

Joint Service Partnership: Extending the Live Training Transformation Product Line

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ABSTRACT

In concert with the Marine Corps Training Modeling and Simulation Master Plan and as part of the Range Modernization and Transformation (RM/T) programs, there exists a requirement to support the Live, Virtual, and Constructive (LVC) Training Environment within the synthetic battlefield that combines LVC training tools through collaborative interoperability techniques. RM/T is a live training Family-of-systems which supports Planning, Situational Awareness, Exercise Control, and After Action Review capabilities. However, due to system complexity, various acquisition strategies have produced stove-pipe systems with duplicative capabilities. As a result, the overall live training acquisition total-life cycle budget and schedule has been costly.

An architectural framework analysis was conducted to determine the feasibility of implementing a developmental solution versus reuse of other service capabilities. The analysis determined that the Marine Corps should leverage the Army's Live Training Transformation (LT2) product line based on the Common Training Instrumentation Architecture. As a result, the Army's Project Manager Training Device and Marine Corps Program Manager Training Systems - Live Training Systems formally signed a Program Level Agreement to establish an LT2 product line partnership to support synergistic development of Marine Corps RM/T programs. The goal of this partnership is to promote service acquisition total-life cycle cost savings across Marine Corps RM/T and Army LT2 programs by; 1) promoting joint interoperability, 2) implementing architectural standardization, and 3) maximizing reusability and commonality of existing LT2 product line components.

This paper will address the details of the architectural analysis, and the factors that guided the development of the Marine Corps Instrumentation Training System (MC-ITS) program as the first Marine Corps LT2 product integrated use case. The MC-ITS program will provide the basis for extending LT2 reuse to other Marine Corps live training programs, and expanding the current Army LT2 capabilities to further enhance the LT2 Consolidated Product Line Management strategy.

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INTRODUCTION

A range of live training tools and simulation capabilities is available to train Marines at all echelons of command. However, utilization of existing live training systems is ad hoc and problematic as the operating forces and training commands struggle with operational commitments and other training requirements. These challenges have hindered the opportunity and ability to integrate live training systems within the mainstream of unit-level and formal institutional training plans. The acceptance and use of existing training simulation capabilities is inconsistent and redundant across the Marine Corps, and numerous shortcomings (U.S. Marine Corps, 2007) exist with the manner in which the Marine Corps has sought to implement live training systems as a key component of comprehensive training plans.

Challenges

Existing live training simulation capabilities have not always adequately met the needs of operating forces and supporting establishments. Infrastructure and interoperability requirements and resource demands have resulted in selected fielding of live training systems to fixed locations which have constrained availability, adaptability, and responsiveness to the operating forces.

The Marine Corps Training Modeling and Simulation Master Plan explains that current capabilities associated with live training in support of ground and air command and control training exhibit the following limitations (U.S. Marine Corps, 2007):

- Distributed Joint and combined training opportunities involving different capabilities are constrained by resources and technology.
- Capability integration missing defined interfaces and interoperability standards

- Acquisition total-life cycle budget and schedule is too costly.

Strategy

This paper will outline a joint architectural and product line strategy for integrating live training instrumentation systems across the combined Marine Corps and Army ground-training continuum and achieve the end-state range instrumentation training use case within two years. As depicted in the following sections, this strategy employs an architectural analysis, various levels of reuse planning and development, and joint service collaboration.

MARINE CORPS LIVE TRAINING BACKGROUND

Marine Corps ranges are established to support force-on-target and force-on-force live training. While the primary purpose of the range is to support live service unit training, Marine Corps ranges need to be able to participate in national joint training as required by the DoD Training Transformation Implementation Plan (OSD, 2004). Marine Corps ranges should also be able to support national experimentations on new war fighting technologies and operational concepts.

Range Modernization/Transformation

The Range Modernization/Transformation (RM/T) capability is a family-of-systems which provides Situational Awareness on trainee performance to evaluators during distributed range training operations. Figure 1 illustrates the high level operational concept for the Marine Corps RM/T Range Investment Strategy (Kelley, 2008).

