

75th MORSS 712CD Cover Page

12-14 June 2007, at US Naval Academy, Annapolis, MD

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(Please use the same title listed on MORSS Form 712 A/B. If the title was changed please list the revised title below.) Revised title:

____ **MATREX: A Unifying Modeling and Simulation Architecture for Live-Virtual-Constructive Applications** _____

Presented in: WG(s) # __29, 31 _____, Backup CG __E_ Special Session _____,

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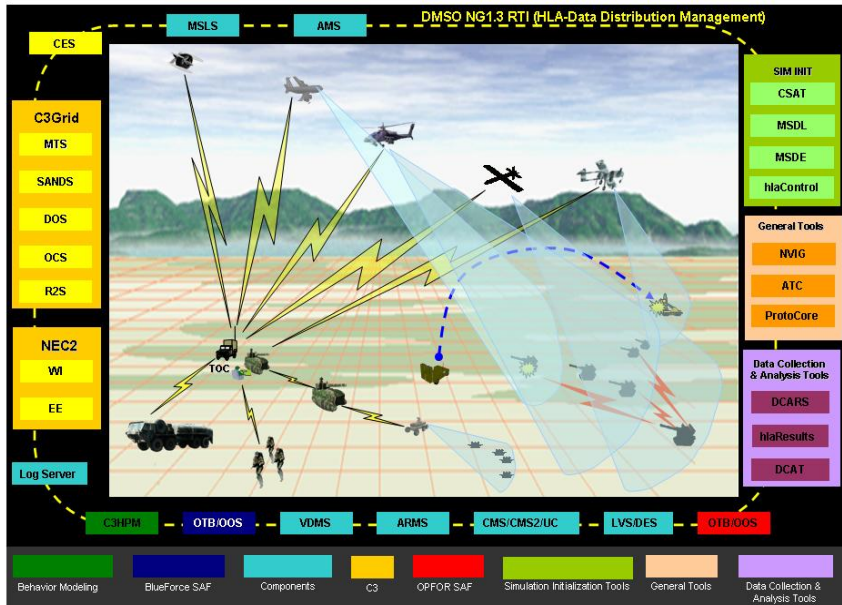
MATREX: A Unifying Modeling and Simulation Architecture for Live-Virtual-Constructive Applications



MATREX Purpose



MATREX v2.0 Environment



Purpose:

To develop a composable M&S environment wherein a collection of multi-fidelity models, simulations and tools can be integrated into an established architecture for conducting analysis, experimentation and technology trade-offs for RDECOM and others.

Benefits:

- Enables reconfiguration and reuse of components for:
 - Engineering model development and evaluation
 - Technology tradeoffs
 - Capabilities assessments
 - Concept development
 - Experimentation
 - Testing
- Mutually and collectively leverages the world-class expertise of all RDECOM M&S laboratories for the benefit of the Army
- Supports decision making over entire acquisition cycle

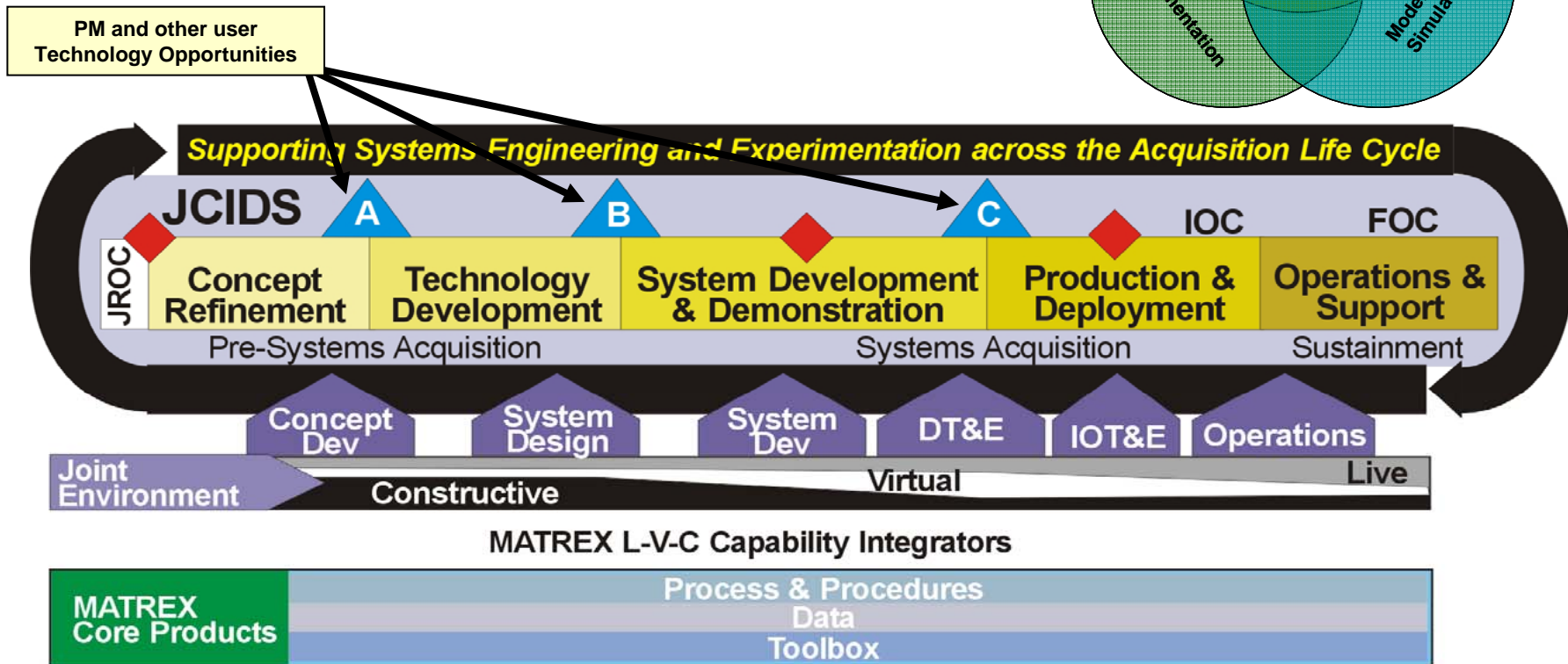
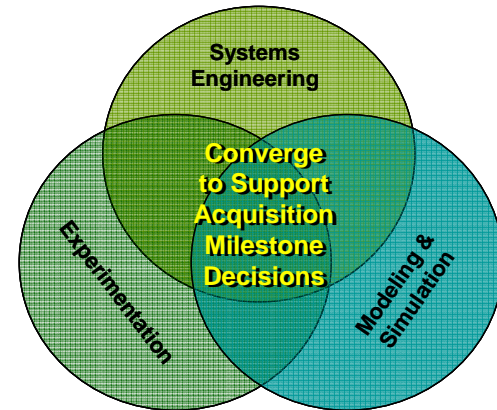
Primary Partners and Customers:

