Joint Technology Gaps – An Enterprise Perspective

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Background

2010 – 2012 Update on Live Domain Technology Initiatives/Gaps

2013 – Enterprise Perspective on Technology/Capability Gaps

- ❑ Live
- ❑ Virtual
- ❑ Constructive
- ❑ Gaming
- ❑ Test
- ❑ PM TRASYS/USMC

Prioritized Enterprise Perspective on Capability Gaps to Shape Investment - Collaboration - Innovation

Criteria used for Prioritization

Tier 1 – "Strategic" Capability Gaps

- Supports multiple PMs/customers
- Relevant to Army need/gap/trends
- Alignment with Warfighter Outcomes (WFOs)
- Essential for program to meet KPP
- Achievable within 1-3 years
- High potential for funding
- High potential for transition

Tier 2 – "Tactical" Capability Gaps

- Important for program to meet KPP
- Achievable within 3-5 years
- Medium potential for funding
- At least 1 critical PM/customer

Tier 1 "Strategic" Capability Gaps

Tier	Rank	Capability Gap Description	Domain
1	1	Enhance Individual/Squad/Scout Training capabilities in the immersive and live training environments to achieve Squad Overmatch and optimize soldier performance in both physical and mental skills -Enhance L/V/C/G training capabilities by leveraging virtual human/intelligent avatar/agent technologies to increase realism/fidelity of the immersive environment	L/V/C/G
1	2	Enhance L/V/C/G interoperability with the Integrated Training Environment (ITE), Mission Command systems and other training systems	L/V/C/G
1	3	Enhance Cyber Warfare Capabilities in test and training environments to include live/virtual/constructive offensive (threat) and defensive Computer Network Operations, Computer Network Attack & Computer Network Defense -Remote mission command of multiple cyber offensive and defensive platform -Modeling and execution of offensive and defensive cyber activities providing force multiplier effects - Virtualization of offensive/threat and defensive networks - Offensive and defensive cyber tools developed as software services available in secure cloud environments	L/V/C/T
1	4	Enhance Live and Virtual training and test capabilities by leveraging augmented/mixed/blended reality technologies to increase realism/fidelity of the training environment	L/V/T
1	5	Enhance current TES and RTCA capabilities to provide more realistic pairing of shooter/target engagements in live test and training environments	L/T
1	6	Enhance weapon tracking/orientation in live and virtual training and test environments	L/V/T
1	7	Provide an integrated aviation test and training capability at the CTCs, Home Stations and test ranges	L/T

Key: C = Constructive, G = Gaming, L = Live, T = Test, V = Virtual

Tier 2 "Tactical" Capability Gaps

Tier	Capability Gap Description	Domain
2	Capability to provide reliable & accurate target TSPI to remote target control system in GPS denied environment; enhance test and training tracking instrumentation to provide reliable and accurate TSPI in GPS denied environment achieving seamless transition between outside and inside buildings, tunnels, alleys and maneuver area in the presence of electromagnetic interference.	L/T
2	Enhance Embedded Training capability to enable the Warfighter training "Anytime, Anywhere"	L/V/C/G
2	Execution of L/V/C/G capabilities in scalable virtualized/cloud environments including support for dynamic provisioning and load balancing, reduced complexity for exercise planning and control, and integration with tactical systems/cloud environments to provide training and simulation capabilities "on demand" (Training/Simulation as a Service (TaaS/SaaS)).	L/V/C/G
2	Enhance live/virtual/constructive Electronic Warfare (EW)/Intelligence, Surveillance and Reconnaissance (ISR) capabilities in test and training environments to include live and simulated offensive/threat and defensive communications and RF electronic attack (EA) in aviation and ground assets to locate, maneuver to and jam communications/RF signals	L/V/C/T
2	Integration of unmanned/unattended air and ground vehicles, sensors, and systems in test and training environments to include representation of the entities and their interactions and effects on other entities and the terrain within the live and simulated battlespace.	L/V/C/G/T

Key: C = Constructive, G = Gaming, L = Live, T = Test, V = Virtual

Wrap-up

Wide Range of Capability Gap Categories

- ❑ Emerging
- ❑ Current investment (PoR, SBIR, BAA, S&T)
- ❑ Domain vs Enterprise Considerations
- ❑ Joint/Multinational

Capability Gap Database Development Status

Slides Available on LT2 portal

Backup

FY13 Training & Education WFOs

STRI

Future Army Learning: Why Are the Army's Warfighter Outcomes So Important?

