ITEA Journal 2012; 33: 327–332

Preparing Today's Department of Defense Test-and-Evaluation Professionals for Tomorrow's Challenges

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The greatest asset we have is our people. Divided into five sections, this article examines the many facets of preparing today's Department of Defense test-and-evaluation (T&E) professionals for tomorrow's challenges: (1) the T&E workforce, (2) T&E competency development, (3) T&E certification standards, (4) T&E education and training, and (5) taking the DoD T&E workforce to the next level.

There has never been a greater need than there is now for professionals in test and evaluation (T&E) to strive for increased knowledge within their chosen profession to keep pace with our increasingly complex environment. We are living in a world in which technology is changing by an order of magnitude every 10 years. Coupled with the Department of Defense's (DoD) and industry's desire to deliver highly complex products and systems of systems at the very tip of technology development to the customer more efficiently, this environment creates a challenge for our T&E professionals that stresses their ability to keep current.

There are many challenges confronting our T&E workforce today. We understand that T&E is conducted throughout the life cycle, from program initiation through sustainment, to reduce design and programmatic risks. That sounds easy, right? Now let's add to this challenge that the key T&E technical requirements need to be traceable to objectives during preparation of the T&E master plan and the T&E strategy needs to be effective, efficient, and defensible. As chief developmental testers, our ultimate requirement is to provide critical information for use in the acquisition decision process. This information may include assessment in areas such as the following:

- specification compliance;
- capabilities, limitations, and deficiencies;
- system safety;
- compatibility with legacy systems;
- certification and accreditation of information assurance;
- certification of joint interoperability;
- characterization of system functionality with information for cost, performance, and schedule trade-offs;
- documentation of the achievement of contractual technical performance; and
- verification of incremental improvements and system corrective actions.

To meet these important challenges, the DoD T&E workforce must be prepared and confident in its abilities. This preparation, leading to increased professional capability, is accomplished through numerous education and training opportunities. These opportunities should be appropriately sequenced and available throughout the careers of workforce members.

Description of the T&E workforce

The T&E acquisition workforce is made up of civilian and Service members from each of the military departments—Army, Navy and Air Force—as well as civilian members of the DoD Fourth Estate, which includes defense agencies such as the Missile Defense Agency and Defense Information Systems Agency. *Table 1* shows the current numbers of T&E workforce positions under the Defense Acquisition Workforce Improvement Act.

Table 1. T&E acquisition workforce positions as of the second quarter, fiscal year 2012 (source: AT&L Datamart)

	Civilian	Military	Total
Army	2,181	46	2,227
Navy	2,570	482	3,052
Air Force	1,675	1,322	2,997
Fourth estate*	346		346
Total	6,772	1,850	8,622

*Military positions assigned to fourth-estate defense agencies are tracked by Service.

The T&E workforce is made up of engineers, mathematicians, physicists, chemists, biologists, etc. During their careers, T&E professionals may hold a variety of billets such as the following:

- chief developmental tester,
- chair, T&E working-level integrated product team,
- assistant program executive officer for T&E,
- assistant program manager for T&E,
- chief test engineer,
- chief test pilot,
- test director or manager,
- test engineer,
- acquisition T&E department head,
- T&E department head,
- chief test officer,
- test officer,
- lead experimentation engineer,
- T&E executive, or
- lead test engineer.

Typical T&E activities include the following:

- serving as chief developmental tester for a major defense acquisition program or major automated information system;
- serving as the chair of a T&E working-level integrated product team or as a member representing the materiel developer, tester, or system evaluator;
- analyzing requirements or capabilities documents to determine testability and measurability;
- planning, organizing, managing, or conducting test or evaluation associated with equipment or materiel throughout all acquisition phases;
- determining scope, infrastructure, resources, and data-sample size to ensure that system requirements are adequately demonstrated; analyzing, assessing, and evaluating test data or results; and preparing reports of system performance and T&E findings;
- developing T&E processes and modifying, adapting, tailoring, or extending standard T&E guides, precedents, criteria, methods, and techniques to include design of experiments, modeling and simulation, and information-assurance T&E and certification;
- designing and using existing or new test equipment, procedures, and approaches;
- writing, editing, and staffing a T&E strategy or T&E master plan, as well as system-level or individual-element test plans;
- conducting developmental T&E (DT&E), supporting operational tests, evaluating or analyzing test results or test data, and preparing and presenting evaluation or assessment results; and
- categorizing test data, equipment, materiel, or system deficiencies and certifying readiness for operational test and evaluation.