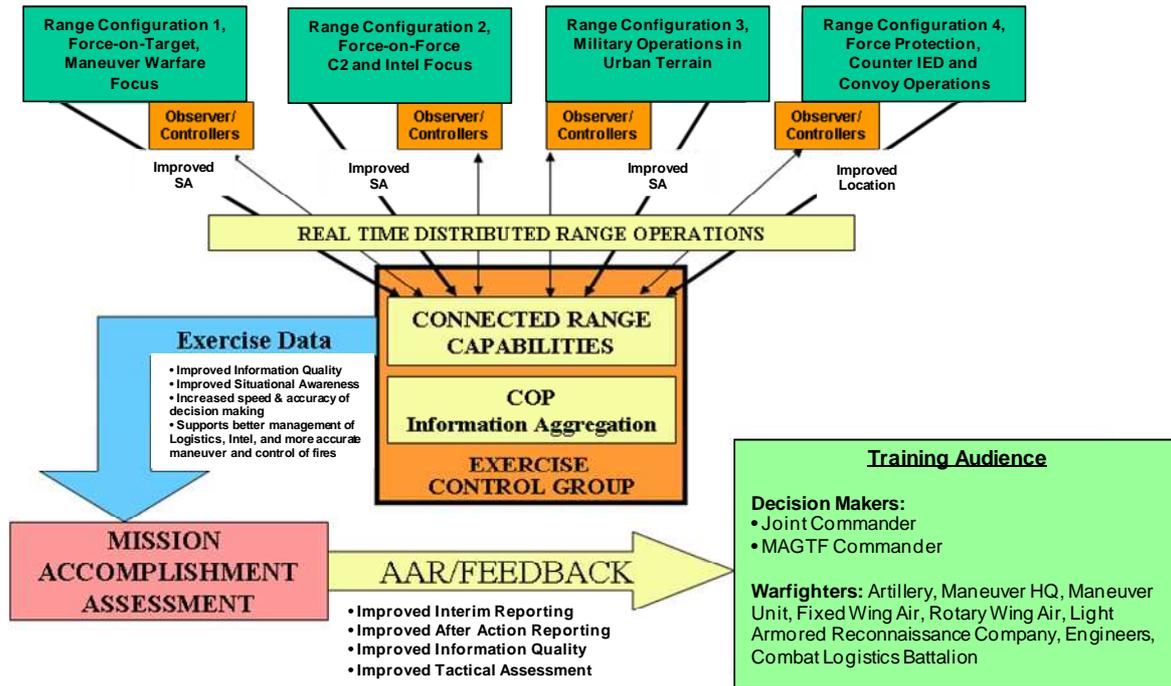


Figure 1. RM/T High Level Operational Concept

The RM/T will modernize Marine Corps training ranges by evolving them to a training environment that is compliant with a *common* training architecture that allows LVC training systems to interoperate, thereby increasing Marine Corps training capabilities and achieving the Office of the Secretary of Defense’s “Training Transformation” goals to support both Service and Joint training (OSD, 2004). Furthermore, RM/T will enable Marines to train more effectively by supporting near real-time adjudication of engagements during force-on-force training. It will also provide near real-time interaction between Marines and Computer Generated Forces (CGFs). Both force-on-force and live-fire training will make use of targets with instrumentation and CGFs.

Range Instrumentation Systems

Range Instrumentation Systems (RIS) is a subset of RM/T family-of-systems that enable Marines to realistically interact with each other, targets, and CGFs during both force-on-force and live-fire (force-on-target) exercises. Unique Marine Corps capabilities include employment concepts, the Marine Air Ground Training Facility (MAGTF) organization, and Marine Corps-specific organic weapons. Marine Corps training requirements include ground-to-ground direct fire using Tactical Engagement Simulation Systems (TESS) or CGFs. Ground-to-ground indirect fire and area weapons training requirements allow Marines,

weapon systems, and vehicles to engage targets through RIS with indirect fire being generated by indirect weapons systems, surrogate instrumented weapons or computer generated indirect fired weapons. Also, air-to-ground fixed and rotary wing aircraft have to be tracked.

The RIS also supports ground-to-air, air-to-air and surface-to-ground engagements. The RIS supports force-on-force and live-fire training using instrumented Marines and weapon systems. The system must adjudicate, record, and disseminate engagement results, enable position and casualty tracking, and support centralized exercise control and monitoring. The RIS will eventually support automated interactive targetry, CGF, and provide AAR capability.

RIS ARCHITECTURE FRAMEWORK ANALYSIS

The purpose of the RIS architecture framework analysis is to identify the training capabilities that affect the RIS Product Line Architectural Framework (PLAF) and to develop strategies for accommodating these capabilities in the PLAF. These influencing capabilities fall into three categories:

1. Organizational capabilities that constrain the design choices

2. Technological capabilities that are embedded or embodied in the product
3. Product capabilities that include functional features and qualities of the product

Typical Marine Corps training capabilities are summarized in figure 2 (U.S. Marine Corps, 2006; U.S. Marine Corps, 2007).

Organizational Capabilities	Technological Capabilities	Product Capabilities
<ul style="list-style-type: none"> • Management • Training process and development environment • Training development schedule • Training development budget 	<ul style="list-style-type: none"> • Hardware • Software • Architecture • Communications • Networks 	<ul style="list-style-type: none"> • Functional features • User and system interfaces • Performance and dependability • Security • Product cost

Figure 2. Categories of Influencing Capabilities

The architecture framework analysis was conducted in two phases:

1. Capability requirements analysis to identify needed capabilities

2. Capability reuse analysis for accommodating needed capabilities identified in Phase 1

The results of the architecture framework analysis will characterize the important influencing capabilities and developed strategies for ensuring buildability, implementation, and changeability of the RIS PLAF.

Phase 1: Capability Requirements Analysis

In April 2008, PM TRASYS hosted a user conference at the MCAGCC to analyze and identify user requirements and training gaps in the live training environment. The outcome of the conference was a set of new warfighter training requirements summarized in figure 3. The conference identified five functional capability areas which further categorized the requirements: Scenario Design, Concept of Operations Master Scenario Event List Management, Exercise Control, Assessment, and After Action Review Generation.