The S&T community uses Army Warfighter Outcomes (WFOs) as the authoritative source for articulating Warfighter needs to shape research and future technological solutions. The eleven Training and Education (T&E) WFOs (see box) focus on solutions to allow commanders to train Soldiers and units at home station through live, virtual, constructive, gaming, and instructional technologies.

These WFOs describe the Army's need for technologies and solutions that provide increased Soldier learning and retention, deliver training at the point of need, increase training realism and rigor, and allow for training geographically distributed units and Soldiers. These solutions must also be affordable and low overhead to be useful to the Army. The WFOs will assist industry and academia to discover and develop the learning technologies of the future and increase future Army readiness.

T&E FY13 Warfighter Outcomes

1. Realistic, Mission Command-Centric ITE
2. Accessible Learning Capability
3. Low Overhead Immersive T&E Capability
4. Enhanced Gaming Capability
5. Individual Training for Tactical Tasks
6. Interface for CDR-Managed Training
7. Virtual Human Capabilities
8. Adaptive Training & Innovative Learning
9. Enhanced/Integrated Live Training Capability
10. Cultural Awareness
11. Models & Simulations for Training Effectiveness Analysis

Tier 1, Gap #1: Squad Overmatch Technology Return On Investment (ROI) Analysis

Goal — **Optimal Human Performance**

Achieve

Proficiencies
- Resilience
- Mental
- Situational Awareness

Develop

Skills
- Problem Solving
- ...
- Attention Control
- ...
- Kinesics
- ...

Stimulate

Stressors
- Member of Patrol Killed in Action
- Exposure to Dead Bodies
- Seeing Injured Women / Children
- ...

