DASN RDT&E CHSENG Comments to TASKER 014001c

Review of the Defense Science Board, <u>The Role of Autonomy in DoD Systems</u>, July 2012

In general, DASN RDT&E CHSENG concurs with this report. These corrections are recommended for changes to the document to improve its impact and correct a few errors. A few comments to the report are noted below, for the author's consideration:

Executive Summary:

Section 1.1 of Executive Summary states:
"Autonomy is a capability that enables a particular action of a system to be automatic or, within programmed boundaries, or "self-governing"."   It is not "computers making independent decisions and taking uncontrolled action". Autonomous systems are "at some level, supervised by human operators".

A special consideration must be given to unmanned vehicles that require stealth to be effective. Undersea unmanned vehicles will have supervised autonomy, but the requirements for controlled action are at best challenging. Radio communications will potentially compromise stealth. Tethered undersea communications (e.g. acoustic communications, optical communications) are very limited in range and/or bandwidth. Opportunities for supervision in the undersea domain will be more limited than unmanned systems in other domains such as air, space, ground and sea surface.

Pg 1: From the outset, this document expressed a concern regarding the "operational accountability" of employing autonomous systems. Commanders are accountable for the battlefield effects within their area of responsibility (AOR). A commander has operational and legal responsibilities for actions, or lack of action in their AOR.

Pg 2, 30, 32: The uncertainty of employment of autonomous systems is an unknown risk for the commander.   The commander my delegate responsibility, but not accountability. There is a body of knowledge on "Operational Risk Management" (ORM) that is employed to incorporate safety considerations in the early processes of operational planning. Special considerations for the new operational challenges for the employment of autonomous systems in the context of ORM may be useful.

Pg 3-4, 12, 21, 33: Autonomous unmanned systems have some similarity to artificial intelligence or analytical engines. At this early stage of DoD employment of autonomy there may be benefit in considering previous DoD experience. The case of military working dogs has value in this situation. The dogs have considerable capacity for autonomous operation. The dogs only have operational utility when a strong bond has been formed with the dog handler. The dog handler and the dog form a team with special capabilities. Commanders are confident that they can employ human-dog teams because the human is very familiar with the dog's "thinking" and capabilities. The human's familiarity is a result of a long training period where the human and their dog have been trained and tested against specific performance standards. It is possible that humans could be "teamed" with an autonomous system for training and testing programs similar to the dog programs. This would contribute to the commander's confidence for employing autonomous systems.

Pg 7, 9, 13, 16: The chart has no metric for victory. The employment of autonomous systems only makes sense if they contribute towards mission success. There is a case for assessing autonomous systems in a dynamic game environment. A Live-Virtual-Constructive (LVC) training environment holds promise for supporting the training/testing of human-autonomous teams in a repeatable tactical situation.

Para. 4.1 (page 60). Change "government-owned software package" to an open systems architecture based on open standards, and open business model and published interfaces. (recommended addition): Such an architecture should be based on a Government/Industry consortium such as the Future Airborne Capability Environment managed by the Open Group.

4.1, page 61: add a reference to the DoD Open Systems Architecture Contract Guidebook for Program Managers. Also add reference to the Unmanned Air System Common Ground Control Segment (UCS) architecture managed by OSD.
Also on page 61, replace the word 'ownership' with license rights.
Page 62 also has a reference to 'ownership' where the term 'license rights' should be used.

Rationale: The Government never owns intellectual property unless a Government employee does the work. The Government does enjoy very powerful license rights to the intellectual property for the systems that it funds for development (DFARS 227.71, 227.72, 252.227-7013, -7014, 7015 and 7018).

In summary, military operations are accomplished through team work. A question raised about autonomous systems is "can they become part of the team"? A military conflict is similar to a football game in which the opposition is dynamic and will adapt to changing offensive schemes. What team roles and functions can autonomous systems satisfy? Can the employment of autonomous systems enhance team performance in tactical situations? These questions are not typically addressed in acquisition OT&E events, but should be answered prior to the acquisition of an autonomous system.

Office of Naval Research Comments to TASKER 014001c:
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Recommend concurrence with Final Report with one change:
1) Delete the following: on pg. 89 (Appendix A): "ONR's Persistent Littoral Undersea Surveillance (PLUS) program has recently begun to transition and provides collaborative detection and cueing for ASW." and on pg. 114 (Glossary): "PLUS - Persistent Littoral Undersea Surveillance.