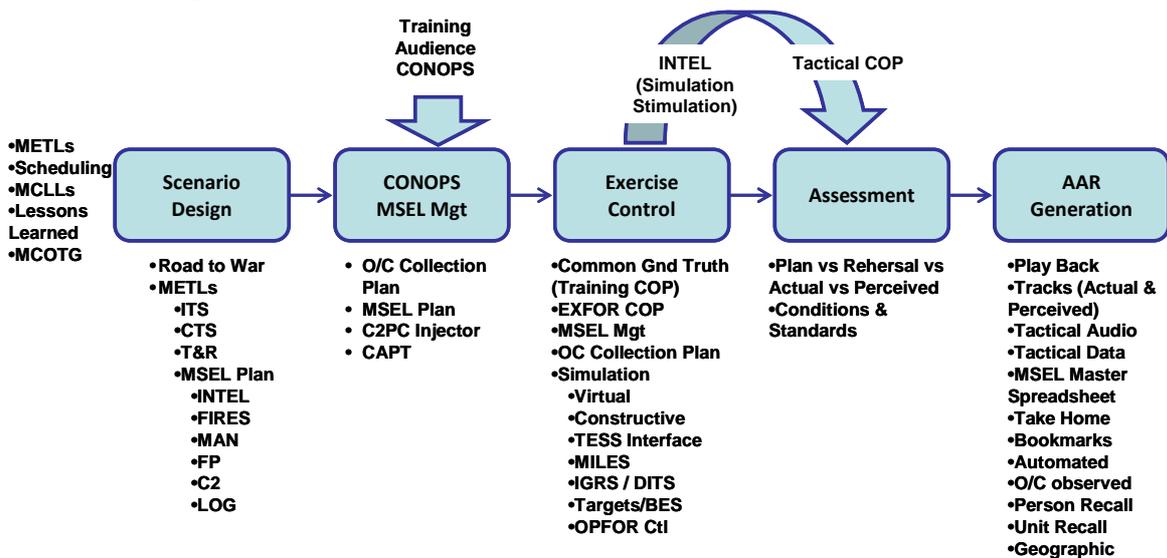


Figure 3. User Requirement

The new warfighter training requirements identified in the five functional capability areas were consolidated with the Range Instrumentation System (RIS) Operational Requirements Document Key Performance Parameters and used as the basis for the capability requirements analysis. The analysis was conducted to identify important capabilities needed in the RIS PLAF, and determine the feasibility of implementing a new developmental solution or investigating reuse of the Army's LT2 Product Line and CTIA.

Live Training Transformation (LT2) Product Line

The Live Training Transformation (LT2) Product Line program is a Family of Training Systems (FTS) which integrates the Army's operational requirements for live training (Dumanoir, 2005). The LT2 Product Line is designed and developed to comply with the Common Training Instrumentation Architecture (CTIA). LT2 systems use CTIA-compliant, common, reusable assets (software, hardware and data) to "compose" and implement Objective Instrumentation Systems at Marine Corps Training Centers and Homestations. The common components include standard interfaces to

virtual and constructive simulation systems, tactical command and control systems, targetry systems that require interoperability with LT2 systems, and training information systems.

Common Training Instrumentation Architecture (CTIA)

The CTIA was developed to support the LT2 product line and to establish the standards, interfaces and protocols that are the foundation upon which to build the family of composable, fully integrated LT2 training systems. Through the CTIA, LT2 systems support the integration of new technologies over time that is essential for maintaining training system relevance and train objective force units to effectively employ the force-multiplier capabilities of the advanced digital technologies being fielded in the coming years (U.S. Army, 2009).

The CTIA defines the framework for the design and development of common, reusable components that establish essential commonality across the family of LT2 systems. The common architecture design assures that LT2 products have the flexibility needed to support the transformation of live training systems and produce substantial reductions in Operations and Maintenance costs.

The capability requirements analysis process included mapping (tracing) the Marine Corps RIS Operational Requirements Document (U.S. Marine Corps, 1999), 2008 User Conference requirements, and RM/T FoS Capabilities Integration Document (Kelley, 2008) to the Army LT2/CTIA Domain Requirements Set. The one-to-one, or in some cases one-to-many, mapping discovered that the Army capabilities provided over 87% of the Marine Corps RIS Operational Requirements Document requirements. The remaining 13% were related directly to Marine Corps specific organizations, training systems and unique C2 systems (U.S. Marine Corps, 2006). Furthermore, it was determined that the User Conference requirements were also provided by the CTIA/LT2 domain. Figure 4 illustrates how the MC-ITS System/Subsystem Specification (SSS) traces back to RIS Operational Requirements Document through the CTIA/LT2 domain requirements.