Provide

Technologies

Inject →

$ COST $

Inject →

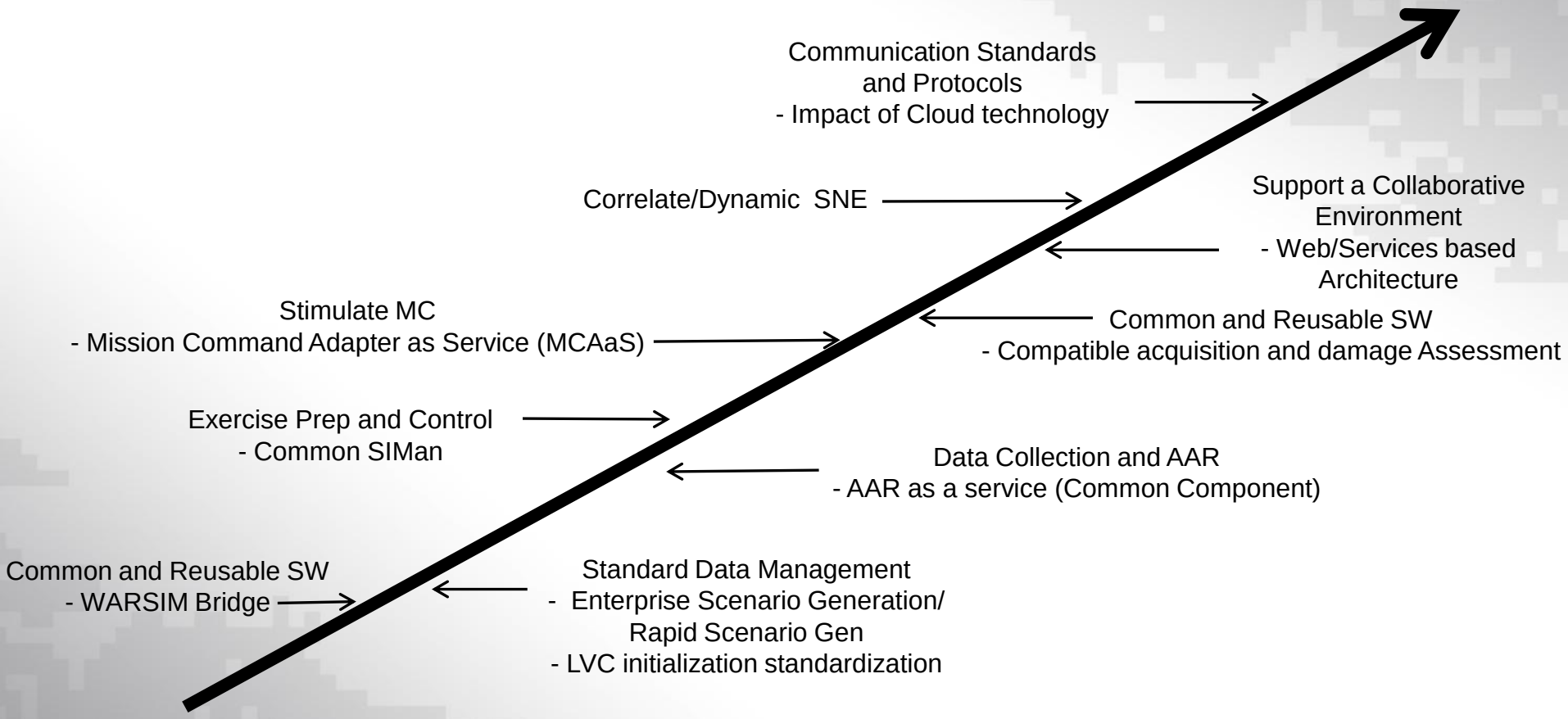
$ COST $

Tier 1, Gap #2: L/V/C/G Interoperability

What Is the Integrated Training Environment?

Solution: A system of systems that, by design, combines and connects key training enablers in a persistent and consistent manner to accurately stimulate Mission Command Systems to meet the commander's training objectives within the appropriate Operational Environment.

Tier 1, Gap #2: Enhance Integrated Training Environment (ITE)

