

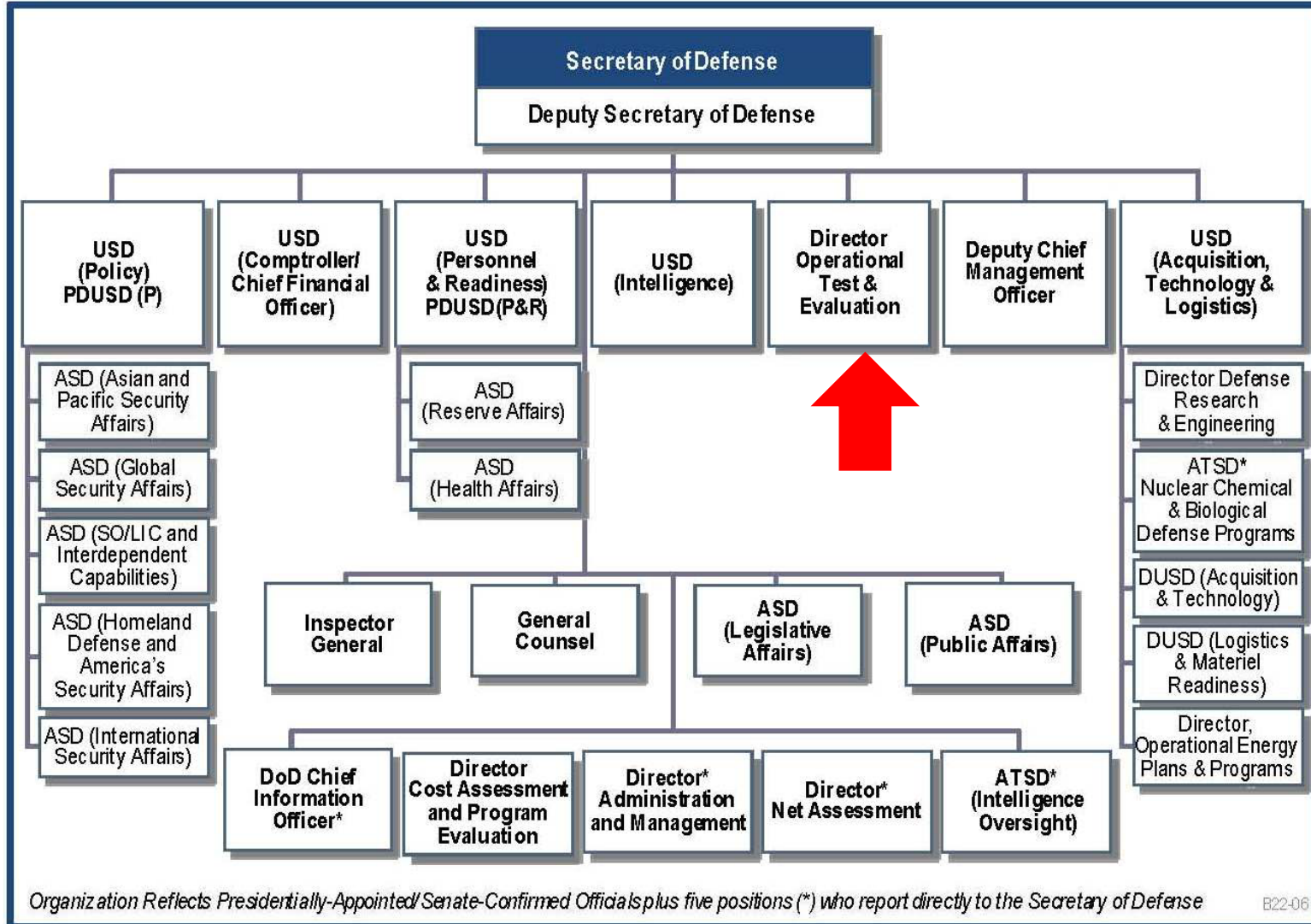
Operational Testing and Autonomy

**Dr. Robert Holcomb
The Institute for Defense Analyses**

3 March 2016

- **Some Background on DOT&E**
 - History
 - Role in OT
- **Characteristics Necessary in Operational Testing**
- **How Should We OT Autonomous (or Semi-autonomous) Systems?**
 - DoD Directive 3000.09

