

Synthetic Training Environment (STE) Technology/Industry Day



PEO STRI
1-2 September 2015



Administrative



Mr. Jerry Sirmans
Deputy Project Manager

Integrated Training Environment (PM ITE) PEO STRI

- Restrooms
- Refreshments
- Please silence your cellphones
- This event is being recorded, please do not record audio/video or take pictures.
- The presentation slides will be made available for download.
- PEO STRI employees may sit in room 320 to make room for Industry, Academia and visiting Government employees.
- Q&A cards will be available for questions that you may have. We will try to answer them at the end of the day.





Agenda



Day One:

- | | | |
|---------------|-------------------------------|-----------------|
| • 0800 – 0855 | Sign-in | |
| • 0855 – 0900 | Administrative | Jerry Sirmans |
| • 0900 – 0915 | Opening Remarks | MG Maddux |
| • 0915 – 0930 | Streamlined Acquisition | LTG Williamson |
| • 0930 – 0945 | Evolution of Training | BG (P) O'Neil |
| • 0945 – 1000 | Break | |
| • 1000 – 1020 | STE Vision/Objectives | COL Unrath |
| • 1020 – 1040 | STE Acquisition | COL Gaddy |
| • 1040 – 1100 | STTC Perspective – S&T | COL Buhl |
| • 1100 – 1130 | STE Collaborative Environment | Harry Sotomayor |
| • 1130 – 1300 | Lunch | |
| • 1300 – 1345 | STE Conceptual Architecture | Harry Sotomayor |
| • 1345 – 1430 | STE Technology Needs | Rob Parrish |
| • 1430 – 1445 | Break | |
| • 1445 – 1500 | Precedence at STRI | Rob Parrish |
| • 1500 – 1530 | Way Ahead | Devin Lyders |
| • 1530 – 1600 | Q&A | All |
| • 1600 – 1615 | Closing Remarks | COL Gaddy |

Day Two:

- | | | |
|---------------|---------------------|--|
| • 0900 – 1700 | One on One Sessions | |
|---------------|---------------------|--|





Classification/Statements



Classification of information and handouts is “UNCLASSIFIED”.

Distribution A – Approved for public release, distribution is unlimited

Technical Information has been certified by ITE Subject Matter Expert and the Public Affairs Officer who have approved release for this Technology/Industry Day only.





Opening Remarks



MG Jonathan Maddux
Program Executive Officer Simulation, Training and Instrumentation
Orlando, Florida

Disclaimer

Information presented is subject to change

Request questions be withheld until the end of the day or during the one/one sessions.





Evolution of Training



BG(P) Mark O'Neil

**Deputy Commanding General Combined Arms Command, Training
Fort Leavenworth, Kansas**





*“The Intellectual Center
of the Army”*

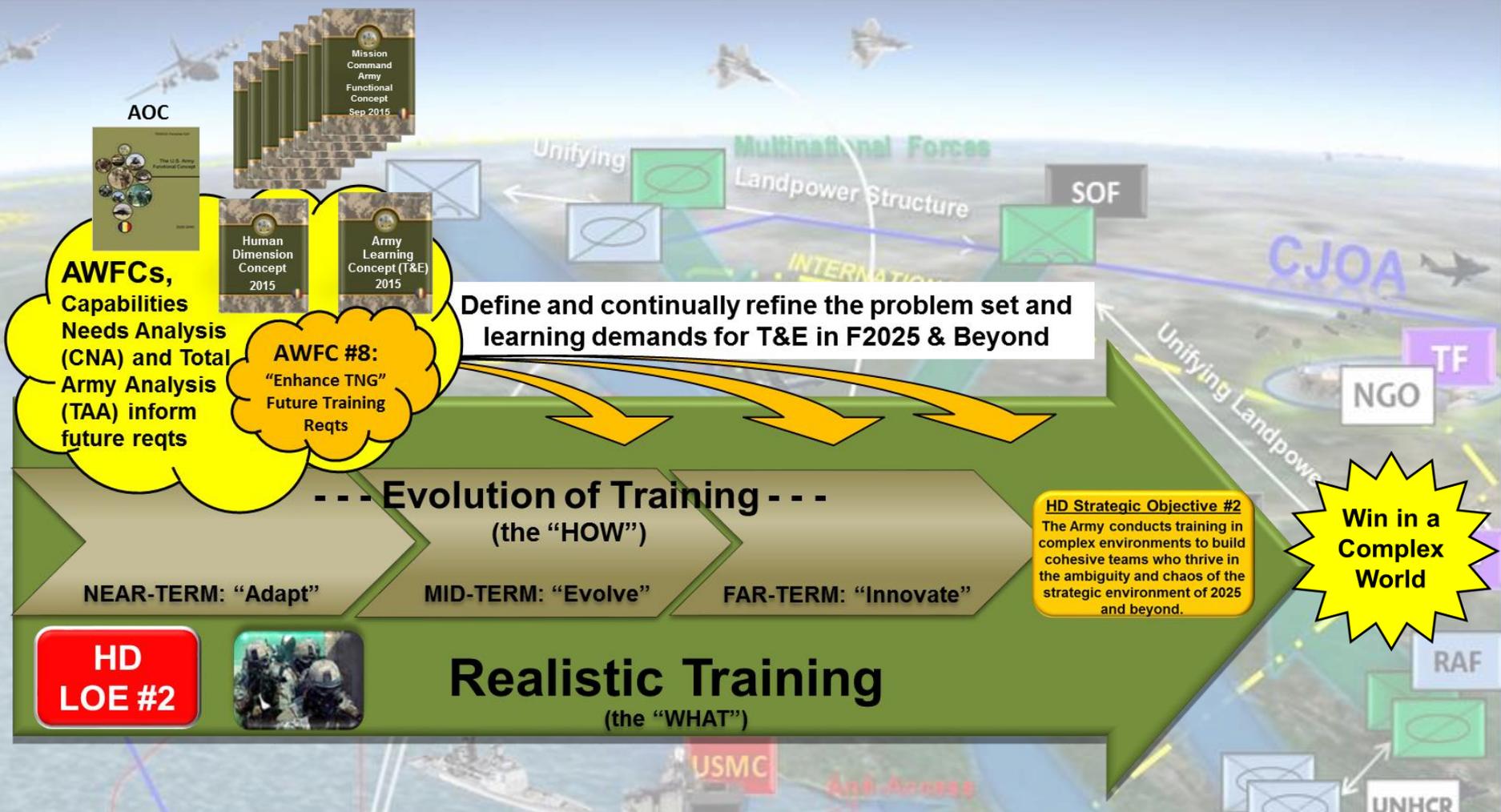


Realistic Training for FORCE 2025

BG (P) Mark O’Neil

Deputy Commander Combined Armed Center - Training

1 SEP 15

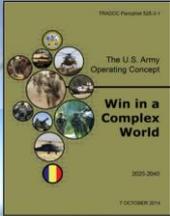


Conceptual Foundation and Capabilities Development for Realistic Training:

- Both supporting and supported by the other two Human Dimension LOE's (Cognitive Dominance and Institutional Agility);
- Focused on collective training (training "teams");
- The overarching goal (the "What") described and informed by the Army Warfighting Challenges (the "Why" from the conceptual basis and analytical underpinnings) and supported by the Evolution of Training (the "How," across the DOTMLPF);
- Envisioned as a DOTMLPF integrated and holistic training approach to support the Army Operating Concept



Win in A Complex World



Problem: Given a future where the Army must balance modernization, readiness and force structure, **how does the Army enhance realism in training** to build cohesive teams, trained & ready across the Range of Military Operations (ROMO), that can improve and thrive the ambiguity & chaos of the strategic environment of 2025 & beyond?

(i.e., achieve Human Dimension Strategic Objective #2)

LOE #1

& Governance

LOE #2

Integration

LOE #3

Policy,

Preparing Teams Across all Training Domains

Training Environment

“Where Soldiers Train”

Training Management & Assessment

“What enables Commanders & Leaders to apply the operations process to build and maintain training readiness.”

Training Infrastructure

“What enables the environment (facilities, ranges, network, services, etc.)”

Vision:

Enhance and evolve capabilities for demanding training in complex environments that approximate the physical stresses of combat and the multiple cognitive and ethical challenges, to build cohesive teams that can thrive when conducting Unified Land Operations in the strategic environment of 2025 and beyond.

Evolve across DOTMLPF-P





AMERICA'S ARMY

OUR PROFESSION – LIVING THE ARMY ETHIC

U.S. Army Combined Arms Center and Fort Leavenworth

"We cannot expect to capture the imagination of combat-seasoned forces that have been in some of the most complex environments imaginable for almost a decade by sitting them in a classroom and bludgeoning them with PowerPoint slides. We must make the 'scrimmage' as hard as the 'game' in both the institutional schoolhouse and at home station."

-- General Martin E. Dempsey



★ ★ ★
CAC

Visit us at usacac.army.mil



STE Requirements



COL Craig Unrath

**National Simulation Center Director and TRADOC Capability Manager
Integrated Training Environment
Fort Leavenworth, Kansas**



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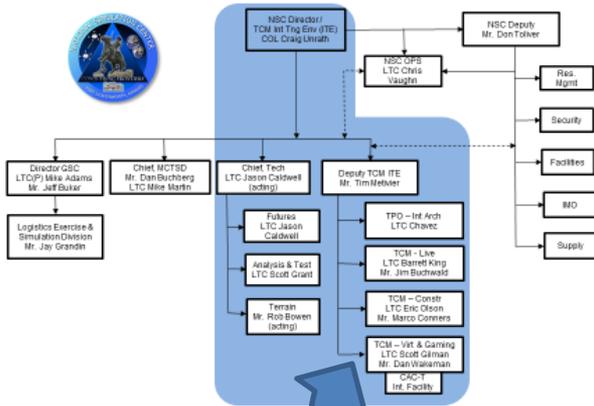




National Simulation Center / TCM Integrated Training Environment



National Simulation Center



- Army's centralized planner, manager, and integrator for all capability development user activities associated with implementing and sustaining components of the ITE
- Coordinate, direct, and synchronize the integration of TCMs Live, Virtual & Gaming, Constructive, and TPOs Terrain the Integrating Architecture in support of TSS-E

Authorities

- AR 5-11 Management of Army Models and Simulations (30 May 14)
- TRADOC Reg 350-38 Training Policies & Mgmt of TADSS (13 MAR 13)
- TRADOC Reg 71-12 US Army TRADOC Capability Mgmt (3 OCT 12)

TRADOC Capability Manager Charters

The graphic features a central circle with 'ITE' in the middle. Surrounding it are various logos and terms: 'TCM' (Tradoc Capability Manager), 'TPO' (Training Policy Office), 'LVC-IA' (Live, Virtual, Constructive - Integrating Architecture), 'VIRTUAL', 'CONSTRUCTIVE', and 'GAMING'. The logos include the Army crest and the text 'INTEGRATED TRAINING ENVIRONMENT'.

Evolving to Meet the Future



In the beginning ... the Integrated Training Environment (ITE)



Next generation training ... the Live/Synthetic Training Environment (STE)

- Single Synthetic Training Environment built on One World Terrain concepts
- Use of Common & Authoritative Data Sources
- Point of Need training - compliant with the Common Operating Environment, enhancing mission command training
- Secure and sustainable, cloud-based training capability that is less reliant on physical facilities and devices
- Rapidly accessible training capability that includes Joint, Interagency, Intergovernmental and Multinational Partners & Unified Action Partners



Emerging STE Capability Timeline



<u>FY23</u>	<u>FY26</u>	<u>FY29</u>	<u>FY32</u>
<ul style="list-style-type: none"> • Architecture/Cloud • Common Synthetic Environment • Common Operating Environment • Data Strategy; Simulation Initialization Data • After Action Review • Exercise/Scenario Development • Authoritative Sources & Configuration Management 	<ul style="list-style-type: none"> • Warfighting Functions Interfaces to STE (Mvmt & Maneuver, Fires, Intel, Sustainment, C2, Protection) • Semi-Automated Forces (i.e., Opposing Force, Grey and Green Force Structure Elements) 	<ul style="list-style-type: none"> • Information Operations, Electromagnetic Fight, Operational Variables, Cyber, Master Scenario Event List, Automation, Data Strategy • Mission Rehearsal • Running Estimates • Link to Joint & Combined (Joint, Interagency, Inter-governmental, Multinational [JIIM] / Unified Action Partners [UAP]) Simulations & Simulators 	<ul style="list-style-type: none"> • Appended Platform Training at Points of Need • Human Performance Enhanced Capabilities • Complex Training Environment in Brigade & Above • Training Performance Records • Measure Effectiveness of Learning (Human Dimension) • Institutional/Self-development Training Support Resident in Synthetic Training Environment • Automatic Behaviors (Brigade & Above)
<ul style="list-style-type: none"> • Replaces: <ul style="list-style-type: none"> – Games for Training/Flagship – Synthetic Environment Core (SECore) 	<ul style="list-style-type: none"> • Replaces: <ul style="list-style-type: none"> – AVCATT – Close Combat Tactical Trainer – Semi-Automated Forces 	<ul style="list-style-type: none"> • Replaces: <ul style="list-style-type: none"> – Live, Virtual, Constructive Integrating Architecture – JLCCTC – IEWTPT 	<ul style="list-style-type: none"> • Replaces: <ul style="list-style-type: none"> – To Be Determined
Company & Below Virtual Military Equipment (VME)		Brigade & Above Command Post/Tactical Operations Center	
Simulate All War Fighting Functions (WfF)			
Stimulate Mission Command (MC) Information Systems			
Terrain / Common Moving Models (CM2)			
Point of Need (PoN)			