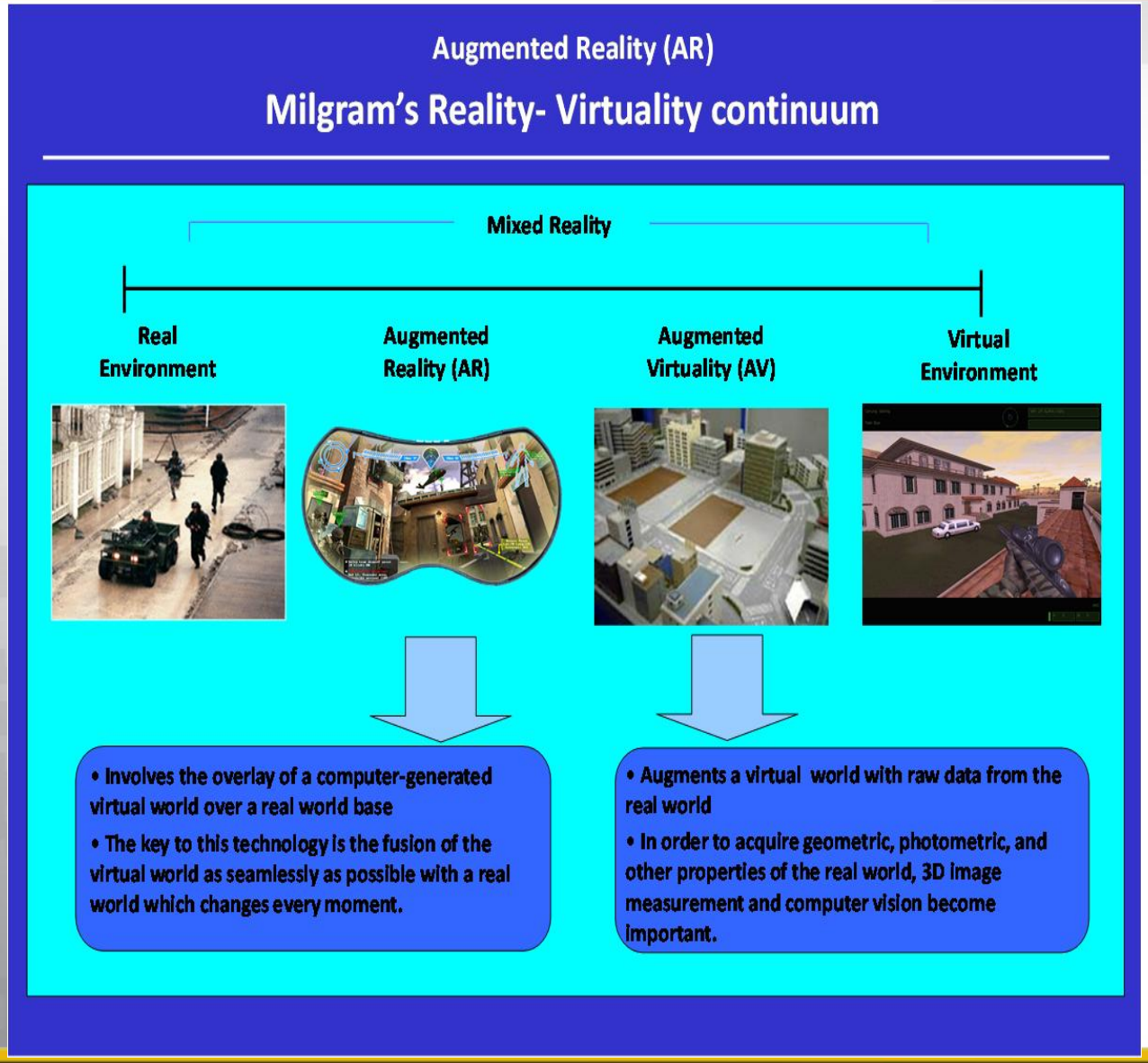


Tier 1 Gap #3
Threat Cyber Warfare Capability Gaps

Threat cyber capabilities

- Enhance threat cyber capabilities for threat Computer Network Operations, threat Computer Network Attack and Computer Network Defense
- Remote mission command of multiple cyber offensive platforms
- Modeling and execution of offensive cyber activities providing force multiplier effects
- Threat M&S Cyber Defense models to complement Threat Cyber Attack models
- High fidelity cyber threat models – beyond messages – takeover UAV, jammer, attack cell phones
- Supervisory Control & Data Acquisition (SCADA) and power grid modeling and vulnerabilities– jamming, cyber, weapons

Tier 1, Gap # 4: Augmented Reality/Mixed Reality



Use Cases

- Individual training - CFFT (FO, JTO, JTAC)
- Squad training – DSTS
- Live training
- Collective training
- AR mentor

Key Technology Areas

- HMDs/See thru Goggles
- Position location
- Weapon tracking
- Movement tracking
- Haptic Feedback
- Virtual humans
- Natural language
- AI

Tier 1, Gap #4:
Live FoT & FoF Augmented Reality

Objective:

Develop Augmented Reality (AR) solution to simulate near real time ballistic and burst effects on target and night/obscurant conditions (opaqueness) during individual, unit/team, and collective force-on-force and force-on-target training exercises.

Goal would be to develop a system that is ultra light weight (not impact head positioning), power friendly (operate for hours), and allow the soldier to changing firing positions (prone, kneeling, supported, standing) or orientation (and maintain AR acuity). System must also be easily appended to a host weapon platform (MK-19, M203/320, and XM25).

