Invited Article

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Test and Evaluation and the ABCs: It's All about Speed

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When Lt Gen Charlie Croom took over as the Director of the Defense Information Systems Agency (DISA) in July 2005, he brought us a new message: "It's All about Speed." What he meant was simply this: It takes us too long to get new capabilities into the hands of the warfighters. When he retired this past summer, 3 years after his arrival, he left a legacy of change—of innovation—in how we acquire and test information technologies (IT) in DISA.

Key words: Acquisition; adopt-buy-create; capability T&E; information technology; scalability of performance; scalability of support; interoperability; security.

General Croom was right. My experience with acquisition and testing of information technologies began in 1998 on my arrival in the Army Test and Evaluation Command and my assignment as Evaluator for one of the Army's "digitization" systems. Six days after my arrival, I found myself at Ft. Hood, Texas, seeing the new capability for the first time. I was amazed at this new system and wished I'd had it in my units way back when. Six *years* later, we hadn't managed to get that system through the acquisition process, had not even completed the Initial Operational Test and Evaluation (IOT&E). It took the operational necessity of the second Gulf War to get that system into units other than the test unit. And when we did that, we had to spread the few systems we had for testing out to those other units and didn't give them the luxury of time to do a lot of training. But what a remarkable difference that Blue Force Tracking system made for the warfighters.

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There are many reasons why we took more than 6 years to field the system; hindsight suggests to me that none of them was particularly good. There were other ways to develop, test, and field the new system; we just didn't look "outside the box" of DoD 5000 to find them. That's the message General Croom brought to Defense Information Systems Agency (DISA). When he looked at how industry, especially companies like Google, eBay, Amazon, and Travelocity, just to name a few, brought new capabilities to its customers in short cycles—with speed—he asked why the Department of Defense (DoD) couldn't do the same. The fact is, we can, but it requires some fundamental changes in acquisition philosophy. It is time that we took a hard look at how we acquire and test information technologies in the DoD.

Adopt—buy—create

Shortly after his arrival, Lt Gen Croom cast his message of speed in these terms: "Adopt before Buy, Buy before Create"—the ABCs. It was a simple message; to speed up the process of getting enhanced capabilities into the hands of the soldiers, sailors, airmen, and marines that need them, we would look first for something already available in the Department—say an Army system for example, that would satisfy a need identified by the Navy—and adopt it for fielding to the entire Department. If there was no capability already fielded, then we would look for a commercial product—maybe even "the 80% solution"—and buy it for fielding to the Enterprise, then add capability in short cycles. As a last recourse, we would create it; last because that approach comes with a lot of program management overhead, cumbersome decision-making processes, and sometimes heavy-handed oversight, not to mention lengthy periods of development and testing—processes that are slow to move and adjust when it's all about speed.

There were other innovations in this new acquisition paradigm. One notable innovation was to bring competition into the acquisition process; the theory being that if there is more than one provider of a capability, and those providers make money based on product use within DoD, then competition for market share will motivate those providers to continually improve their products and entice more users to their

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Table 1. Test and evaluation for the ABCs

IT acquisition strategy	Capability maturity/risk	Critical T&E issues
Adopt	Capability in use in Department of Defense	Scalable performance and support
Buy	Capability in use in commercial sector	Scalable performance and support Secure Interoperable
Create	New capability to be developed	Scalable performance and support Secure Interoperable Effective, suitable, survivable

side. It's an interesting idea that DISA has put to the test, and we are starting to see it work in the Net Centric Enterprise Services (NCES) program.

Those of us in the test and evaluation (T&E) business need to hear, loud and clear, the message of speed because we can ill-afford to be an obstacle in the path of bringing capability improvements to the warfighters. Instead, we need to be an *enabler* in the process that ensures rapid delivery of effective, suitable, interoperable, and secure information technologies. That type of agility can only occur when we are involved from the beginning. In some commercial circles, they refer to this as "test driven development."

T&E for the ABCs

The ABCs present an opportunity for innovation and invention in T&E. Once we have identified a capability need, through what is now the Joint Capabilities Integration and Development System (JCIDS), the program manager formulates an acquisition strategy. For an IT system, the acquisition strategy is essentially a choice among the ABCs—adopt what's available already, buy it, or create it. Likewise, we should have a T&E strategy that corresponds to the ABCs.