STE Acquisition



COL Roland Gaddy
Project Manager Integrated Training Environment
Orlando, Florida

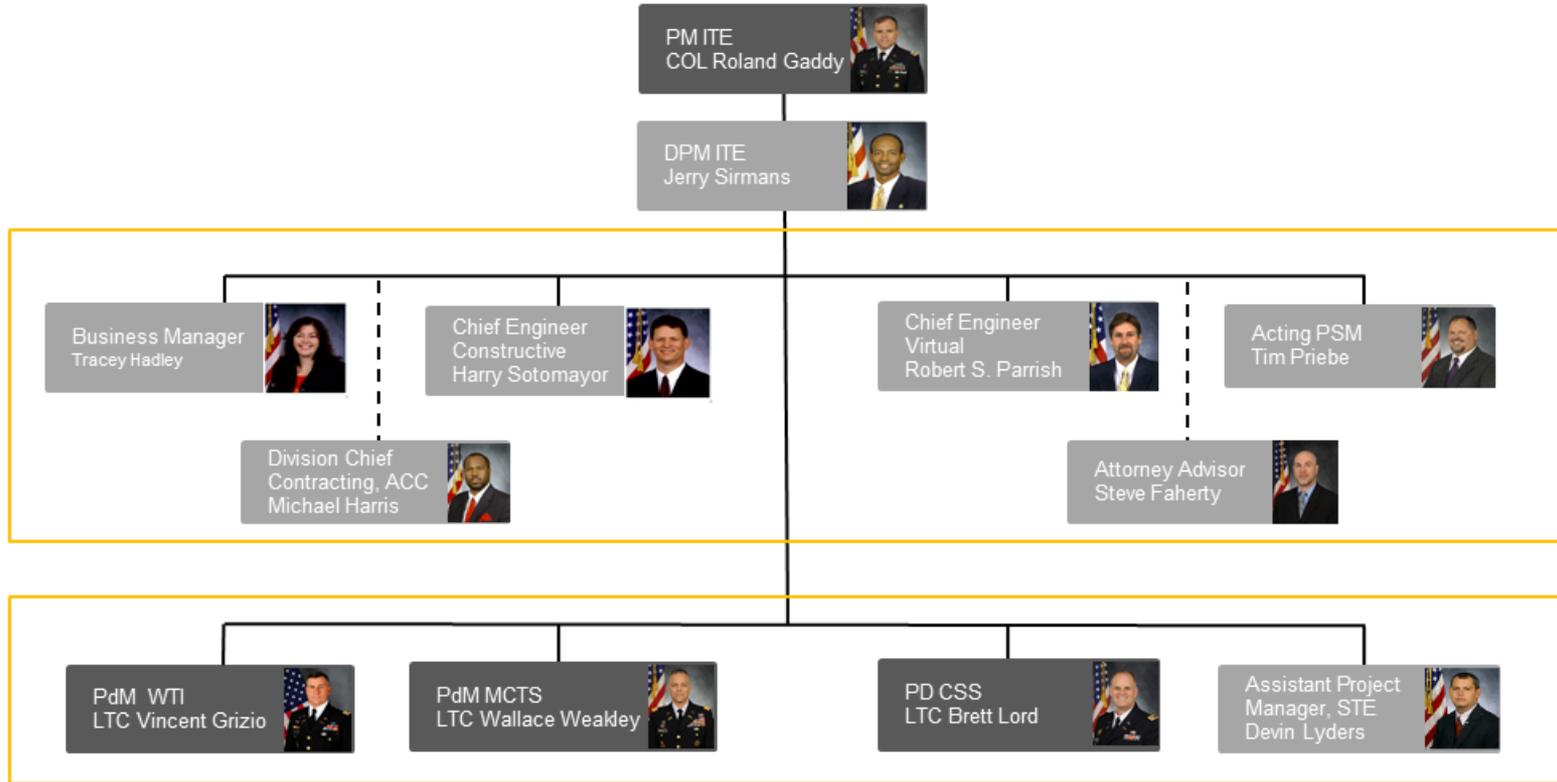




PM ITE Structure



PM ITE





PM ITE PORTFOLIO



Virtual (Squad – Battalion)

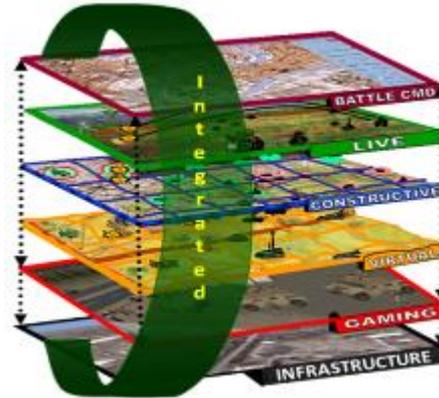


Constructive (Battalion – Theater)



UFG 15 / WFX

(Brigade & Below)



Gaming (Company and Below)



Synthetic Environment





PM ITE Strategic Focus



TODAY

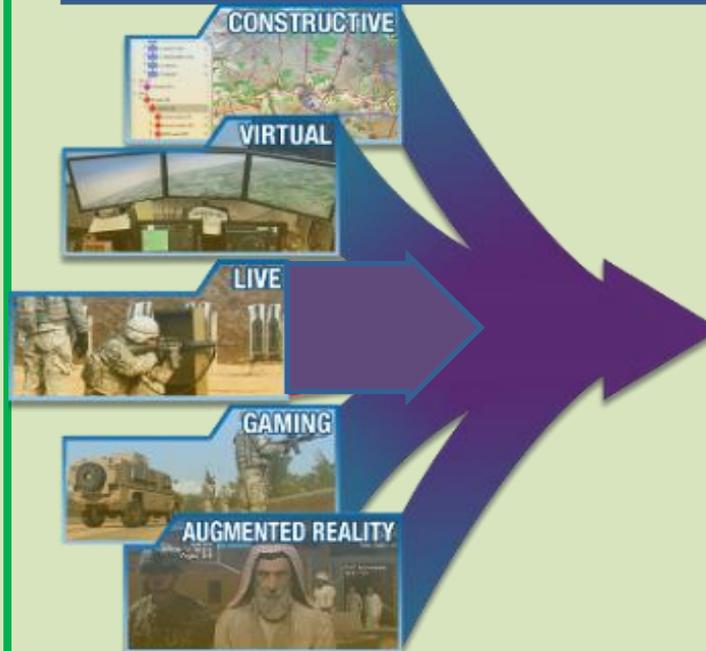
Provide capability to train a BCT for Decisive Action at home station, with combat multipliers, in a doctrinal area of operation



STRATEGIC PRIORITIES

Synchronize transition from legacy systems to future capability

Provide capability to replicate the complexity of the Operational Environment, UA partner Interoperability, Collective Training at the Point of Need





How We Succeed Together



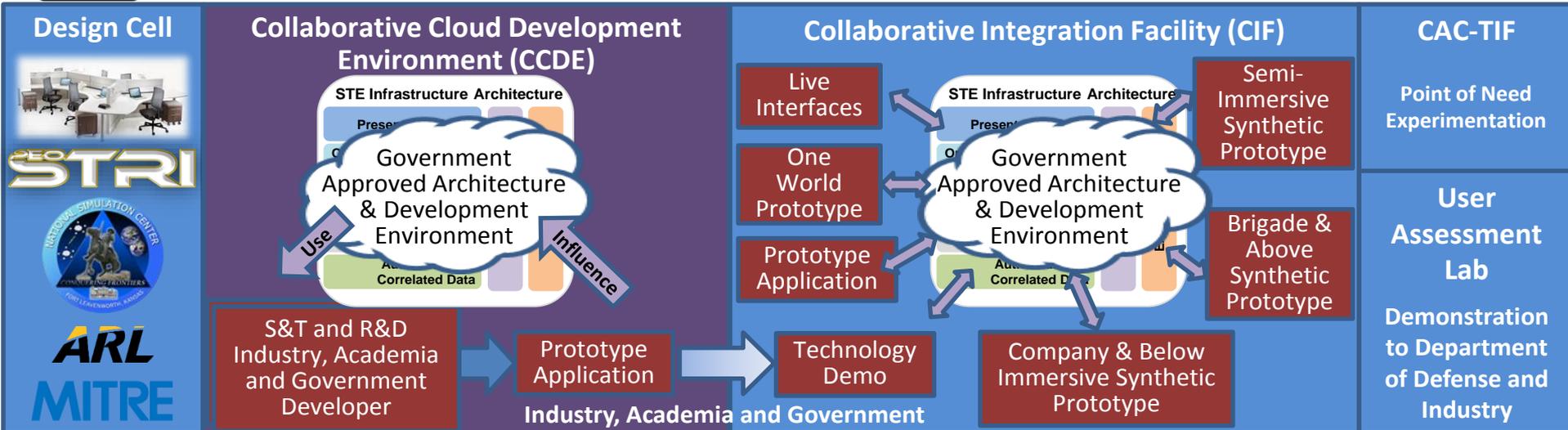
- Reduce Operational Complexity
- Improve Soldier and Unit Readiness
- Provide More Realistic Training Environments
- Reduce Development Costs
- Reduce Operations and Sustainment (O&S) Costs
- Increase Agility to provide customized training on demand
- Leverage Army Enterprise Networks
- Leverage prevailing industry standards
- Common Operating Environment (COE) Compliant

NEED INDUSTRY AND ACADEMIA TO HELP US SHAPE THE FOUNDATION OF THE FUTURE ARCHITECTURE FRAMEWORK

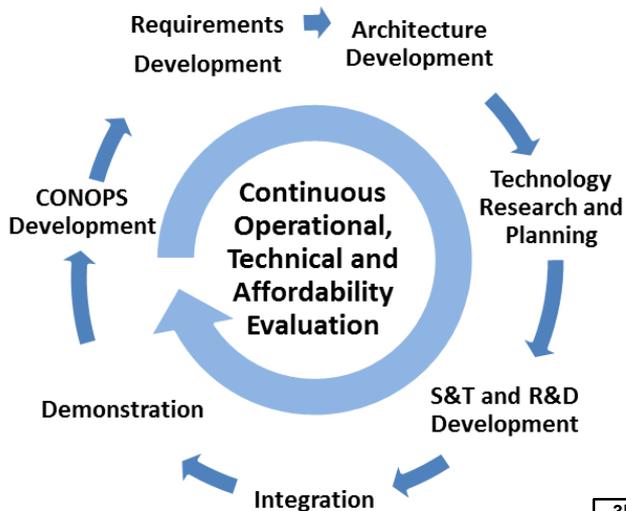




Collaborative Environment



Requirements/Technology Convergence Cycle



Illustrative Synthetic Training Environment Application View

User Interfaces	CP/TOC	MC Interface	Web Interface					
	Ground Vehicle	Driver View	Gunner View	Vehicle Control	Weapon Control			
	Air Vehicle	Cockpit View	Aircraft Control	Weapon Control				
	Squad/Individual	3D Viewer	Motion Control	Weapon Control				
	Live	Augmented Reality Goggles	Indirect Fire Weapon Effects	Direct Fire Weapon Effects				
	Tech Ops	Monitor	Control	Resource Management				
	System Interfaces	Plan/Prepare	Web GUI	WTSP	Terrain	Platform Data	Weapon Data	Data Export
		Services	Logistics	Maneuver	Line-of-Sight	Battle Damage Assessment	Environment	
		Network	LandWarNet	SIPR	NIPR	Joint Information Environment	Tactical	

3D: Three Dimensional
 CAC-TIF: Combined Arms Command Training Integration Facility
 GUI: Graphical User Interface
 MC: Mission Command

R&D: Research & Development
 S&T: Science & Technology
 SIPR: Secret Internet Protocol Router Network
 NIPR: Non-secure Internet Protocol Router Network
 WTSP: Warfighter Training Support Package





Emerging Timeline



Army Level MDD Schedule

FY	FY2015				FY2016				FY2017				FY2018				FY2019				FY2020				FY2021				FY2022				FY2023							
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
Acquisition (DoDI 5000)	18-22 POM Input				MDD				★ Materiel Solution				Technology Maturation and Risk Reduction Phase				Engineering and Manufacturing Development Phase																							
	POM Sync IPR				SSN				AoA				RFP				A				CA												LDD				IOC			
	New Emerging Requirement Funding																POM Programmed																							
JCIDS/ Requirements (CJCSI 3170)	Industry Day																																							
	LVC-IA ICD, NeMC ICD, CNA 17-21, Initial CONOPS				Abbreviated IS-CDD, Updated				IS-CDD & CONOPS Updates				Formal IS-CDD JCIDS Staffing				IS-CDD Validation																							
Collaborative Environment Phases	Crawl Phase: Prototype Architecture, Design, Storyboard, Collaboration Facility (Partners 1 building), Integration Facility (MITRE LAB), Technology Demonstration (Simulation and Training Technology Center [STTC]), Experimentation (Combined Arms Command Technology Integration Facility [CAC-TIF])												Walk Phase: Improved Architecture, Design, Storyboard, Collaboration Facility (New facility to accommodate functional categories), Integration Facility (i.e. Joint Development Integration Facility), Technology Demonstration (STTC) Experimentation (CAC-TIF)												Run Phase: Matured Architecture, Consolidated facility for Collaboration/Integration/User Evaluation															

