Navy T&E—Three Decades of Change

Matthew T. Reynolds
Test & Evaluation Office, Naval Sea Systems Command,
Arlington, Virginia

Steven K. Whitehead
Commander, Operational Test & Evaluation Force,
Norfolk, Virginia

The one word that few would disagree characterizes the recent history of U.S. Navy test and evaluation (T&E) is evolutionary. Particularly in the last three decades, Navy T&E continually redefined itself. But that redefinition has not come from a lack of vision or focus; in fact, it is the result of very successful efforts of the T&E community to keep pace with the dramatic changes taking place in warfighting and in the new technology being introduced into the fleet. It would seem that, in general, Navy T&E has always been right for the time! This paper traces Navy T&E from the 1940s (when it first became recognizable) to the present, showing how developmental T&E and operational T&E have evolved—sometimes along seemingly separate paths—but always along complementary paths.

Formal, visible test and evaluation (T&E) in the U.S. Navy, whether characterized as developmental or operational, has roots that date back more than 50 years in that service's history. The beginnings of structured developmental and operational T&E date back to the establishment of Commander, Operational Development Force (COMOPDEVFOR), in September 1945. Headquartered in Norfolk, Virginia, onboard the USS *Adirondack*, and commanded by RADM Robert Briscoe, USN, the command's mission was to conduct operational and developmental test of Navy weapon systems.

The genesis for establishing COMOPDEVFOR can be traced, almost directly, to the failure of U.S. Navy torpedoes during World War II. In a nutshell, ineffective development and testing, weak fleet introduction and nonexistent teamwork resulted in release to the fleet of a weapon that would not destroy the enemy. In addition, Japanese employment of kamikaze tactics warranted the development of a counter tactic. In June 1959, COMOPDEVFOR was re-designated as Commander, Operational Test and Evaluation Force (COMOPTEVFOR), and the developmental and operational test communities were split, with COMOPTEVFOR responsible for the independent operational T&E of Navy systems, as well as initial tactics development.

During the 1960s, developmental T&E (DT&E) and operational T&E (OT&E) enjoyed little visibility. DT&E was conducted as a routine part of system development, and OT&E, when conducted at all, was conducted after the system's introduction to the fleet—so late that the Navy had little opportunity to make significant changes to the system.

The 1970s

T&E was brought to the forefront as a result of revolutionary changes in Department of Defense acquisition policy and performance of systems employed during the Vietnam War. The acquisition process model of "try-before-buy" was instituted, and few systems were deployed without rigorous DT&E and OT&E. OT&E, although previously conducted in the Navy, was made a firm requirement for programs proceeding into full-scale production and fleet introduction. DT&E, previously treated only as a barely distinguishable part of systems engineering, now began to have its own identity and better visibility.

Funding also was more available than it had been previously to design thorough test scenarios to ensure suffi-

cient data were available to minimize the increasing risks. And there *were* increasing risks. The 1970s was the decade in which digital technology made its way to the fleet, both through new ship and aircraft acquisition programs, and through back-fits into the older platforms. Analog systems were quickly converted in the race to reduce combat system reaction times to meet the rapidly expanding threat. Each year, the fleet moved closer to having more integrated sensor, command and control, and weapons systems in its platforms. The CVN-68 class aircraft carriers, the F-14 Tomcat aircraft *(Figure 1)*, the SSN-688 class submarines and the DD-963 class destroyers completed construction and transitioned to the fleet in large numbers.