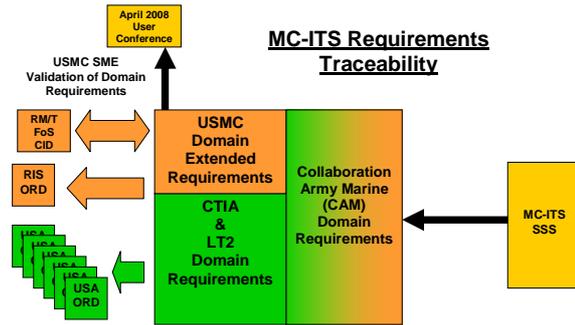


Figure 4. MC-ITS Requirements Traceability

Phase 2: Capability Reuse Analysis

The first MC-ITS increment leveraged the mobile Army Homestation Instrumentation Training System (HITS) Company set capability baseline approximating an 87% out of the box reuse solution of LT2 software, hardware, and documentation assets (released in May 2009). Also, shown in figure 5, three components were modified and two new components were added to the product line.

MC-ITS Increment 1	LT2 Product Line Components		Component Type	
Reuse As-Is	33	87%	CTIA Services AssetDB 2D Map 3D Viewer	GUI Framework Common PU Gateway After Action Review Event Log
Modify	3	8%	Common PU GC Message Service Common PU Controller Entity Commander	
New (Marine Corps-specific)	2	5%	Common PU IGRS Gateway IED Support Tool	
Increment 1 Total	38	100%		

Figure 5. MC-ITS Increment 1 LT2 Reusability Matrix

The increment release was extended to include the remaining 13% of Marine Corps-specific capability requirements in support of company level training at ranges such as Twentynine Palms in FY09. For example, specific player unit technologies and range infrastructure (i.e. integrated GPS radio system communications) will be integrated with the current LT2 common player unit gateway and controller components. These specific Marine Corps player unit technologies which include the Marine Corps Training Improvised Explosive Device and Training Counter Radio Electronic Warfare (TCREW) surrogate jammer are instrumentation solutions required to support Improvised Explosive Device (IED) and Convoy training. The final MC-ITS solution will provide basis for extending reuse to other Marine Corps live training programs. Future live training capabilities introduced

by the Marine Corps will also result in opportunistic reuse for the Army live training systems.

The combined capability requirements and reuse phases of the Architectural Framework Analysis determined that the core infrastructure assets could be implemented using standard LT2 core components with minimal

changes. Only one CTIA architecture change was required to support the initial MC-ITS Company Set capability. Figure 6 illustrates the Product Line Architecture Framework infrastructure and components which MC-ITS directly reuses.

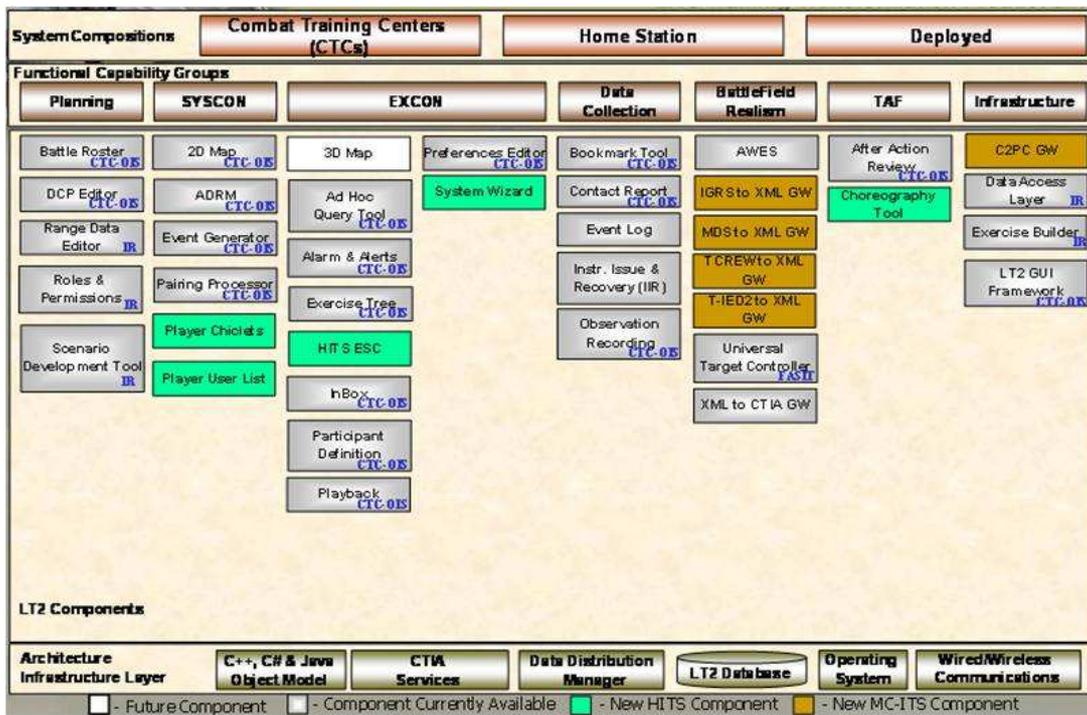


Figure 6. MC-ITS Product Line Architectural Framework

Result of Architecture Framework Analysis

Both phases of the architecture framework analysis showed that adopting an available, reusable, and extendable architecture would be beneficial in supporting Marine Corps live instrumented training objectives. Also, it was determined by the architecture framework analysis that starting from scratch to develop a new architecture would be too costly and time consuming to implement. The Army had invested significant resources on the development of LT2/CTIA and the technology was mature.