- RDECOM HQ, RDECs, and Labs
- PM FCS (BCT) MSO / FCS LSI
- TRADOC (BLCSE)
- 3CE (Cross Command Collaboration Effort) including TRADOC, ATEC, FCS LSI, RDECOM
- Other Army PMs and PEOs

Critical M&S capabilities necessary to support Network Centric Warfare representation and analysis

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Enable cross-commodity M&S tools, capabilities, processes and people to support technology development, systems integration and product development across the life cycle.



Reduce expense of "Live" activities

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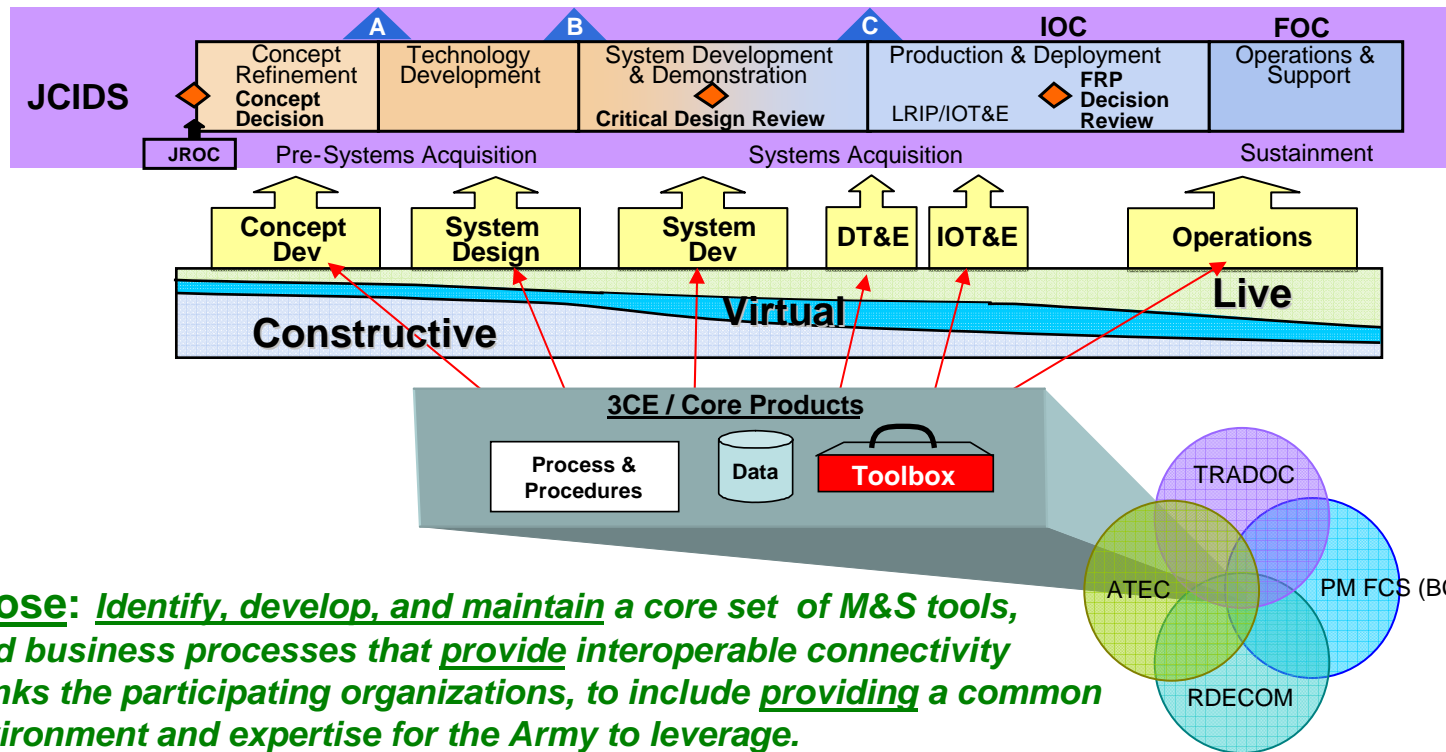