A key member of the T&E workforce is the chief developmental tester required by the National Defense Authorization Act for fiscal year 2012. The chief developmental tester is a part of the program office and is responsible for the following:

- coordinating the planning, management, and oversight of all DT&E activities for the program;
- maintaining insight into contractor activities and overseeing the T&E activities of other participating government activities; and
- helping program managers make technically informed, objective judgments about contractor DT&E results.

T&E competency development

In fiscal year 2008, the T&E Functional Integrated Product Team (FIPT) formed a group of subject-matter experts to develop the T&E competency model. The subject-matter experts defined the seven units of competency with 25 competencies and 66 competency elements. Completed during 2011, the T&E workforce survey analysis of the results was presented to the T&E FIPT. Based on the results a review of the competencies against the Defense Acquisition University (DAU) curriculum, the competencies were updated by the T&E FIPT with additional elements being added, bringing the total competency elements to 69. *Table 2* shows the high-level competencies.

T&E certification standards

The Defense Acquisition Workforce Improvement Act delineated the establishment and management of the DoD acquisition workforce. *Table 3* depicts the 15 acquisition career fields, with T&E listed as the sixth largest career field (6 percent of the acquisition workforce).

Table 2. T&E competency model

Unit of competence	Competencies
Planning	**(1)** Risk identification
	(2) Capabilities assessment
	(3) Program T&E strategy development
	(4) Test cost estimating
Preparation	**(5)** Coordination of T&E activities and events
	(6) Test readiness
Test execution	**(7)** Risk management
	(8) Test control management
	(9) Data management
Analysis	**(10)** Data verification and validation
	(11) Data reduction and assimilation
Evaluation	**(12)** Determination of test adequacy
	(13) Validation of test results
	(14) Evaluative conclusions
Reporting	**(15)** Technical reviews
	(16) Lessons learned
	(17) Documentation
Professionalism	**(18)** Customer service
	(19) External awareness
	(20) Flexibility
	(21) Communication
	(22) Technical credibility
	(23) Critical thinking
	(24) Professional ethics
	(25) Leadership and management

Certification within the T&E career field requires (a) a technical degree (bachelor's or graduate degree from an accredited university), (b) at least 2 years of appropriate work experience in the field, and (c) successful completion of required professional courses. The courses are established by the T&E functional leader, the deputy assistant secretary of defense for developmental test and evaluation (DASD(DT&E)). The DASD(DT&E) and staff work closely with the military Services, defense agencies, and DAU through the T&E FIPT to determine the required set of courses and experience for each level of certification. Most of these courses are offered by DAU, but Service-equivalent courses are acceptable substitutes. These courses can be formal in-residence (classroom) courses, computer-based continuous learning modules, or online Web-based courses. The levels of certification are as follows:

- Level I—entry level,
- Level II—journeyman level, and
- Level III—senior or executive level.