AoA: Analysis of Alternatives
CA: Contract Award
CJCSI: Chairman Joint Chiefs of Staff
CNA: Capabilities Needs Analysis
CACTIF: Combined Arms Center Technology Integration Facility
CONOPS: Concept of Operations Center
DoDI: Department of Defense Instruction

ICD: Initial Capabilities Document
IPR: In Progress Review
IOC: Initial Operating Capability
IS-CDD: Information System Capabilities Development Document
LDD: Limited Deployment Decision

JCIDS: Joint Capabilities Integration & Development System
LVC-IA: Live, Virtual, Constructive Integrating Architecture
MS A: Milestone A
MS B: Milestone B
MDD: Materiel Development Decision
NeMC: Net Enabled Mission Command

POM: Program Objective Memorandum
RFP: Request for Proposal
SSN: Sources of Sought Notice
STTC: Simulation & Training Technology Center
TMRR: Technology Maturation and Risk Reduction





STTC Perspective – Science & Technology



COL Harold Buhl

Deputy Director, Human Research and Engineering Directorate

Orlando, Florida





Synthetic Training Environment (STE) Science and Technology (S&T)

COL Harold Buhl Jr.
Army Research Laboratory -Orlando



- **Army lead for simulation & training technology research and development to ensure readiness**
 - **Research furthers the state-of-the-art of simulation and training science to innovate with technology**
 - **Development matures technology for transition to programs of record and reduce risk for industry investment**
- **Nexus of collaboration with industry, academia, and other government partners to execute the mission**
- **Align activities with requirements and technology needs**

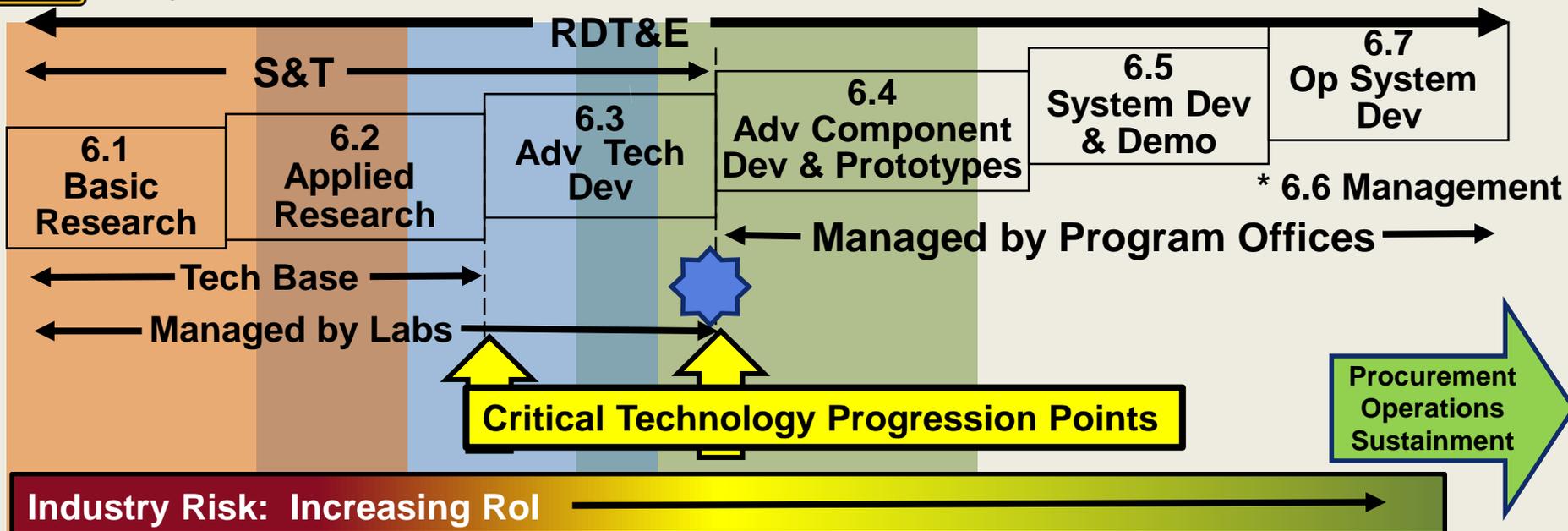
The Lead Organization for Simulation and Training S&T





U.S. ARMY
RDECOM

Accelerating Innovation



- Opportunities to Accelerate**
- Cooperative R&D
 - IRAD Investment
 - Commercial Sector Innovation
 - Collaborative Environment
 - More...

- Challenges to Accelerate**
- Time- Based Resource Process
 - Contracting Lead Time
 - Requirements and Testing
 - Exaggerated Marketing
 - More...

Increment 4 Increment 3 Increment 2 Generalized Timing of STE Tech



SFC Paul Ray Smith Simulation & Training Technology Center

Partial Chart Credit DAU



Single Synthetic Environment

Provide representations of warfare and environment interactions required to drive any training instantiation

Artificial Intelligence

Develop autonomous, free thinking virtual characters (Virtual Humans)

One-World Terrain

Develop a canonical terrain implementation across all training instantiations

Open Anti-Fragile Architecture Enabling VCG Cooperative & Correlated Functions

Recognizing non-speech cues and overcoming the uncanny valley

Increasing complexity and requirements in terrain representations (e.g. cultural considerations) with real-time requirements

Point of Need

Distribute training where needed, on demand for a variety of interfaces, such as Augmented Reality

Broad Based S&T Training Support

External S&T Dependencies

Augmented Reality & Augmented Virtuality for Collective Training

Training Effectiveness

Adaptive Instruction and Intelligent Tutoring

Network Bandwidth & Latency

Vehicle Embedded Training

Reduced Software and General Operations and Sustainment Life Cycle Costs





U.S. ARMY
RDECOM

Collaboration

ARL



- **Open Campus Initiative / Access to ARL Laboratories, and Orlando Leadership**
- **Support to Independent Research and Development activities / Cooperative Research and Development Agreement (CRADA)**
- **Contracting for Research and Development technologies, prototypes and services**

DISCOVER

INNOVATE

TRANSITION



SFC Paul Ray Smith Simulation & Training Technology Center



- **Army lead for simulation & training technology research and development to ensure readiness**
 - **Research furthers the state-of-the-art of simulation and training science to innovate with technology**
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The Lead Organization for Simulation and Training S&T





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Further Information

ARL

ARL

Contact:

Michelle Milliner, Public Affairs Specialist
ARL-Orlando - University of Central Florida
(Contractor), 407-384-5227
Michelle.Milliner@us.army.mil



SFC Paul Ray Smith Simulation & Training Technology Center



STE Collaborative Environment



Mr. Harry Sotomayor

Chief Engineer, Project Manager Integrated Training Environment

Orlando, Florida

Agenda:

- Better Buying Power 3.0
- Collaborative Environment
- Collaborative Environment Approach
- Industry Expectations
- Potential Contracting Options
- Incentives to Participate in Collaborative Environment





Better Buying Power 3.0

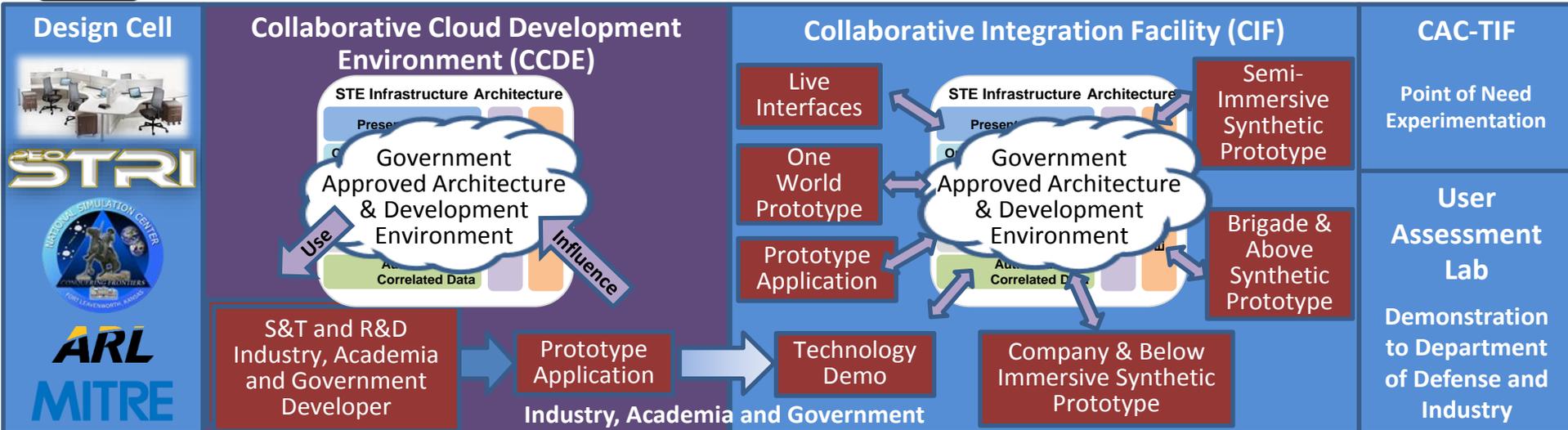


- Incentivize Productivity in Industry and Government
 - Improve the return on investment in DoD laboratories
 - Increase the productivity of corporate IRAD
- Incentivize Innovation in Industry and Government
 - **Increase the use of prototyping and experimentation**
 - Emphasize technology insertion and refresh in program planning
 - **Use Modular Open Systems Architecture to stimulate innovation**
 - Increase the return on and access to small business research and development
 - Provide draft technical requirements to industry early and involve industry in funded concept definition
 - Provide clear and objective “best value” definitions to industry

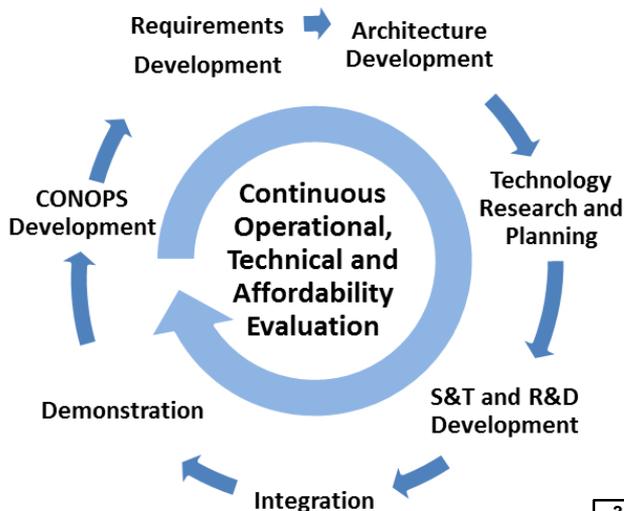




Collaborative Environment



Requirements/Technology Convergence Cycle



Illustrative Synthetic Training Environment Application View

	CP/TOC	MC Interface	Web Interface				
User Interfaces	Ground Vehicle	Driver View	Gunner View	Vehicle Control	Weapon Control		
	Air Vehicle	Cockpit View	Aircraft Control	Weapon Control			
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3D: Three Dimensional
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 SIPR: Secret Internet Protocol Router Network
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 WTSP: Warfighter Training Support Package





Collaborative Environment

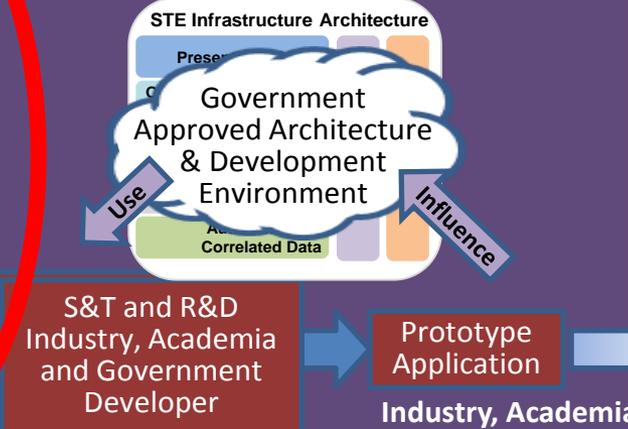


Design Cell

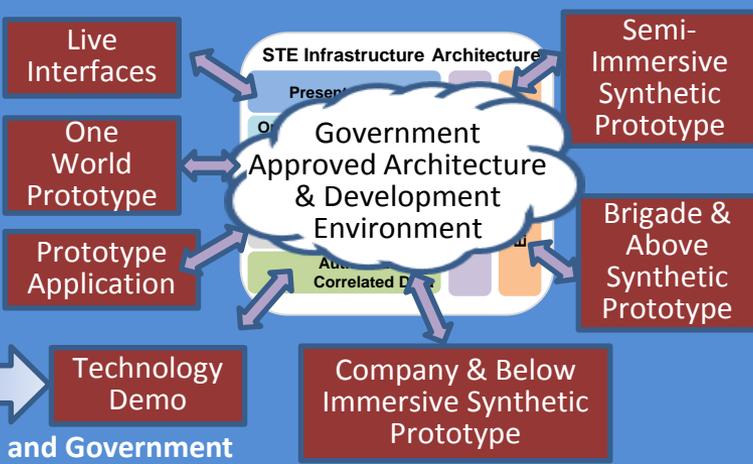
PEO STRI
NATIONAL SIMULATION CENTER
CONQUERING FRONTIERS
FOR LEADERSHIP. AHEAD.

