

Correcting The Vision – Introducing The Joint National Training Capability (JNTC) Advanced Training Technology Laboratory (JATTL)

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ABSTRACT

Until recently there has been no real single portal for migration of technology and technical training concepts into a single Joint context. This however, is necessary for the Joint National Training Capability (JNTC) to achieve its mission of “training the Joint warfighter”. This portal is the flagship laboratory for the JNTC network or Joint Training and Experimentation Network (JTEN), known as the JNTC Advanced Training Technology Laboratory (JATTL). This laboratory will act as a lens by concentrating on Research, Development, Test & Evaluation (RDT&E) of technologies, which enhance capabilities in the JNTC technical focus areas (Command, Control, & Intelligence, Surveillance, Reconnaissance (C2 & ISR); Live, Virtual and Constructive (LVC) Environment; Instrumentation, Data Collection and After Action Review (AAR); Opposing Forces; Information/Knowledge Management; Architecture/Standards) while ensuring interoperability, maturity, stability and most importantly relevance for candidate technology under development for use in Service and Joint training environments. The ATT mission is to evolve, enhance and provide tools, processes and products for the JNTC by acting as the technology pipeline in support of joint training for the warfighter. A sustained process using systems engineering and acquisition best practices to identify, evolve, enhance and develop new capabilities that address training requirements, challenges and shortfalls is essential. ATT is and will leverage existing and future Science & Technology (S&T) investments to a maximum extent with Industry, Academia, Government and International organizations. Finally, by taking a holistic approach, the JATTL will assimilate joint standards and architectures to enable a seamless integrated LVC training environment for on demand warfighter use.

This paper will describe the concept for the JATTL and explain the modes and methods for transferring technology and expertise into the JNTC as well as outlining technical challenges that it is focusing on to set new benchmarks.

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INTRODUCTION

Until very recently modeling and simulation in the Department of Defense (DoD) was treated on a service by service basis. This provided numerous challenges concerning interoperability, duplication of effort and most importantly an almost insurmountable issue with provision of a holistic architecture that could support Joint, Combined and Coalition training in a meaningful and consistent way.

There is little doubt that there is a long way to go to truly enable a Joint framework that is supportive of and not disadvantageous to service training requirements. However, the development of the Joint National Training Capability (JNTC) is a significant step in the right direction to influencing the Joint train on the tracks to success.

Facilitation of training under the JNTC has been through consensus of the services with Joint guidance on how their devices and systems plug into the first evolution of the Joint simulation architecture. To enable training transformation however, there is a need to do more than iterate and reuse devices (legacy) that evolved from a truly stove-piped development paradigm. There is a need for a focal point for development of technologies, techniques and concepts that support the Joint warfighter. These technologies, techniques, and concepts require a transformational shift in culture from the exploration stage to in-service operation consistent with the standards, policies and architectures that the JNTC is providing the Department of Defense (DoD) joint training community.

This focal point is the JNTC Advanced Training Technologies Laboratory (JATTL). In particular, the JATTL will be the pipeline that provides JNTC with the technology needed to conduct joint training in a rapidly changing environment by focusing on and understanding implementation of the four pillars of JNTC as identified in the DoD Training

Transformation (T2) Plan – realistic combat training, adaptive and credible opposing forces (OPFOR), common ground truth, and high quality feedback as shown in figure 1. An overarching requirement for the JATTL is to facilitate the development and maturation of foundational technologies and solutions, which make JNTC effective in providing the warfighter an ability to *train as he fights*. The JATTL is a single point of entry for the services to test and evaluate their technologies and concepts in a joint context while keeping their service requirements in tact. The JATTL is a Live, Virtual, and Constructive (LVC) facility that produce substantive new capabilities for the JNTC by enabling Research, Development, Test & Evaluation (RDT&E), integration, certification, and baseline configuration management of new joint training capabilities. This will enable service training whilst preserving a joint context where it makes sense.