Cross Command Collaboration Effort (3CE)



3CE Mission and Intent

Mission (Vision): *Develop a cross command Army M&S and data environment for design, development, integration, and testing of capabilities, systems, and prototypes.*



Intent:

Purpose: *Identify, develop, and maintain a core set of M&S tools, data, and business processes that provide interoperable connectivity which links the participating organizations, to include providing a common 3CE environment and expertise for the Army to leverage.*

End State: *A 3CE environment that meets the common requirements of all three commands and PM FCS BCT to conduct distributed DOTMLPF development.*

Relevant Today and Into the Future

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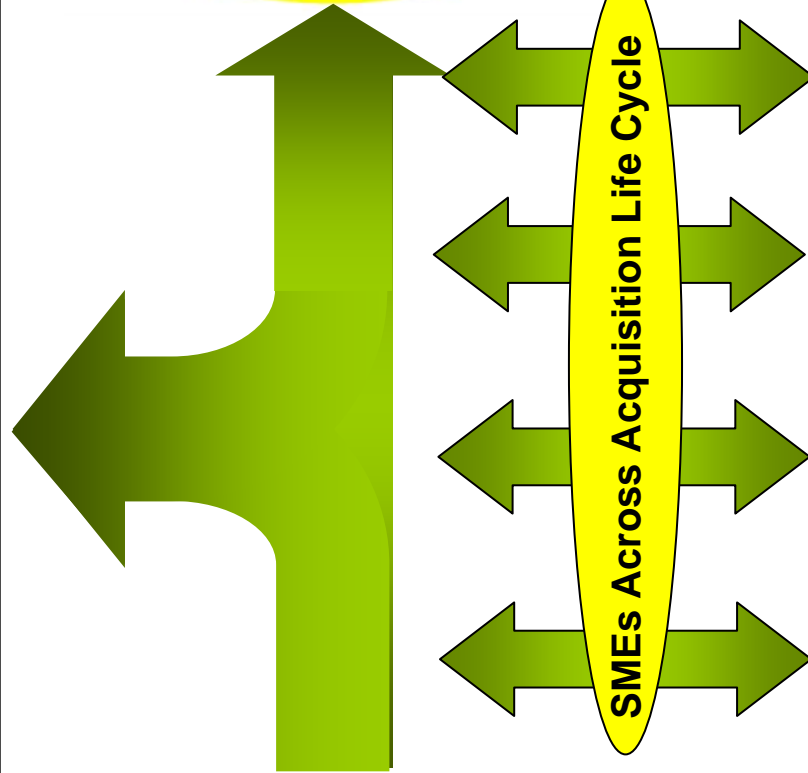


MATREX Collaborations



Distributed to

TRADOC	UofA Maneuver Battle Lab Air Maneuver Battle Lab Depth & Simultaneous Attack BL Battle Command Battle Lab TRAC Leavenworth TRAC-WSMR
ATEC	IRCC WSMAR HQ USAOTC USAOTC-IEW Electronic PG, Fort Lewis APG Test Center WDTC, Dugway PG RTTC RTTC-RSA
PM	PEO-STRI NLOS-LS PM FCS (BCT) – FCS LSI
Other Services	LMC-Orlando (USN) Navy Research Lab Naval Air Warfare Center JTAGGS (USAF)



Partners & Collaboration

ATEC (OTC/DTC)

- Test Event Support
- Live Interface
- Sim to C2
- Sim Research

TRADOC

- Analytical Requirements
- BLCSE Conversion to HLA
- FFID Planning
- Sim Infrastructure & Tools

3CE

- Core Planning
- Sim Systems Engineering
- Federation/FOM/Tools
- FCS Spin Out 1
- Sim Infrastructure & Tools

