Future Construct/Architecture for Modeling and Simulation Support to Joint and Collective Training Across the Continuum of Military Operations

21 October 2016

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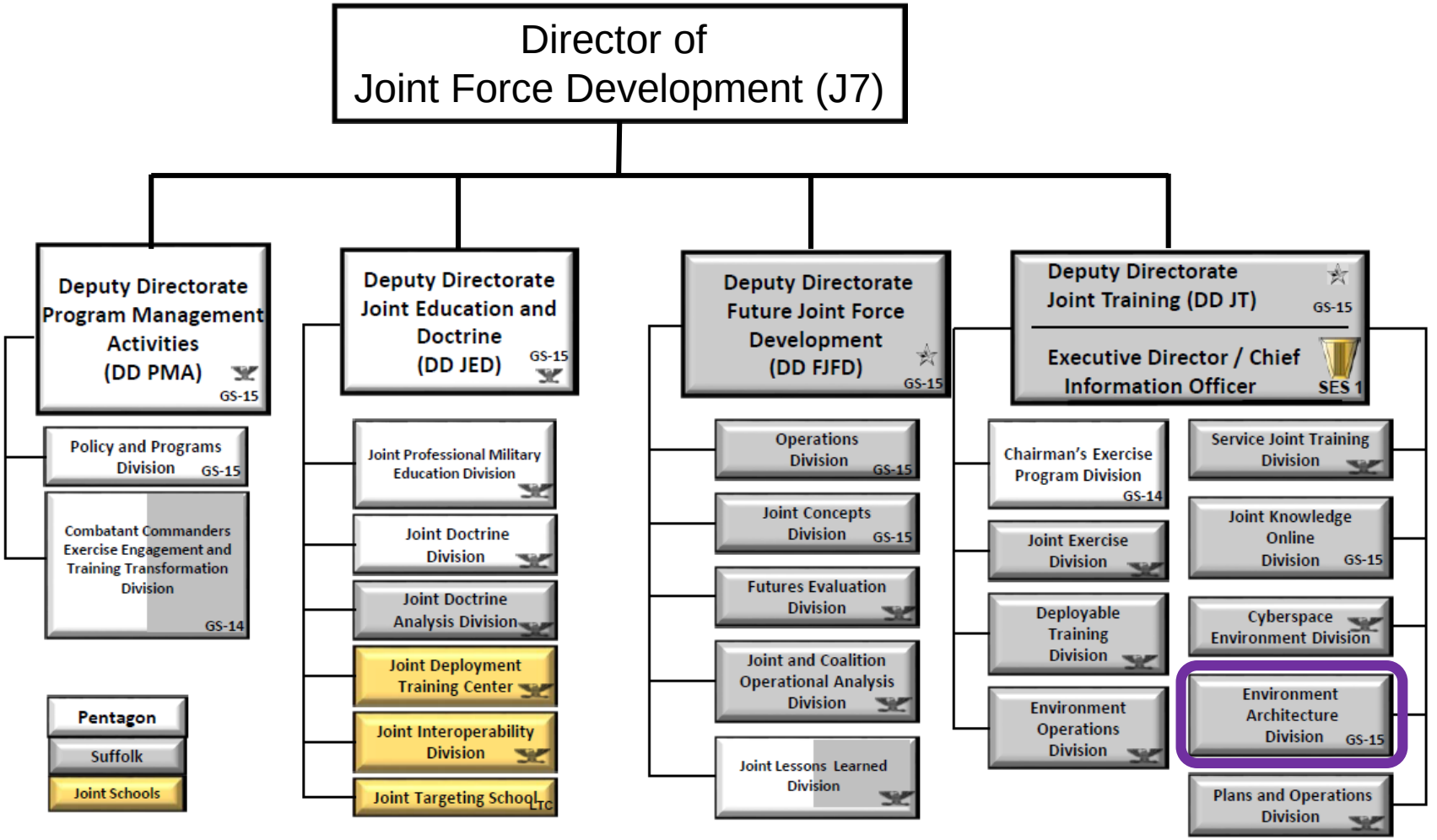

Joint Staff J7 Environment Architecture Division

Function: Designs the architecture, defines the technical standards, approaches and specifications, integrates the current simulation capability and builds the next generation joint training enablers, to improve the operational effectiveness of the current and future joint force.

Key Tasks:

- Provide the Force Development/Training Environment Framework by which the Force receives stimulus in the Live, Virtual and Constructive training Domains that contribute to force readiness
- Design, build, integrate, facilitate testing, and release material solutions that enable Joint, individual, staff and collective Training.
- Protect information across the Force Development Information Technology Environment through network certification, accreditation and Computer Network Defense.
- Provide oversight, life cycle and fiscal management of Information Technology assets and services

FY-16 Initiatives

- Deliver JLVC 1.0 and Joint Training Tools and services to the release baseline
- Integrate, Deliver and support use of JLVC v0.8 Production Baseline
- Sustain and obtain protected Mission Network and services
- Support improved accountability and management of Information Technology assets

Challenges for Joint Training

- **Federated Architectures are outdated—vulnerable and inefficient.**
  - **Predominantly monolithic** (all or nothing)—Lack the adaptability to reflect changing operational environment and emergent threats
  - **Built to differing standards**—significant time and specialized skills to integrate
  - **Expensive to operate and sustain**
  - **Technically complicated**—limiting the ability to make effective change to the synthetic representation of the operational environment
  - **Support discrete events** versus continuous on-demand (24/7) accessibility
  - **Growing mandates for cybersecurity** and infrastructure consolidation
- **IT advances show more efficient, agile, and secure systems are possible**
- **Growing demand for M&S supported training—slowed due to the complexity, time and cost required to plan, and execute exercises**
- **Reliance/dependence on "proprietary solutions" may limit innovation and increases licensing costs**
- **Expanding demand for integration of partner nation M&S capabilities**

M&S capabilities lack the architectural framework and technological approaches that provide sustainable/agile tools

Joint Training Synthetic Environment (JTSE) Current Vision

A JTSE toolset that enables accurate, timely, relevant and affordable education, training, exercises, and mission rehearsal in support of current and future Combatant Command and Service readiness priorities.