Reusing the LT2/CTIA would reduce the overall Marine Corps acquisition costs by two-thirds, and fielding schedule by three years. Thus, the decision was made to leverage the Army's Live Training Transformation (LT2) product line based on the Common Training Instrumentation Architecture

(CTIA). The effort resulted in the Marine Corps Instrumented Training System (MC-ITS) program built upon the LT2 Family of Training Systems framework.

Joint Service Partnership

The Program Manager Training Device (PM TRADE) and Assistant Program Manager – Live Training Systems (PM TRASYS APM-Live) formally signed a Program Level Agreement (PLA) to establish a Live Training Transformation (LT2) product line partnership and support synergistic development efforts for the Marine Corps Range Modernization/Transformation (RM/T) programs. The goal of this partnership is to promote joint interoperability and maximize reusability of existing LT2 product line components to reduce acquisition costs and risks associated with PM TRASYS Range Instrumentation Systems (RIS).

The PLA establishes PM TRASYS as a major stakeholder in the LT2 strategy to develop a live training range product line centered on common architectures (i.e. Common Training Instrumentation Architecture (CTIA)) and standards evolution (Samper, 2007). PM TRASYS has committed to reuse of the CTIA architecture and will ensure the integrity and maintenance of the LT2 product line used in the development of their systems starting with the first LT2 delivery of MC-ITS to Twentynine Palms site in FY09.

The MC-ITS program shall provide the basis for extending LT2 reuse to other Marine live training programs and extend the current LT2 capabilities available to the future LT2 Consolidated Product Line Management strategy that will consolidate product line development and sustainment efforts for the LT2 Family of Training Systems (LT2-FTS) (U.S. Army, 2008). As part of the PLA the Collaboration Army Marine (CAM) IPT has been established. This forum supports collaboration efforts with existing products that can be mined for new assets that either service can leverage.

MARINE CORPS INSTRUMENTED TRAINING SYSTEM (MC-ITS)

The MC-ITS represents the solution set for implementing the Marine Corps LT2 Product Line Architectural Framework (PLAF) strategy. Based on

the architecture framework analysis results, a MC-ITS requirements crosswalk was performed against existing LT2 component and product capabilities located within the LT2 portal and funded for future development. By reuse of the existing LT2 common components developed to CTIA standards (Rivera, 2008), a MC-ITS product roadmap will be created to support evolutionary and incremental acquisition. This methodology will achieve cost avoidance through planned modular reuse resulting in Joint synergistic capabilities between Army and Marine Corps development efforts and reduction in total ownership costs for the MC-ITS program.

The MC-ITS is a training system that provides a high-fidelity deployable instrumented training capability to support platoon thru battalion-level live force-on-force and force-on-target training. Figure 7 is a graphic depiction of the threshold Company Set configuration being fielded to the MCAGCC in August 2009. The system tracks locations of soldiers and vehicles and simulates weapons effects and engagements, allowing units to “train as they fight” against living opponents and targets. Accurate feedback in the form of an After Action Review is provided to training units. The Mobile Company Set consists of light deployable components that can be rapidly assemble/disassembled and transported to support deployed training.