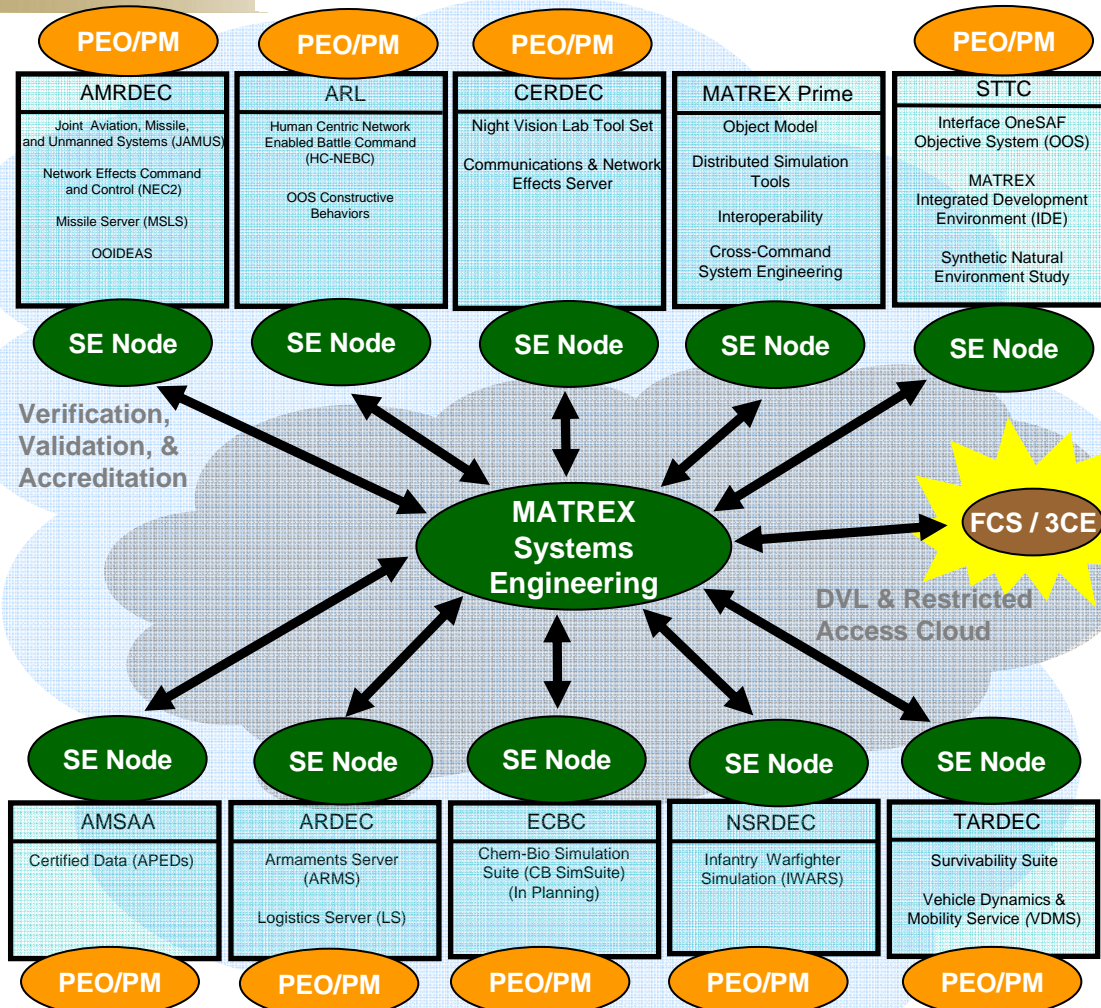
FCS LSI

- FOM
- FCS Simulation Environment (FSE)
Collaboration & Development
- GFX Delivery, Training & Support

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Systems Engineering for MATREX and RDECOM - Operational View



Integrated M&S System of Systems Engineering Capability for RDECOM via MATREX:

- Supporting PEOs and PMs with a coordinated RDECOM approach
- Common integrating SoS Architecture synchronized across RDECOM
- Standing up SE Nodes for M&S across RDECOM:
 - Integrated M&S Culture
 - Common Engineering Tools
 - Common Requirements Database, terminology, and processes
 - Distributed / Collaborative enabling services:
 - Web Collaboration (STEM, IDE, AKO)
 - DVL Services
- Maximize interoperability, flexibility and adaptation of RDECOM M&S capabilities to the Acquisition Communities needs.
- Common OM and Core Capabilities/Tools

MATREX reduces Technical and Cost Risks for the FCS and other programs through external coordination of RDECOM M&S

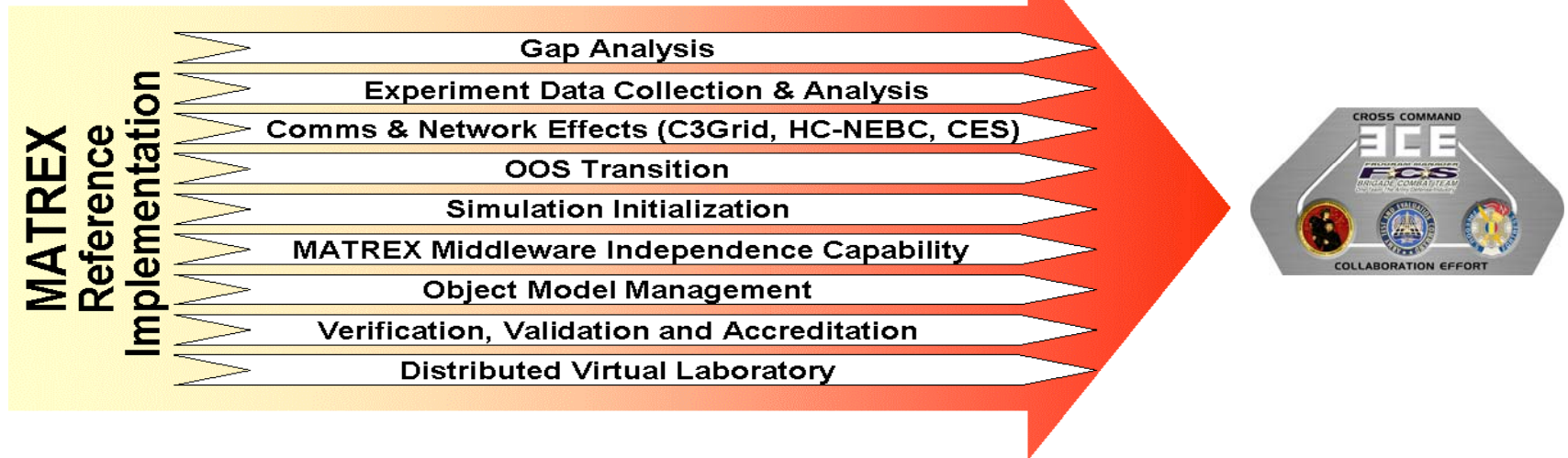
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MATREX Strategy Applied