- **Support interoperability/integration** among DoD/mission partner simulations
- **Maximize ease of use**—easy enough for direct use by military audience
- **Scale** to support multiple simultaneous users/events
- **Provide "on-demand" M&S services** delivered via web-browser
- **Reduce costs** associated with development and support of new/improved functionality
- **Simplify provisioning and use** of training capabilities to both trainers and training event participants
- **Replicate the desired operational environment**
- **Mitigate fair fight conflicts** (e.g., using the techniques described in NATO/STO technical report TR-IST-094, Framework for Semantic Interoperability).

Operational Outcome

Commanders and trainers will develop, maintain, and assess readiness by using the JTSE to:

- Support the full spectrum operations of Joint, interagency, and multinational Enable the rapid and efficient execution of Joint Event Life Cycle (JELC)
- Enable the training audience to exploit their organic capabilities and collaborate within and across LVC training domains
- Conduct events in the same battle space regardless of physical location
- Preserve the “art” component of people training people
- Promote functional Interoperability with mission partners
- Expand the scope of the traditional command post exercise (CPX) beyond Phase II (Seize the Initiative) and Phase III (Dominate) of joint operations

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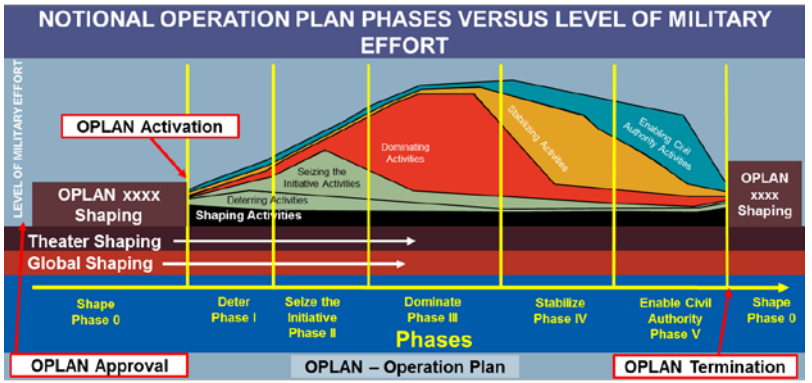
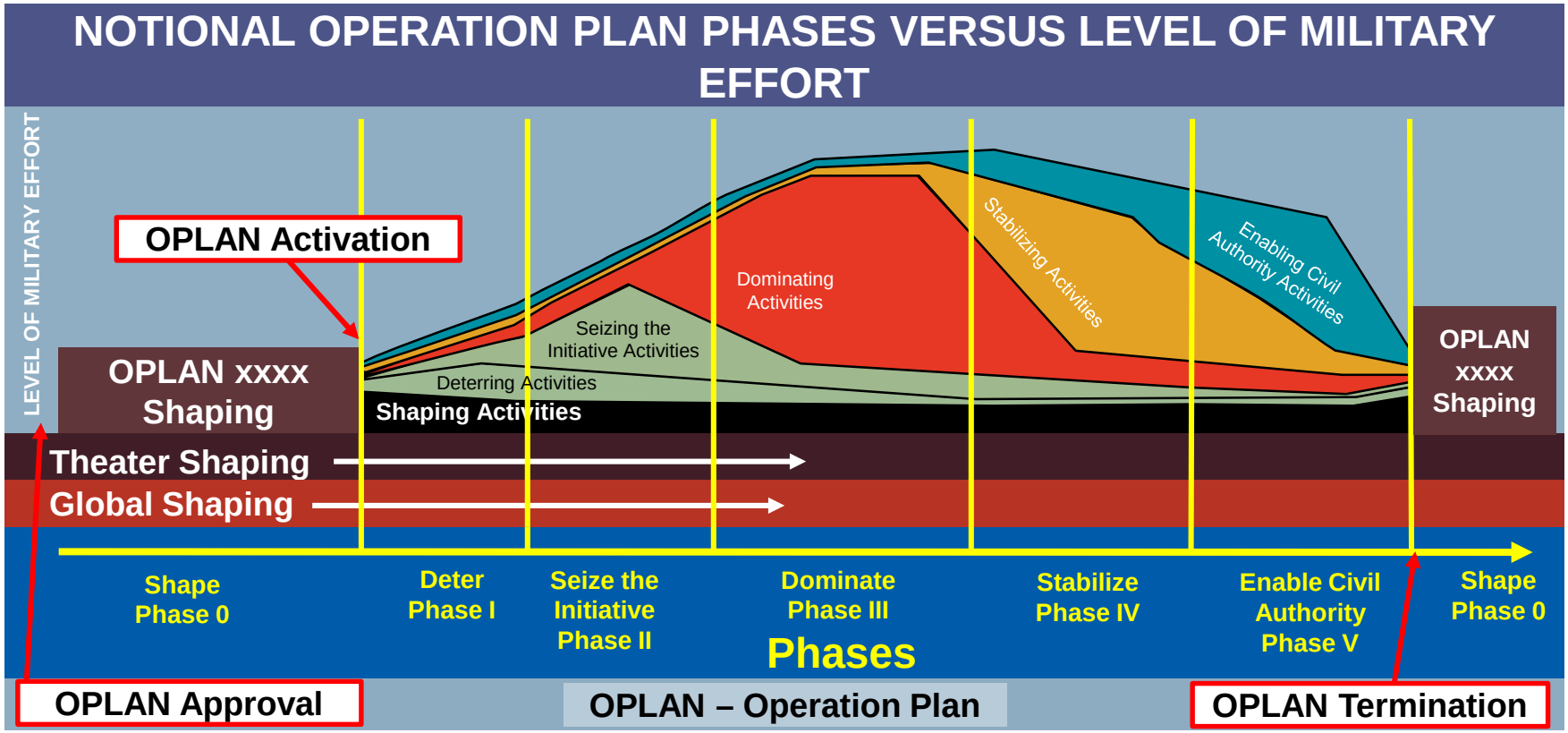


