OTA Roundtable: Applying the T&E Requirements Process to Unmanned / Autonomous Vehicles

Stephen C. Daly
Deputy Director, Operational Test & Evaluation for Land & Expeditionary Warfare
Office of the Secretary of Defense
Pentagon Room 1D548
(703) 697-3891
stephen.daly@osd.mil
Requirements

- Warfighters write requirements or “must have” capabilities – not testers, not evaluators.
- Warfighters define the concept of operations – not testers, not evaluators.
- Program Managers, testers, evaluators need to understand the **RATIONALE** behind the warfighter’s requirements and the warfighter’s CONOPS.
  - PM: where to trade cost, schedule, and performance.
  - Tester: structure tests to demonstrate system & unit performance.
  - Evaluator:
    - Assess unit mission accomplishment.
    - Assess system performance.
    - Answer the “so-what” question.
Comprehensive Testing

• Works in a well-known process to demonstrate system performance in a “model-test-fix-test” methodology.
  - Developmental Test & Evaluation.
  - Live Fire Test & Evaluation.
  - Operational Test & Evaluation.
  - Evaluation of the significance of system performance & unit mission accomplishment performance.

• Comprehensive T&E characterized by some as:
  - “Too slow.”
  - “Too costly.”
  - “You don’t understand that my UAS/UAV is special.”
  - “We’re at war for gosh sakes.”
DOT&E Point of View

• Many past systems started as Advanced Concept Technology Demonstration (ACTD).
  ▪ Execution of ACTD’s often skimps on the demonstration.
  ▪ Often fail to address operational suitability issues.
  ▪ Often has a cumbersome transition to a program-of-record.

• Common theme is to avoid government test in any form.

• In IOT&E:
  ▪ Some UASs have been assessed as operationally effective.
  ▪ To date, none have been assessed as operationally suitable.
  ▪ Services have applied lessons learned and corrections to improve these systems since IOT&E.
  ▪ Lessons apply to other Unmanned Systems in development.
Shadow IOTE in 2002 at Fort Hood

- Operationally effective under fair weather conditions and in the absence of an air threat for cued reconnaissance and surveillance missions … not operationally effective to target acquisition missions.
  - 57% of Recon-Surveillance reports were timely and accurate.
  - Demonstrated target location error in excess of 200 m (80 m req’d).
- Not operationally suitable.
  - Not reliable, not maintainable, 2 AV crashes and 1 significant damage.
  - Operational Availability meets user requirements due to redundancy.
  - Demonstrated ability to meet the Commander’s operational tempo.
- Not survivable.
  - Susceptibility to detection is high.
  - Seen and heard within effective ranges of many threats.
  - Significant electromagnetic vulnerability.
Predator IOTE in 2000

• Predator is not operationally effective or suitable.
  ▪ Disparity between the apparently successful fielded system and the
    systems that did not perform well in IOT is largely attributable to the fact
    that the system is tasked and operated well within known limitations
    such as effective time-on-station, weather restrictions, expected threats,
    expected accuracy, and dissemination abilities.
  ▪ Capable of surveillance, recon, & battle damage assessment missions.
  ▪ Poor Target Location Error (TLE), weather restrictions, and ineffective
    communication impact strike support, CSAR, area search, and
    continuous coverage.
  ▪ Cannot meet requirements outlined in the ORD & KPPs.
  ▪ Lack of relief-on-station procedures and poor reliability renders the
    system unable to meet the 75% Effective Time-on-Station (ETOS)
    requirement at range of 400 nm.
  ▪ Serious deficiencies in reliability, maintainability, and human factors.
Raven IOTE in 2006 at Fort Bliss

• Raven SUAS is operationally effective.
  ▪ Infantry company commander benefits from enhanced situational awareness and more operational planning options.
  ▪ Used effectively in lieu of manned reconnaissance.
  ▪ Can recognize manned-sized objects, but cannot identify armed from unarmed personnel or find IEDs.
  ▪ AV susceptible to acoustic and visual detection.

• Raven SUAS is not operationally suitable.
  ▪ SUAS-equipped unit cannot sustain itself in prolonged combat.
  ▪ Consumed parts at a rate in excess of the parts allocation.
  ▪ Operators were able to quickly repair the AV if parts were on-hand.
  ▪ AV was not reliable, demonstrated 5.6 hrs MTBSA (12 req’d).
Observations & Advice

- Focus on warfighter’s mission accomplishment, CONOPS, and total life-cycle cost.
  - Understand the rationale behind the capabilities and KPPs.
  - Cleary define mission success.
- Reliability ..... Reliability ..... Reliability.
- Take advantage of inherent redundancy, balance vs workload.
- Some tactical UAS fielded without operators – additional duty.
- Target location error and resolution.
- Weapons – create whole new set of additional operational issues.
- Work to reduce UAS susceptibility in early design efforts.
- System proliferation creates airspace management issues – will face similar terrestrial battlespace management issues.
- Extreme Environments – hot, cold, wind, weather.
- Countermeasures, GPS jamming, friendly Counter IED Systems – complex spectrum.
- Incorporate Real-Time Casualty Assessment System (RTCA).
- Warfighter’s operate in a joint environment today.
Back-up Slides
“There is a Director of Operational Test and Evaluation in the Department of Defense, appointed from civilian life by the President, by and with the advice and consent of the Senate.”