USJFCOM

JNTC Pillars and Their Meaning



UNCLASSIFIED

JNTC Pillars and Event Definitions

3/29/2004

Figure 1 – JNTC Four Pillars outlined in Training Transformation (T2) Plan

THE GLASS IS HALF FULL

If we take just a moment to step back and look at the history of simulation in the DoD, it is easy to see that it is a relatively recent one, particularly where distributed simulation is concerned. It is only 15

years since the start of the aggregate level simulation protocol (ALSP) and the delivery of the Army simulation Network (SIMNET). As can be seen in figure 2 there has been a compression of development and activity in the past five years that rivals the previous 10. This is due to many reasons not the least being improvements in software engineering practices, computational power improvements, and a more educated and experienced simulation workforce.

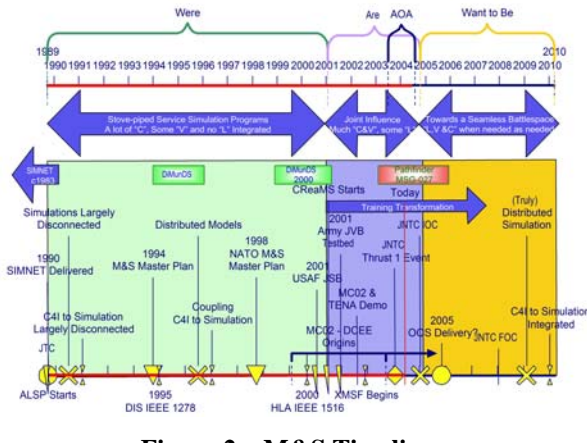


Figure 2 – M&S Timeline

It is emphasized from the outset that there are challenges and shortfalls associated with distributed simulation in all domains. Especially LVC integration on a persistent network nationally, as envisioned initially, and internationally as the JNTC matures and Coalition partners are integrated into the Joint Training & Experimentation Network (JTEN).

It is easy to reflect on experiences such as the Joint Simulations (JSIMS) program and be a little cynical where the concept of holistic approach to simulation is concerned across the DoD. The compelling evidence of what the JNTC is achieving in the months leading to Initial Operating Capability (IOC) is however profound.

JNTC has been progressively building on its experiences to routinely operate nationally with an increasing tempo of events in the coming years (4 pre-IOC events in 2004, ~15 events in 2005, and eventually 40 events by Full Operational Capability (FOC) in 2009). In the past this type of scenario did not readily provide an avenue for Services to interface with the joint community to fuse their ‘good ideas’ amongst the Services, agencies and joint community.

WHY HAVE A JATTL?

As already alluded to, there is a requirement for a focal point for development and integration of joint training technologies. This does not necessarily require that all development and integration be conducted in the one location, rather the JATTL should be considered as the flagship node on the greater JTEN (Figure 3).

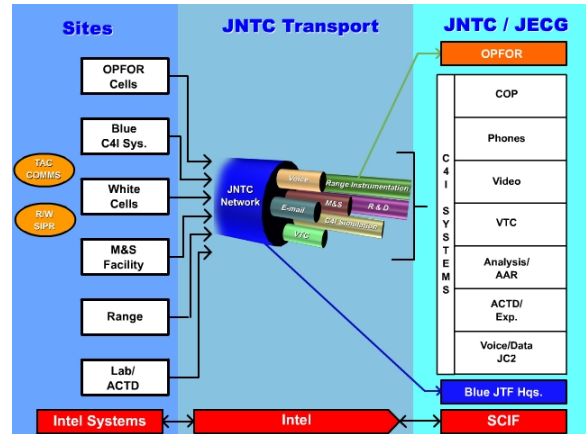


Figure 3 – JTEN Network Concept

This in itself poses a number of significant challenges to ensure that research and development is conducted in an enterprise environment that can adapt to changing circumstances. In a nutshell the JATTL is the vehicle through which the ATT group can achieve its mission of “Evolving, enhancing and providing tools, processes and products for the Joint National Training Capability.” The JNTC Technical Process Action Teams (PATs) have been established in a structure aligning with JNTC technical focus areas that represent the functions necessary to achieve the mission of training the Joint warfighter:

