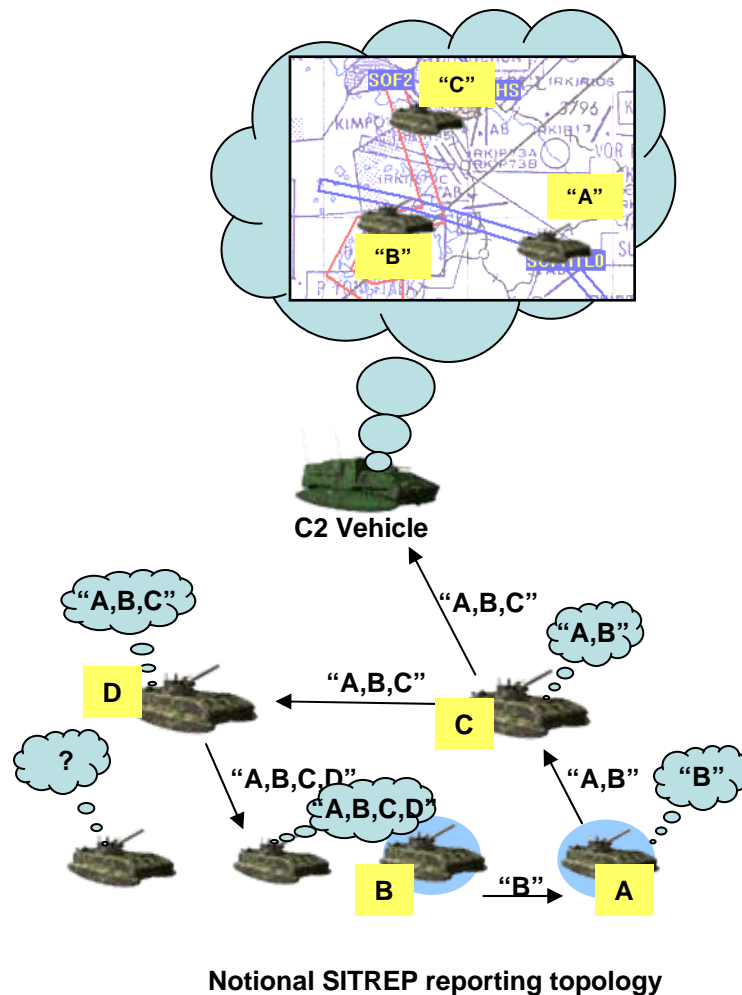
- Enables the modeling of the *propagation and maintenance* of situational awareness (SA) as it originates from the simulated battlefield
  - Converts data from battlefield simulations into reported / detected information
  - Models the reporting of that information from the detecting/reporting platform to other platforms via defined reporting hierarchies
  - Maintains information about known entities (friendly & enemy) on behalf of the simulation(s) modeling the battlefield entities

