Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2023-0084

Topic # N121-043
Landing Gear Structural Health Prognostic/Diagnostic System
(ES3) Engineering & Software System Solution, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: Persistent Maritime Unmanned Aircraft Systems Program Office (PMA) 262

Transition Target: MQ-4C Triton

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Other Transition Opportunities: CH-53K King Stallion, P-8A Poseidon, F/A-18E/F Super Hornet, E/A-18G Growler

Notes: ES3 has transitioned the N121-043 technology on a rotorcraft platform for On-Board Weight & Balance System (OBWBS) that has been operating reliably in service since 2018.

Image Courtesy of ES3

WHAT

Operational Need and Improvement: The MQ-4C currently requires a time intensive fueling and weighing procedure in order to safely operate the aircraft. The goal of the OBWBS technology is to eliminate the need to tow the MQ-4C back and forth to a hanger or shelter. To satisfy this goal, the OBWBS must demonstrate ability to accurately determine the weight and CG of the MQ-4C outdoors immediately before and after fueling—under normal fueling conditions including environmental effects such as wind. If successful, the elimination of the towing steps will reduce fueling turnaround time and also reduce wear and fatigue cycles from towing. This will reduce unplanned maintenance of the landing gear and associated attachment structure, and reduce the risk of overloading the nose landing gear while towing. In addition, the OBWBS will perform a health monitoring function for the landing gear by measuring shock strut charging gas (nitrogen, N2) pressure and temperature. Aircraft shock struts tend to lose N2 when flying at high altitudes for prolonged periods of time, as is required by the MQ-4C.

Specifications Required: A System Design Specification (SDS) is being developed for an OBWBS on the MQ-4C Triton. The OBWBS is a multi-function landing gear health monitoring system that can directly measure landing gear strut pressure/temperature for use providing prognostic/diagnostic capabilities for both OBWBS and Condition Based Maintenance Plus (CBM+) for the landing gear subsystem.

Technology Developed: The MQ-4C OBWBS utilizes landing gear sensors, interfacing data collection components, and control units developed specifically for use in this extremely harsh environment. The technology allows for flexibility and expansion of data collection requirements to fit a variety of operational needs. Sensor capabilities include landing gear strut pressure/temperature on each Main Landing Gear (MLG) and Nose Landing Gear (NLG) struts.

Warfighter Value: Provides real-time information on aircraft gross weight and center of gravity--eliminating the use of aircraft scales--providing large cost savings due to elimination of maintenance activities for towing aircraft into the hangar after fueling to verify aircraft weight and balance prior to operations. The system also implements CBM+ in accordance with DoDI 4151.22P for detection of loss of Nitrogen (N2) and hydraulic fluid in landing gear shock strut while aircraft is in flight during extended operations at high altitude and low temperature--providing increased safety avoiding mishaps associated with hard landings due to improperly serviced landing gear shock struts.

WHEN

Contract Number: N68335-23-C-0107 **Ending on:** Jan 24, 2025

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Define System Requirements	Low	System Requirements Review (SRR) with System Design Specification (SDS)	4	4th QTR FY23
Conceptual and Preliminary Design	Low	Preliminary Design Review (PDR)	4	1st QTR FY24
Detail Design	Low	Critical Design Review (CDR)	4	2nd QTR FY24
Developmental Testing	Low	Developmental Test Report (DTR)	5	2nd QTR FY24
Manufacture Prototypes	Low	Inspection and Acceptance Testing Reports	5	4th QTR FY24
Sensor and System Qualification Testing	Low	Qualification Test Report (QTR)	5	2nd QTR FY25
Calibration and Laboratory Vallidation (CALV) Testing	Medium	CALV Test Report	6	2nd QTR FY25
On Aircraft Ground Demonstration (OAGD)	Medium	OAGD Test Report	7	4th QTR FY25

HOW

Projected Business Model: ES3 intends to be the Original Equipment Manufacturer (OEM) of the MQ-4C Triton OBWBS. The manufacturing will utilize a combination of organic and key supplier sources--controlled via ES3 design, documentation and quality control. A key component of the business model is the use of ES3 Intellectual Property (IP) and proprietary algorithms relating to the prognostic and diagnostic capabilities of the Triton OBWBS.

Company Objectives: ES3 objectives are to identify additional Navy operational needs and platforms that could utilize the MQ-4C OBWBS components for a tailored solution to improve their existing capability. ES3 is already working with CH-53K (PMA-261) for transition of an OBWBS, but desires additional insertion of the technology into other Navy programs.

Potential Commercial Applications: ES3 completed full rate production on a rotorcraft OBWBS in July 2018--with plans to target additional rotorcraft customers. In addition, as the P-8A is a commercial derivative of the Boeing 737-Next Generation aircraft, ES3 is targeting commercial applications for an OBWBS.

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