These technical focus areas are:

- Command, Control, Communications, Computers (C4);
- Live, Virtual and Constructive (LVC) Environment;
- Instrumentation, Data Collection and After Action Review (AAR);
- Opposing Forces (OPFOR);
- Information/Knowledge Management;
- Architecture & Standards;

ATT is the function that is unique in that it cuts horizontally through all of the other technical focus areas and provides RDT&E guidance, through the Technical Director of the JNTC, to ensure that direction is maintained in accordance with the technical management plan. There are a number of

well-defined goals that must be achieved to satisfy the ATT mission, these are:

- The efficient execution of core competencies to provide a Research, Development, Test and Evaluation (RDT&E) pipeline in support of joint training for the warfighter.
- The provision of a sustained process using systems engineering and acquisition best practices to identify, evolve, enhance and develop new capabilities that address joint training requirements, challenges and shortfalls.
- Leverage existing and future Science and Technology (S&T) investments with Industry, Academia, Government and International organizations.
- Define and coordinate required Joint “to be” standards and architectures to enable a seamless integrated Live, Virtual and Constructive training environment as rapidly as possible.

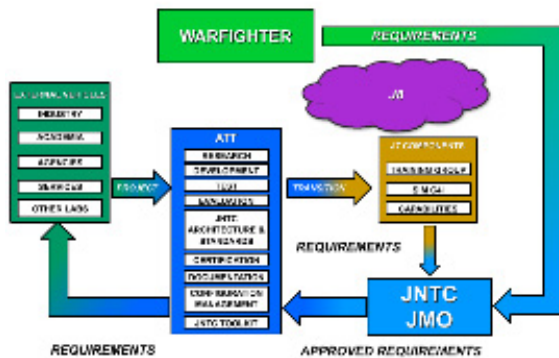


Figure 4 – ATT Relationships in the Requirements Pipeline

POLISHING THE LENS

If we are not going to perpetuate the paradigm of looking backward to go forward then we clearly need a new way of doing business. This requires that rather than perpetuate the method of simulation advancement we look at establishing an evolutionary approach to facilitate the JNTC “as is” architecture development. The evolution of the “as is” architecture will be based on a set of requirements that define the capabilities needed by the Services and Combatant Commanders (COCOMS) to conduct JNTC exercises (Figure 4). This evolution will occur in a “market”

environment where there are many competing technologies and constituencies that must be considered to arrive at a consensus for what constitutes the best path to the “to be” architecture. Essentially, the market will prevent any one given solution being mandated for use if there are competing solutions available and in use across the stakeholder population (i.e. the Services and COCOMS). The reason for this is it is too costly for a stakeholder to switch from a solution that is considered *adequate* for their needs to another equally effective solution, regardless of how “wonderful” that solution is, due to the cost associated with making the switch. We need to recognize that in the real, market-driven world you cannot mandate a single solution, such as was attempted with JSIMS, across a large stakeholder population without incurring significant risk of failure, to say nothing of the immense cost and difficulty associated with addressing each stakeholder’s evolving requirements over the long development life cycle of a single solution. The most practical approach is to maximize reuse of existing capabilities (tools/standards/processes/procedures) used by the stakeholders by initially addressing interoperability issues to achieve the required capability to conduct JNTC exercises then selectively investing to evolve to the “to be” architecture realizing you will never end up with a single solution that fits the needs of all stakeholders. At best you will evolve to a set of solutions that address the stakeholders’ individual needs (for Service level training) that when federated can also be used for JNTC training. JNTC’s main priority is to address the interoperability among these solutions and to invest in capabilities that increase training effectiveness while decreasing the time and cost to conduct joint training exercises. This market driven approach is healthy as it provides an environment where stakeholders/users can more easily adopt new solutions that emerge over time without the impediments of the traditional acquisition process that is not effective at reacting to the rate at which technology is evolving. Moreover, there is a possibility that novel technologies may become available in the future that which are disruptive and cannot be considered in a timely manner by the traditional acquisition process. This is the basic recipe for transformation in how we acquire, employ, and nurture the tools we use to conduct JNTC training.

