

# Department of the Navy SBIR/STTR Transition Program

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NAVSEA #16-649

Topic # N141-023

Wireless Hydraulic Actuator Monitor (WHAM) Phase II

International Electronic Machines

## WHO

**SYSCOM:** NAVSEA

**Sponsoring Program:** Virginia Class PMS 450

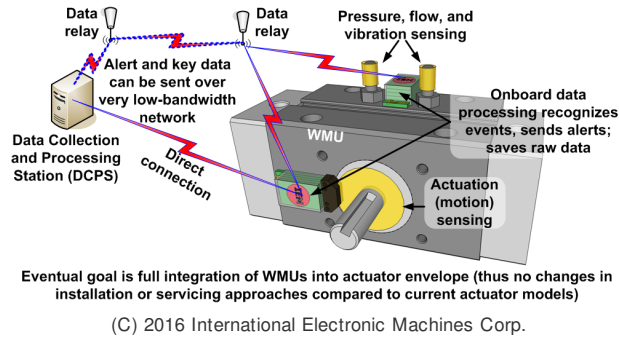
**Transition Target:** PMS 450, PMS 397 (Ohio Replacement)

**TPOC:**  
(215)897-8358

**Other transition opportunities:**

Any military systems which make use of hydraulic actuators -- surface ships and others -- can benefit from WHAM.

**Notes:** Actuators are used in virtually all large military and industrial systems and processes; WHAM can also apply, with minor modifications, to pneumatic and even electrical actuator systems, broadening its potential market.



## WHAT

**Operational Need and Improvement:** Scheduled maintenance on mission-critical hydraulic actuators often wastes time and money, and causes system downtime, by removing and refurbishing perfectly functional actuators and provides no way of recognizing that an actuator may be failing prior to schedule. WHAM provides the ability to detect developing problems in actuators or connected valves and thus to maintain actuators and valves only when and as needed.

**Specifications Required:** WHAM is required to create a wireless sensor system which will provide actionable maintenance data for actuators and if possible associated components such as valves. WHAM must not interfere with other systems electronically or physically, including having no impact on installation and removal of actuators; thus WHAM must be integrated with or at least confined to the envelope of the existing actuator.

**Technology Developed:** WHAM Phase I developed a small wireless system which could monitor multiple key aspects of actuator operation and recognize both proper operation and multiple conditions related to actuator operational issues and failure. IEM also has collaborated with primes and manufacturers to ensure that both the physical system and wireless data transmission is integrated with established systems properly. Current work is on developing the final system design and key software algorithms for condition detection and alerting.

**Warfighter Value:** WHAM will provide assurance of mission-critical actuator operation while reducing system downtime, reducing the demand for maintenance manpower, and reducing cost in terms of both time and money for system maintenance, thus both reducing costs and increasing safe and reliable system operation.

## WHEN

**Contract Number:** N00024-16-C-4005 **Ending on:** December 31, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Initial proof of concept	N/A	Show complete system gathering data from key points	3	November 2014
Breadboard validation	N/A	Demonstrate ability to automatically detect and recognize simulated system problems	4	November 2015
Refined prototype testing/demonstration (Phase II Year 1 Final)	Low	Prototype system accurately detecting real issues on actuators/valves	5	December 2016
Test/demonstration in external high-fidelity setting (Phase II Year 2 final)	Med	System demonstrated on external testbed under control of Navy	6	December 2017

## HOW

**Projected Business Model:** IEM's preferred production approach would be to include WHAM as part of the actuator monitor manufacturing process, incorporating the system directly into the actuator. For low-rate production IEM could produce the WHAM units themselves and provide them to the manufacturer; larger-rate production might require additional manufacturing partners.

**Company Objectives:** IEM intends to expand this type of PHM/CBM system to other industries and organizations dependent on actuators to control essential processes. IEM's particular focus is on transportation-related applications (land, sea, air) but WHAM would be applicable to even stationary industrial process actuator systems. IEM seeks interested military and corporate partners to explore these options.

**Potential Commercial Applications:** Actuators -- hydraulic, pneumatic, and electric -- are used throughout the world for the control of processes, for opening and closing valves, loading materials, and other functions. This is a multi-billion dollar industry with many critical-path applications in military, industrial, and other civilian contexts such as nonmilitary ocean vessels and aircraft. All such applications can benefit from reliable monitoring of the operation and condition of their actuators.

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