## Data inputs define the desired SA reporting Topology



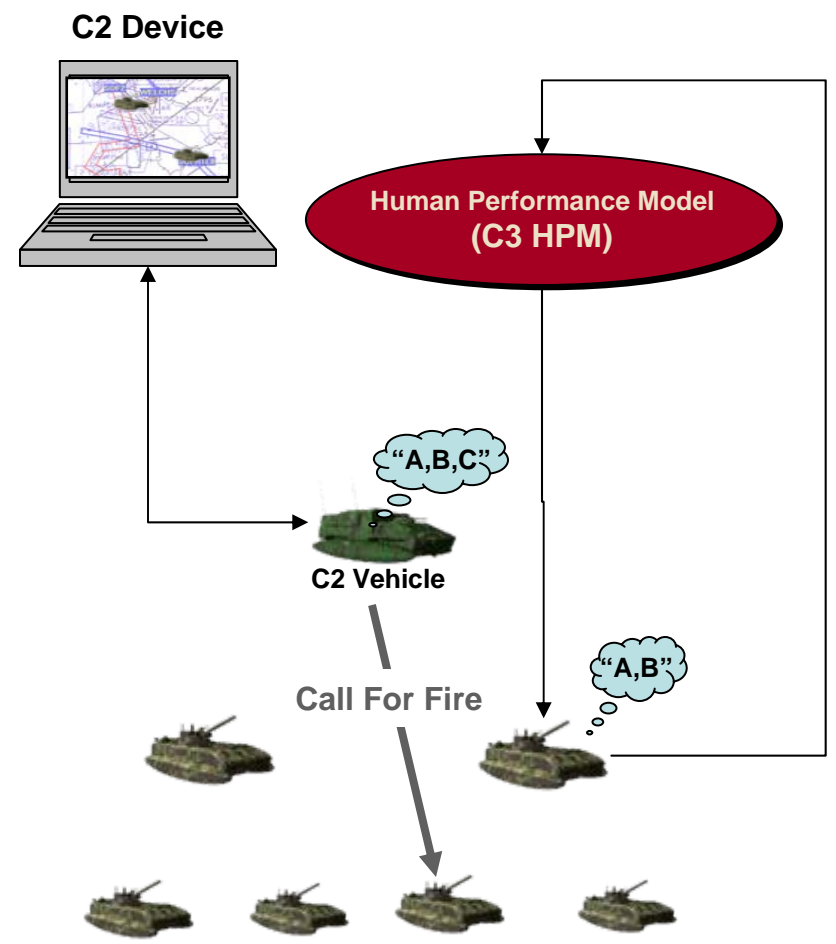
**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

- Enables the modeling of the *propagation and maintenance* of friendly and enemy situational awareness (SA) as it originates from the simulated battlefield
  - Converts data from battlefield simulations into reported / detected information
  - Models the reporting of that information from the detecting/reporting platform to other platforms via defined reporting hierarchies
  - Maintains information about known entities (friendly & enemy) on behalf of the simulation(s) modeling the battlefield entities



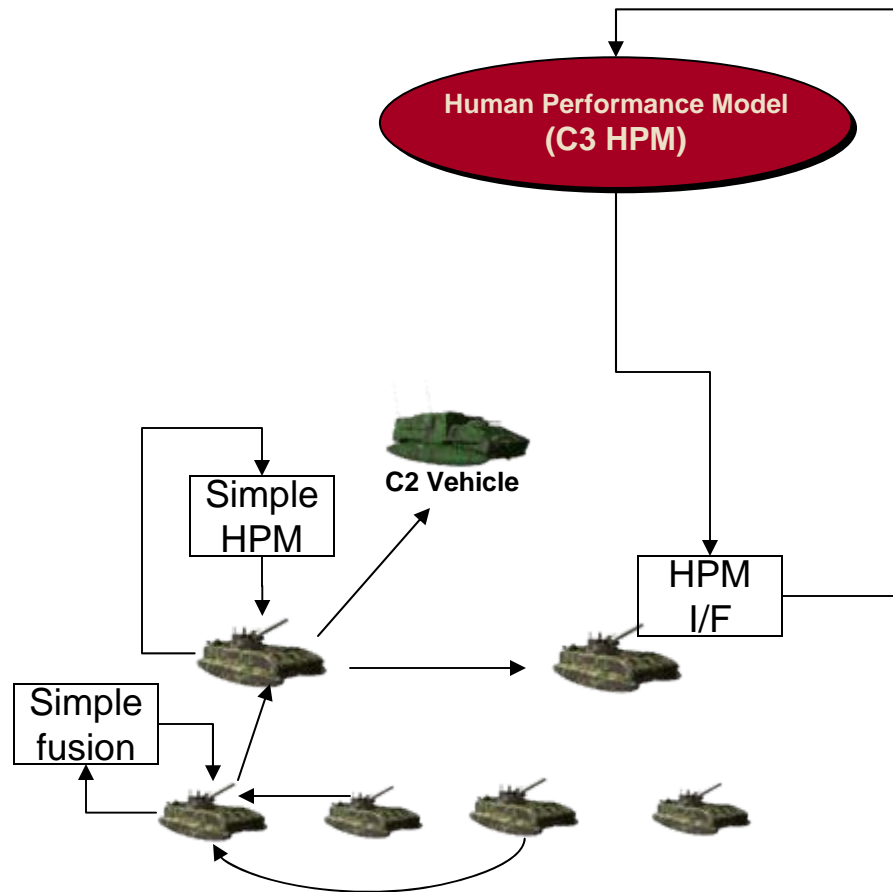
Notional SITREP reporting topology

- Conveys SA information to external components as appropriate
  - C2 Devices with human operators
  - Simulations modeling C2 constructive behaviors
- Enables the sending of other (non-SA) messages/orders between battlefield entities
  - e.g., Call for Fire (CFF) from requesting unit to the authorizing unit