The ATT Mission

The ATT group has a broad mission that primarily requires the ability to evolve the “as is” JNTC architecture to the “to be” architecture as rapidly as practical. It must achieve this based on required capabilities to execute JNTC exercises justified by significant reduction in the time and cost to conduct JNTC exercises (compression of the Joint Event Lifecycle (JELC)). This will be done in collaboration with the COCOMS, Services, Agencies, industry, academia and multinational partners. To be truly effective ATT through the JATTL needs to address the “market” environment that impacts the evolution to the “to be” architecture. This will be achieved through close consultation with industry, academia, agencies, Services and other laboratories resulting in focused technical reports and projects (Figure 4) that will be widely read and distributed to avoid the “not invented here” syndrome that happens all too often when simulation developers are focused on immediate needs without due diligence to satisfy the long-term requirements in a systematic way.

The JNTC Federation Evolution

A quick glance at figure 5 provides a snapshot of the “as is” architecture of the JNTC federation. This federation represents a selection of Service models and simulators that contribute to the horizontal, vertical and integrated training events that the JNTC provides to the joint training audience.

To take this architecture to the “to be” structure there must be systemic systems engineering practices and processes institutionalized in joint federation development and integration.

specific modifications. An example is the Joint Federated Object Model (JFOM) development process having well-defined activities as both a JFTT development sub-process and a JNTC event-specific development process; one difference being on-going Base Object Model (BOM) development activity (JFOM composition / decomposition) and its association with toolkit development, and the event-specific JFOM activities which is more likely to be focused on FOM modifications to support interoperability among participating federates during a JNTC event execution.

Providing the appropriate support environment for a given JNTC event requires a set of processes used to identify and / or derive the set of LVC operational and technical requirements relevant to the specific joint mission areas and training objectives (reference the Universal Joint Task List and Joint Tactical Tasks). These requirements may be based on authoritative requirements from previous JNTC events and can also be expected to consist of new LVC requirements specific to the training exercise under consideration. To reduce event life cycle costs the LVC environment will support leveraging and reuse of LVC requirements by maintaining a repository of LVC functional and non-functional requirements. A rapid requirements generation capability is especially important as the frequency of JNTC-based events is anticipated to be 35-40 events per year by FOC. Official guidance documents mandate the use of well-structured and well-defined systems engineering and configuration management processes for all JNTC events. As such, all JNTC events need to use efficient and accurate requirements definition and management processes; the LVC environment will provide a mechanism to support rapid LVC requirements definition and management. JNTC operational and technology stakeholders are anticipated to be significant users / benefactors of this capability within the LVC environment and the mission-area requirements repository will be maintained as part of the JFTT.

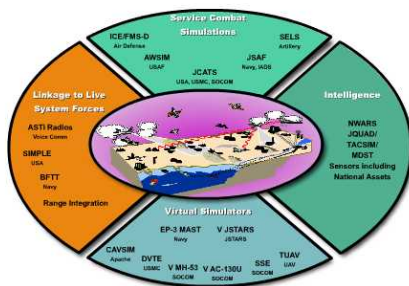


Figure 5 – JNTC Federation

Processes associated with maintaining Joint Force Trainer Toolkit (JFTT) components may also be used to define (in part or in entirety) event- or exercise-

Additional processes include activities associated with the discernment of appropriate Live, Virtual, and /or Constructive technologies to include the identification and selection of specific M&S components that can satisfactorily meet the LVC requirements discussed above. The timely selection of appropriate M&S and other LVC support components relies on the use of another data repository, specifically a JFTT Metadata repository that accurately catalogs the specific capabilities and

limitations of various types of component technologies authorized for use in a JNTC-based training environment. This metadata repository can be accessed during the design and planning stages of every JNTC event to determine which components are most suitable to meet the event LVC requirements. Creating the Metadata repository and keeping it updated and accurate will be an on-going process and is considered a critical activity to establish and maintain the JFTT.