Joint Operations and CPX Focus



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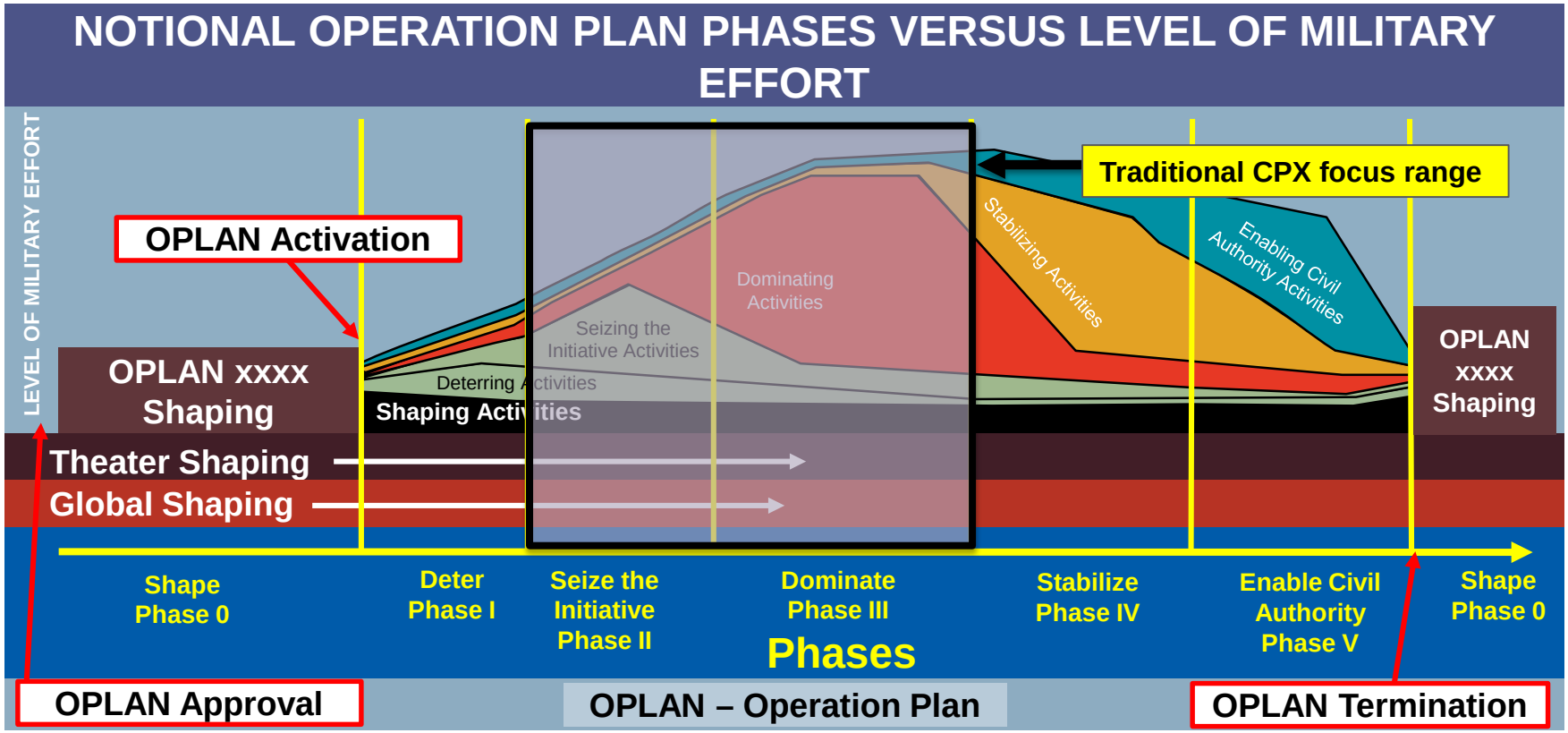

