Guidance

DOT&E and AT&L directives require the seamless integration of developmental and operational testing throughout the life cycle of a system under test. In their joint memo of 25 April 2008 DOT&E and AT&L defined integrated testing as follows:

"Integrated testing is the collaborative planning and collaborative execution of test phases and events to provide shared data in support of independent analysis, evaluation and reporting by all stakeholders particularly the developmental (both contractor and government) and operational test and evaluation communities."

Background

If planned and executed appropriately, integrated testing allows for a faster and more cost efficient T&E process that ultimately provides the Services with capable systems sooner and at a reduced cost as compared to sequential testing. As noted by DOT&E on 24 November 2009, integrated testing will never do away with the need for a dedicated operational test to confirm that systems will work in combat. The statutory requirements (USC 139, USC 2399) for dedicated operational testing are also clear. Fielding of past acquisition systems have been needlessly delayed by heel-to-toe segregation of developmental and operational testing. Such inefficient processes have been criticized by government studies.

Generally, technical performance measures that need only simple validation are candidates for measurement during integrated testing. If the data from these tests are to be used for the operational evaluation, the components and systems must be production representative. Measures that should be measured in dedicated OT&E include mission-dependent capabilities, CONOPS-related functions, scenario-dependent outcomes, and end-to-end or system-of-systems interactions or effects.

Integrated testing of production representative test articles may come about in two ways: (1) a developmental test incorporates characteristics of operational testing into the test, or (2) the data from developmental testing is accepted as adequate for the operational evaluation. The latter type of integrated test requires that the metrics being measured be equally valid under the conditions for developmental and operational testing. The description of plans for integrated testing should be documented throughout the TEMP. The relevant paragraphs are:

- **Paragraph 3.1, T&E Strategy of the TEMP:** The overarching T&E strategy section of the TEMP should address the conditions for integration of DT and OT testing, if planned.

- **Paragraph 3.2.1, Mission Oriented Approach Section of the TEMP:** Discuss when and how developmental testing will reflect the expected operational environment. This will help integrate developmental testing with operational testing.

- **Paragraph 3.2.3, Developmental Test Events Section of the TEMP:** Describe how selected developmental test events will reflect the expected operational environment. This will help integrate developmental testing with operational testing.

- **Paragraph 3.4, Operational Evaluation Approach Section of the TEMP:** Summarize integrated testing strategy to include: (1) developmental test data that will be used for operational evaluation and (2) conditions for data pedigree and test conduct that will make data suitable for use in the operational evaluation.

Best Practices

Metrics that do not usually depend on the conditions of the test are cargo and storage capacity requirements, common to amphibious and non-combatant ship programs. These requirements typically require the ship to provide a specified amount of cargo or vehicle storage capacity. Since the amount of space available does not depend on the conditions of the test, a developmental test that measures the capacity should provide adequate data for an operational evaluation. Developmental tests that are often used to provide this data include Marine Corps Certification Exercises and Navy In-service Inspections.

Integrated testing of production representative components and systems can be useful to measure satellite surveillance performance, communications range and throughput, storage capacity, network backup and restore capabilities, vehicle or sensor performance, weapons accuracy, countermeasure performance, bandwidth, sensitivity, user load simulations, or satellite autonomous operations.

For systems with high reliability requirement thresholds that would be impracticable to test fully in OT&E, it is sometimes possible to include data from operationally realistic integrated testing. This might be done for the whole system or for the important subsystems. In such cases, the TEMP should include rationale, applicability, and any limitations for including integrated test data in the evaluation of reliability. For systems adopting this approach, data from environmental testing (e.g. thermal, vacuum, vibration, rain, ice, sand, etc.) can assist with assessments of long-term reliability when combined with historical data and appropriate caveats.

Air Warfare Ship Self-Defense test events, particularly those conducted on the remotely controlled Self-Defense Test Ship,[1] are good examples of integrated tests where a developmental test is executed under conditions that are sufficiently operationally realistic. During Self-Defense Test Ship events, aerial targets are flown directly at the test ship. The combat system elements of the ship are operated by civilian experts via remote control. As a developmental test platform, the test ship provides a highly controlled environment for testing specific system metrics. By ensuring that the aerial targets are representative of actual anti-ship cruise missile threats and that the flight profile of the target is the same as the threat, the developmental test can be used as an integrated test.

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[1] The Self-Defense Test Ship is a former Spruance Class Destroyer that has been equipped with multiple modern-day anti-air warfare combat systems. The ship and its combat systems are both capable of being operated by remote control, thereby reducing the risk of mishap when engaging anti-ship cruise missiles and aerial targets.