An artifact of the LVC discernment and JFTT component selection processes is the need to establish interoperability among the interacting LVC components. Two additional processes aimed at achieving LVC component interoperability are the JFOM development process and the Test and Training Enabling Architecture (TENA) Logical Range Object Model (LROM) development process. Other critical processes used to create the Environment are related LVC support processes for the myriad of LVC components used to provide the technology infrastructure for the conduct of a JNTC exercise. As discussed earlier, some aspects of these processes are used in the LVC simulation environment to sustain persistent resources that exist within the JFTT and other aspects are required to support specific JNTC event design, planning, and preparation activities.

In summary, the JNTC LVC simulation environment has been established to provide a unified framework to support JNTC events using a well-managed and persistent set of LVC resources. While the management and oversight of the LVC environment is the responsibility of the Joint Warfighting Center (JFWC), the use and maintenance of the LVC environment is the responsibility of the combined JNTC operational and technical communities (e.g., Services, COCOM's, USJFCOM). The JNTC LVC Simulation Environment will provide the means (processes and resources) to integrate live, virtual, and constructive elements into a seamless joint training environment.

DISTRIBUTED DEVELOPMENT INTEGRATION & OPERATION

Collaborative Techniques

The distributed nature of JNTC requires engineers, scientist, technicians and program managers to keep risk low through constant collaboration over distance. The internal management and external

execution philosophy is truly a cultural shift for the technical community as many were content to be road warriors spending months on temporary assignment to remote laboratories. This is cost prohibitive and really not in the best interests of an organization that professes to be a distributed network of facilities.

CORRECTING THE VISION

The JATTL has the responsibility to focus on the long-term requirements of the JNTC. This is in contrast to the responsibilities of the Simulation, Command & Control, Computing and Communications Group (SIM/C4) that are charged with the responsibility of employing the "as is" architecture in support of JNTC events. This architecture is provided through the technologies assembled from the JFTT as shown in Figure 6.

Building the Joint Force Trainer Toolkit

As already mentioned the SIM/C4 group addresses near-term capabilities that can be implemented to support exercises that are in the active planning cycle, which require near term exercise execution 6-9 months in the future.

This requires that SIM/C4 maintains and employs the "as is" architecture with all of the associated near term repositories, tools, documentation, configuration management (CM) and, verification, validation and accreditation (VV&A). The obvious difference being that ATT addresses capabilities that must be produced through use of a comprehensive RDT&E process that will impact exercises 9+ months in the future.

Significant enhancements to the "to be" system and architecture tools, processes, procedures, and standards are not driven by short-term exercise execution as this will lead to unnecessary requirements creep and a loss of focus on the immediate need to produce a successful training event. It is ATT that integrates new capabilities into the "as is" architecture through use of the JATTL and it's associated technical nodes on the JTEN network. Consequently it will fall on the JATTL staff to provide the necessary training of SIM/C4 personnel to employ new capabilities as they are matured and passed into the "as is" environment.



Figure 6 – The Joint Force Trainer Toolkit

The JATTL Facility

Having described the purpose of the JATTL and the methods it employs to conduct research and development in satisfying and maturing future JNTC requirements it is necessary to provide an insight into the actual facility.

The JATTL will be completed by March 2005 and will cover approximately 30,000 square feet with the ability to host up to 250 engineers, scientist and analyst as the facility matures. It is the flagship R&D facility on the JTEN network and will rely on connectivity to support shared data requirements. The facility itself is near the Joint Warfighting Center and will initially share a new home with the J9 C2 & ISR prototyping laboratory as it expands.

The internal networks for the JATTL will primarily be fiber based with both Gigabit Ethernet as well as fiber-channel™ to exploit the capabilities of managed storage area network (SAN) technologies. The use of SANs will ease the stress and time consumption that is often associated with the necessity to reconfigure test-bed environments. The objective is to enable the JATTL team to recall previous test configurations in minutes rather than days and to minimize the risks associated with the requirement to configure patches make software updates or make security changes to configurations.