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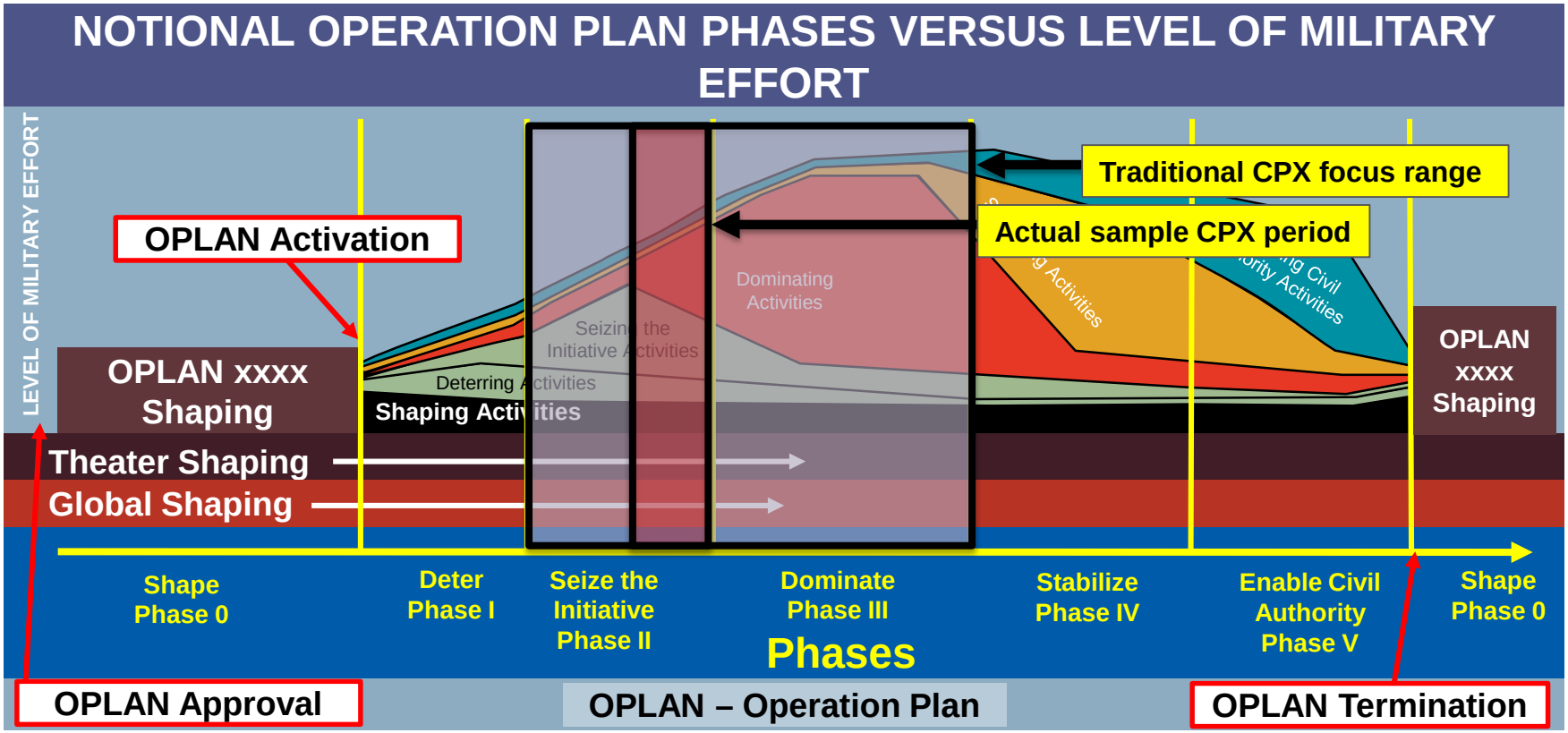