ARL
MITRE

Collaborative Cloud Development Environment (CCDE)



Collaborative Integration Facility (CIF)



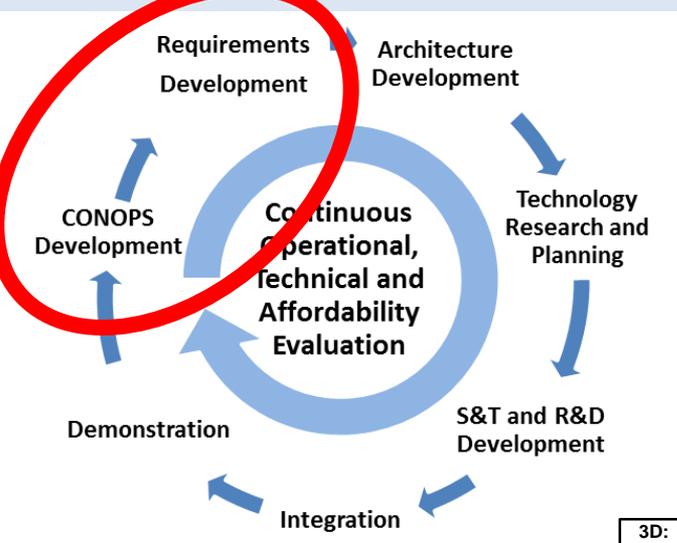
CAC-TIF

Point of Need Experimentation

User Assessment Lab

Demonstration to Department of Defense and Industry

Requirements/Technology Convergence Cycle



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Collaborative Environment



Design Cell

STRICENT

NATIONAL SIMULATION CENTER

CONQUERING FRONTIERS

FOR LEADERSHIP. AHEAD.

ARL

MITRE

Collaborative Cloud Development Environment (CCDE)

STE Infrastructure Architecture

Present

Government Approved Architecture & Development Environment

Use

Influence

Correlated Data

S&T and R&D Industry, Academia and Government Developer

Prototype Application

Industry, Academia and Government

Collaborative Integration Facility (CIF)

Live Interfaces

One World Prototype

Prototype Application

STE Infrastructure Architecture

Present

Government Approved Architecture & Development Environment

Correlated Data

Semi-Immersive Synthetic Prototype

Brigade & Above Synthetic Prototype

Company & Below Immersive Synthetic Prototype

Technology Demo

Industry, Academia and Government

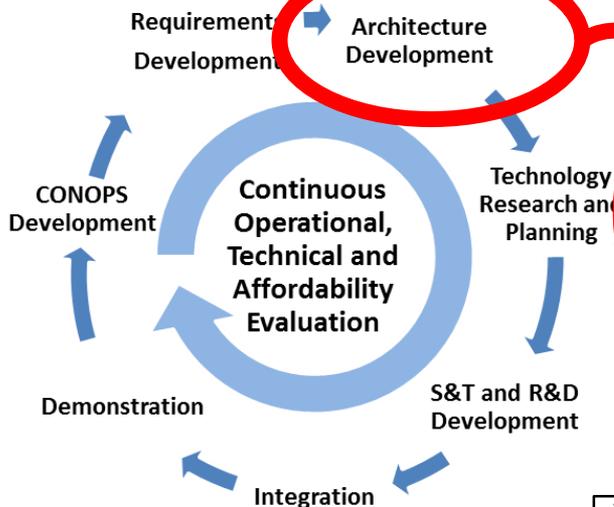
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Requirements/Technology Emergence Cycle



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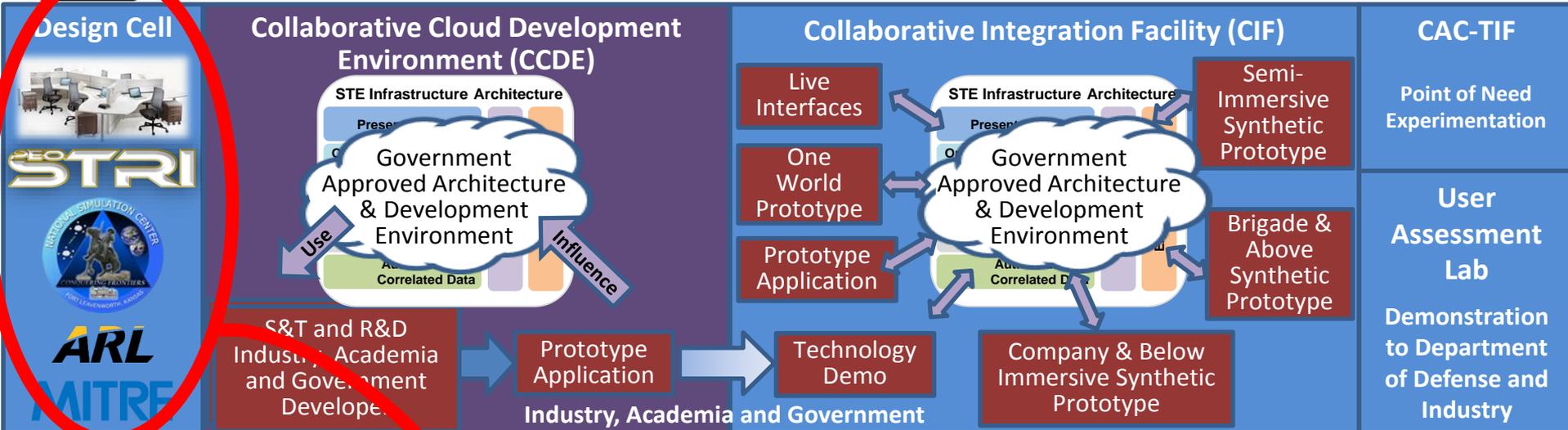
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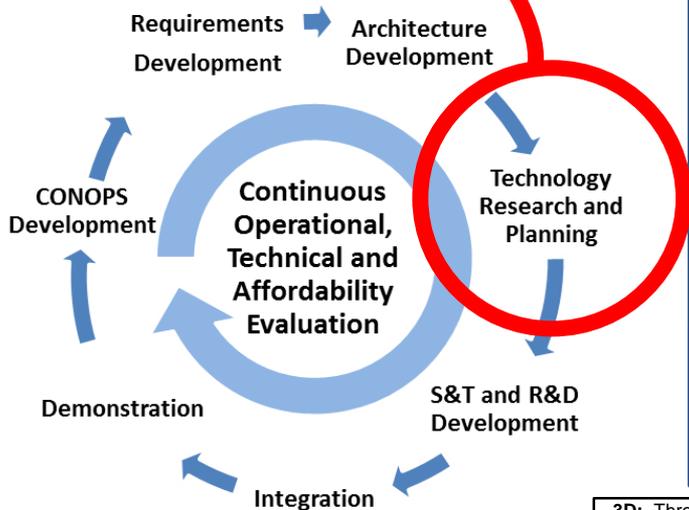




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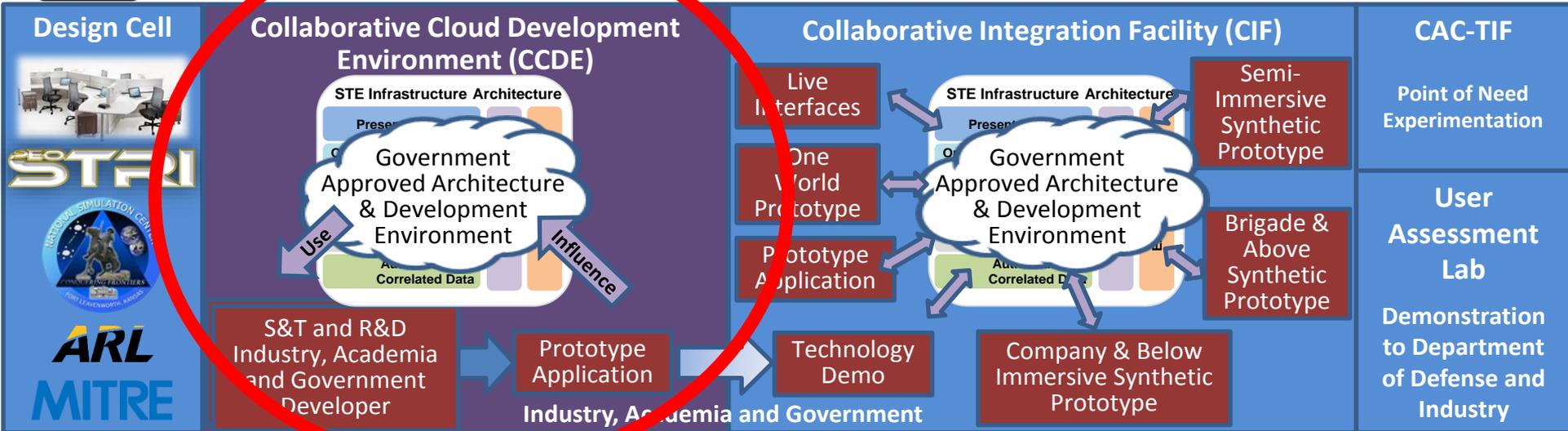
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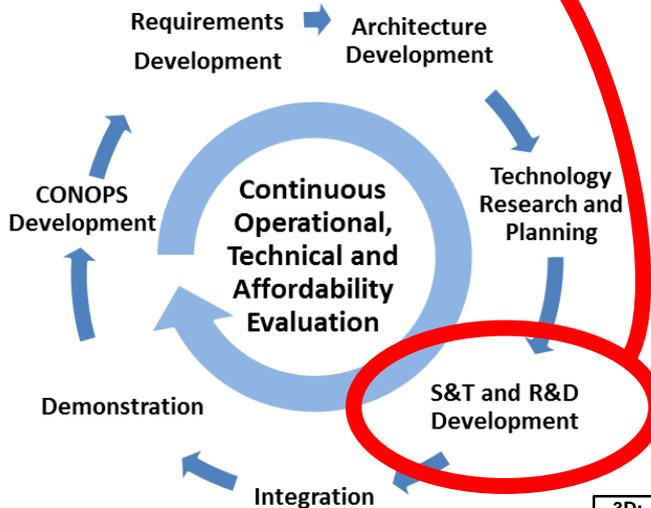




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Requirements/Technology Convergence Cycle



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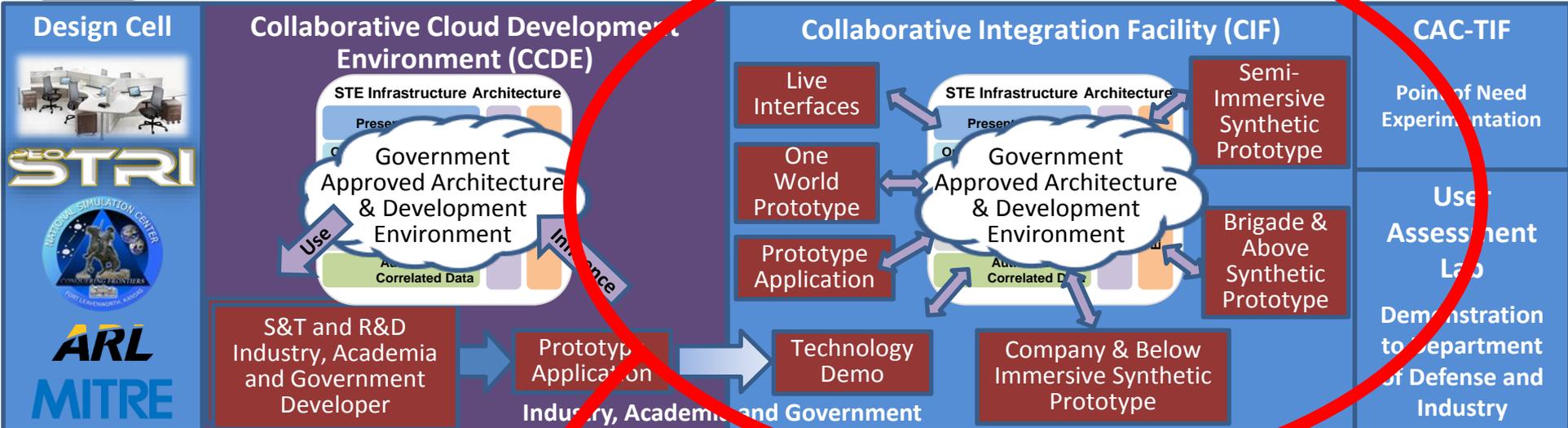
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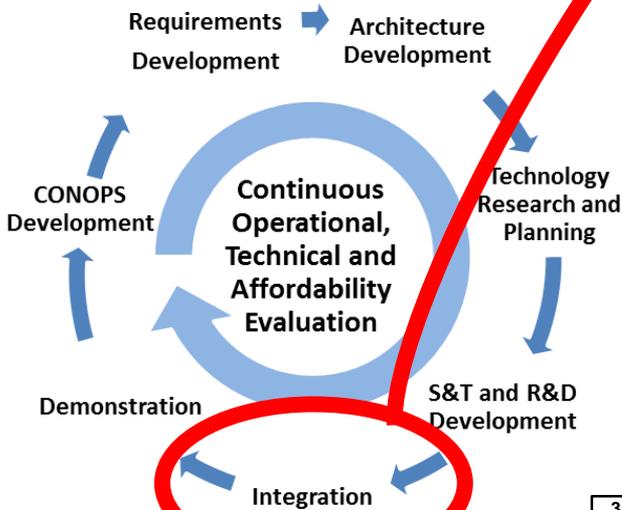
R&D: Research & Development
 S&T: Science & Technology
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Collaborative Environment