The JATTL as a system will comprise a set of interdependent technologies such as:

- Collaborative Information Engineering & Knowledge Management (presently represented by Information Workspace

(IWS), but will extend to include configuration management, document management, systems engineering tools and video Tele-conferencing tools).

- Enterprise Systems Management (to provide the JATTL with the ability to control and manage technical configurations that span to remote locations/laboratories).
- Visualization (to provide teams in all locations with common views of the information environment and to facilitate collaborative engineering through team synchronous methods.)
- Flexible data routing (The JATTL will comprise a computational fabric as well as a storage fabric that will improve performance of system configurations and better support clustered high performance Linux, UNIX and Windows environments). This will also better enable the introduction of concepts such as distributed data centers.
- High Performance Computing (HPC) and Scalable Parallel Processing (SPP) assets to address the issues of scalability, composability, and fidelity required as the JNTC moves beyond IOC.

The technologies that will enable the aforementioned capabilities to be instantiated consist of commercial off the shelf (COTS) combined with where appropriate government off the shelf (GOTS) technologies. Some of the technologies not typically found or exploited in the as is architecture today are described as:

- Storage technologies – capacity of demand management, shared file systems, disk mirroring, striping and replication, intelligent deployment of applications and files, switching and long haul storage communication devices that are presently represented by fiber-channel™ and iSCSI™ protocols, but could include Infiniband™ and others as the requirement arises and the test authority make appropriate recommendations.
- Physical layer switching – to provide physical control at the patch panel level to reconfiguration of long haul and complex local test networks. This provides for control over security through total visibility at all times of the physical and local topology of the test environment. This

capability also adds media conversion to the network between copper and fiber infrastructures without the addition of peripheral devices.

- Multi-channel visualization – to provide RDT&E teams with the ability to view the simulation network and composite applications in ways that support test and evaluation of progress including the employment of collaborative technologies. This will also be crucial as priorities such as enterprise after action review are developed. The ability to distribute high fidelity images and video between sites will contribute to the change in integration methodologies to a truly distributed environment.
- Scalable Computing Technologies – this comprises not only the use of cluster PC based computing technologies but also the development of concepts such as role based computing, global file systems and fault tolerant computing. JNTC has requirements for both high performance technical computing as well as enterprise GRID based distributed computing services.

The aforementioned list is by no means exhaustive and will evolve as research tasks are performed and capabilities overhauled or new capabilities introduced to improve the effectiveness of JNTC to meet its increasing operational tempo.

JNTC Technical Challenges

The JATTL will develop a technical pipeline that will manage multiple technical challenges in parallel. This was introduced in the ATT relationships process flow as depicted in figure 4.

These technical challenges not surprisingly can be grouped under the JNTC technical focus areas and are the initial challenges that have been assessed as necessary for the next evolution of the architecture. Some of the identified challenges to be resolved through RDT&E by the JATTL are as follows:

C2 & ISR Challenges

The ATT group will provide RDT&E and integration of new or improved networking, standards, processes and concepts through the replication of a JTEN

Service Delivery Point (SDP) node and/or Hub Site in the JATTL.

Therefore it will be necessary to research emerging technologies such as network peering, network compression products, security appliances, Voice over Internet protocol (VOIP), coalition network products, throughput analysis and network management products.

Training Transformation (T2) vice the T2 Implementation plan poses considerable challenges for integration of C2 & ISR capabilities seamlessly into the LVC environment for JNTC to allow not only bi-directional traffic between simulations and operational systems but also intelligent linkages that provides truly dynamic interactions. The ability of a C2 system to dynamically provide orders to constructive forces with an implicit understanding of commander's intent is but one challenge being addressed through coordination between the ATT group and the Services. This is done with full recognition that the simulated world does not terminate within itself but must seamlessly connect with real world systems to reinforce the "train as you fight" paradigm.

The Joint Battle Management Command & Control (JBMC2) is firmly in the sites of JNTC to support the joint warfighter in training, operational test, mission rehearsal and experimentation. The ATT group through application of the JATTL and close interaction with the J8 will provide value to advancement of the prototype Standing Joint Force Headquarters (SJFHQ) by providing technologies to stimulate that environment in a realistic manner.