DAU offers three designated T&E courses, with one course specifically required for each certification level. Prerequisite courses must also be completed. The three designated T&E courses are as follows:

- Level I: TST 102, Fundamentals of Test and Evaluation, is an online Web-based course that takes about 6 to 8 weeks to complete. This course provides the basic tenets of T&E and introduces the DoD T&E organizational structures and oversight offices within the Office of the Secretary of Defense. Service T&E organizations and infrastructure are also discussed. TST 102 has 17 lessons, with an exam at the conclusion of each. Also, two homework assignments must be submitted and graded. The first assignment covers test planning, and the second covers data analysis and test reporting.
- Level II: TST 203, Intermediate Test and Evaluation, is currently a 1-week resident course. This course is offered at DAU regional sites. TST 203 closely examines the requirements process and the T&E documents required for management of a program's engineering development throughout the life cycle. The course covers modules on a variety of subjects, such as current events in T&E, reliability, T&E master plan, test requirements, test planning, test execution, data analysis and evaluation, test reporting, test ranges and resources, statistical methods (design of experiments), and ethics. TST 203 has daily work-group exercises or case studies and two written exams (midweek and final). Plans are under way to increase the scope of TST 203 in fiscal year 2013 and add 1 week to the course in fiscal year 2014. The intent is to provide more in-depth coverage of T&E topics and a greater opportunity for students to participate in practical applications, such as case studies, research projects, or student briefings, and lessons learned.

Table 3. Defense acquisition career fields

Acquisition career field	Positions
Systems Planning, Research, Development, and Engineering – Systems Engineering	39,071
Contracting	30,271
Life Cycle Logistics	17,218
Program Management	15,840
Production, Quality, and Manufacturing	9,313
Test and Evaluation	**8,622**
Facilities Engineering	7,329
Business – Financial Management	6,864
Information Technology	5,645
Auditing	4,273
Systems Planning, Research, Development, and Engineering – Science and Technology Manager	3,206
Purchasing	1,274
Business – Cost Estimating	1,271
Systems Planning, Research, Development, and Engineering – Program Systems Engineer	482
Industrial/Contract Property Management	465

Table 4. T&E Level I core certification standards

Acquisition Training	• **ACQ 101** Fundamentals of Systems Acquisition Management
Functional Training	• **CLE 023** Modeling and Simulation for Test and Evaluation • **CLE 025** Information Assurance (IA) • **CLE 035** DTEPI Introduction to Probability and Statistics • **SYS 101** Fundamentals of Systems Planning, Research, Development, and Engineering • **TST 102** Fundamentals of Test and Evaluation
Education	• Baccalaureate or graduate degree in a technical or scientific field such as engineering, physics, chemistry, biology, mathematics, operations research, engineering management, or computer science
Experience	• 1 year of experience in test and evaluation

- Level III: TST 303, Advanced Test and Evaluation, is a 1-week senior-level resident course. This course covers T&E from a management level with emphasis on critical thinking and higher-learning proficiency. Case-study methods and student presentations are used for evaluation. Executive-level guest speakers from the Office of the Secretary of Defense and the Components (military services, DoD agencies, and DoD organizations) present examples of the highest levels of decision making.

Table 4 shows the requirements for Level I certification and the flow of courses. DAU provides the basic certification courses, but certification is managed by each Component's defense acquisition career manager, who acts as the certification agent for that Component's members. The remaining certification requirements can be found at the DAU website.

Opportunities for T&E education and training

In addition to the three T&E courses described in the previous section, there are other opportunities for education and training. Each certified member of the acquisition workforce must maintain professional competency. The minimum requirement for training and education is 80 hours within the last 24 months. After completing TST 303, there are no additional T&E courses to take at the level of the Office of the Secretary of Defense; however, DAU does offer many continuous learning modules with associated academic credit that can count toward the 80-hour requirement. Component T&E training courses and college-level courses related to testing (such as statistical analysis, program management, engineering management, logistics, or budgeting) can count toward the 80-hour requirement.

In addition, many associations—such as the International Test and Evaluation Association, National Defense Industrial Association, and National Contract Management Association—provide professional activities applicable to the T&E career field. These types of organizations also sponsor seminars, workshops, and conferences to support career development.