Requirements/Technology Convergence Cycle



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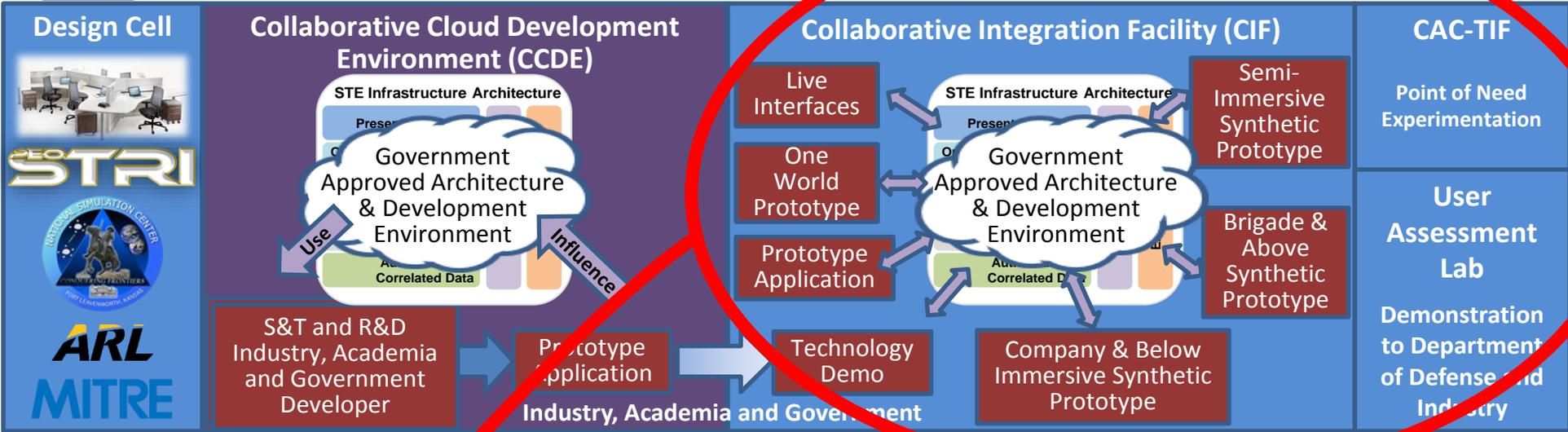
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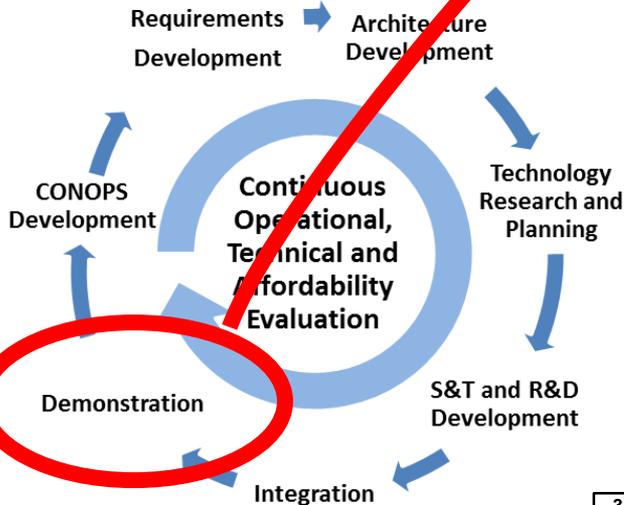




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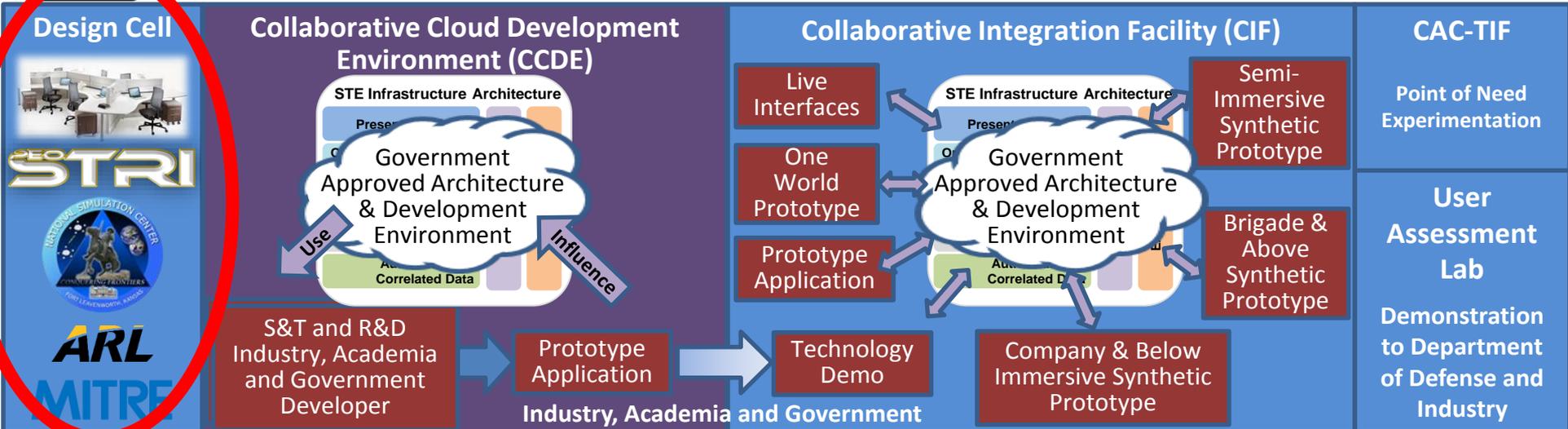
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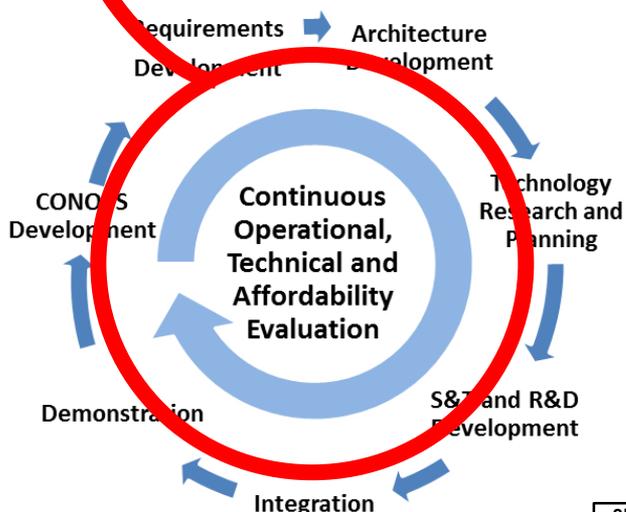




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Industry/Academia Participation



- RFIs will identify STE technology gaps and focus areas that may influence industry/academia research
- Industry/Academia will be given access to STE architecture
 - Develop prototype solutions
 - Influence evolution of architecture
- Prototypes will be evaluated at Collaborative Integration Facility
 - Rapid Prototyping Events
- Evaluations of prototype usability and affordability will help mature STE design

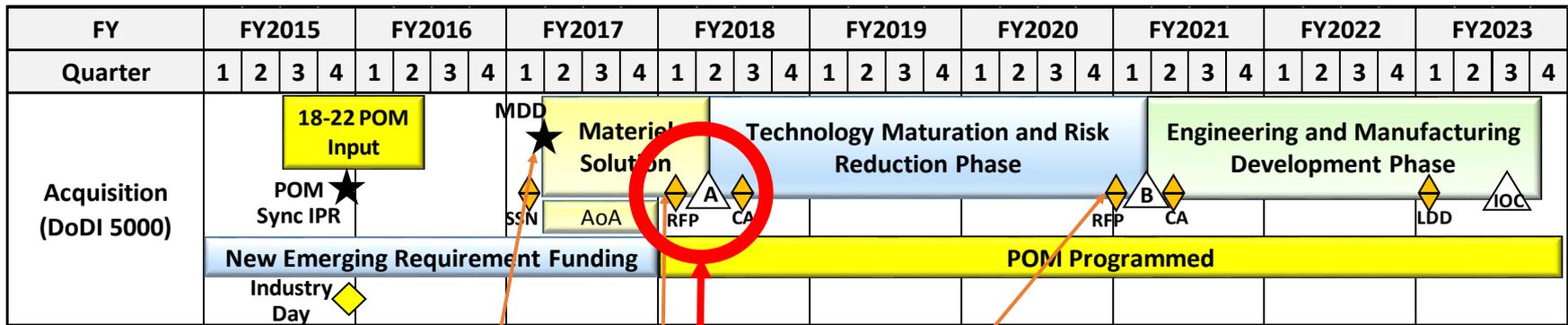




Potential Contracting Options



- Broad Area Announcement (BAA)
- Other Transaction Authority (OTA)
- Small Business Innovative Research (SBIR)
- Small Business Technology Transfer (STTR)
- Indefinite Delivery Indefinite Quantity (IDIQ)
- Cooperative Research and Development Agreement (CRADA)
- Prize Program
- Others



Initial window for contracts
(planning purposes)





Incentives to Participate in Collaborative Environment



- Opportunity to influence:
 - Current and future STE concepts
 - STE architecture, services, and standards
 - Key STE interfaces to: COTS/GOTS, Live training, MC systems, Operational systems, Joint training, Army Training Information Systems (ATIS), Enterprise Data Services (EDS), Networks (DoDIN/LWN/AEN), etc.
- Potential for broad applications in other communities (Army M&S communities, ATEC/OTC, etc.)
- Opportunities to “demo” applications/products throughout the continuous evaluation process (STE CE, STTC RRTB/VTB, NIE/AWAs, AEWEs, etc.)
- Opportunities to identify dual purpose solutions for both Training and Operational applications





Architecture



Mr. Harry Sotomayor
Chief Engineer, Project Manager Integrated Training Environment
Orlando, Florida

Agenda:

- STE Goals/Objectives
- STE Architecture Conceptual Framework
- STE Illustrative Use Cases
- Open Standards
- Architecture Challenges
- Way Ahead





Bottom Line Up Front



- We need your help to evolve the STE architecture
 - Presenting a conceptual architecture today
- We are early in this process and acknowledge it will take years to evolve
- You have the opportunity to be on board at the outset, and to participate in that evolution





Strategic Goals and Objectives



- Reduce Operational Complexity
- Improve Soldier and Unit Readiness
- Provide More Realistic Training Environments
- Reduce Development Costs
- Reduce Operations and Sustainment (O&S) Costs
- Increase Agility to provide customized training on demand
- Leverage Army Enterprise Networks
- Leverage prevailing industry standards
- Common Operating Environment (COE) Compliant

NEED INDUSTRY AND ACADEMIA TO HELP US SHAPE THE FOUNDATION OF THE FUTURE ARCHITECTURE FRAMEWORK





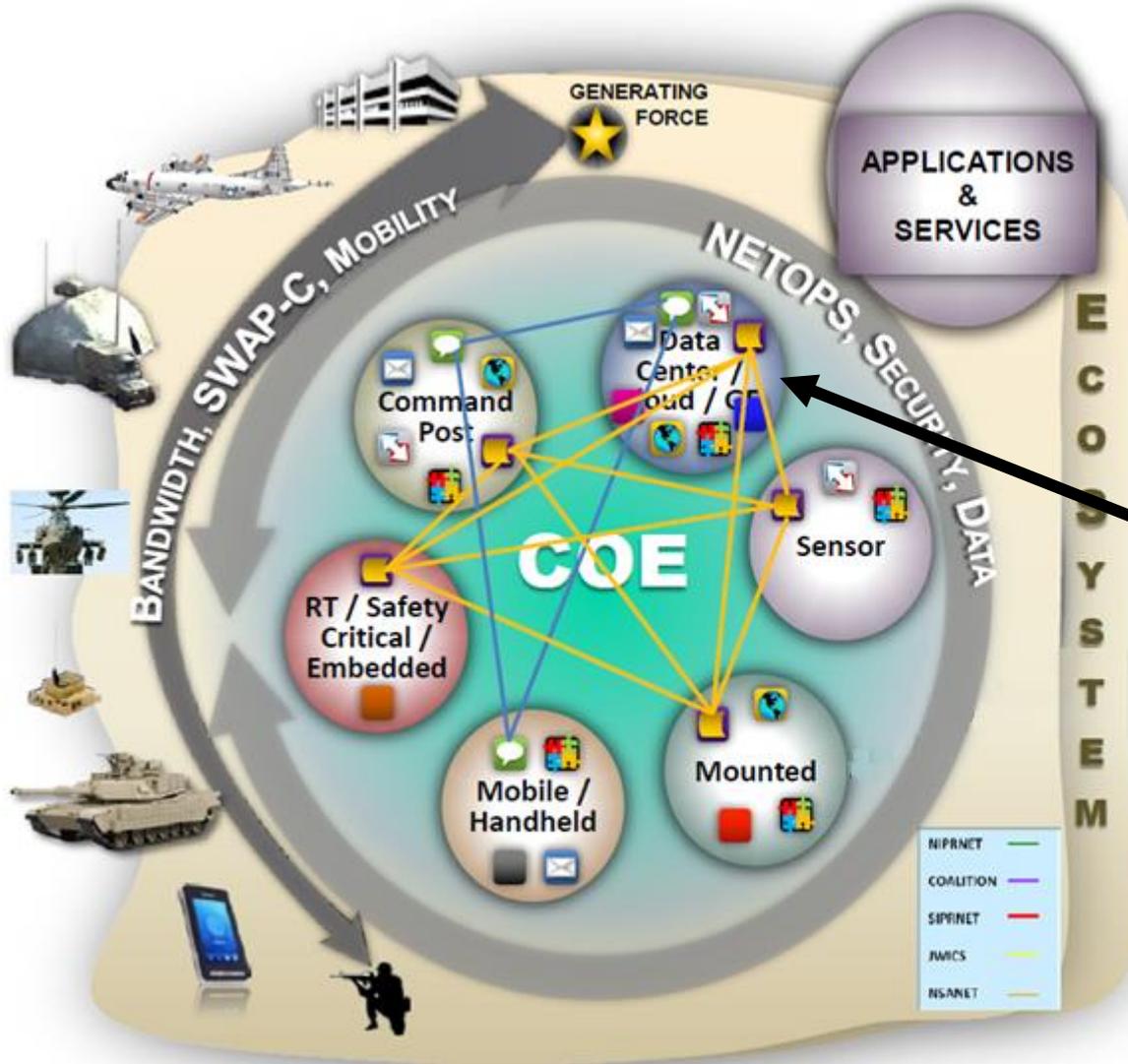
STE Architecture Tenets & Constraints



- Deliver “Training as a Service” from the cloud to the point of need
 - Modular, composable, scalable, service-oriented
 - Automated to minimize tech support
- Common Operating Environment (COE) Compliant
 - Adhere to COE principles and tenets
 - Align with COE Technical Roadmap
- Align with Army Network Campaign Plan 2020
- Architecture will evolve over time as technologies advance
- Leverage prevailing industry standards
- Standard data formats and network protocols
- Multi-level security at model, data, and network levels
- Provide collective and cognitive training from Company and Below through Echelons Above Corps