The augmented reality system should be able to:

- Couple with LOMAH to enhance visual shot placement representations
- Provide visual cues of where rounds are going/landed (MK-19, XM-25)
- Simulate other than daylight conditions to expand training effectiveness

Tier 1, Gap #5: Test/Training Common Gaps

- No capability exists to adjust fires through visual verification of blast effects with Non-Line of Sight (NLOS) Direct Fire (DF) weapons
- TESS do not accurately represent weapons due to laser limitations (vegetation, obscurants, inability to lead target, etc)
- TESS do not enable realistic vehicle and dismount RTCA in urban terrain
- Probability of kill (Pk) tables are not dynamically updateable and do not address indirect fires BDA, fly out models, and automated medical casualty assessment
- Vehicle occupants are not impacted as a result of IEDs or indirect fires on vehicles
- Communication kills are not played for damaged radio antennas on platforms

Tier 1, Gap #5: Next Gen MILES Overview

Today

Small Arms Transmitter Module

Transmitter

904 nM

- MILES code
- Ammo type
- Player ID

Detector

- Does not penetrate obscurants (smoke / fog)
- Laser continues past effective range of weapon
- Not eye safe
- Appended detectors

Future

Small Arms Transmitter Module

Transmitter

904 nM
or
1500 nM

- MILES code
- Ammo type
- Player ID
- GPS coordinates

Detector

- Better penetration of obscurants
- Laser continues past effective range of weapon
- Eye Safe
- Integrated detectors
- Cost of 1500 nM is currently prohibitive

Tier 1, Gap #5: Other Potential MILES Enhancements

- **Multiple sensors for system adaptability to atmospheric and distance variations that affect laser detection performance at target**
- **Atmospheric propagation mathematical model embedded in processor**
- **Sensor measurements as input into model**
  - ❑ GPS receiver (weapon position sent as laser data packet and reconciled against target's position – eliminates roll-off)
  - ❑ Altitude (prone, kneeling, standing linked to variations in scintillation index)
  - ❑ Temperature, air pressure, humidity (linked to scintillation index)
  - ❑ µWOM (weapon elevation angle linked to scintillation index)
    - Accelerometers sense trigger/recoil (weapon types can be detected by shock profile)
    - Gyros + magnetometer track angular rifle "jump"
  - ❑ Low light capable CMOS camera (muzzle flash detection + computer vision)
- **Real time processor control of laser modulation and output power in response to sensor measurements**

Tier 1, Gap #6: Orientation Tracking

- **Develop a way of training Non-Line-Of-Site and Line of Sight orientation systems where laser based approaches will not work or are not optimal:**
  - M109A6 SP Paladin, M119A2, 105mm Towed Howitzer, Mortars
  - Small arms, RPGs, Machine guns
  - MK-19, M320/203, and XM25
  - Binoculars / laser designators

- **Supports multiple domains**
  - Live – requires NLOS capability
  - Virtual – DSTS, EST and CFFT
  - Test – Leveraging training communities RTCA solutions
- **Fast slew rate of 60° per second (threshold metric) and a slew rate of 300° per second (objective metric)**
- **Allow use of actual weapon**
- **No initialization or calibration for the sensor**
- **Low cost - less than $2000 per unit.**