Networked Fires



- Leverage 3CE requirements development (TRADOC Integrated Process 3 “Networked Fires” (IP-03), LSI mission threads, ATEC OTC, TRADOC BLCSE, ...) to drive capability, integrated process, and methodology development for 3CE, ATEC OTC, TRADOC BLCSE)
- Develop MATREX overarching M&S Framework consisting of:
 - OneSAF Objective System (OOS) integration into M&S architecture
 - Integrated capabilities and baseline that supports analysis of Future Force Network Centric Warfare (NCW)
 - MATREX Middleware Independence Capability (MMIC) which enables Live-Virtual-Constructive interoperability
 - Work toward a common means of simulation initialization and data collection and analysis tools and processes

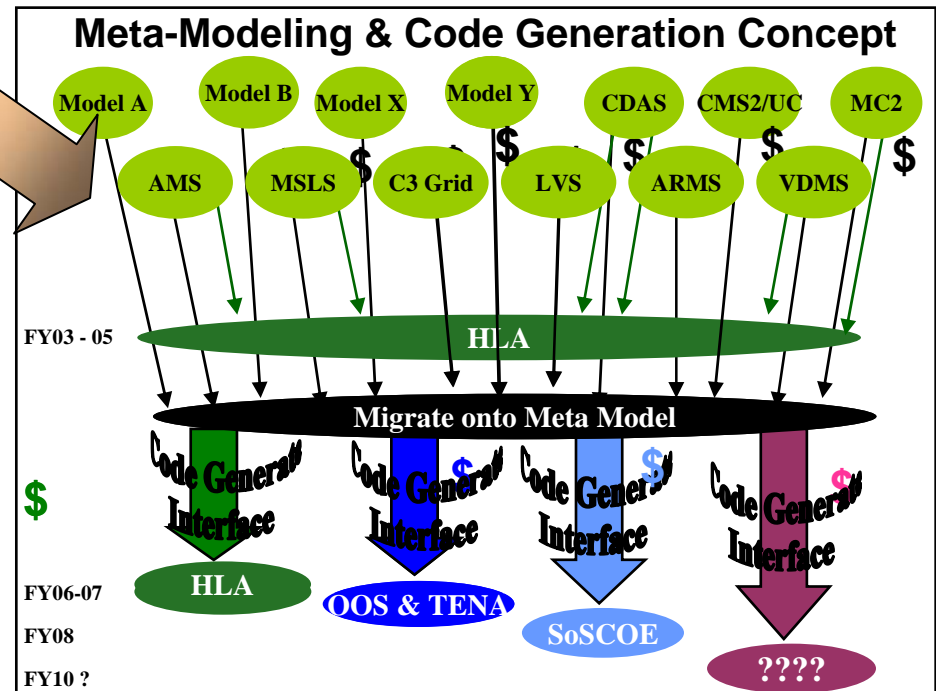
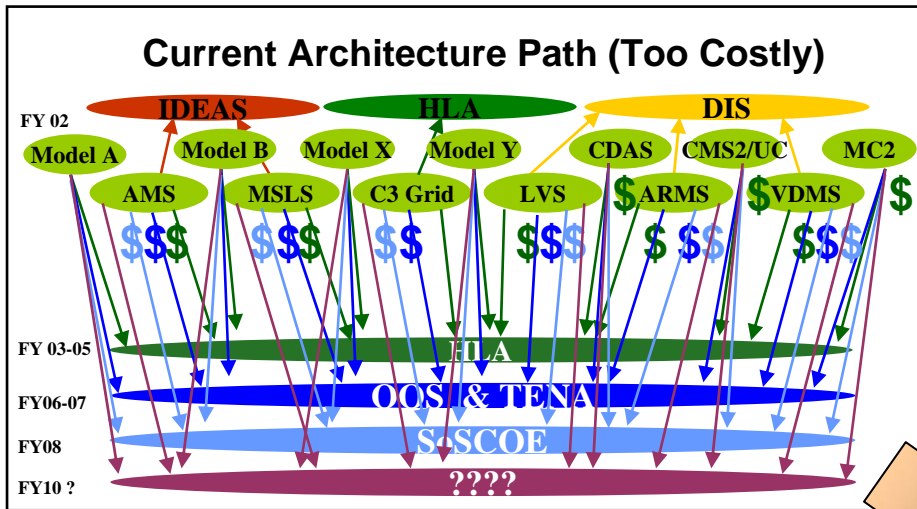
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MMIC Problem Space

Problem:

- The Army spends millions of dollars per year migrating Models and Simulations between various middleware architectures and building gateways
- The average rate of change migrating from one middleware layer to the next is increasing



Technical Milestones

Block 1

- MATREX Tools v1.3
 - FCS FOM Changes for IV-1
- MATREX Tools v1.4
 - Merged BLCSE FOM
 - Sync Point Support
 - RTI 1516 Plug-in
- MATREX Tools v1.5
 - Dynamic DDM Support
 - Time Management Support
 - TENA MW Plug-in

Block 2

- Construct TENA & MATREX Object Model
- Build TENA execution using TENA tools
- Prototype the OOS Plug-in
- Build initial Protocore Object Model

Block 3

- Build initial Protocore Object Model Translator
- Complete OOS Plug-in
- Implement Save and Restore