The JATTL will be capable of replicating problems or anomalies from the operational JTEN and develop fixes for these problems can be tested and certified to provide the ability to minimize risk to the operational network. This will require the R&D node to be integrated into the M&S operational network for checkout of persistent site equipment prior to fielding. This will provide a smoother transition of field type one sites to upgraded capabilities while reducing risk.

Opposing Force (OPFOR) Challenges

The opposing force requirements for the JNTC provide the ATT group with significant challenges that will be resolved through the JATTL in concert with service centers of excellence. It will be necessary to integrate Live and Virtual OPFOR

Systems in a common environment and field realistic OPFOR Command, Control, & Communications (C3) to support JNTC events. This will provide JNTC with the ability to generate realistic communications intelligence for both non-conventional and conventional C3 live and virtual systems.

In addition JNTC requires the development of OPFOR infrastructure supporting Joint Urban Operations (JUO) including representations of terrorist cells. This will require a full suite of capabilities to provide a credible OPFOR Information Operations Capability including:

- Joint Threat Emitter (JTE)
- Military Deception
- Information Intrusion
- Electronic Attack - Jamming and Direction Finding
- Computer Network Operations
- Counter-Intelligence
- Develop 2nd & 3rd Order Effects
- OPFOR Signal Intelligence
- OPFOR Information Operations Red Teams
- Information Assurance

Other capabilities include the need to reduce the joint exercise lifecycle (JELC) through a rapid OPFOR Scenario Development Capability necessary to develop and sustain the OPFOR Database, the creation of advanced OPFOR Exercise Planning and Rehearsal Tools.

Instrumentation, Data Collection and After Action Review (AAR) Challenges

One of the greatest challenges for JNTC is the integration of live play into the constructive and virtual environment. Since the first major range integration demonstrations during Millennium Challenge 02 (MC02) issues of interoperability and data management have become better understood. This is where GOTS technologies such as the TENA have made their impact on JNTC events. TENA takes what were closed architectures and opens them despite the stove piped development of instrumentation on the various ranges. The JATTTL will aid further by using cooperation rather than competition to work towards common standards.

The live aspect of simulation brings with it fidelity issues and an explosion in volume of data that can be captured and used to assist in validating root cause

during joint training events. The JATTTL will focus initially on implementing the T2 instrumentation goals, such as:

- ground truth data via interoperable instrumentation systems.
- interoperable inter/intra service ranges.
- Real-time and post event after action review capabilities.

This requires that all Time, Space and Position Indication (TSPI) data can be read through common standards regardless of the manufacturer of the range system. This also requires that the data presently stored in range specific locations, which is not available to the JNTC enterprise, become available to facilitate analysis and comparative assessment in the future.

Where AAR is concerned there is a great deal to be done to ensure that the Joint trainers have the right tools and information at their fingertips to capture the most efficiency from training opportunities. It is the AAR component that is truly an enterprise service that will span the JNTC through the live, virtual, constructive, and C2 & ISR environment, bringing causality and understanding to complex problems. This will require integration, control, capture, query and near real time analysis of voice, video, simulation and C2 & ISR information on demand to build the AAR packages necessary to bring home the lessons learnt.

Live Virtual & Constructive Environment Challenges

When JNTC is thought in terms of simulation it is normally in terms of the federation of simulations and systems as shown in figure 5. It is true that for the level of training that is provided for the Joint Task Force (JTF) commander that constructive simulation makes the most sense and can provide the scale of environment needed to train at division and above during these vertical events. However, with the integrated and horizontal events there are many more challenges to be met in terms of fidelity and the integration of the technologies in terms of instrumentation, virtual simulations, OPFOR, and C2 & ISR necessary to provide a "seamless" LVC environment. The future of the LVC Joint Force Trainer Toolkit (JFTT) development strategy is depicted in Figure 7.

