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Realizing ''Jointness'' Through Early Testing of Systems in a Distributed Live-Virtual-Constructive Environment

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In the mid-1990s, the U.S. Department of Defense (DoD) recognized the potential to streamline acquisition by more extensively using modeling and simulation in system development to get a better understanding of the system design. A number of initiatives were started, placing a greater emphasis on models, simulations, and virtual prototypes of specific systems running in a synthetic representation of the battlefield tailored to that system. The test community, likewise, recognized the potential opportunities to test weapon systems "before metal was bent," gaining early insight to system performance. To explore the feasibility of distributed testing, the Joint Test and Evaluation Joint Advanced Distributed Simulation (JADS) Program was chartered. The core conclusion of the JADS Program was that integrating distributed test capabilities with simulations does provide test utility; however, many infrastructure challenges must be overcome to make distributed testing timely and cost effective while still providing meaningful results to program managers and system evaluators. The fundamental infrastructure issues were twofold. First, installing a network for each test event took a significant amount of time, and second, the technical solutions used at each test center varied drastically, requiring time and money to develop gateways to bridge across different protocols.

Dr. John B. Foulkes

In November 2004, the need for a corporate enterprise-wide solution to distributed testing was reaffirmed in the "Testing in a Joint Environment Roadmap," which called for the establishment of a persistent integration capability for test laboratories and open-air ranges. Department decision-makers acted on that Roadmap and created the Joint Mission Environment Test Capability (JMETC) beginning in fiscal year 2007. JMETC provides a DoD-wide capability for the test and evaluation of a weapons system in a joint context for developmental and operational testing, interoperability certification, net-ready key performance parameter compliance testing, and joint mission capability portfolio testing.

The JMETC program has proven to be a cost effective, time saving, DoD-wide infrastructure capability for linking distributed facilities and enabling customers to test and evaluate warfighting capabilities in a joint context. In the first two years, the JMETC program has established persistent network nodes at 33 test sites and has demonstrated in five distributed test events how it expeditiously and efficiently provides the test community with an infrastructure capability that supports testing across the acquisition process. JMETC provides readily-available, persistent connectivity between testing facilities with standing network security agreements, common integration software for linking sites, and accredited test tools for distributed testing. The key achievement of JMETC is a structured corporate approach to the multitude of technical solutions, enabling test managers to put their focus on the systems under test rather than the distributed test infrastructure.

Collaborating across initiatives and converging where appropriate, the corporate approach used by JMETC first started under the Joint Infrastructure Enterprise Initiative. When the Department decided to invest in an enterprise solution to distributed testing, the DoD Test Resource Management Center (TRMC) recognized the need to foster coordination with all of the DoD stakeholders who have an interest in distributed live, virtual, and constructive (LVC) concepts as an integral part to the DoD Acquisition, Test and Evaluation, and Training Community operations and business practices. The TRMC led a series of nine meetings (1) to provide an understanding of ongoing LVC activities, (2) to discuss key issues affecting a more robust use of LVC environments, and (3) to identify possible solutions to those issues along with possible courses of action. The findings and recommendations from the Joint Infrastructure Enterprise Initiative meetings, as presented to the *Testing in*

a Joint Environment Senior Steering Group (TSSG) for action, identified the top challenges of distributed testing as clearly defining joint requirements for warfighting systems, enabling cross-domain solutions, certifying information assurance, and leveraging the investments across the test and training communities. Each of these identified challenges is related to the distributed infrastructure, with the exception of defining joint requirements for warfighting systems, which is beyond the mission of the TRMC.

To improve the corporate distributed test enterprise, the TRMC has taken action addressing each of the Joint Infrastructure Enterprise Initiative–identified challenges related to test infrastructure. Coordinating with the Office of the Secretary of Defense (OSD) Networks and Information Integration (NII), a Tiger Team has recently been formed to identify issues and recommend solutions regarding the implementation of the DoD Information Assurance Certification and Accreditation Process (DIACAP) at test facilities. To enhance coalition testing and to satisfy multilevel security needs, collaboration has begun with the newly-formed Unified Cross Domain Management Office to satisfy test community requirements for National Security Agency–approved solutions to bridge networks of different classifications.

Similar to the collaboration and convergence of different technical solutions, test methods must be aligned to coherently test multiple systems executing common joint mission threads in order for the Department to cost effectively realize the benefits of joint testing on a large scale. The Joint Test and Evaluation Methodology (JTEM) Program has developed a capability test methodology to define, plan, conduct, and analyze a warfighting capability in a Joint context. The capability test methodology consists of six major steps—going from the initial test strategy to the evaluation of the joint mission effectiveness. By looking at the various interactions among weapon systems, the goal of this methodology is to enable all the systems executing a joint mission thread to leverage the same process to create a consistent joint test environment.

Shifting focus from infrastructure to test realism

With the corporate enterprise tackling the infrastructure challenges of the distributed infrastructure, we can shift our focus from detailed technical solutions to the true realism of the LVC environment—that is, the verification and validation of the distributed LVC environment. Now that we can look beyond how the "bits" are sent between sites, we can concentrate on the real test issues of ensuring the "fair fight" in the test environment, e.g., correlating terrain dynamically between the virtual world and the open-air range. For semi-automated forces to meaningfully be included in a test event, advancements must be made in more sensible semi-automated force behaviors, both reacting to threats and properly interpreting live C4I messages. Furthermore, with the greater emergence of information operations, cyber-warfare, and other nonkinetic, nontraditional warfare, our simulated environments must be enhanced to incorporate the full spectrum of the battlespace. In summary, the higher the degree we can verify and validate a distributed LVC environment to replicate combat to include all the interactions between systems when the warfighter executes a joint mission, the earlier we can gain insight to the "jointness" of a warfighting system and, ultimately, the utility it will provide the warfighter. ❑

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