Taking the DoD T&E workforce to the next level

Based on the increasing complexity of systems being developed, the DASD(DT&E), in coordination with DAU, recommended revision of the core education requirements to advance our technical proficiency within the T&E profession. Among those initiatives are the following:

- T&E education requirements: Beginning October 1, 2012, the T&E career field requires a baccalaureate or graduate degree in a technical or scientific field such as engineering, physics, chemistry, biology, mathematics, operations research, engineering management, or computer science. The rationale for the change is the increasing complexity of systems and the need to develop more rigorous, scientific, and statistically based T&E design and methodology. The technical or scientific degree will provide the foundation necessary for T&E professionals.
- DAU T&E curriculum update: The DAU T&E curriculum is being revised to include increased rigor within the courses, increased student application through practical-application exercises, and additional critical thinking within student exercises. The intent is to provide a robust training curriculum that takes the T&E professional from entry level to senior level as shown in *Figure 1*.

The DASD(DT&E) has a roadmap to assist in T&E workforce development through improvement blocks each year, culminating in fiscal year 2015. The goal is to develop T&E professionals capable of performing their critical roles throughout the acquisition life cycle. *Figure 2* depicts the DASD(DT&E) roadmap.

Conclusion

Today's T&E professionals make up the sixth largest career field in the DoD acquisition community and will continue to have a major impact on weapon-system assessment. Today's T&E arena has become increasingly more complex and challenging. It is

Entry Level
Laying the foundation
Providing the nuts and bolts of T&E

Journeyman Level
Hands-on application and exercises
Implementation and execution

Senior Level
Critical Thinking
Higher level of proficiency

Figure 1. T&E progression from entry through senior level.

imperative that T&E professionals of today leverage every opportunity to maintain and increase their intellectual capital within the T&E profession.

T&E professionals should maintain professional standards and growth throughout their career by taking advantage of available educational and training opportunities. This concept will maximize the effectiveness of the T&E workforce while ensuring the necessary growth to keep up with advancing technologies. ❑

Mr. Thomas Simms is currently serving as the deputy director, test and evaluation (T&E) competency and development in the Office of the Deputy Assistant Secretary of Defense for Developmental Test and Evaluation (ODASD(DT&E)). In this role, Mr. Simms is responsible for developing policy, practices, and procedures for the Department of Defense (DoD) T&E community and providing advocacy, oversight, and guidance for the education, training, and certification of the DoD T&E acquisition workforce. Mr. Simms has more than 25 years of experience in the development, test, and evaluation of complex DoD weapon systems. Prior to joining ODASD(DT&E), Mr. Simms served as the director for test policy and integration at the Missile Defense Agency; he was responsible for the agency's test policy and test manpower and was the primary interface with the Office of the Director of Operational Test and Evaluation on missile-defense-related topics. Mr. Simms earned a bachelor of science in mechanical engineering from the University of Massachusetts, Dartmouth, in 1985. In 2006 he earned a master of science in engineering management from George Washington University. Mr. Simms is DAWIA Level III certified in T&E.

Mr. Terry Murphy is a retired Marine officer with 26 years of operational and training experience within such billets as commanding officer; platoon commander; operations officer; plans officer; chemical, biological, radiological, and nuclear officer; operations chief; infantry and reconnaissance platoon sergeant; and squad leader. In addition, Mr. Murphy has more than 15 years of test-and-evaluation (T&E) experience within uniformed and