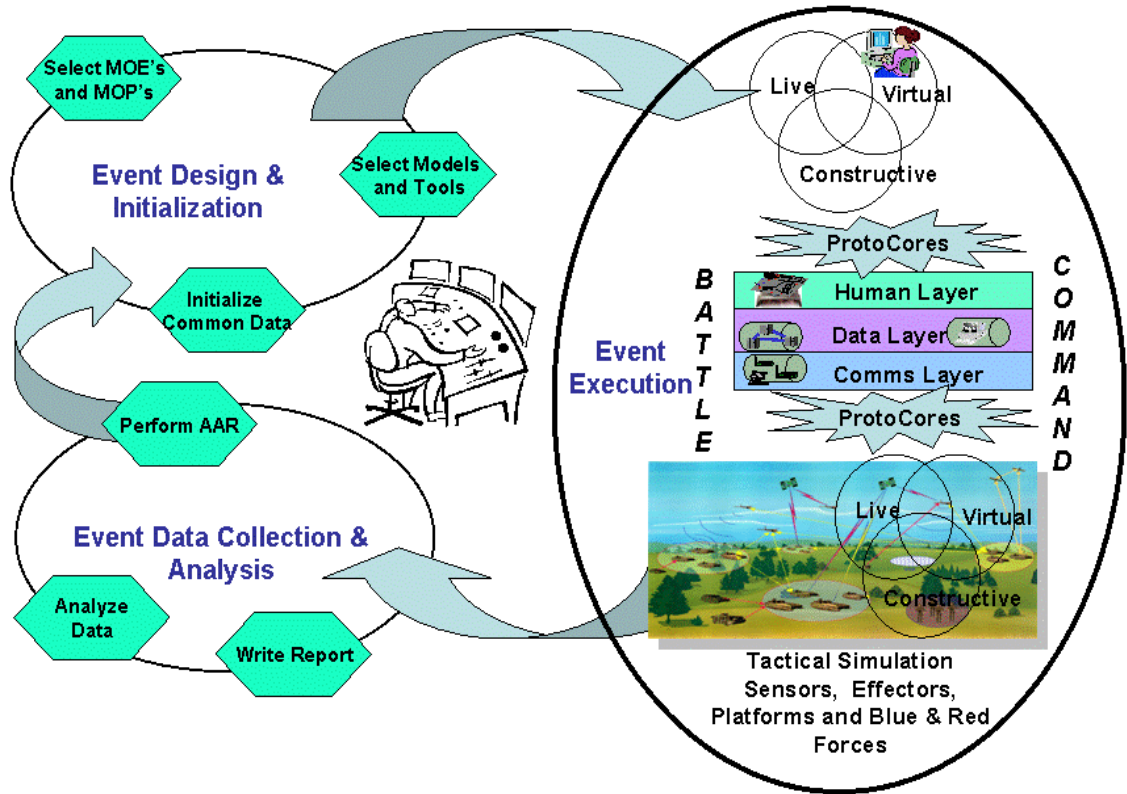
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Event