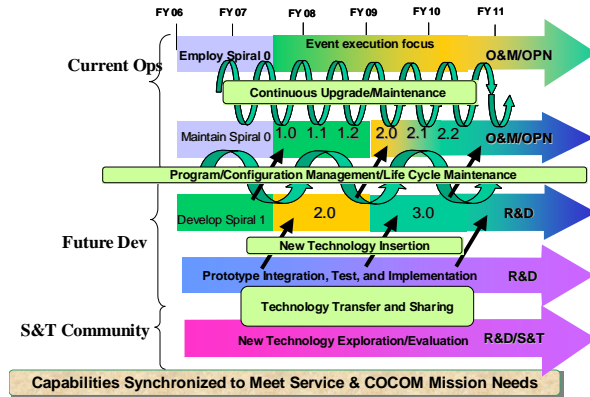


Figure 7. LVC JFTT Development Strategy

M&S technologies focus on identifying technological products/concepts that support establishment of a seamless joint training environment for horizontal, vertical, integrated and functional mission planning, rehearsal, training, and experimentation events. Selected projects will research, develop, test, evaluate and integrate new or improved technologies, standards, processes, and concepts that support the JMO M&S technology program to include database/scenario generation & repository, SIM initialization, mission planning/rehearsal, course of action, full spectrum, common environment, common sensor engagement (level playing field), large-scale terrain representation, composable and scaleable simulation environments, non-attrition models (other than combat adjudication), joint federated object model, immersive virtual technologies, and massive multi-player on-line gaming/military training applications.

Information/Knowledge Management Challenges

There are many challenges in developing the JNTC collaborative environment across the Services and COCOMS. Knowledge/Information Management ATT technology focus will identify and select advanced knowledge/information management and collaborative information environment technologies to ensure real-time, collaborative, distributed information sharing among JNTC participants. At present the JNTC is leveraging the SJFHQ collaborative environment SJFHQ (CE) and will contribute to its advancement as the technology is further integrated into the daily routine of JNTC.

Selected projects will research, develop, test, evaluate and integrate new or improved technologies, standards, processes, and concepts that support the JMO Knowledge/Information Management program

to include collaborative tools for information sharing, knowledge management technologies, Joint Exercise Control Group (JECG) systems, information systems automation, Wide Area Network (WAN) & SAN management, resource management, planning, and scheduling tools, and other large scale distributed computing information systems solutions.

Architecture & Standards

The JNTC Architecture & Standards program utilizes a disciplined approach detailing operational, system, technical, and overall aspects of Joint horizontal and vertical training through development of *architecture products* and defining common and open standards. Architecture products are those graphical, textual, and tabular items that are developed in the course of gathering architecture data, identifying their composition into related architecture components or composites, and modeling the relationships among those composites to describe characteristics pertinent to the architecture's purpose. The specific set of JNTC architecture products and standards for "as is" is documented in the JNTC Implementation Plan. The "to be" set of JNTC architecture products and standards will evolve as new technologies and processes are discovered and formalized through methodical systems engineering practices. Final determination of acceptance and implementation of new architecture products and standards will be through consensus building across the JNTC PAT venues in the same manner the "as is" state was identified.

CONCLUSION

The JNTC as it meets IOC goals and objectives will need to look well into the future to ensure that it evolves as a world-class training capability. This will require facilities such as the JATTTL to be working as the unifying center of excellence on the research and development side of the capability with the Service laboratories, academia, industry, and multinational partners ensuring that the S&T investments made are worthwhile and truly contribute to the enterprise.

The JATTTL is already working on a range of challenges through support of industry, academia and Service laboratories as a temporary distributed facility and when completed will quickly ramp up to support a wider range of objectives in support of the JNTC.

The separation of near term interests (six to nine months) from long-term capability investments is the only way to ensure that the JNTC does not become myopic. It is the JATTTL that will provide the innovation necessary to correct the Joint training vision.

ACKNOWLEDGEMENTS

Thanks to Joe Bricio-Neto for reworking the graphics for the paper. And thanks to Lloyd Ashby for putting together many of the original presentation slides.

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