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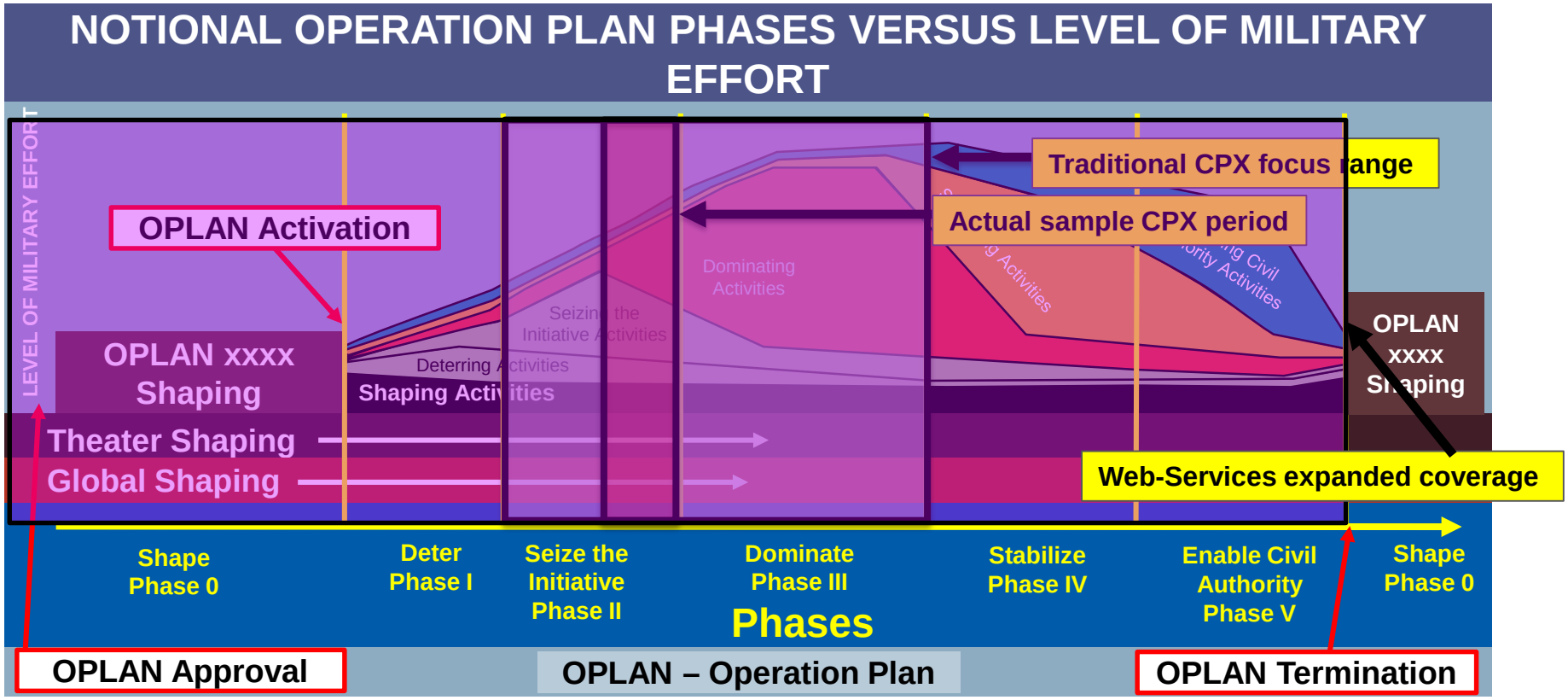
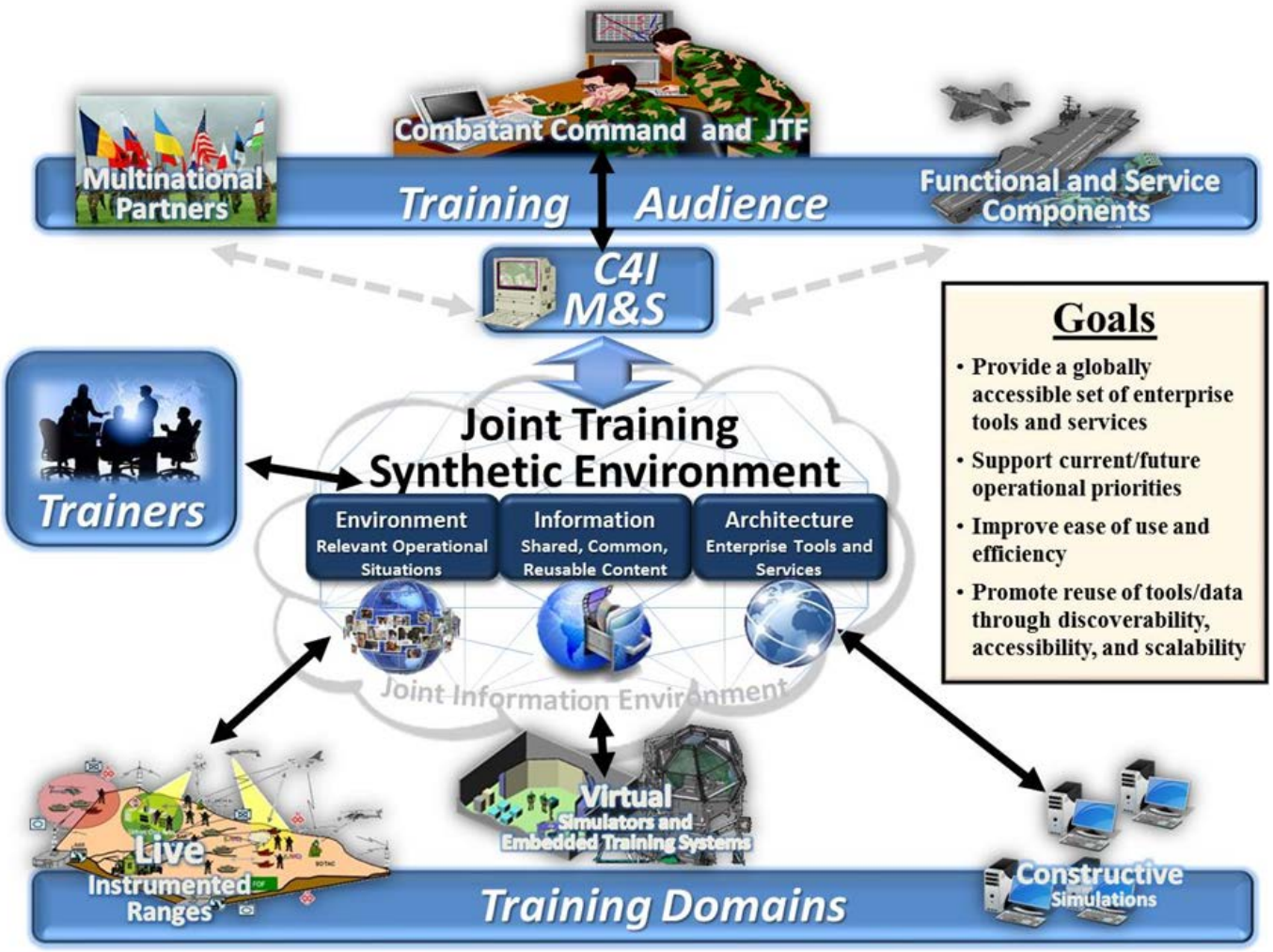