- Design & Initialization
- Execution
- Data Collection & Analysis

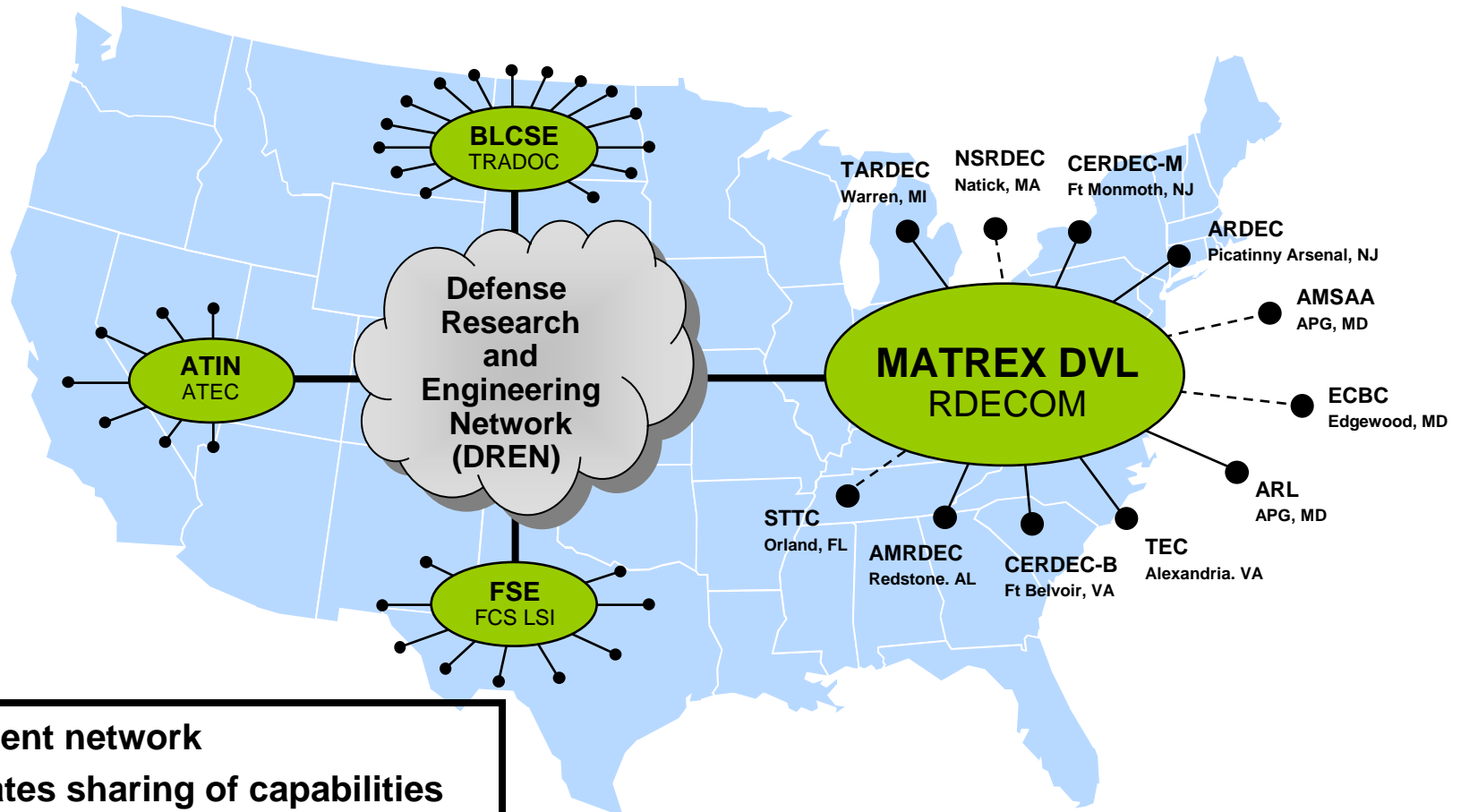
Advantages

- Process-oriented
- Composable federation
- Multi-resolution
- BCT and smaller





MATREX Distributed Virtual Laboratory Connected to 3CE



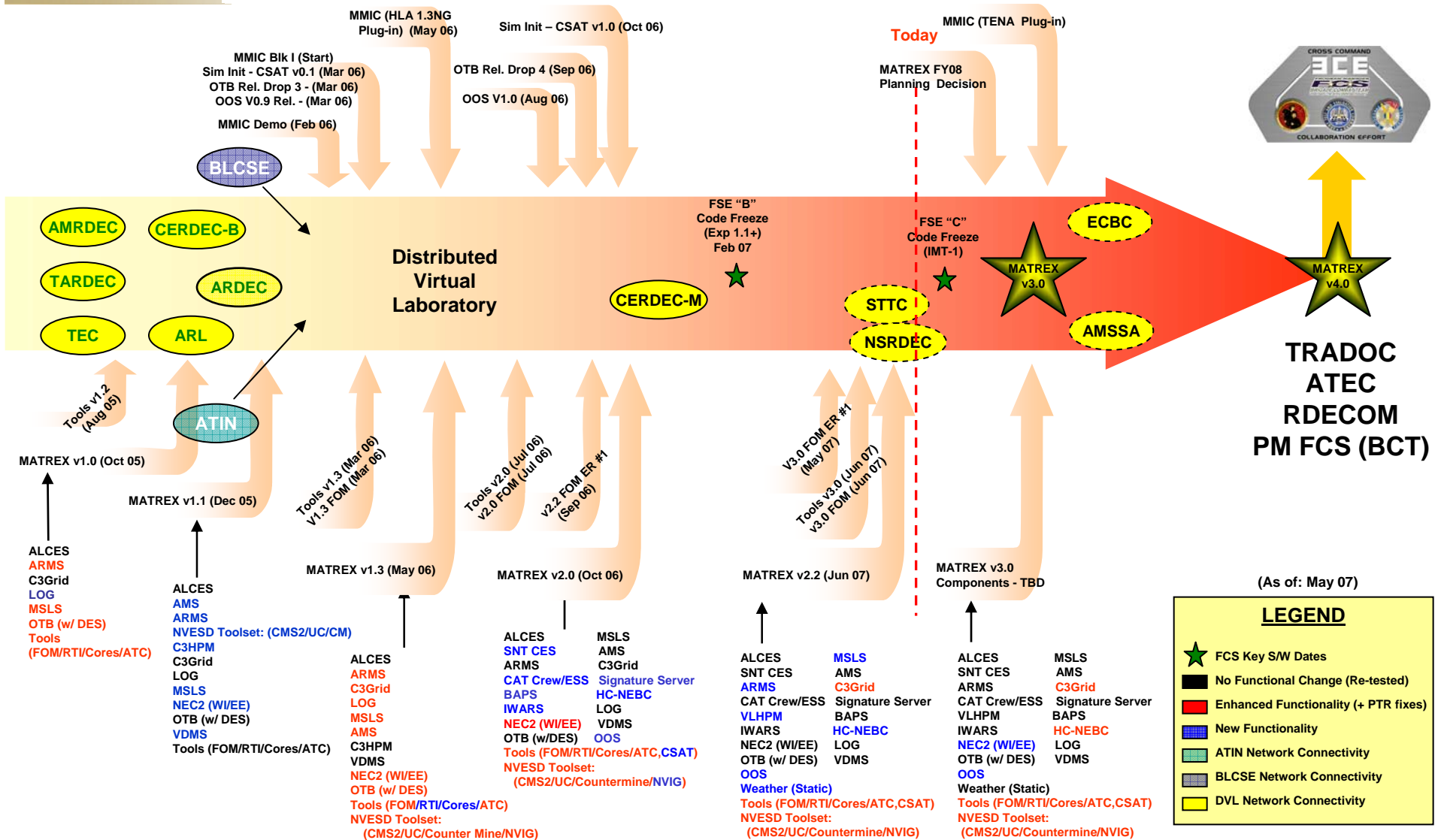
To Be Connected - - - - -

- Persistent network
- Facilitates sharing of capabilities
- Collaborative use of RDECOM and Army resources
- Work requirements as integrated systems of systems

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MATREX DVL and Reference Implementation Release Schedule





Conclusion



- MATREX is helping to advance simulation technology, infrastructure, and processes to enable better informed decision making.
- MATREX (RDECOM) is working with TRADOC, ATEC, and the PM-FCS(BCT)/FCS LSI to build an Army solution for M&S experimentation applicable across the acquisition life cycle.
- MATREX is providing many of the tools and methodologies to help reduce technical, cost and schedule risk for PMs.