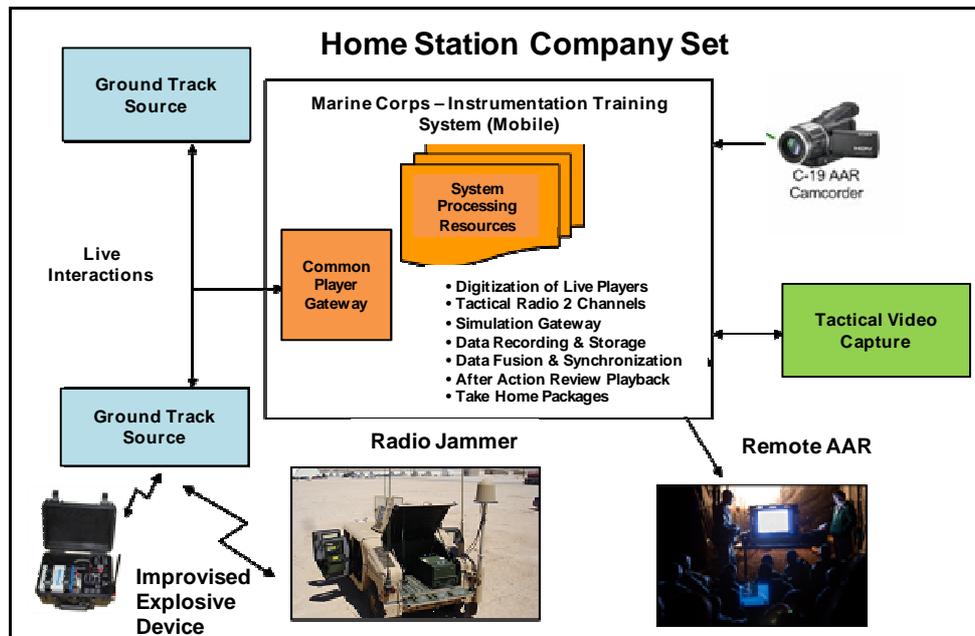


Figure 7. MC-ITS Company Set Configuration

The MC-ITS is scalable and can track up to 2000 live and 8000 constructive participants within a 20Km x 20Km training area. MC-ITS instrumentation can integrate with current and emerging Range Instrumentation Systems. MC-ITS can interoperate with various Constructive and Virtual simulations as well as the Test and Training Enabling Network Architecture (TENA). The hardware footprint ranges from a laptop (up to 300 entities) with basic Battle Tracking and AAR to a portable rack for Battalion set. The system is Microsoft-based thus the user interface is well-known to most warfighters, and requires only a few hours of training to operate.

MC-ITS Implementation Strategy

The MC-ITS will be used primarily during Battalion/Taskforce and below live combined arms force-on-force and force-on-target training exercises and test events, and deployed training sites. It will collect data in support of simulating the effects of actual weapons systems, munitions, countermeasures, counter-countermeasures, simulating of weapon effects experienced during live training, and testing in a comprehensive LVC Training Environment. The MC-ITS program is being developed from the defined LT2 Family of Training Systems which will re-use existing software assets from Common Training Instrumentation Architecture (CTIA) and LT2 programs following an LT2 product line development strategy.

The MC-ITS starting baseline will leverage the Army's complete Homestation Instrumentation System (HITS) Company Set capabilities. The initial fielding will integrate the Integrated GPS Radio System (IGRS), Training Counter Radio Electronic Warfare, Marine Corps Training Improvised Explosive Device, and Tactical Video Capture System with the core capabilities provided by reusing the Army's HITS. The IGRS based player unit integration approach utilizes the LT2 Common Player Unit Interface Control Document which defines the standard message set using XML-based protocols between multiple player unit networks, Tactical Engagement Simulation Systems to include Multiple Integrated Laser Engagement System programs, and the CTIA architecture. This standard Interface Control Document provides basis for an XML-defined two-way guard cross domain solution linking the existing Army unclassified player unit networks with the classified LT2 live training systems which includes the MC-ITS program. MC-ITS and IGRS will both be radio agnostic and interoperable. Future goals will include synchronizing common architecture and component baselines for both programs. For example, the Marine

Corps Tactical Video Capture System will be integrated using the CTIA video Service Oriented Architecture Interface Control Document approach which will maximize reuse across visualization programs.

MC-ITS Governance Strategy

PM TRASYS program representatives from both Government and Industry will participate within the established LT2 organizational structure and processes specified by the LT2 Concept of Operations (U.S. Army, 2006). The two primary working groups include the Common Component Working Group (CCWG), and Architecture Working Group (AWG). The goal of the Common Component Working Group is to oversee the development and foster the evolution of LT2 components that can be used by multiple programs as-is, or with modifications. The CCWG meets weekly to review common component issues. Responsibilities of the CCWG include:

- Review all changes for merit and component or program impacts
- Maintain the list of LT2 Product Components that have been designated as LT2 Common Components
- Define and maintain the LT2 PLAF view as well as all common components included in LT2 product views on the LT2 Portal
- Maintain the Component Agreement template and update as necessary
- Help resolve development issues submitted by the LT2 component developers
- De-conflict LT2 Common Component issues
- Review common component program trouble reports (PTRs) that may impact external software interfaces
- Monitor the LT2 Programs for component development effort against the schedule posted on the LT2 Portal
- Monitor the CTIA technical effort.

Architecture issues come from the domain and product team requirements analysis, design, and integration and test. The Architecture Change Board (ACB) prioritizes these issues. The ACB determines the priority of issues and in what spiral they should be worked. In addition, the ACB can elect to fast track trivial issues. The Architecture Working Group is the team that works the issue and creates the Architecture Change Package (ACP). The AWG assigns a task team to work the issues. The task team creates an overview package that is reviewed and approved by the AWG. The overview is the high level concept for fixing the issue and is a

subset of the full ACP. Once the overview is approved, the task team creates the full ACP and conducts a Peer Review of the package. Issues from the Peer Review are resolved and incorporated in the package to create the final ACP.

The MC-ITS program LT2 product line architectural framework shown in figure 6 above denotes the planned reuse approach for composing the LT2 common components compliant with CTIA. The instantiation of the MC-ITS product includes CTIA infrastructure services, as-is component reuse, modified components, and introduction of new components to the product line.

MC-ITS Incremental Development Strategy

The MC-ITS Integrated Product Team has looked at several other existing LT2 artifacts and products for potential reuse. In fact, several LT2 HITS artifacts such as the test procedures, software user’s manual, and information assurance documentation have been reused. A prime example of LT2 product reuse is the Army Data Collection Plan Editor component. The MC-ITS team performed an analysis of using this component to build an Exercise collection plan. Also, the team is investigating the use of automated planning tools to provide initial Master Scenario Event List planning data to MC-ITS. A Build Plan has been identified to manage the timely integration of new software capabilities and interfaces. Figure 8 highlights the planned integration efforts to system developmental integration spirals.