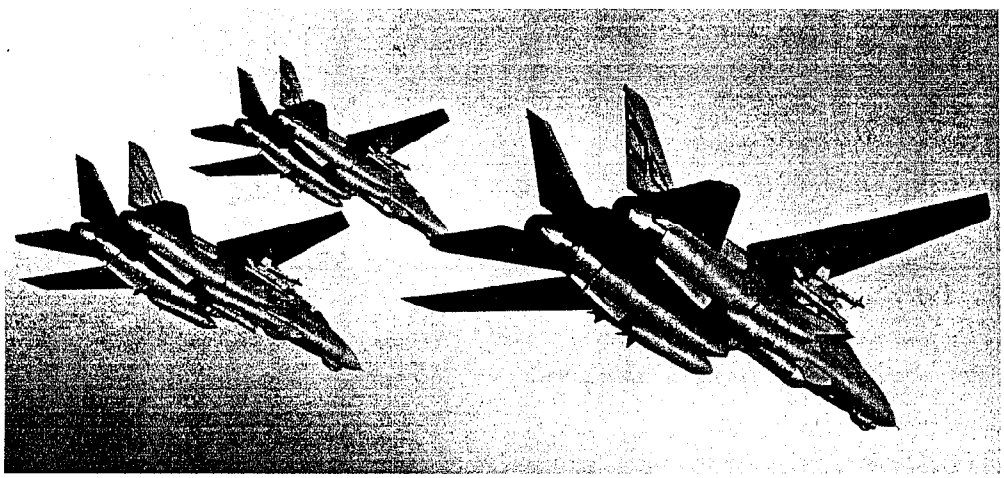

Figure 1. The F-14 Tomcat fighter aircraft—first introduced into the fleet in the 1970s (U.S. Navy photograph)

The 1980s

Whereas most of the OT&E conducted in the 1970s was back-fit into ongoing programs, the OT&E conducted in the 1980s had been forward-fit into programs from their beginning. This allowed much more opportunity to smartly scope and conduct independent OT&E. In addition, it enabled the DT&E to be planned from the beginning with a focus on the operational, thereby allowing it to nicely complement and build up to the planned OT&E. The timing could not have been better. Ships and aircraft that had been designed from the beginning as integrated platforms were just completing design and thus required the best T&E that could be planned and conducted. This T&E was needed not only to verify that these systems met their performance requirements, but also to smooth the transition of these new, complex technologies to the fleet. For example, this was the decade when CG-47 class cruisers—with the then-new, well-integrated Aegis combat system—became a mainstay of the fleet and a core participant in battle group operations.

The 1990s

An old lesson learned first in the mid-1940s was relearned in the 1990s: DT&E and independent OT&E did not need to be planned separately. Because DT&E and OT&E were becoming somewhat of a continuous spectrum, it was found that the line dividing them could be drawn differently on different programs. In fact, conducting some events as *combined* DT&E and OT&E made sense in many situations in order to reduce the increased risks in acquiring highly complex, interdependent systems.

Although some had originally seen a major thrust of OT&E as trying to determine how a system could fail, that paradigm was clearly dispelled in favor of one where both DT&E and OT&E were seen as efforts to continually *support*, throughout the course of an acquisition program, not only the major program go/no-go decisions but also the more routine design and systems engineering decisions. Of course, the independently planned and conducted operational evaluation (OPEVAL)—the original and continuing centerpiece of OT&E—was still the very formal and visible "graduation exercise" of the development period, as well as the gateway to full fleet introduction.

The change of attitude toward more complementary DT&E and OT&E opened the door for innovative approaches to T&E. These approaches saved significant resources at a time when the size of the fleet, along with the number and funding of new acquisition programs, were being significantly reduced year after year. While decreases in program funding brought the most immediate limitations to the scope of T&E programs, they were further constrained by the lack of available ship steaming and aircraft flight hours during which T&E could be conducted. T&E programs also were limited by a growing backlog of needed but unfunded improvements to at-sea ranges, land-based test facilities and threat-representative targets. The F/A-18 Super Hornet and the DDG-51 Aegis destroyer were platforms tested and delivered to the fleet during this era.