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Acronyms



- 3CE – Cross-Command Collaborative Effort
- ACS – Aerial Common Sensor
- AKO – Army Knowledge On-Line
- ALCES – Aggregate Level Communications Effects Service
- AMS – Aviation Mobility Service
- AMSWG – (OSD) Acquisition Modeling & Simulation Working Group
- ARMS – Armaments Service
- ATC – Automated Test Capability
- ATEC – Army Test and Evaluation Command
- ATIN – ATEC Test Integration Network
- AUTL – Army Universal Task List
- BCT – Brigade Combat Team
- BLCSE – Battle Lab Collaborative Simulation Environment
- C3HPM – Command, Control, & Communications Human Performance Model
- C3GRID – Command & Control, Computer GRID
- CES – Communications Effects Server
- CMS – Countermine Server
- CMS2 – Comprehensive Munitions & Sensor Server
- CSAT – C4ISR Static Analysis Tool
- C4ISR – Command & Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
- DCARS – Data Collection, Analysis & Reporting System
- DCA – Data Collection & Analysis
- DCAT – Data Collection & Analysis Tool
- DES – Damage Effects Server
- DOTMLPF – Doctrine, Organization, Training, Materiel, Leadership, Personnel & Facilities
- DOS – Dynamic Organization Service
- DTC – Developmental Test Command
- DTE – Distributed Test Event
- DT&E – Developmental Test and Evaluation
- DVL – Distributed Virtual Laboratory
- EE – Effects Engine
- FCS – Future Combat Systems
- FOC – Full Operational Capability
- FOM – Federation Object Model
- FRP – Full Rate Production
- FSE – FCS Simulation Environment
- HLA - RTI – High Level Architecture – Run Time Interface
- HC-NEBC – Human Centric – Network Enabled Battle Command
- HPM – Human Performance Model
- IDE – Integrated Development Environment
- IOC – Initial Operational Capability
- IOT&E – Initial Operational Test and Evaluation
- IER – Information Exchange Requirement
- IP03 – Integrated Process 03, Networked Fires
- IPT – Integrated Process Team
- IWARS/DI – Infantry Warrior Simulation/Dismounted Infantry
- JCAS – Joint Close Air Support
- JCIDS – Joint Combat Integrated Defense System
- JROC – Joint Requirements Oversight Council
- JSBE – Joint Service Battlespace Environment
- KPP – Key Performance Parameters
- LSI – Lead Systems Integrator (FCS)
- LVC – Live Virtual Constructive
- LVCI – Live Virtual Constructive Interoperability
- LVS – Lethality/Vulnerability Service
- MATREX – Modeling Architecture for Technology, Research, & EXperimentation
- MC2 – Mobile Command & Control
- MDA – Model Driven Architecture
- MMIC – MATREX Middleware Independence Capability
- MOE – Measures of Effectiveness
- MOP – Measures of Performance
- M&S – Modeling and Simulation
- MSDE – Military Scenario Development Environment
- MSDL – Military Scenario Definition Language
- MSLS – Missile Service
- MSO – PM FCS (BCT) Modeling & Simulation Office
- MTS – Message Transceiver Service NCW – Network Centric Warfare
- NEC2 – Networked Effects Command & Control
- NVIG – Night Vision Image Generator
- OCS – Organic Communications Service
- OneSAF – One Semi-Automated Forces
- OOS – OneSAF Objective System
- OTB – OneSAF Testbed Baseline
- OTC – Operational Test Command
- PEO – Program Executive Office
- PM – Product, or Program or Project Manager
- R2S – Relative Roles Server
- RDECOM – Research, Development, & Engineering Command
- RDEC – Research, Development & Engineering Center
- S3E – Systems Engineering, Experimentation, and Enterprise
- SANDS – Situational Awareness Normalization & Dissemination Service
- SE – Systems Engineering
- Sim Init – Simulation Initialization
- SNE – Synthetic Natural Environment
- SoS – System of System
- SoSE – System of System Engineering
- SOSCOE – System of Systems Common Operating Environment
- STEM – Science and Technology Enterprise Management
- S&T – Science and Technology
- TENA – Test & Training Enabling Architecture
- TIE – Technical Integration Event
- TRADOC – Training & Doctrine Command
- UAV – Unmanned Aerial Vehicle
- UC – Universal Controller
- UJTL – Universal Joint Task List
- USAF – United States Air Force
- USMC – United States Marine Corps
- VDMS – Vehicle Dynamics & Mobility Service
- V&V – Verification and Validation
- VV&A – Verification, Validation & Accreditation
- WECM – Warfighter Electronic Collection and Mapping
- WI – Warfighter Interface

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