SPIRAL 1			SPIRAL 2		
Drop 1	Drop 2	Drop 3	Drop 4	Drop 5	Drop 6
HITS Baseline	Record & Display Operational Status	TIED Mapping	DITS (II)	Exercise AAR & Playback	Collaboration Environment
Automated MILES Check Out & Check In	PLI	Add 2D Map T-CREW2 Code & Modeling	TVCS	Debriefing Material Presentation	Operational Planning Toolset Interface
	T-CREW2 & MC-TIED SA	CTIA Infrastructure Support	HLA	AV Time Sync & Control	Support Exercise Scenario Design
	IGRS	DITS (I)	JCATS	GUI Development & Enhancement	C2PC Interface
	New LT2 Common Player Gateway	DIS Support	TACS	Integrate Map Playback	
	• Company Set HW			TACS, IRSS, MDS	
	• IGRS BS Kit			Visualization	
	• AAR Kit			CAPT & Ripple	
			• Fixed Site HW		

Figure 8. MC-ITS Incremental Software Build Plan

System design documentation is being prepared incrementally in concert with the delivery of common and unique components leading to end state deployment at Twentynine Palms. Figure 9 is a notional depiction of the MC-ITS incremental development life-cycle. System level design was reviewed early in the life-cycle at the System

Requirements Review (SRR) and System Design Review (SDR). Each spiral of incremental development includes three In Process Reviews (IPR) and software drops. Each IPR is similar to a combined System Requirements Review, Preliminary Design Review, and Critical Design Review covering the near term design. Each IPR has entry and exit criteria related to the development and design artifacts are reviewed.

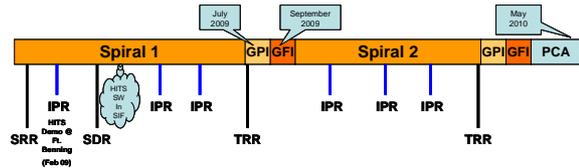


Figure 9. MC-ITS Incremental Development Lifecycle

The MC-ITS testing methodology and strategy is defined in the Software Test Plan. The strategy is to conduct Functional Configuration Audits that include both developmental testing and an operational demonstration. Formal testing will not begin until a Test Readiness Review (TRR) with entry and exit criteria as been conducted. Software Spiral One is Developmental Testing with the Government Preliminary Inspection in the PM TRASYS System Integration Facility.

Government Final Inspection will be conducted on-site at Twentynine Palms. Software Spiral Two will a combined Developmental and Operational Test. The Government Preliminary Inspection will be conducted in the PM TRASYS System Integration Facility and the Government Final Inspection will be conducted on-site at Twentynine Palms. Prior to formally accepting the system, a Physical Configuration Audit will be conducted at the vendor facility.

MC-ITS Future Capabilities

Future Marine Corps capabilities will include the reuse of LT2 Future Army System of Integrated Targets (FASIT) architecture and standard Interface Control Documents to integrate existing obsolete deployed Remote Engagement Target System (RETS), and Battlefield Effects Simulations. RETS is a standard Army computer controlled target system modified to meet Marine Corps requirements. Reusable components include: Armor Moving Target Carrier, Pop-Up Targets, Portable Infantry Target Systems, and Target Holding Mechanism for Tank Gunnery.

Battlefield Effects System devices are used in live and non-live fire training environment to provide a more realistic OPFOR threat. Battlefield Effect Systems includes pyrotechnic blasts, visual signatures, sound effects simulation, and gunfire simulation. Reusable components include: Black Smoke generator, Hostile (artillery) Fire and Target Kill Simulator, Small Arms Gunfire Noise Simulator, Tank Gunfire Simulator, and Surfaces-to-air Signature Launcher Simulator. Furthermore, the MC-ITS team will investigate potential reuse of software programmable radios such

as the Joint Tactical Radio System as a future instrumentation reuse capability.

End-state Use Case

The Marine Corps Air Ground Combat Center (MCAGCC), Twenty-nine Palms, CA Mojave Viper live range instrumentation use case is supported by several systems. Figure 10 depicts the components deployed or planned for deployment.