- **DOT&E was created by Congress in 1983.**
- **Director is appointed by the President and confirmed by the Senate.**
- **Director's reports, by statute, go directly to the Secretary of Defense and Congress.**
- **Responsible for all operational test & evaluation (OT&E) & monitoring and reviewing live fire test & evaluation (LFT&E) within DoD.**
- **Responsibilities outlined in Title 10, United States Code – 10 USC 139, 2366, 2399, 2400.**



“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 the purpose of determining the effectiveness and suitability of the weapons, equipment, or munitions for use in combat by typical military users; and
- the evaluation of the results of such test.”

- **Is the system operationally effective?**
- **Is the system operationally suitable?**
- **Is the OT&E and/or LFT&E adequate?**
- **Is the system survivable and lethal?**

Operational effectiveness is 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
- training
- doctrine
- tactics
- survivability
- vulnerability
- threat.



Operational Suitability **(Defense Acquisition Guidebook)**

Operational suitability is the degree to which a system can be satisfactorily placed in field use, with consideration given to

- reliability
- availability
- compatibility
- transportability
- interoperability
- wartime usage rates
- maintainability
- safety
- human factors
- manpower supportability
- logistics supportability
- documentation
- environmental effects
- training requirements



So What Does That Have to Do With Autonomy?

- **DOT&E will be responsible to oversee joint and Service operational testing of autonomous systems**
 - Will approve test plans as adequate or not, including safety considerations
 - Will monitor test events
 - Will have access to all data from test events and will analyze it independently from the Service
 - Will report directly to four Congressional Committees as well as SecDef and Services on their findings
- **Our involvement is done in conjunction with the Service**
 - Not conducting separate test events, but approving Service test plans as being adequate in the Director's view
 - Not generating separate data but using the Service data gathered in their OT events
 - Also can include monitoring of DT events and in some cases can use DT data in their OT analyses

- **OT, by the definition in Title 10, requires “realistic combat conditions” and “typical military users”**
 - It is not a DT or lab-type of environment
 - Typically involves not just the system under test, but the unit that is equipped with that system
 - As well as a set of missions assigned to that unit, with a commander and staff appropriate to the unit size
 - Also includes a realistic, living and breathing OPFOR who has the intent and capability to win
 - Some method of assessing real time casualties for realistic combat conditions
 - Could be joint
- **We focus on unit accomplishment of missions, not merely on system performance**
 - First we ask “Does the system work?”
 - Then we ask “What is the effect of the system on the unit’s ability to accomplish missions?”



How Will You Evaluate Autonomous Systems?

- **DoDD 3000.09 specifies the DOT&E role in autonomy:**
 - Principal oversight responsibility for development of T&E standards (including *after* IOT&E)
 - Evaluate for oversight systems whether they have had sufficient V&V and T&E in realistic operational conditions, including adversarial action, to minimize probability and consequences of failure, unintended engagements or loss of control
- **We will examine what it is the system is expected to do, and what missions it is expected to enable or improve in a typical unit**
- **Then we will determine metrics that can measure if the system actually does do what it is expected, and if it does in fact enable or improve the unit missions**
 - Tracking from system specifications back to requirements and ultimately to unit capabilities
 - Isolating the contribution of the system to mission accomplishment
- **Live Fire will examine lethality of systems equipped with a weapon**

- **DOT&E has an explicit and an implicit role in the testing of autonomous systems**
- **They are required to do so in a realistic operational environment, and the Director will be the judge of when a test plan is adequate**
- **The enemy will play a large role in any OT**
- **The earlier DOT&E is involved in test planning, and in observing DT events, the better they can prepare for comprehensive and adequate OT events**