Tier 1, Gap #6: Weapon Tracking/Orientation – Virtual Use Cases

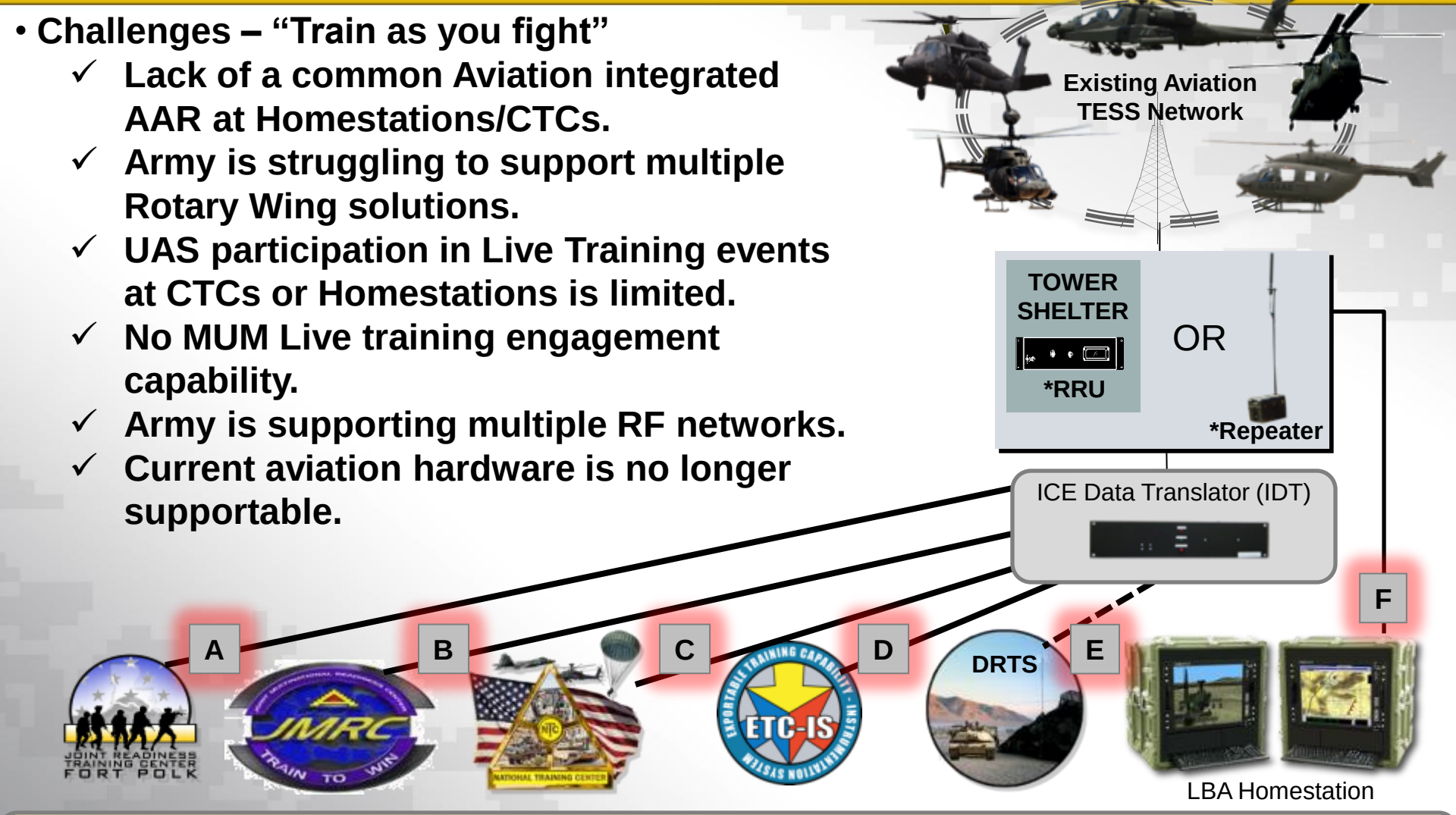
DSTS

EST

CFFT/JTAC

Tier 1, Gap #7: Existing Aviation TESS Architecture

- Challenges – "Train as you fight"
  - ✓ Lack of a common Aviation integrated AAR at Homestations/CTCs.
  - ✓ Army is struggling to support multiple Rotary Wing solutions.
  - ✓ UAS participation in Live Training events at CTCs or Homestations is limited.
  - ✓ No MUM Live training engagement capability.
  - ✓ Army is supporting multiple RF networks.
  - ✓ Current aviation hardware is no longer supportable.