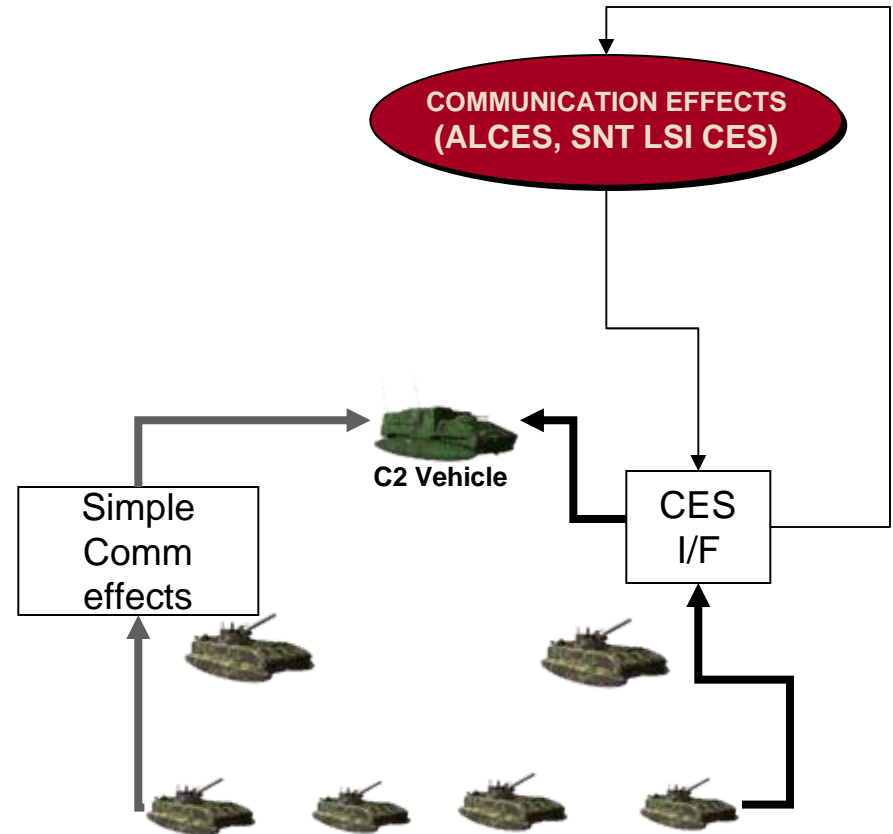


- Models surrogate fusion and HPM processing
  - Surrogate, organic Human Performance Model (HPM) for message processing
  - Surrogate, organic message fusion
- Provides **interfaces** to external processing
  - Provides interfaces to external, higher-fidelity representations as desired





- Models surrogate **message communications effects**
  - simple message delays
  - “perfect” – no delays
- Provides an interface to external, higher-fidelity Communications Effects Server (CES) representation as needed
- Can apply comms effects equally to all “communicated” messages (SA, CFF, Fire missions, orders, ...)





# Future Work



- Support for Blue Situation Awareness Initialization
- Support for Fusion
- Support of FCS LSI SNT CES v4.0 (new interface)
- GUI interface

- **RDECOM (RDEC's)**

- Aviation and Missile Research, Development and Engineering Center (AMRDEC)
- Armament Research, Development and Engineering Center (ARDEC)
- Army Research Laboratory (ARL)
- Communications-Electronics Research, Development and Engineering Center (CERDEC - Belvoir/Monmouth)
- Edgewood Chemical Biological Center (ECBC)
- Natick Soldier Research, Development and Engineering Center (NSRDEC)
- Simulation & Training and Technology Center (STTC)
- Tank and Automotive Research, Development and Engineering Center (TARDEC)