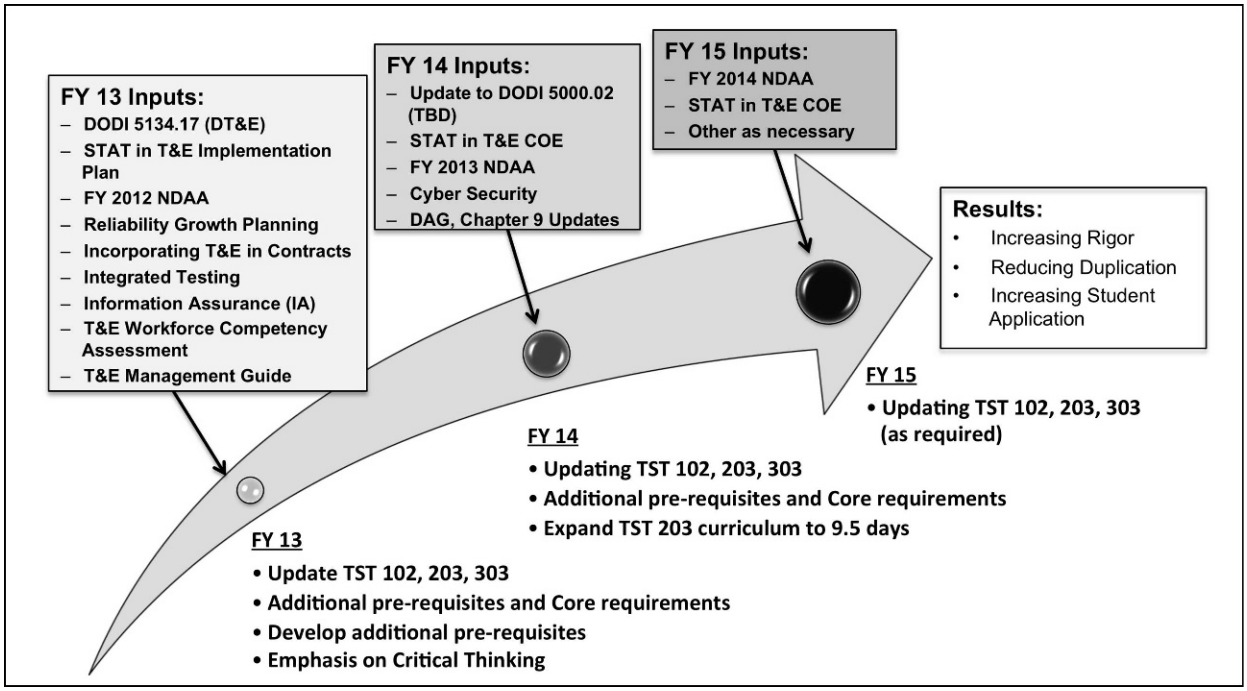

Figure 2. T&E workforce-development roadmap from the Deputy Assistant Secretary of Defense for Developmental Test and Evaluation for fiscal year 2013 through fiscal year 2015.

civilian service. He currently supports T&E competency and development within the Office of the Deputy Assistant Secretary of Defense for Developmental Test and Evaluation. This assignment includes such areas as T&E workforce development, T&E policy updates, and T&E guidance and tool development or updates. His prior assignments include T&E manager and program manager—combat support equipment, Marine Corps Systems Command; and T&E lead within the Office of the Joint Program Manager—Individual Protection CBRN. He holds a master of science in engineering management, a master of arts in management, and a bachelor of arts in social science. Mr. Murphy is DAWIA Level III certified in test and evaluation; systems planning, research, development, and engineering—program systems engineer; and program management; and Level I certified in information technology. E-mail: terry.murphy@osd.mil

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Dr. Paul Alfieri served 20 years in the U.S. Navy. He was a helicopter pilot and specialized in antisubmarine warfare operations while deployed on several aircraft carriers (USS Ticonderoga*, USS* America*, and USS* Enterprise*). Dr. Alfieri was assigned to the Navy Staff at the Pentagon for 3 years and spent 9 years at the Naval Air Systems Command as a tester, program manager, and systems engineer. Dr. Alfieri is DAWIA Level III certified in test and evaluation, program management, and systems engineering. Dr. Alfieri completed the program-management course at the Defense Systems Management College in 1987 and joined the faculty in 1991. He has served as a course director and course manager for various engineering and test-and-evaluation courses, and as chairman for the Test and Evaluation Department at the Defense Acquisition University. In 1998, Dr. Alfieri completed his doctorate in education at Virginia Tech, and in 2002 he graduated from the Industrial College of the Armed Forces at the National Defense University. Dr. Alfieri is currently the performance learning director for the Test and Evaluation Functional Area at DAU.*

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Acknowledgments

The authors would like to acknowledge their leaders within ODASD(DT&E) and DAU for their guidance and support during the development of this article.