The new millennium

In the last few years, the operational commanders' requirements came to focus on battle group and battle

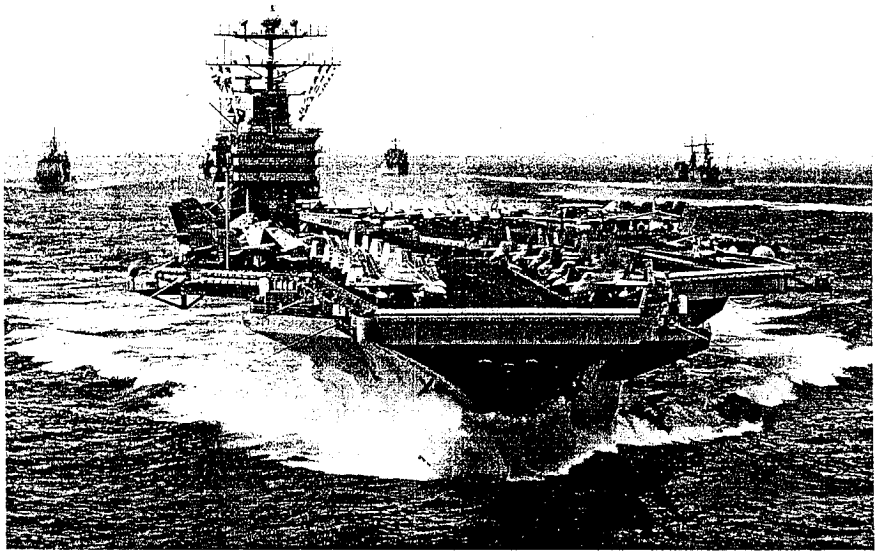

Figure 2. The USS John C. Stennis *(CVN-74) battle group underway in the Indian Ocean during fleet operations in 1988. T&E of battle force capabilities presents significant challenges for the Navy (U.S. Navy photograph)*

force interoperability *(Figure 2)*. In fact, this caught the requirements generation and acquisition communities somewhat by surprise. Both communities had been developing requirements and defining acquisition programs by *system boundaries*—the way they had for the previous several decades—when in fact what the operational commanders needed were not individual systems but battle force *operational capabilities*. T&E, particularly OT&E, helped identify this shortcoming. More importantly, the acquisition and T&E communities today are struggling with the challenge of articulating and refining requirements for such capabilities and their concept of operations. They also are attempting to determine how to apply the systems engineering process to these capabilities. Both communities recognize that T&E—both DT&E and OT&E—will not be just a gatekeeper used to verify that systems are ready to go to the fleet; they also will be day-by-day partners in mitigating risk and providing early assurances that programs are headed in the right direction. Toward this end, COMOPTEVFOR had greatly expanded its repertoire of services to include not only OTs, but also developmental test assists (DT assists), verification of correction of deficiencies, and computer software development process reviews. The feedback from COMOPTEVFOR is no longer restricted to a published report 90 days after completion of testing. The standard business practice now calls for feedback during OT in the form of anomaly reports and the release of related data to the designer to isolate and correct problems during development. The operational testers are no longer, and have not been for many years, isolated "behind the wall." They are out there with the developers, lending their operational perspective and insight to reduce acquisition risk where it really counts—early on.

1940	2000
Reduction in Defense $$ and partial loss of industrial base.	Reduction in Defense $$ and partial loss of industrial base.
Generations of warfighters untested	Generations of warfighters untested
Continual mission shifts	Continual mission shifts
Inventory of weapons untested in war	Inventory of weapons untested in war
Reluctance to test	Reluctance to test
Reliance on Modeling and Simulation	Reliance on Modeling and Simulation

Table 1. A comparison between conditions in the years 1940 and 2000 indicates that, although many things have changed, many things have remained the same or have come full circle

A word of caution is appropriate. This is not the time for Navy T&E to rest on its laurels. To paraphrase the advice often heard from investment brokers (and sound investment in warfighting capability is a fundamental precept of T&E) that *past performance is not necessarily indicative of future performance* is very applicable to the uncertainty of T&E. As *Table 1* indicates, although many things have changed and improved, some of the fundamental issues impacting the T&E process have come full circle. Many of the conditions that characterized early, struggling and sometimes problematic "early years" seem to exist today. The comparison shown in Table 1 indicates that, although many things have changed, many things have remained the same or have come full circle.