- **FCS LSI**

- **BLCSE (MMBL and TRADOC)**

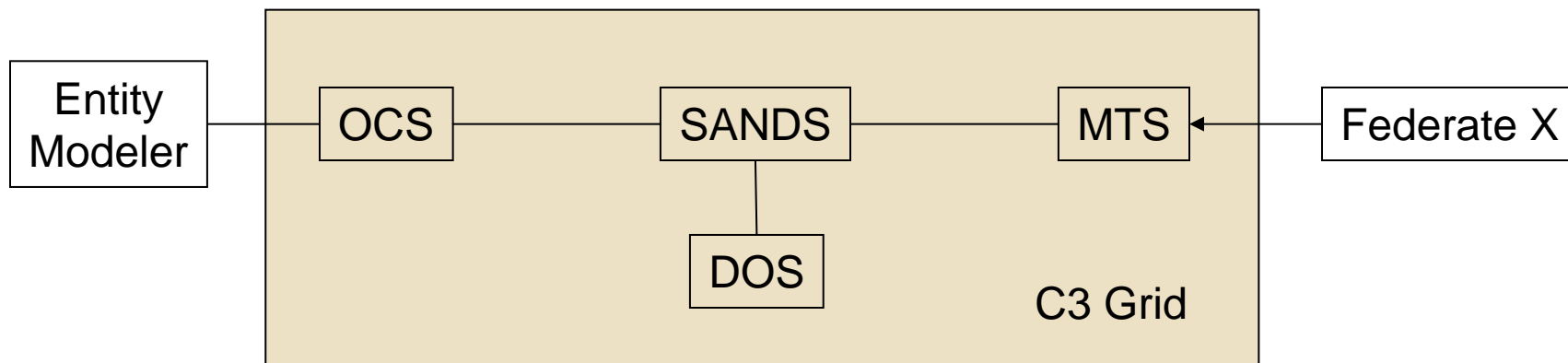
- **PM C4ISR On-The-Move**

| Name                | Title             | Phone                   | Email                       |
|---------------------|-------------------|-------------------------|-----------------------------|
| <b>Government:</b>  |                   |                         |                             |
| Tom Hurt            | MATREX PM         | (703) 806-0995          | tom.hurt@us.army.mil        |
| Chris Metevier      | MATREX Deputy PM  | (407) 384-3865          | chris.metevier@us.army.mil  |
| <b>Contractors:</b> |                   |                         |                             |
| Gary Smith          | Design & Dev Lead | (703) 425-2205 ext. 224 | gsmith@d-a-s.com            |
| John Vintilescu     | Deputy            | (703) 425-2205 ext. 208 | jvintilescu@raytheonvtc.com |
| Thomas McAfee       | SW Engineer       | (703) 425-2205 ext. 218 | tmcafee@raytheonvtc.com     |
| Paul McCray         | SW Engineer       | (703) 425-2205 ext. 232 | pmccray@d-a-s.com           |
| Tim Good            | SW Engineer       | (703) 425-2205 ext. 202 | timothy.good1@us.army.mil   |

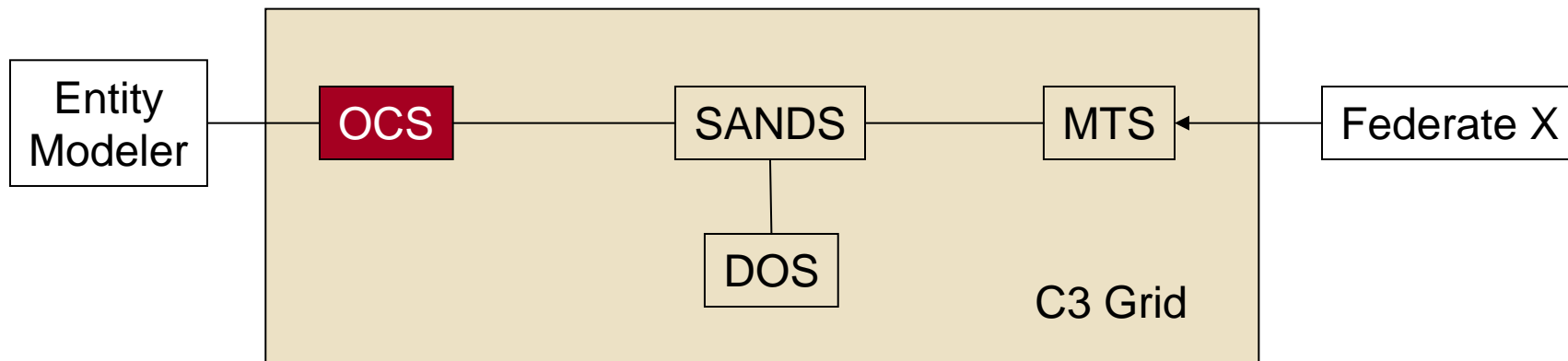
MATREX IDE Website: <https://www.matrex.rdecom.army.mil>