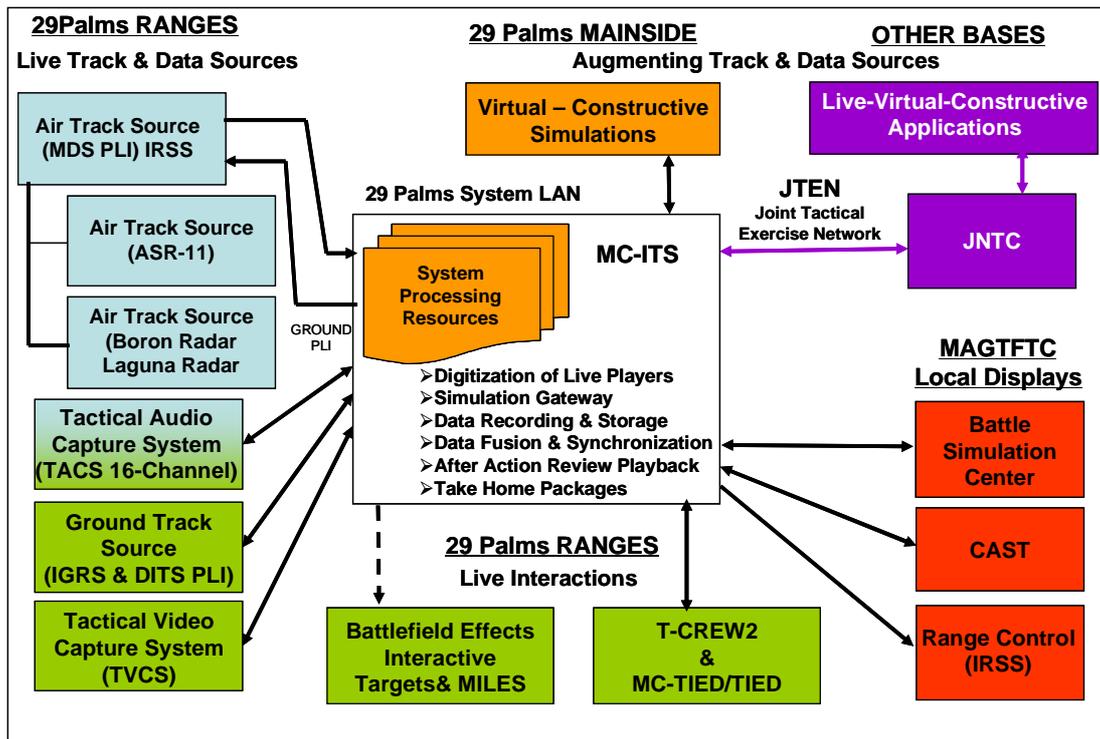


Figure 10. MCAGCC RM/T Use Case

MC-ITS will provide live training instrumentation capabilities and connect to Virtual and Constructive simulations, Battlefield Effects, and Interactive Targets. Using MC-ITS, the range will be capable of using the Joint Training and Experimentation Network (JTEN) to interoperate with remote sites and Joint exercises. Other use cases unique to the Marine Corps include counter IEDs and target training. These capabilities will be available in future increments.

SUMMARY AND BENEFITS

The architecture framework analysis identified major Marine Corps warfighter training capability

requirements, and determined that these capabilities could be fulfilled by 87% reuse of existing LT2/CTIA product line. Furthermore, the analysis provided evidence of potential Army leverage of Marine Corps capabilities. As a result, the Marine Corps and the Army have adopted the LT2 strategy and collaboration effort between PM TRADE and PM TRASYS to derive a new live training product line from existing LT2 programs for the development of future Marine Corps Live Training Systems. Proposed objectives that have been met included the following:

- Development of Program Level Agreement that aligns Army and Marine Live Training Program efforts relative to organization structure, development processes, and

Consolidated Product Line Management (CPM) strategy.

- Collaboration on development and sustainment of core software assets common to both organizations based on adoption of LT2 Concept of Operations.
- Participation within the LT2 Integrated Product Team process to foster software reuse, standards evolution and maintain integrity of the combined product lines.
- Collaboration of schedule alignment relative to product fielding between programs to mitigate divergence of the baselines and reduce life cycle support costs.
- Development of an initial Marine Corps LT2 Product Line Architectural Framework (PLAF) strategy beginning with Marine Corps Instrumentation Training System (MC-ITS) proof of concept.

The LT2 Standardization efforts and Consolidated Product Line Management strategy will provide the following benefits for both organizations:

- Single management mechanism to consolidate all LT2-FTS sustainment and enhancement development efforts. Fostering common live training solutions while lowering total ownership life cycle costs across programs while mitigating potential cost, schedule and performance risks
- Consolidation of test resources reduces: overhead, integration and test costs, and information assurance management and certification costs across LT2-FTS.
- Quality of service and products are increased through testing and resolving issues once while deploying common solutions to all programs and training sites.
- Government and Industry work together to establish interoperability and technology insertion standards that foster Government product line evolution and simplify acquisition processes while allowing industry to maintain its competitive edge or business model.

PM TRASYS live training programs will achieve opportunistic and systematic reuse across the LT2 Product Line. Reuse benefits of the product line will be measured in terms of:

- Reduced development costs for LT2 products. A component is developed once and reused across multiple LT2 products.
- Reduced maintenance costs for LT2 products. The product line promotes centralized

maintenance. A problem report or upgrade for a component is made once and can be deployed across the LT2 Product Line.

- Reduce training costs across the product line. If the user interface and tools used across the product line are common, then users can move across ranges without being re-trained. In addition, training products such as exercise planning data or After Action Review (AAR) templates can be reused across ranges.

Going forward, a collaborative Integrated Product Team mechanism will be used for coordinating all funding, contractual, technical, and management matters as related to the development efforts between the two organizations. This allows for a bi-directional product visibility at the appropriate levels. Both organizations will work together to identify common enhancement opportunities and collaborative research and development efforts based on similar training requirements that can be shared across LT2 products benefiting Army and Marine Corps future live training environments.

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