“Operational test and evaluation means --
- the field test, under realistic combat conditions, of any item of (or key component of) weapons, equipment, or munitions for use in combat by typical military users; and
- the evaluation of the results of such test.”
“The Director shall --

• prescribe, by authority of the Secretary of Defense, policies and procedures for the conduct of operational test and evaluation in the Department of Defense;

• provide guidance to and consult with the Secretary of Defense and the Under Secretary of Defense for Acquisition and Technology and the Secretaries of the military departments in general and with respect to specific operational test and evaluation ...;

• coordinate operational testing conducted jointly by more than one military department or defense agency;

• monitor and review all operational test and evaluation in the Department of Defense;

• review and make recommendations to the Secretary of Defense on all budgetary and financial matters...;

• monitor and review the live fire testing activities of the Department....”
Operational Effectiveness

The overall degree of mission accomplishment of a system when used by representative personnel in the environment planned or expected for operational employment of the system considering:

- organization
- doctrine
- tactics
- survivability
- vulnerability
- threat
Operational Suitability

• The degree to which a system can be **satisfactorily placed in field use**, with consideration given to:
  - availability
  - compatibility
  - transportability
  - interoperability
  - reliability
  - wartime usage rates
  - maintainability
  - safety
  - human factors
  - manpower supportability
  - logistics supportability
  - documentation
  - training requirements
<table>
<thead>
<tr>
<th>Name</th>
<th>Title/Role</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stephen C. Daly</td>
<td>Deputy Director, Land &amp; Expeditionary Warfare</td>
<td>703-697-3891, <a href="mailto:Steve.Daly@osd.mil">Steve.Daly@osd.mil</a></td>
</tr>
<tr>
<td>Michael D. Crisp</td>
<td>Deputy Director, Air Warfare</td>
<td>703-692-9929, <a href="mailto:Mike.Crisp@osd.mil">Mike.Crisp@osd.mil</a></td>
</tr>
<tr>
<td>Thomas B. Blann</td>
<td>Deputy Director, Naval Warfare</td>
<td>703-681-5417, <a href="mailto:Thomas.Blann@osd.mil">Thomas.Blann@osd.mil</a></td>
</tr>
<tr>
<td>William J. McCarthy</td>
<td>Deputy Director, Net-Centric &amp; Space Systems</td>
<td>703-681-5411, <a href="mailto:William.McCarthy@osd.mil">William.McCarthy@osd.mil</a></td>
</tr>
<tr>
<td>Richard G. Sayre</td>
<td>Deputy Director, Live Fire</td>
<td>703-614-3991, <a href="mailto:Rick.Sayre@osd.mil">Rick.Sayre@osd.mil</a></td>
</tr>
<tr>
<td>David W. Duma</td>
<td>Principal Deputy Director</td>
<td>703-697-4813, <a href="mailto:David.Duma@osd.mil">David.Duma@osd.mil</a></td>
</tr>
<tr>
<td>COL Bill Bennett</td>
<td>Senior Military Assistant</td>
<td>703-697-3655, <a href="mailto:Henry.Bennett@osd.mil">Henry.Bennett@osd.mil</a></td>
</tr>
<tr>
<td>Dr. Ernest Seglie</td>
<td>Science Advisor</td>
<td>703-697-3655, <a href="mailto:Ernest.Seglie@osd.mil">Ernest.Seglie@osd.mil</a></td>
</tr>
<tr>
<td>Hon. Charles E. McQueary</td>
<td>Director, Operational Test &amp; Evaluation</td>
<td>703-697-3655</td>
</tr>
</tbody>
</table>

**Organizational Chart**

- **Deputy Director, Land & Expeditionary Warfare**
  - Land Warfare Systems
  - Expeditionary Warfare System
  - Future Combat Systems
  - Battle Command
  - Land Munitions
  - Rotary & Tilt-Rotor Aircraft
  - Tactical UAV
  - Chem-Bio Defense Program
  - Joint Rapid Acquisition Cell
  - Integrated Resource Analysis
  - T&E Threat Resource Activity
  - Joint Test Board

- **Deputy Director, Air Warfare**
  - Air Combat Systems
  - Strategic Air Combat Systems
  - Aircraft Carriers
  - Air Launched Munitions
  - Endurance UAVs
  - Air Warfare C4ISR Systems
  - IR/UV/RF Def Combat Sys
  - Airlift Systems
  - Joint T&E Program
  - Center for Counter Measures

- **Deputy Director, Naval Warfare**
  - Surface Ships
  - Submarines & UUVs
  - Navy Combat Systems
  - Radars
  - Sonars
  - EW System
  - CEC
  - Naval Munitions
  - Missiles
  - Guided Projectiles
  - Torpedoes

- **Deputy Director, Net-Centric & Space Systems**
  - Space & Strategic Systems
  - Net-Centric Systems
  - Strategic C4ISR Systems
  - Major Automated Info System
  - Chemical Weapons Demil
  - Network Information
  - Assurance & Interoperability Assessment

- **Deputy Director, Live Fire**
  - Live Fire – Land, Air, Naval
  - Lethality & Survivability
  - Joint IED Defeat
  - Joint Live Fire Program
  - Joint Aircraft Survivability
  - Joint Technical Coordinating Group-Munitions
  - Effectiveness

---

26 February 2008 -- Slide 14