OSD Maintenance Challenge

Abstract Form	
Paper Title:	In-System Maintenance Robotics
Author:	Stephen McKee
Organization:	NAVSEA 04X3
Phone:	(360) 340-4830
Email:	stephen.e.mckee@navy.mil

Abstract: (300-500 words)

The Naval Shipyards are responsible for the depot maintenance of various Navy vessels and are in the early stages of forming an increased functionality to create a long-term, modular environment that enables rapid growth and adaptation to support future technologies. A key element of this environment is the development and deployment of various-sized unmanned and autonomous robots that can perform in-systems assessments and repairs.

Industry and DOD continue to make strides to leverage the budding robotics industry. Some of the applications have been put into Intelligence, Surveillance, and Reconnaissance applications in the air-land-sea military spaces. Industry and academia have also tailored smaller solutions for infrastructure assessments (e.g., piping and bridges) and the bio-medical fields (e.g., surgical applications). Only recently have the Naval Shipyards begun to evaluate how to employ robotics technologies for the advancement of their mission.

Coincident with these advances, the National Institute of Standards and Technology is in the process of developing acceptance testing for robotic systems. The increasing capabilities of the robotics technology are approaching the point of transition to actively enhance depot maintenance operations.

This effort proposes to engage industry partners in a progressive series of challenging maintenance applications to aid the DOD maintenance community in the development and fielding of robotic solutions:

• Exterior system corrosion and fatigue assessment - This task would adapt existing commercial and DOD solutions to perform assessments of uneven surfaces open to the atmosphere. This assessment would also entail dynamic mapping for any future repairs.

• Exterior system repair and preservation – This task would move beyond the assessment efforts and perform repair and preservation actions without the need for humans proximate to the site(s).

• Interior tank assessment – This task is expected to negotiate a more complex space including baffles and intervening structures (e.g., pipe runs) to discern the condition of the underlying tank structure.

• Interior tank surface repair, preparation, and preservation – This task would move in the complex space and perform weld/epoxy repair, ensure adequate surface cleaning and preparation, and then apply a preservation coat to ensure the long-term viability of the tank. Creation of the anthology of the repair, including non-destruction testing, would be required.

• In-system piping inspection and repair – This task would be the culmination of the effort as the spaces would be more constrained than previous efforts. A series of progressively smaller diameter pipes would be selected to gage the effectiveness of the various robots.

These unmanned and autonomous solutions, whether in individual or swarm configurations, are expected to yield increased worker efficiencies through concurrent, augmented, and autonomous efforts. Properly constructed and deployed, the in-system robots will also provide real-time data into a unified system to allow more expedient problem resolution than currently exists.

The development of these solutions is necessary, and the time has come to adapt the existing robotics technology to increase the capacity of the DOD maintenance community.