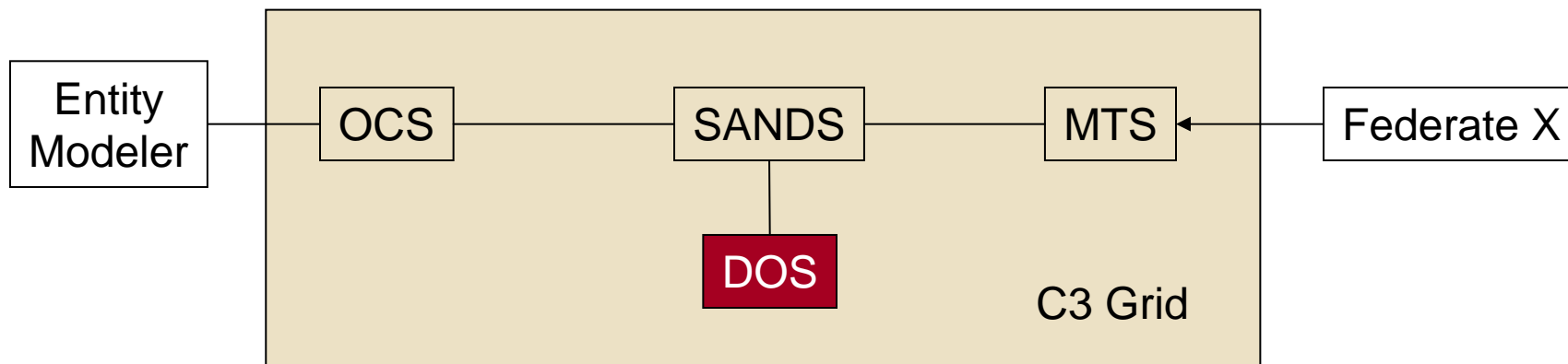
# Backup



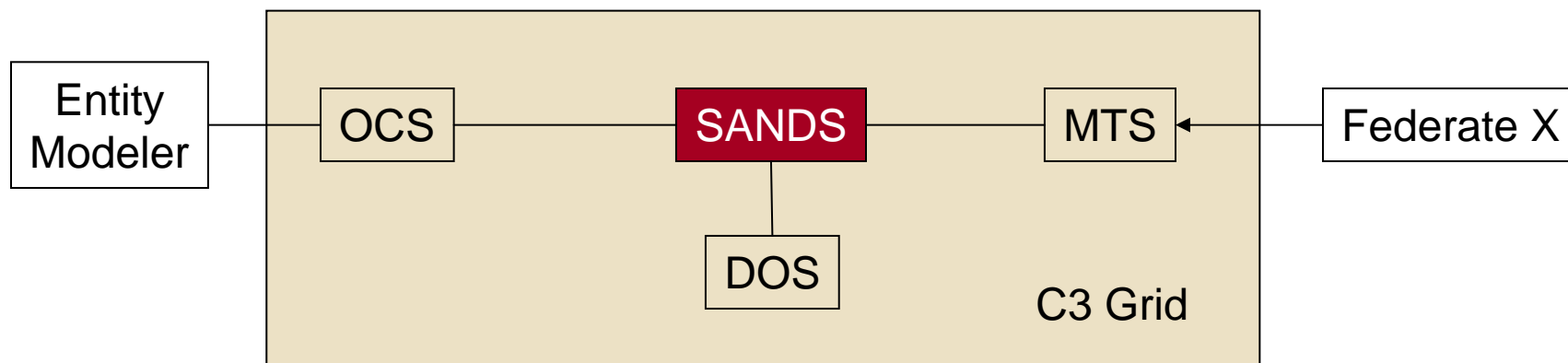
- **OCS** – Organic Communication Service
- **DOS** – Dynamic Organization Service
- **SANDS** – Situational Awareness Normalization & Dissemination Service
- **MTS** – Message Transceiver Service
- **R2S** – Role Resolution Service