This is not to say that we have not made progress in improving the T&E process. Without a doubt, we *have* made progress! However, the uncertain future of infrastructure investment and resource availability combined with an unending pressure to field new systems as fast

36th Annual International Telemetering Conference (ITC/USA '00)

2000

Telemetry—Adapting to a Modern World

October 23–26, 2000

Town and Country Hotel,
San Diego, California USA

KEYNOTE TECHNICAL SESSION:

- **"Predicting the Unpredictable"—Mr. David Farber, Chief Technologist, FCC**
- **"Advanced Wireless Technologies"—Dr. Chuck Jackson, Consultant specializing in telecommunications and public policy**
- **"Ultrawideband Technology: The Wave of the Future?"—Dr. Robert Fontana, President and Founder, Multispectral Solutions, Inc.**
- **"Network Centric Warfare"—RADM Joseph Dyer, USN, Commander, Naval Air Warfare Center, Aircraft Division, and Assistant Commander for Research and Engineering, Naval Air Systems Command**

- Introductory and advanced telemetry short courses
- Displays and exhibits from more than 100 suppliers

REGISTRATION
Visit the ITC/USA '00 Web Site
www.telemetry.org
or
Contact Norm Lantz
310-336-4200 (tel), 310-336-6885 (fax)
norman.lantz@aero.org

EXHIBIT BOOTH SPACE
Contact Bill Graham
858-674-5100 ext. 4076 (tel)
grahame@ti.L-3com.com

The Department of Defense finds this event meets the minimum regulatory standards for attendance by DoD employees. This finding does not constitute a blanket approval or endorsement for attendance. Individual DoD Component commands or organizations are responsible for approving attendance of their DoD employees based on mission requirements and DoD regulations.

as technologically possible will continue to present new challenges. These challenges will require innovative solutions and even closer working relationships between Navy T&E, acquisition and the fleet.

Summary

Although the DT and OT communities will continue to frequently differ on their opinions about how much T&E is enough in a given program, it is a truism that "the best decisions come from conflict." It is that continual, reasonable "conflict" and the checks and balances between the communities that in the end continue to bring the very best product to the warfighter. The OT commands for all of the military services hold to a core value with regard to their mission:

"Our ultimate customer is the soldier, sailor, airman...our sons and daughters...who will judge our efforts with their lives and their mission accomplishment. This is a sacred trust which will not be compromised."

This core value is one that has grown to be shared by all involved in the T&E business in the U.S. Navy. It is fair to say that it has become part of our culture. ❑

Matthew T. Reynolds has worked in the Naval Sea Systems Command since 1968. Initially, he served as the test program manager for two nuclear cruiser ship acquisition programs, the USS California *(CGN-36) class and the USS* Virginia *(CGN-38) class. In 1972, he became the director of test and evaluation for the Surface Ships Directorate. In 1979, Reynolds was selected to become director of the then-new Test and Evaluation Office within the Naval Sea Systems Command—the position he has continued to hold since that time. His award-winning book,* Test and Evaluation of Complex Systems, *was published in 1997. He is a past-president of ITEA and currently is chairman of ITEA's Strategic Planning Committee. He holds a bachelor's degree in electrical engineering and master of science degree in engineering administration.*

Steven K. Whitehead has been the technical director for Commander, Operational Test and Evaluation Force, since 1996. He has worked in test and evaluation for more than 15 years, beginning as an engineering technician at the Naval Undersea Warfare Center (NUWC), Newport, Rhode Island. From 1985 to 1991, he worked as a weapon systems analyst at the Naval Warfare Assessment Center, Corona, California, in support of NAVSEASYSCOM, Strategic Systems Programs Office (SSPO) and COMOPTEVFOR. He holds a bachelor of science degree in electrical engineering; a master of science degree in management; and is a 1994 graduate of the Naval War College.