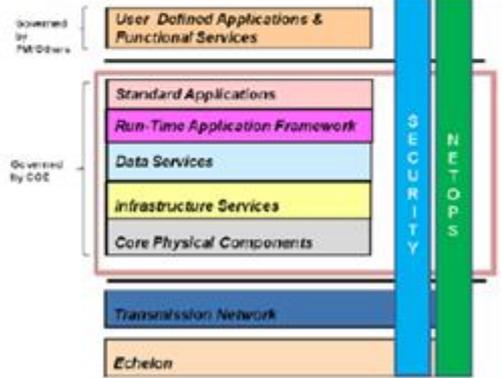
Common Operating Environment



Organize Computing Environments

- Scope of COE implementation requires systematic and manageable approach
- Clustering similar systems based on mission environments to facilitate implementation

COE Reference Model





COE Tenets



COE Tenets (COE Implementation Plan):

- The COE must be **standards-based**.
- The COE must be **scalable across the enterprise**.
- The COE will default to **commercial off-the-shelf** solutions.
- The COE must be compliant with overarching DoD directives.
- The COE will require that software applications are abstracted from the hardware and software infrastructure supporting them.
- The COE will implement a **Service-based Architecture approach**.
- The COE will serve as a **reference architecture that will aid the S&T community and industry in developing applications that are relevant and readily usable**.
- The COE must remain relevant.
- The COE will be enabled by **appropriate security solutions** to protect against cyber threat at the outset.
- The COE will enable unity of effort across all deployment phases.
- COE successful implementation will depend on the time-phased introduction

“Establish a common software foundation (technical baseline) with the Programs of Record building and integrating widgets, applications and services on to the technical baseline.”

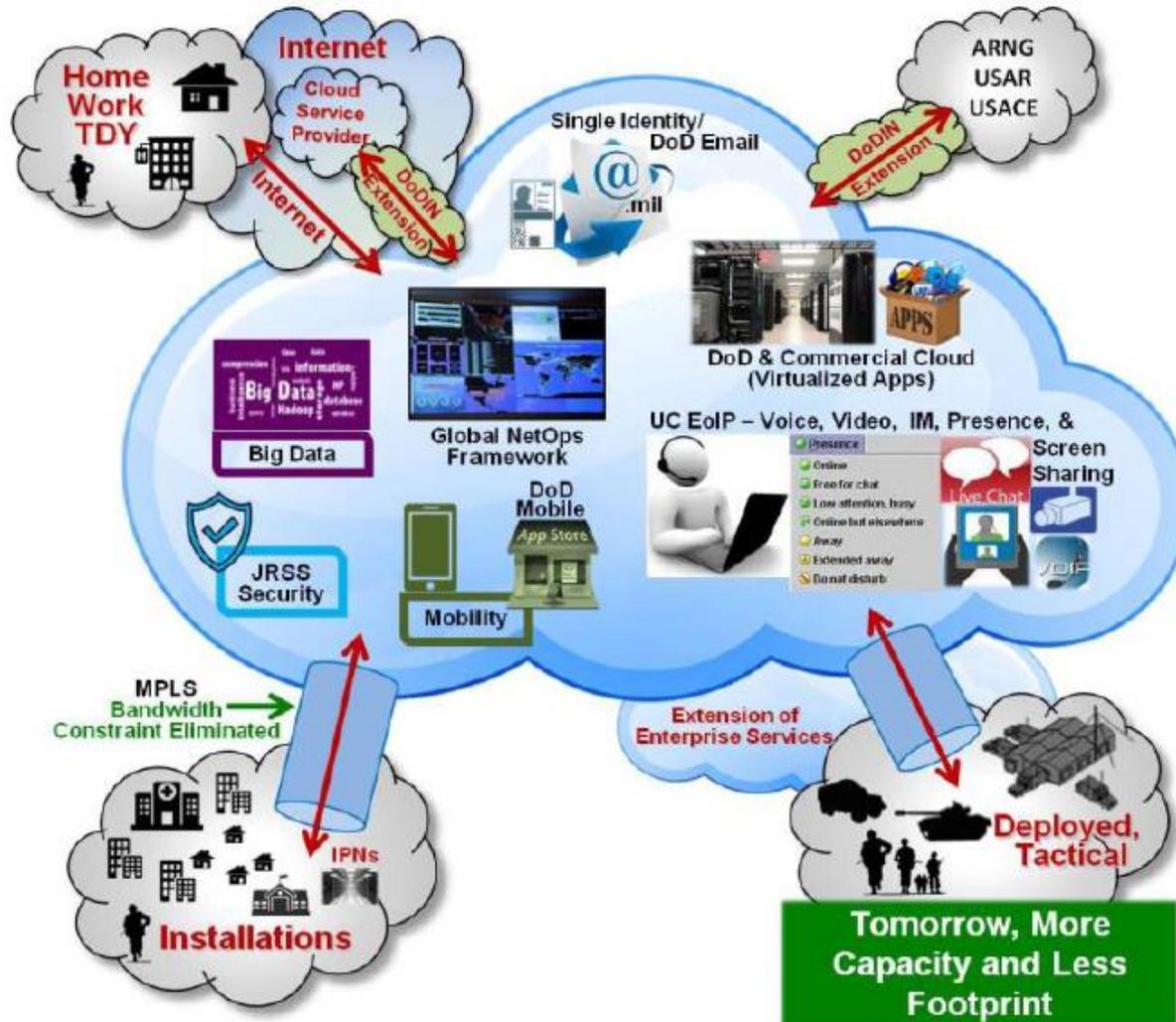




Army Network Campaign Plan 2020



- STE must provide training to all points of need



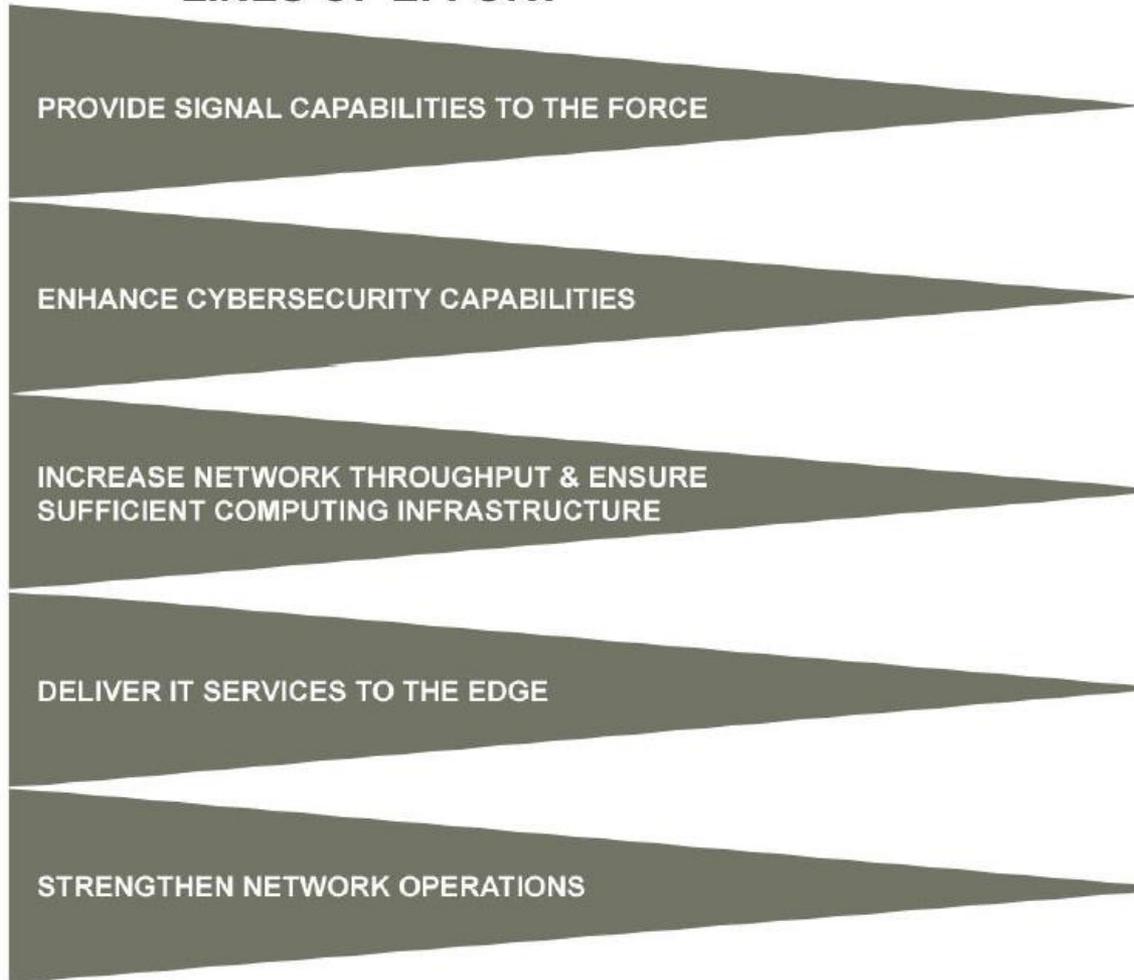


Army Network Campaign Plan 2020



LINES OF EFFORT

DESIRED END STATES





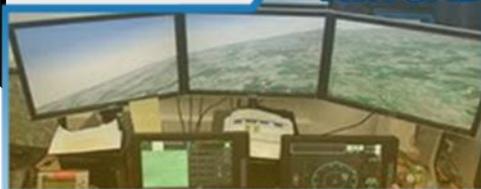
VCG Collapse to STE Architecture



Virtual

- Low entity count (hundreds)
- Entity level behaviors
- High frame rate
- Small terrain playbox
- High detail terrain
- High detail visual modeling
- High detail physics
- Real-time only
- Checkpoint/restore
- High bandwidth

VIRTUAL



Constructive

- High entity count (> 1 million)
- Aggregate unit behaviors
- Low frame rate
- Large terrain playbox
- Moderate/low detail terrain
- No visual models
- Low detail physics
- Time managed
- Checkpoint/restore
- Low bandwidth
- Run faster than real-time

CONSTRUCTIVE



Gaming

- Low entity count (hundreds)
- Entity level behaviors
- High frame rate
- Small terrain playbox
- High detail terrain
- High detail visual modeling
- High detail physics
- Real-time only
- Checkpoint/restore
- High bandwidth

GAMING



Synthetic Training Environment

AVCATT: Aviation Combined Arms Tactical Trainer
 JLCCTC: Joint Land Component Constructive Training Capability
 IEWTPT: Intelligence & Electronic Warfare Tactical Proficiency Trainer





Architecture Conceptual Framework



Notional STE Architecture

Presentation Layer

User interfaces (Thick and Thin Clients, HMD, etc)

Orchestrated Business Processes

Workflow Management (Automated error handling, Wizard-like process flows, etc)

Composite Services

Combined Low Level services providing capabilities (Scenario Gen, Warfighting Functions, AAR, etc)

Low Level Services

Basic service components (Movement, Sensing, Engagements, *Behaviors*, etc)