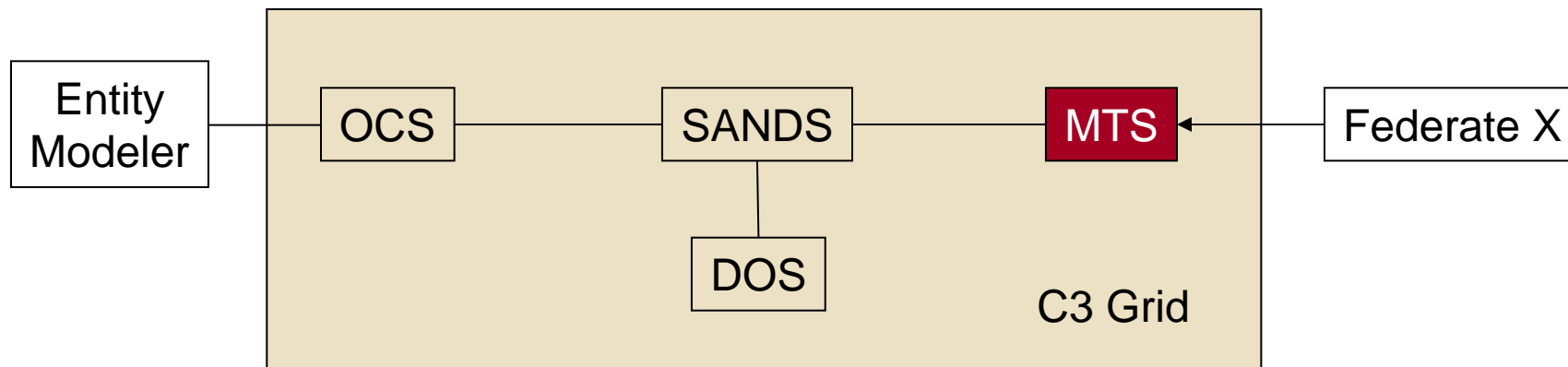
- OCS – Organic Communication Service
- OCS provides a filter mechanism from outside models to the C3Grid
  - Provides an abstraction layer between the interactions of the C3Grid components and the simulation architecture.
  - The OM used by the C3Grid remains flexible because it is isolated from the exercise. As new interfaces are defined only the abstraction layer defined within OCS needs to be changed.



- DOS – Dynamic Organization Service
- DOS manages the C3Node structure in the C3Grid
  - The C3Node is a mechanism to combine “who talks to whom” and “who acts on what”
  - DOS initializes the C3Node Architecture in an exercise
  - During the exercise, DOS manages command succession and proper message flow



- SANDS – Situational Awareness Normalization & Dissemination Service
- SANDS manages (or coordinates the management of) the local operational picture (LOP) for each simulated platform
  - Interfaces for fusion, human performance modeling, message generation and the proper dissemination of information
  - Messages needing comms effects are sent to MTS. Information from the entity to itself are processed within SANDS.
  - SANDS acts on behalf of the simulated entities by managing information flow from them and to them



- MTS – Message Transceiver Service
- MTS allows for realistic modeling of radio and network communications
  - MTS interfaces with the CES for proper modeling of communications equipment
  - MTS routes messages to the proper receiver. A message with multiple receivers will be copied and sent with appropriate comms effects in MTS



# C3Grid - Message Flow