Joint Training Synthetic Environment Operational View



JTSE Capabilities

Requirements

Environment
Relevant Operational Situations

Information
Shared, Common, Reusable Content

Architecture
Enterprise tools and services

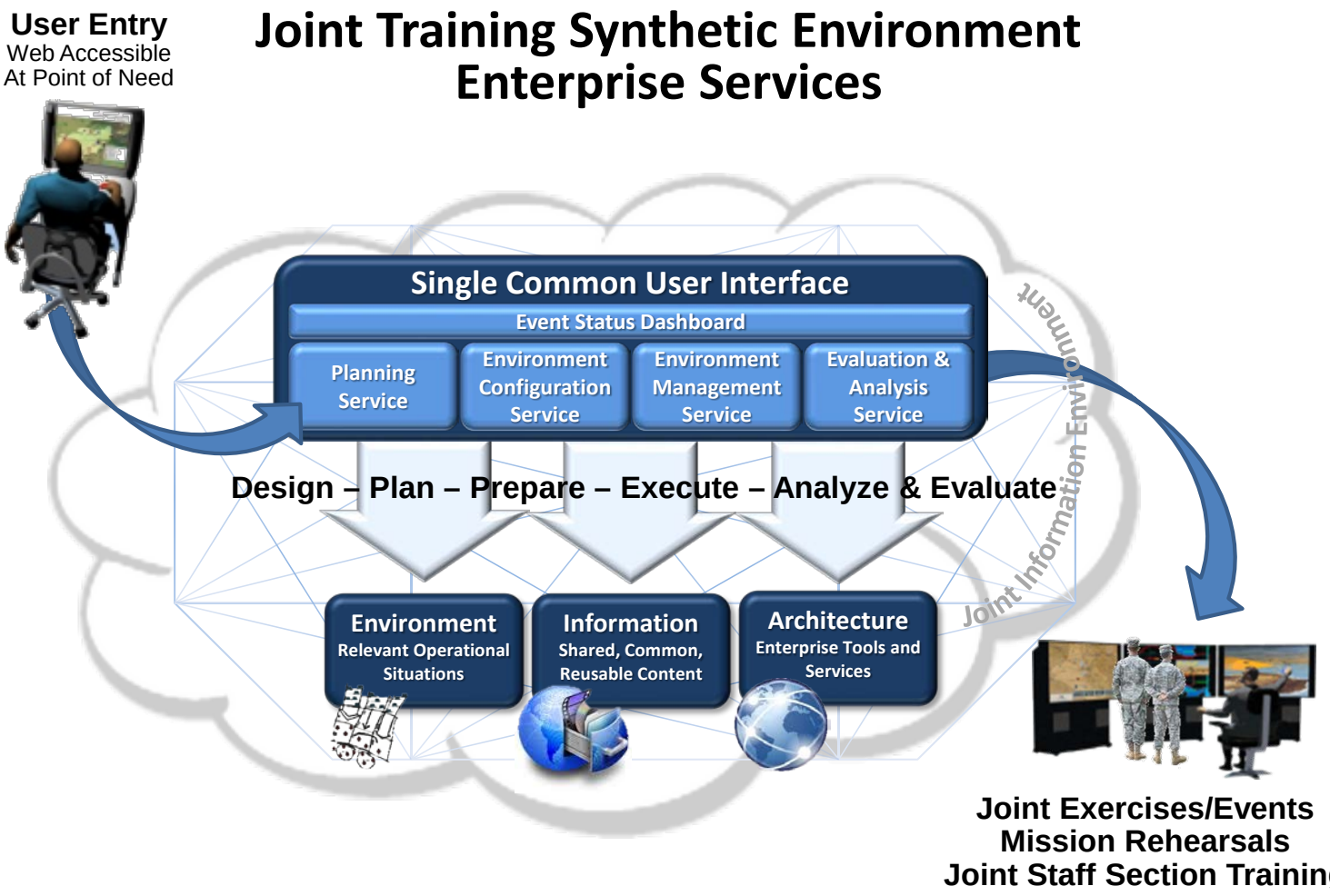
Gaps

Collaborative – Dispersed units coordinate, collaborate, and conduct training
Accessible – Trainer access tools through direct-use services
User Friendly – Intuitive interfaces for the trainer
Automated – Reduce manual processes for planning, execution, and data
Operational Relevance – Support current/emerging operational objectives
Agile – LVC environments that quickly adapt to operational need
Assessable – Provide tools that capture event data

Efficient – Minimize resources required to produce/manipulate scenario data
Trustworthy – Provide safeguards for secure, current, and relevant data
Discoverable – Provide search capability and access to info and services
Flexible – Dynamically manipulate data/data services for training objectives

Enterprise-based – Persistent training services via common-use networks
Integrated – Shared tools for DoD objectives through common standards
Sharable – Sustained access to share information with mission partners