Authoritative & Correlated Data

Scenario, *Terrain*, Parametric, Order of Battle, etc

Core Infrastructure

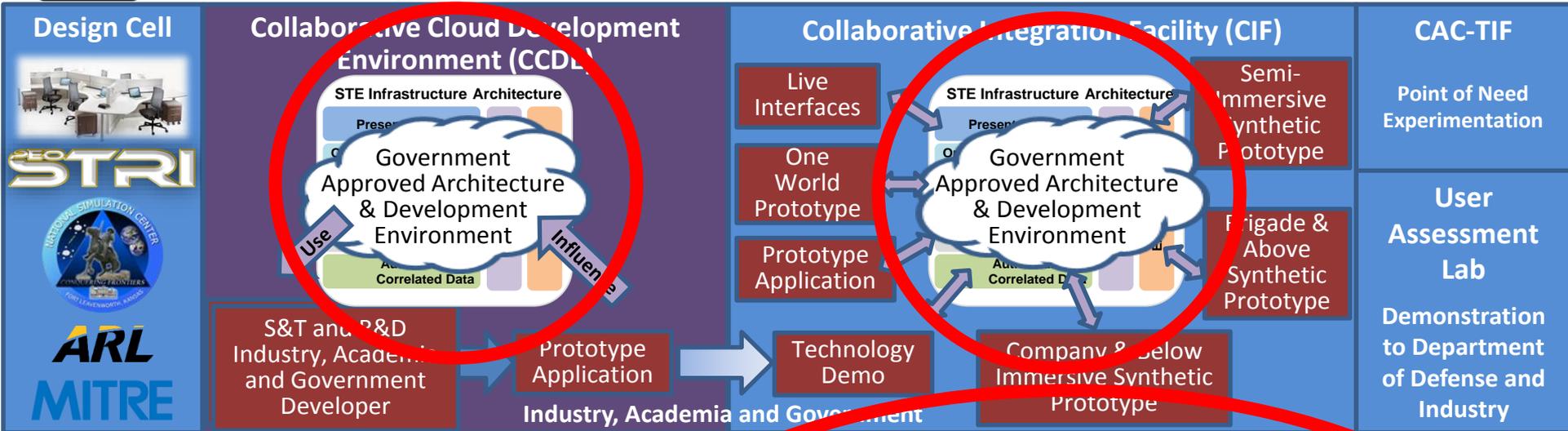
Core support services, resources and SOA backbone (Software Repository, SOA Registry, Pub/Sub, etc)

External Services

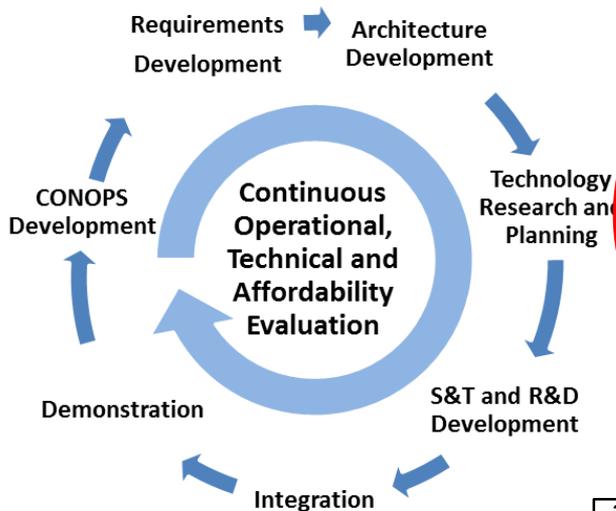
External Services leverage existing enterprise capabilities (Vmware, PKI, etc)



STE Architecture in the Collaborative Environment



Requirements/Technology Convergence Cycle



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Potential Open Standards



- Service registration and discovery (e.g.: OSGi service registry)
- Business Process Modeling (e.g.: Business Process Modeling Notation (BPMN))
- Presentation
 - JavaScript Object Notation (JSON)
 - HyperText Markup Language (HTML)
 - Ozone Widget Framework (OWF)
- Data Standards
 - Terrain (e.g.: OTF, CDB, etc.)
 - 3D Models (e.g.: FBX, Collada)
 - Scenario (e.g.: MSDL)
- Service Definition
 - Web Services Description Language (WSDL)
 - Web Application Description Language (WADL)

**Collaborative Environment will select standards to be used for STE.
Goal is for STE to keep pace with technology developments and
defacto industry standards.**





Architecture Challenges



- Cloud Enabled “Training as a Service”
 - Training resources available to End User without Tech Support
- Point of Need Delivery
 - Content delivery across operational networks
 - Architecture must be flexible to support distributed processing in Data Center or on local nodes
- Maintain concurrency with prevailing industry standards
 - Use existing standards bodies to evolve new standards if needed
 - Parametric Data, Behaviors, etc
- Maintain concurrency with COE
 - Comply with COE Data Center requirements/limitations

**Need Industry and Academia to help us shape the foundation
of the future architecture framework**





Architecture Support Challenges



- **Seamless scalability from immersive collective Company and Below (gaming) though Echelons Above Corps**
- Convergence of Virtual, Constructive, Gaming
- **Concurrent support for divergent levels of modeling detail**
- Support for varying user interfaces
- Integrated cyber models
- Advanced modeling of culture and infrastructure
- Intelligent tutoring systems
- Artificial Intelligence
- Human Dimension Modeling
- **Terrain generation, resolution, and delivery**

Need Industry and Academia to help us develop scalable cloud-enabled training components





Architecture Way Ahead



- Develop and evolve STE Enterprise Architecture and standards with Industry and Academia.
 - Anticipate RFI publication on or about November 2015.
- Establish STE Portal to facilitate communication and collaboration on the architecture.
 - For planning purposes, anticipate on or about 2QFY16.
 - usarmy.orlando.peo-stri.mbx.ste-mail@mail.mil
- Brief Army Acquisition Executive on STE Architecture Concept incorporating feedback from Industry and Academia
 - Anticipated on or about FEB 2016
- Establish an Architecture Working Group
 - Anticipated summer 2016





STE Technology Needs



Mr. Robert Parrish

**Chief Engineer, Project Manager Integrated Training Environment
Orlando, Florida**

Agenda:

- Introduction and Background
- Better Buying Power 3.0
- Collaborative Environment
- STE “Big 6” Technology Needs
- On-going activities
- Way Ahead





BLUF



- Government has identified STE technology needs, and wants to inform Industry and Academia about select technology challenges.
- Government requests Industry's and Academia's help to maintain awareness of leap-ahead and disruptive technology investments.
- Government requests Industry and Academia consider these technology areas in their future technology/research efforts.
- Government requests help identifying major technology gaps required to implement the STE concept, not currently included in the following presentation.





Modernization Strategy in a Fiscally Challenged Environment



2015 → 2042 Focus Our Future Efforts



Protect S&T to ensure next generation of breakthrough technologies

Delay some new capability development and invest in the next generation of capabilities



Incremental upgrades to increase capabilities; modernize aging systems

Enable near-term readiness for contingencies

Reduce Operation & Support cost; address Non-Standard Equipment

2014 → 2030 Maintain the Momentum We Have Created





Better Buying Power 3.0

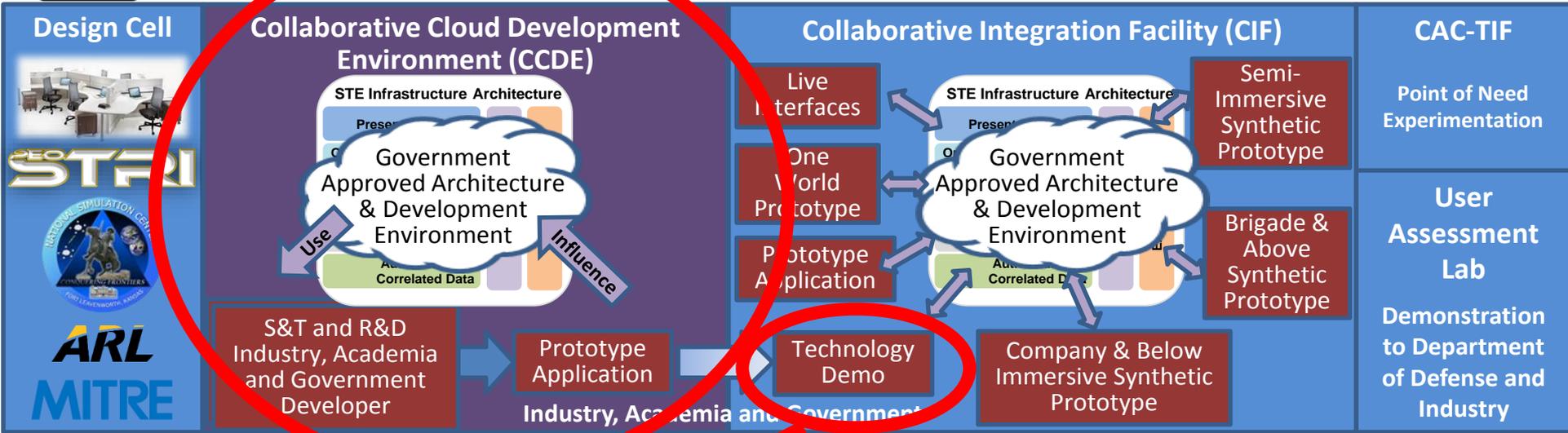


- Incentivize Productivity in Industry and Government
 - Improve the return on investment in DoD laboratories
 - ***Increase the productivity of corporate IRAD***
 - ***Remove barriers to commercial technology utilization***
- Incentivize Innovation in Industry and Government
 - ***Increase the use of prototyping and experimentation***
 - ***Emphasize technology insertion*** and refresh in program planning
 - Use Modular Open Systems Architecture to stimulate innovation
 - ***Increase the return on and access to small business research and development***
 - Provide draft technical requirements to industry early and involve industry in funded concept definition
 - Provide clear and objective “best value” definitions to industry

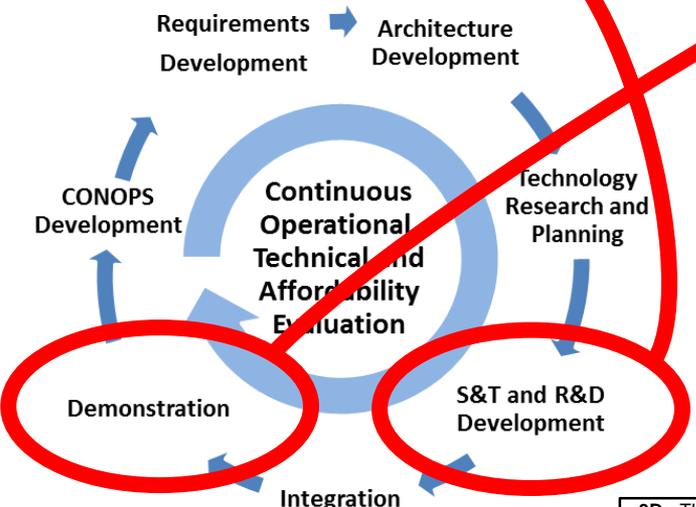




Collaborative Environment



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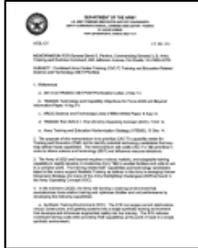
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S&T Operational Drivers

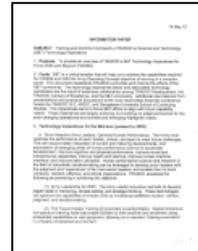


March 2015



**CAC-T T&E
S&T Priorities Memo**
BG O'Neil to
GEN Perkins

May 2015



**TRADOC S&T Imperatives
for F2025B Info Paper**
BG Quintas
COL Cross

June 2015



**S&T
Needs Memo**
GEN Perkins to
HON Ms. Shyu

“Potential technologies to support this capability include:

- Immersive technologies
- One world terrain technologies
- Big data analysis and cloud technologies
- Artificial intelligence technologies
- Training effectiveness research” ...

“S&T is a critical enabler that will help us to achieve the capabilities required for F2025B and fulfill the Army Operating Concept objective of winning in a complex world”

“I ask for your continued support of our Technology Imperatives ... that will make the biggest impact across the AOC and AWFCs.

- Grow Adaptive Leaders, Optimize Human Performance“
- ...

STE technology needs aligned with TRADOC technology imperatives and CAC-T S&T priorities.





Technology First Principles



“In the development of new technologies it is important to adhere to the following foundational principles to maximize their utility to the STE and to the Soldier:

- Emphasize integration of technology with the STE Architecture framework, standards and interfaces
- Keep user interfaces simple and intuitive
- Maximize reliability and reduce life cycle costs
- Reduce training operation and logistics demands
- Design for scalability
- Design self-healing systems/architecture”

- TRADOC S&T Technology Imperatives Information Paper (14 May 2015) – provides an overview to TRADOC’s S&T Tech Imperatives for Force 2025 and Beyond (F2025B)





STE Technologies Needs (Big 6)



Identify investment areas that maximize future training capabilities for the STE.

Supports Increments 1 and 2

Supports Increments 2 and 3

Single Synthetic Environment

- Develop an Open System Architecture to converge Virtual, Constructive, and Gaming capabilities into a single Synthetic Training Environment (STE).
- Replicate environment to address: Human Dimension, Cyber, CBRNE and Mega-cities.
- Leverage techniques for data distribution and storage under various network constraints.
- Leverage investments on computational and performance limitations to support high fidelity representation and scalability.

One-World Terrain

- Complete global terrain data coverage
- Advanced Data Collection to help provide “digital dirt” of all land, sea, air, space, and cyber domains.
- Next generation source cleaning, fusion, data storage, distribution and applications for a global terrain database.

Point of Need

- Methods to optimize delivery at PoN
- Trade space from current to future immersive environments (Training Effectiveness).
- Systems Interface (i.e. HMI/HCI)
- Leverage augmented and mixed realities initiatives
- Low cost sensor technologies for interpreting and predicting human action.

Artificial Intelligence

- Leverage Virtual Humans to reduce role players
- Replication of a free thinking hybrid synthetic OPFOR/threats.
- AI to replicate large Unit routines.
- AI for culturally aware VH and Small Units.