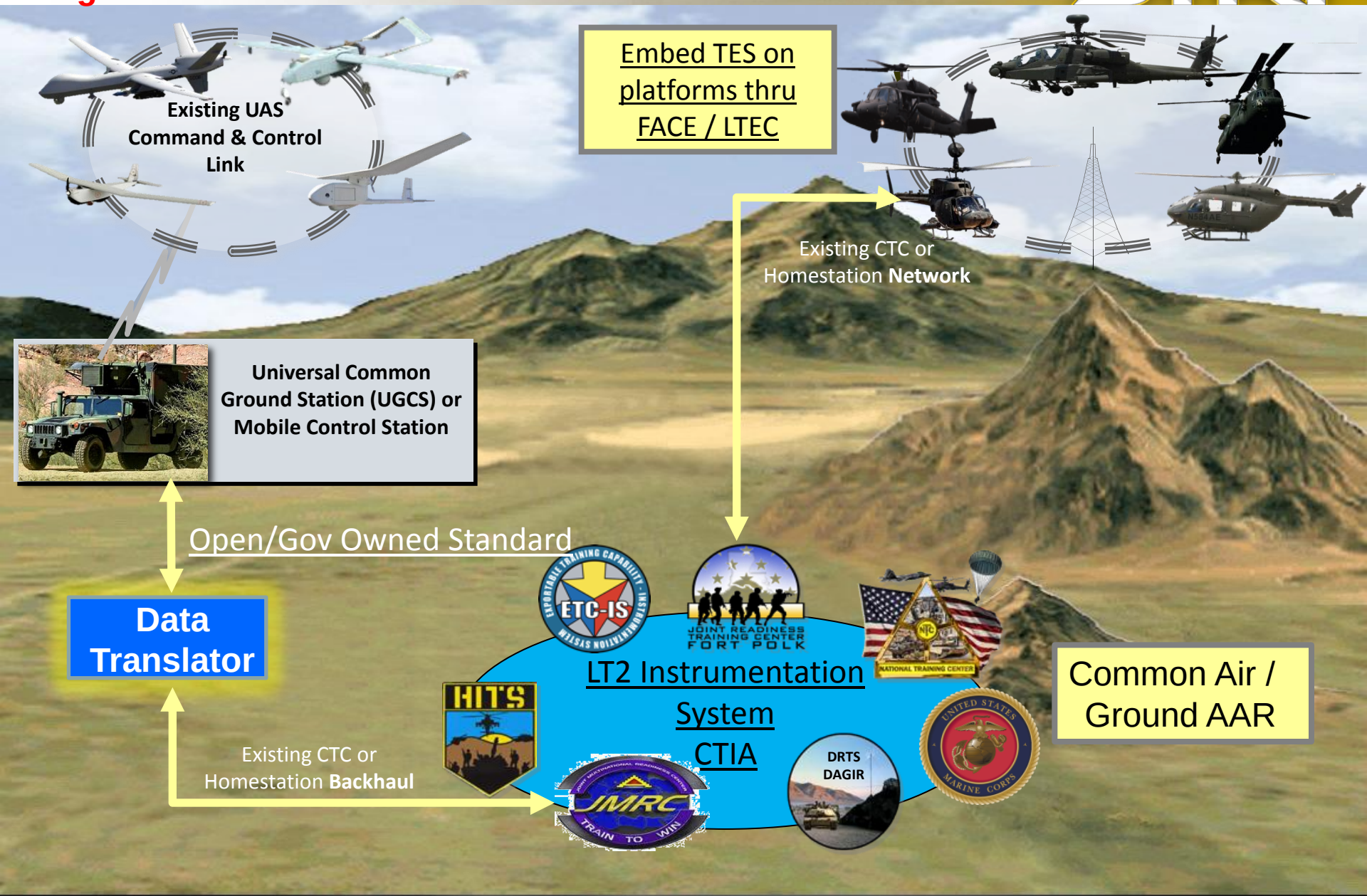


UAS Integration is key in order to "Train As You Fight"

Tier 1, Gap #7: UAS-TESS Proposed Architecture

Tier 1, Gap #7: Aviation Live Training

Long Term Vision



Tier 2, Gap #2: Embedded Training "Initiatives and Opportunities"

11 Dec 2006 Bolton Memo → AR 70 - 1 AR 350 - 38 → PEO STRI is the acquisition authority for all Army TADSS

Ground Vehicles | **Mission Command** | **Aviation** | **Dismount** | **Counter Mobility**

Army Common Operating Environment (COE)

Live, Virtual, Constructive (LVC) Integrated Training Environment (ITE)