If the acquisition approach is to adopt something already available in the DoD, then that capability has presumably negotiated all of the acquisition and T&E wickets to achieve its fielding decision. More specific to T&E, that capability has already been determined to be effective and suitable for its intended use. As a capability proposed for the enterprise, however, there are two relevant issues to resolve before full deployment:

- scalability of performance (Does the capability still perform at acceptable levels under greater use at the enterprise level?),
- scalability of support (Is there sufficient capacity for supporting the capability at the enterprise level, such as help desk capacity?).

There may be other considerations, but the motivation behind the adopt strategy is to accept the risk and make an existing capability available to a broader user base.

In the case of the "buy" approach, the premise is that we have identified a commercial product that satisfies all or part of the need identified in JCIDS. The product is already in the commercial marketplace, but more specifically to T&E, it has satisfied unit and functional testing by the vendor. If we accept the capabilities and limitations of the commercial product as is, then the remaining issues for us to verify prior to use in the DoD environment are:

- performance and support at the enterprise level,
- interoperability with other DoD systems or services,
- security (information assurance).

Focusing T&E resources on these areas will permit rapid assessment and recommendations for the acquisition decision makers.

In the case of the "create" approach, no existing capability in the Department or commercial sector satisfies enough of the identified need. In this case, the capability must be developed, and T&E will have to answer all standard evaluation concerns. *Table 1* summarizes the T&E concept for the ABCs.

However, the create approach must not be "business as usual" for DoD acquisitions. The key for IT acquisition is to bring new capabilities forward in small, warfighter-relevant increments, or "sprints." In the commercial sector, some refer to this process as "Agile development." There is a wealth of information available about agile processes, so I will not attempt to describe it in detail here. At the core of this process, however, is the idea that a small team of developers, users, and testers work together to define, build, test, and field new capabilities in short cycles—"build a little, test a little, field a little" as General Croom would say. To field the system, we would start small and scale rapidly, with T&E monitoring to ensure capability effectiveness as use scales upward.

There are some fundamental differences in the ABC approaches when compared to current acquisition

Table 2. Test and evaluation in the Department of Defense acquisition process

Activity	Test agent	Conditions	Customer	Reference
Developmental T&E	PMO/contractor/ government DT organization	As determined by PMO; generally benign, lab; developer personnel	PMO	DOD 5000
Operational T&E	OTA	"Operationally realistic,…, typical users"	MDA	Title 10 DoD 5000
Joint Interoperability Test Certification	JITC	"Applicable capability environments"	J6	DODD 4630.5 DODI 4630.08 CJCSI 6212.01D
Security T&E (IA Certification & Accreditation)	OTA, DIA, FSO, NSA	Operational, lab	DAA	DoDI 8510.01 DIACAP*

PMO, Program Management Office; DT, Developmental Test; OTA, Operational Test Agency; MDA, Milestone Decision Authority; JITC, Joint Interoperability Test Command; J6, Joint Staff J6 is Director for Command, Control, Communications, and Computer Systems; DoDD, DoD Directive; DoDI, DoD Instruction; CJCSI, Chairman Joint Chiefs of Staff Instruction; IA, Information Assurance; DIA, Defense Intelligence Agency; FSO, Field Security Office (DISA); NSA, National Security Agency; DAA, Designated Approving Authority; DIACAP, Defense Information Assurance Certification and Accreditation Process; DOT&E, Director, Operational Test and Evaluation.
* Note also the DOT&E Policy on testing IA during OT&E. DIACAP C&A does not complete the requirement for IA testing.

practice. The ABC model accepts risk, whereas our traditional model is founded on risk aversion. The current scheme of acquisition milestones are not a good fit in the ABC model—the ABC acquisition process is too fast. Our traditional acquisition decision-making processes may need to change; for example, in this model, there would be no full deployment decision review. Likewise, our T&E practices should adjust. For example, in none of the T&E approaches suggested is there a concept of a large-scale IOT&E or Capstone event. For IT systems, the IOT&E as we think of it today is an obsolete practice.