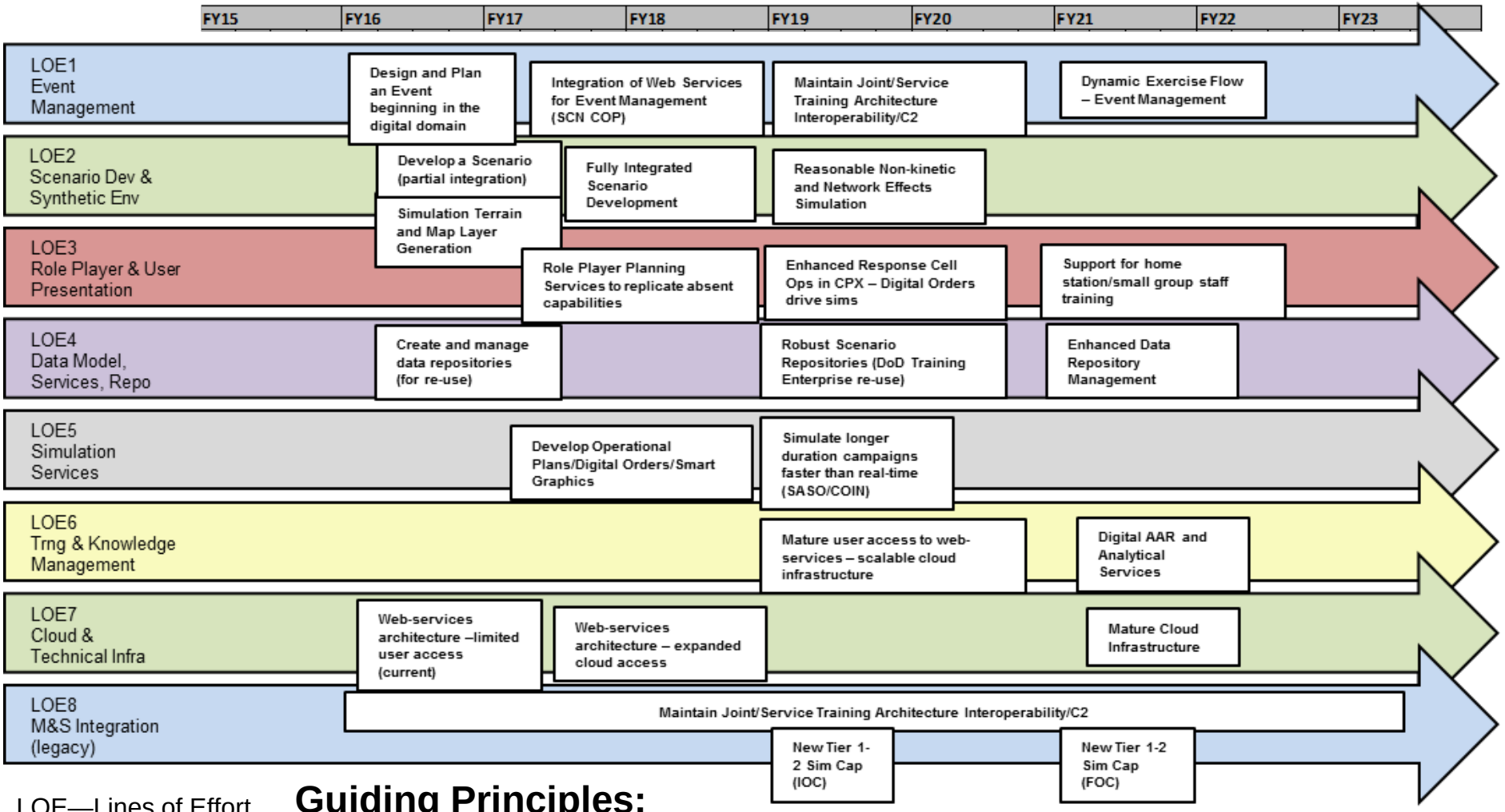
Joint Training Synthetic Environment Concept



Key Supporting Capabilities for Development

- **International Standards:** Promote interoperability, data exchange, open system architecture, software reusability, and information exchange
- **U.S. Joint Information Environment (JIE):**
  - Full use of DoD common-use networks built to JIE architectures/standards.
  - Leverage JIE's single security architecture, enterprise services, and data centers to gain efficiency, reduces redundancy, and improves cyber security
- **Joint Training Enterprise Architecture (JTEA):** Provides the reference architecture and management framework to define JTEA standards/technologies
- **Data Center Consolidation Initiative:** U.S. mandate to reduce number of data centers across the federal government by 40 percent.
- **Mission Partner Environment (MPE):** Mission network based on common standards, concepts, and tactics, techniques, and procedures among nations, commanders, and components for operations and warfighting—similar to FMN
- **Modeling & Simulation as a Service (MSaaS) Technical Activity (MSG-136):** essential enabler for delivering an enterprise-based JTSE

Capability Development Construct and Roadmap



LOE—Lines of Effort

Guiding Principles:

- "Do no harm" to existing functional capability.
- Address common-use services first (e.g. Terrain, OOB)
- Modular capabilities by a use case-based, incremental approach

Constraints for Progress

- **Establishing a *"Cooperative Development"* versus *"Cooperative Integration"* Culture**
  - Current culture is more conducive to building federations versus transitioning toward a web-services based architecture.
- **Keeping Pace with the Information Technology Mandates**
  - Engage and ensure that leadership for each mandate are cognizant of the mission and requirements of the training community
- **Identifying and Adopting Standards**
  - Connect to international organizations that formulate and govern international standards (e.g. SISO, IEEE, NMSG, OGC) for M&S, IT and data
  - Where appropriate, actively participate in their efforts to ensure the Joint training community has a voice in their development
- **Cyber Security**
  - Complying and satisfying security mandates is starting to consume a large portion of our research and development resources
  - The small and discrete nature of the JTSE modular architecture will be easier to secure and isolate vulnerabilities

Conclusion

"The Joint Force faces an increasingly complex global security environment. Both state and non-state actors seek to challenge the current international order…. They use new technologies and asymmetric approaches to avoid our strengths and exploit perceived vulnerabilities. Conflicts are taking on an increasingly transregional, multi-domain, and multi-functional nature that are a marked difference from the methods of traditional armed conflict of the past"

General Joseph F. Dunford, Jr.,
Chairman of the Joint Chiefs of Staff

- Today's operational environment demands a change the manner in which we conduct training
- We (the technical community) have the right ingredients to stimulate the change in "how" we provide the tools and capabilities that support force readiness
- Advancements in IT (i.e. Cloud technology, Data Exchange, Machine to Machine interactions, Processing Speeds, etc) make this the time to change the M&S provisioning paradigm.
- Paradigm shift is not to change the "what" we provide—Training will continue to be the effective stimulation of people in the art of warfighting
- Need to change "how" that stimulus is designed, planned, provisioned and ultimately delivered in order to develop Knowledge, Skills and Abilities needed to fight and win the wars of today and tomorrow

Questions?