Training Standards/Architecture

- VICTORY
- Common Embedded Training System (CETS)
- GCV (ET is KPP)
- Common Vehicle Architecture Description
- LTEC
- Multifunction Vehicle Port Interface Standard
- Virtual Gunnery Trainers
- Virtual Driver Trainers
- AGTS/CCTT (ACSL/BCSL)
- Maintenance Training

- SIMCI
- Tactical Radios for Training
- Sim enabled CP CE
- Intel

- FACE
- Aviation TESS
- AVCATT

- Integrated Soldier Power and Data System TESS
- Nett Warrior/DSTS

- Needed capability at Homestation, CTC's

Training community needs to work together to develop common strategies for implementing ET/MR

Tier 2, Gap #2: Embedded Training VICTORY: Why Should You Care?

Why Should Training Community Care?

- PEO GCS: "VICTORY will be called out in all future ground vehicle acquisitions and ECP's"
- Recent Bradley and Stryker acquisitions have already called out VICTORY compliance
- VICTORY is a critical enabler for Army Common Operating Environment
- Vehicle community very active in developing architecture and specifications
  - Updated architecture and specification released 2x annually
  - 200+ working group members – typically 100+ at quarterly meetings
- Training TRADOC Capability Managers actively involved
- Fielding of VICTORY enabled vehicles could reduce cost of training systems ***IF*** training is addressed in future releases of VICTORY architecture and specification

Training to be included in October 2014 release of VICTORY spec

Tier 2, Gap #3: Training/Simulation as a Service (TaaS/SaaS)

What if we could:

- Offer Training and Simulation capabilities *"On Demand" in Operational and M&S environments?*
  - *Provide access to M&S capabilities anywhere, anytime*
  - *Reduce setup and configuration lead time for events*
- Develop, Field and Maintain Apps to small numbers of facilities?
  - *Reduce Army total cost of ownership for hardware/software*
  - *Increase agility and concurrency of training to Soldier*
  - *Push thin/zero clients to soldiers/users at appropriate echelon/interface device*
- Increase utilization of exercise support personnel?
  - *Reduce personnel resources*
  - *Wide Access to World Class Trainers and Role Players*

How?

- *Leverage Cloud Computing, Virtualization and Service Oriented Architecture (SOA) technologies*
- Live:
  - *Provide exercise support tools, support personnel, and constructive wrap for homestation and CTC exercises from Army/Regional Training data centers*
- Virtual:
  - *Provide exercise support tools, support personnel, and SAF from Army/Regional Training data centers*
- Constructive:
  - *Leverage tactical cloud implementations for mission planning/rehearsal, running estimates/commander's decision aids, and embedded training*
  - *Widely accessible validated simulation and exercise support tools for M&S uses*

Tier 2 Gap #4
Threat EW/ISR Capability Gaps

Airborne threat jamming

- Threat COMS and radar electronic attack on airborne platforms
  - Locate, maneuver to and jam COMS and Radar RF signals including GPS and SATCOM transmissions from space.
  - Provide optimum “high ground” location for attack and capability of rapid re-location and movement
- Satellite-to-Satellite threat jamming
- Threat radar jamming models
- Enhanced UAV payloads threat models - Jamming and direction finding (DF)

Tier 2 Gap #5
Integration of Unmanned Systems

- Currently unmanned/unattended systems not well integrated or represented within LVCG training environments
  - *Unmanned Air/Ground systems*
  - *Unattended sensors/munitions*
- Live: Ability to integrate live unmanned systems in Force on Force and Force on Target Training environments
  - *Tracking and data collection*
  - *Instrumentation and adjudication of engagements*
  - *Weapons effects*
  - *Dual use of tactical systems/sensors*
  - *Integration with unmanned system controllers*
  - *Impacts to unmanned system size/weight/power*
  - *Leveraging existing player units for integration with training infrastructure*
  - *Safety and Security considerations*
- Virtual/Constructive:
  - *Entity models within SAF with appropriate behaviors*
  - *Physical representation within manned modules with appropriate user interface*
  - *Integration of unmanned systems controllers with virtual environment*