Intelligent Tutors

- Leverage initiatives in adaptive training methods and techniques.
- Refine Intelligent Tutoring Systems.
- Individual modeling to support Team/Unit modeling.
- Automated Enterprise Hot Wash and AAR.
- Leverage Cognitive/Affective Modeling techniques.
- Training Effectiveness/Human Performance measurements.

Big Data

- Leveraging Real World/Operational data to enhance realism of training
- Actionable intelligence - technologies to support data analytics, algorithms, attribution, visualization and accessibility.
- Facilitate performance assessment and Unit Readiness (i.e. Commander's dashboard)

AAR: After Action Review
AI: Artificial Intelligence
AR: Augmented Reality

C: Constructive Training Domain
CBRNE: Chemical Biological Radiological Nuclear & Explosives
G: Gaming Training Domain

OPFOR: Opposing Force
PoN: Point of Need
STE: Synthetic Training Environment
V: Virtual Training Domain

VH: Virtual Humans
VR: Virtual Reality
WfF: Warfighting Function





Single Synthetic Environment Overview



Army Technology Imperative:

- Represents operational activities (e.g., warfighting functions, Mission Essential Task List (METL), Combined Arms Training Strategy (CATS)) in a synthetic Operational Environment (OE).
- Provide an on-demand, fully immersive environment that fully replicates the complexities of the OE in support of multi-echelon, cognitive, collective training - scalable from squad/team to Joint Task Force (JTF).
- Provide Training & Education (T&E), mission planning, and mission rehearsal capabilities at point of need in a single synthetic environment
- Reduce overhead training costs
- Common Operating Environment (COE) compliant and Live Training Environment interoperable

Technology:

- A modular, composable, open source, service based, open system architecture that leverages commercial standards to converge Virtual, Constructive, and Gaming capabilities into a single synthetic environment
- Data distribution and storage under various network constraints
- R&D in computational and performance investments to support high fidelity representation and scalability
- COTs and Industry AI, Game Engines, Simulation Architecture, and Models





Single Synthetic Environment (SSE) Challenges



- Converging the Virtual, Gaming and Constructive training domains
- Optimizing human performance and address all Human Dimension aspects (physical, cognitive, and Social)
- Ensuring engine (game vs simulation) supports high entity counts
- Ensuring automatic elasticity; horizontal and vertical scalability on demand
- Replicating the Operational Environment (OE) with variable threat environment.
 - Including Political, Military, Economic, Social, Infrastructure, Information, Physical Environment, and Time (PMESII-PT) Operational variables
- Providing required multi-resolution (aggregate and entity/unit and platform) fidelity
- Addressing “Fair Fight” issues (e.g., timing, Live/Synthetic interoperability, distribution, Joint & Coalition interoperability)





One World Terrain Overview



Army Technology Imperative:

- High-resolution, real world terrain of the Earth to support all aspects of training and mission rehearsal needs worldwide
- Terrain correlated with COE and Mission Command Systems
- Multiple views, zoom levels, and overlays
- Complete global terrain and space coverage
- Human terrain

Technology:

- Advanced data collection
- Big data fusion and storage
- Common terrain format
- Industry terrain standards
- Industry geospatial data (e.g. Google)
- Industry weather models
- GIS/Intel terrain
- Cloud-enabled
- Supports multiple resolutions
- Modeling of climate and terrain
- Critical Infrastructure and Megacity representations
- Open terrain standard for 2D and 3D views
- Industry, government, and other terrain collection technologies
- Crowd sourced data for attributes of cities
- Social Media
- Rapidly updates to reflect the real world





One World Terrain Challenges



- Developing One World Terrain service based on an open, common terrain standard and format
- Standardizing collection, processing, storage, distribution, and utilization of geospatial data
- Providing geospatial data for the entire world at multiple resolutions
- Providing first person interactive runtime rendering
- Providing rapid terrain generation
- Simulating terrain effects such as weather and geological occurrences (river flows and earthquakes)
- Modeling patterns of life and cultures of Megacities
- Capturing human terrain
- Synchronizing live and synthetic terrain
- Dynamically modifying terrain based on simulated and real world events
- Accurately reflect real world terrain physics
- Leveraging commercial terrain databases
- Leveraging crowd sourced data
- Establishing metadata definitions
- Automating procedural terrain production





Point of Need Overview



Army Technology Imperative:

- Provide STE capabilities to the Soldier at the point of need
- Delivery of training content at home station and during disconnected, intermittent, and limited (DIL) network conditions.
- Deliver STE from the cloud over Department of Defense Information Networks (DoDIN)

Technology:

- End Devices - Human Machine Interfaces, Augmented Reality, Augmented Virtuality, Virtual Reality to provide affordable Form, Fit, Function
- Content delivery to network edge nodes with replicated data
- Mobile apps
- Enable training with multiple classifications
- Network bandwidth conservation with data optimization algorithms
- Cloud-enabled, Timely, Secure, 24/7, available anywhere





Point of Need Challenges



- Streaming high fidelity training content, optimized for operational and tactical networks
- Considering future network quality of service impacts on GPU location (cloud or end devices) for multi-echelon training audiences
- Rendering high entity counts on end devices
- Delivering and maintaining STE capabilities from cloud locations
- Information Assurance/Cyber Security overhead impacting training experience
- Leveraging mixed reality (e.g., virtual reality, augmented virtuality, augmented reality) devices
- Bandwidth compression algorithms
- Data optimization algorithms
- Persistent 24/7 availability
- Bandwidth and throughput constraints
- Transfer speed constraints
- Data timeliness
- Disconnected, intermittent, and limited (DIL) network conditions
- Network interoperability
- SWaP constrained devices in vehicles (appended/embedded training) and with soldiers
- Synchronizing game state between geographically distributed STE suites
- CPU & GPU load balancing
- Hardware and software virtualization
- Network data compression
- Simulation as a service
- Content delivery networks and clouds





Artificial Intelligence Overview



Army Technology Imperative:

- Accurate behavior modeling to replicate human complexities in virtual entities
- Facilitate individual and unit training in complex environments
- Support adaptive training
- Replicate unit routines

Technology:

- Culturally aware agents
- Automated authoring tools and course of action analysis
- Virtual humans to reduce role players
- Intelligent agent and tutoring systems
- Adaptive training systems
- COTs and Industry AI and models
- Accurately reflects complex behavior





Artificial Intelligence Challenges



- Replicating free thinking, adaptive, autonomous, synthetic OPFOR
- Accurately modeling intelligent agents and complex human and unit behaviors
- Collecting behavior data to inform AI models
- Machine understanding of human intent through voice and non-verbal communication (Facial and gesture recognition)
- Natural language recognition and interpretation
- Leveraging culturally aware virtual humans
- Replicating world cultural patterns
- Expert systems to interpret results to prioritize resources
- Establishing model based AI standard





Intelligent Tutoring Systems Overview



Army Technology Imperative:

- Affordable, tailored, real-time, and interactive training for soldiers and units without the need for human tutors
- Collective and individual training

Technology:

- Team and unit modeling
- Automated Enterprise Hotwash and After-Action Review
- Affective/Cognitive Modeling Techniques
- Training effectiveness and human performance measurement
- Authoring Tools to Extend Applicability Across Training Domains
- Domain Modeling across Dynamic Training Environments
- Human Dimension





Intelligent Tutoring Systems Challenges



- Utilizing commercial technologies to aid in Intelligent Tutoring
- Collecting performance data for commanders to assess unit and soldier readiness
- Collecting physical, social, and cognitive data
- Accurately aggregating individual performance data to higher level units
- Intelligent tutors at the point of need
- Operate tutors from natural language and non-verbal input
- Developing human dimension metrics for physical, social, and cognitive performance
- Developing contextual tutoring curriculum





Big Data Overview



Army Technology Imperative:

- Rapidly interpret and model large amounts of OE data
- Enable a common operating picture (COP) for training allowing commanders to visualize their unit
- Conduct all phases of the operations process for training events (plan, prepare, execute, and assess)
- Unit and individual performance assessments
- After Action Reviews
- Leverage authoritative data sources

Technology:

- Big data analytics to rapidly model threats, scenarios, people, locations, events (news and social media), and other phenomenon
- Visualization and accessibility methods
- Modeling attitudes, beliefs, and behaviors to supply a human dimension
- Take the human “out of the loop”, put them “on the loop” for verification (data to decision; data to training).





Big Data Challenges



- Easily developing and sharing content
- Leveraging large amounts of structured and unstructured data in TADSS scenario generation
- Supporting a variety of user types and roles
- Leveraging non-proprietary data authoring tools
- Leveraging reliable, crowd sourced data
- Ensuring semantic interoperability (share data between computers with unambiguous meaning)
- Aggregating data while maintaining accurate unit behaviors
- Efficiently and reliably transmitting data over Wide Area Networks
- Securing big data





Ongoing STE S&T WG/IPTs Activities



- Working with CAC-T, TCM-ITE, and STTC on the list of STE Technology Needs and Research Areas
- Developing Technology Needs Statements (TNS)/Technology Transition Agreements (TTA) to document/describe key capability gaps and technology needs for the STE
- Working with STTC and DASA (R&T) to align/allocate technology areas to: S&T communities, PEO STRI, Academia, and Industry
- Continuing STE communications and market research with Industry partners (CAC-T RFI, TSIS, TSIS “one-on-ones”, I/ITSEC, etc.)
- Working with ACC-Orlando and STTC to identify contracting vehicles and other agreements to enable technology investments (BAAs, OTAs, IDIQs, SBIRs, CRADAs, etc.)
- Working with CAC-T and DAMO-TR to ensure technology insertions are planned in the Long Range Investment Requirements Analysis (LIRA) 18 and future Program Objective Memorandums (POM)





Near Term Way Ahead



- Develop and evolve STE Enterprise Architecture with Industry and Academia; anticipate RFI publication. On or about November 2015.
- Establish STE Portal to facilitate communication and collaboration. For planning purposes, anticipate on or about 2QFY16.
- Participate with Industry and Academia in our Collaborative Environment. For planning purposes, anticipate on or about 3QFY16.
- Participate with Industry and Academia in future technology/industry days and technical workshops (help develop key interfaces, standards, protocols, and performance specifications). For planning purposes, anticipate late FY16.

We are in the Initial Planning Stages





Way Ahead



- We need Industry and Academia to help us shape our future Army S&T investments
- We need Industry and Academia to help us demonstrate the “art of the possible” and to identify key “leap ahead and disruptive” technologies to enable the STE concept
- We need Industry and Academia to help us align and influence existing Standards bodies (SISO, OGC, etc.) to enable the future STE vision
- Please submit your concise follow up questions to usarmy.orlando.peo-stri.mbx.ste-mail@mail.mil





Precedence for Industry Collaboration



Mr. Robert Parrish
Chief Engineer, Project Manager Integrated Training Environment
Orlando, Florida

Agenda:

- Recent Experience - Overview
- Applicability to STE





Recent Experience - Overview



- PEO STRI/PM TRADE has recent experience working with Industry and Academia.
 - Established common vision
 - Conducted recurring working group sessions with Industry
 - Established and evolved modular, foundation architecture
 - Established interface standards management process
 - Identified components and agreed to standards and protocols
 - Established component agreements
 - Established active configuration management process
 - Established collaboration portal
 - Provided Industry with development/verification tool
 - Demonstrated capabilities
- STE will adopt the observations from PM TRADE's recent experience.





Applicability to STE



- Identify architecture strategic goals and objectives
- Launch working groups to review the problem space establish common STE standards and interfaces.
 - Scalable, modular, composable architecture
- Review the As-Is Live, Virtual, Constructive, and Gaming training processes
- Develop the to-be STE Training Process
- Develop use case approach
 - Terrain, gaming, constructive, virtual, legacy hardware replacement, delivering training solution from the cloud to PoN
- Review Industry standards and determine architecture and standards for the program
- Launch STE Portal for knowledge management, collaboration, and communication with Industry and Academia.
- The architecture will evolve. It will be an iterative process, and will take time.

Industry and Academia participation critical to STE success!





STE Way Ahead



Devin Lyders
Assistant Project Manager, Project Manager Integrated Training Environment
Orlando, Florida

Agenda:

- Summary of Take Aways
- One-on-One's





Summary of Key Take Aways



- Collaborative Environment
 - Described the process
 - Request process participation and feedback
- Architecture
 - Described notional STE Enterprise Architecture (EA) Framework
 - Request Industry and Academia help to develop and evolve STE EA and standards.
 - Anticipate RFI publication on or about November 2015.
 - Establish STE Portal to facilitate communication and collaboration on the architecture. (Anticipate on or about 2QFY16.)
- STE Technology Needs
 - Described six technology focus areas in detail
 - Need Industry and Academia to consider STE technology gaps in future technology investments and research areas





One on One Rules of Engagement



- The Government intends to use this forum to address industry and academia questions and concerns, not to elicit trade secrets or product line marketing.
- Sales pitch or marketing material will not be accepted.
- Video, audio, or any other recording devices will not be allowed.
- 20 minutes is allotted for each one-on-one Government-Industry session. Schedule shall be strictly enforced.
- Topics:
 - Collaborative environment and Intellectual Property concerns
 - Non Disclosure Agreements and Organizational Conflict of Interest concerns
 - Contract vehicles and funding incentives





Closing Remarks



COL Roland Gaddy
Project Manager Integrated Training Environment
Orlando, Florida