None of this suggests we eliminate oversight or testing. Each has a critical role, but we should acknowledge that the processes we've built and put in place for the past decades, and which have always been focused on major defense systems such as tanks, ships, and planes, may not be well suited for the agile IT environment. We should look to the commercial IT sector and pull their good ideas into the DoD. And we should teach innovative IT acquisition concepts, such as agile development and test, to our program managers and testers as part of our formal acquisition curriculum.

T&E for better decision making

There are at least four different test and evaluation activities that support different decision-making processes for information technologies, but the question is, do the four activities improve our *acquisition* decision-making process? The T&E activities include

- Developmental Test and Evaluation (DT&E)
- Operational Test and Evaluation (OT&E)
- Joint Interoperability Test and Certification
- Security Test and Evaluation (Information Assurance Certification and Accreditation)

We do each of these tests for different purposes, and that is certainly understandable. What is not understandable is why these tests are performed under different conditions, by different test agents, for different customers. Developmental testing, for example, helps the program manager find and fix problems, ensure compliance, and improve production processes. It tends to be more technical than operational. Robust DT helps ensure readiness for OT. OT, on the other hand, ensures readiness for fielding. Why doesn't DT ensure readiness for fielding?

Interoperability and security testing are more specialized and feed other decision-making processes, i.e., Joint Interoperability Certification and the Defense Information Assurance Certification and Accreditation Process. Unfortunately, we do not treat these two processes as integral to acquisition decision making, which results in situations in which the Milestone Decision Authority might approve a decision to buy for the Department, while the Designated Approving Authority (DAA) may not authorize its operation on their network. *Table 2* summarizes the T&E landscape for IT.

Our acquisition decision making would be much improved if the various T&E activities fit into a holistic model. Recent emphasis on "integrated T&E," such as written in the December 22, 2007, memorandum signed by the Director of Test and Evaluation and the Under Secretary of Defense for Acquisition, Technology, and Logistics, acknowledges the importance of early involvement of the test community, but

does not do enough to eliminate the barriers that exist between test activities or compel streamlined T&E.

Capability test and evaluation

In DISA, we are working to unite all test activities into a holistic, coherent T&E model. We refer to this model as capability T&E (CT&E). For capabilities being developed in sprints, having four different organizations doing the testing at different times, under different conditions, and writing different reports is laughably inefficient. The commercial sector would never do this.

To the extent possible, we would like to designate a capability test team (CTT) to plan and conduct CT&E events. All CT&E events are a shared resource. To ensure agility in T&E, CT&E events are *risk-based*, according to which ABC acquisition approach is used. For each sprint there is one CT&E event. CT&E can be thought of as a "one team, one time, one set of conditions" approach to T&E. Upon completion, the CTT writes one report for use by all decision makers: the milestone decision authority, the interoperability certifier, and the DAA. One means to obtain buy-in for this concept would be to have all of these decision makers sign the T&E master plan (TEMP).

To ensure acceptance by all decision makers, CT&E test designs must also be *mission-focused*. During the CT&E, typical users exercise the capability under test, similar to beta testing in the commercial sector, and are supported as intended when fielded. The combat developer, part of the CTT, defines and validates the scenario and mission threads. The test conditions replicate the operating environment, leveraging distributed live, virtual, and constructive capabilities, such as the Joint Mission Environment Test Capability (JMETC), to the maximum extent possible. CT&E therefore expands on and puts into practice the concept of "integrated T&E" by including all stakeholders in developing the test strategy at the beginning of the acquisition process and by structuring *all* test activities as shared resources.

Some organizations will see CT&E as an infringement on their independence. There is nothing about the CT&E concept that precludes CTT members from performing independent evaluation. In fact, the CT&E construct works best when all stakeholders have their say. The TEMP should reflect the ABC strategy being followed and describe the CT&E events designed to ensure that critical issues are adequately addressed. Once approved, the CTT executes.

We can fundamentally change the way we acquire and test information technologies in the Department. By focusing on small improvements to capability, development cycles in sprints, and a one team, one time, one set of conditions T&E model, we can simultaneously reduce time to fielding while improving product quality. After all, it's all about speed. ❑

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