Joint Training Synthetic Environment Current Vision

- "Do no harm to existing Training Environment functional capability". Will continue to link Joint Capabilities to Service (USN, USMC, USA, USAF) M&S tools and capabilities.

- Modular Services "on-demand" delivered via web-browser
  - Currently assessing "how much; and for who"
  - Future effort will be based on a set of Technical Approaches / Standards
  - Intent to share with Stakeholder / Enterprise including Multi-National partners

- Easy enough for direct use by military audience (users); maximize ease of use; leverage automation to preserve exercise design, planning, provisioning and execution capability/capacity

- Scalable using potential CLOUD technology to support multiple simultaneous users

- Support "condition" based vs. "time" based phase transition during an exercise; "Faster than Real Time"

Mandate for Change

- **Sustainability of Current M&S is at risk**
  - JLVC is a federation of Service/Joint developed models
  - Manpower (cost) intensive
  - Constant burden on integration (version control)
  - Existing Federation Architecture outdated – vulnerable/inefficient
- **Move M&S to DoD IT Enterprise**
  - Training enclave joining "mainstream" without being consumed
  - Joint M&S available wherever warfighters are
- **Improve Discoverability & Accessibility**
  - Driving jointness deeper = joint training context for Service use
  - Current Joint M&S is too monolithic (i.E., Not composable)
  - Trainers have to compete for simulation expertise support
- **Align with Technology Changes**
  - Cloud enables linkages now to facilitate trainer involvement
  - Hardware speed = more efficient modular software approaches
  - More can be automated to reduce manpower costs
  - Existing infrastructure – 30 year old technology
- **Improve Effectiveness and Efficiency**
  - Trainers are unique with specific training objectives – thus need unique training environments
  - Providing a bigger, more complex training environment than trainers require is wasteful
- **Align Fidelity to training needs**
  - Trainers have varying need for fidelity (C4ISR Dependent)
  - One-size-fits-all approach is too restrictive, exercises may have different fidelity for each domain

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Future Joint Training Environment Characteristics

- **Distributed to the Point of Need – More Inclusive**
  - Optimize movement of personnel and equipment
  - Accessible and scalable; partner inclusive

- **Replicates Uncertainty and Complexity of the Operating Environment**
  - Adaptive and agile - pace changes

- **Stimulate Operational Force (L-V-C)**
  - Exercise/Train the Joint Force (Tier 1 to 4)
- **Compelling and Engaging to the Digital Native**
  - Challenge the professional warfighter (Tier 1 to 4)
  - Capable of/comfortable with managing technology

- **Deliberately Foster Warfighting Innovation**
  - *Create domain to improvise in the application of warfighting concepts*
  - Means to an end, not an end in itself
- **Affordable**
  - Reduced Manpower to operate and maintain (sustain “Art” – automate “Science”)

Objective – Capability (Future)

- **Future Capability**
  - Supports training that is simulation driven and event supported across all phases of the joint campaign and the full range of integrated operations. Will support Force Development (concept development) activities that facilitate the generation and sustainment of warfighting competencies essential to missions identified by leadership.
  - Centered on modular capabilities that are cloud-enabled web-services. Reuse of data and services that result in training and exercise planning, design, preparation, execution, and review all within a common digital environment
- **Outcome**
  - User Friendly – simulation enabled training with less or eliminated M&S Expertise.
  - Operationally representative – looks, responds and feels like the real world
  - Relevant - sensible or logical connection to the current strategic and operational focus
  - Composable – quickly put together to support events/activities across the domain.
  - Scalable – only use what you need to provide effective training Stimulation
  - Responsive – adaptable to changes in both the physical and strategic arena within the decision cycle.
  - Distributed – web accessibility, distributed exchange of information/data
  - Efficient - achieve the desired result with the minimum use of resources, time, and effort
  - Data Driven – Common (authoritative) consistent data sources
  - Reduced Development Costs – Modular approach – increased Machine-to-Machine exchange

Lines of Effort (LOE)

Concept: **Organize the projects into logical groupings (lines of effort) in order to conceptualize what capability they provide and their relationship with the Joint Training Synthetic Environment.**

1. **Event Management** (capabilities to specifically enhance or automate the management and synchronization of an event)
2. **Scenario Development & Synthetic Environment** (capabilities to develop integrated scenario products)
3. **Role-Player & User Presentation** (tools to allow military audience to directly use simulation throughout the JELC for planning, training, learning on demand via the web)
4. **Data Model, Data Services, and Data Repository** (simulation and data manipulation to ingest/modify/correlate data for simulation use)
5. **Simulation Services** (modular services to replicate the Joint environment)
6. **Training & Knowledge Management** (KM services required for Joint training)
7. **Cloud & Technical Infrastructure** (efforts to prepare sims for use in virtual cloud environment)
8. **Joint, Service, Coalition, Agency M&S Integration** (Service simulations & architecture legacy systems)

Note: LOEs are not prioritized. Numerical designation is only for purpose of grouping.