

Topic: N121-043

Engineering and Software System Solutions (ES3), Inc.

Landing Gear Structural Health Prognostic/Diagnostic System

Aircraft landing gear supports the entire weight of an aircraft during landing and ground operations; consequently, Engineering & Software System Solution, Inc. (ES3) a high-end engineering firm specializing in engineering and design of aircraft components and advanced material coatings for aerospace applications has developed Diagnostic Of Landing gear Fatigue In-service Nexus (DOLFIN) multifunction Structural Health Monitoring (SHM) system that can be utilized for fatigue damage tracking of landing gear systems, in this case on the P-8 Poseidon (PMA-290). ES3 is working separate contracts relating to the same topic for the F/A-18 (PMA-265) and is completing a commercial qualification and certification effort on a rotorcraft program that will be fully complete in the next few months. The P-8 DOLFIN program utilizes form, fit and virtually identical functional hardware to this commercial program.

Technology Category Alignment:

None

None

None

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SYSCOM: NAVAIR

Contract: N68335-18-C-0036

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-18-C-0036

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2018-685

Topic # N121-043

Landing Gear Structural Health Prognostic/Diagnostic System (ES3) Engineering & Software System Solution, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: Maritime Patrol and Reconnaissance Aircraft Program Office (PMA) 290

Transition Target: P-8A Poseidon

TPOC:
(301)757-7632

Other transition opportunities: Any aircraft that requires landing gear health monitoring systems or tracking fatigue damage of the airframe landing gear systems and fuselage support structures on platforms such as the F/A-18 and V-22.

Notes: ES3 is also currently on contract to support development of a Strut Operational Readiness Monitoring (STORM) system for the F/A-18 program office (PMA-265) relating to the N121-043 technology.



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P-8A: www.navair.navy.mil/index.cfm?fuseaction=home.NAVAIRNewsStory&id=4302

WHAT

Operational Need and Improvement: Current methods of tracking fatigue damage of airframe landing gear systems and fuselage support structures depend on data collection of aircraft parameters recorded onboard at various sampling rates by structural health monitoring (SHM) devices; however, the data collected to track fatigue damage has its limitations. Limited sets of parameters recorded and low sampling rates allow for gaps in data quality, requiring conservative assumptions to be made for the characterization of landing, ground, and braking events. Errors in aircraft gross weight and center of gravity (CG) estimations require additional conservatism to be applied to fatigue damage tracking values and fatigue life expended values of landing gear systems and their back-up structure resulting in too many inspections, premature replacement of parts, and/or an inability to use aircraft to their full capacity.

Specifications Required: A multifunction SHM system that can directly measure landing gear and support structure loads for use in fatigue damage tracking, provide a method for capturing improved estimations of gross weight and CG, and at the same time provide prognostic/diagnostic methods for assessing the condition of landing gear components.

Technology Developed: The P-8 Diagnostic of Landing gear Fatigue In-service Nexus (DOLFIN) system 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, brake temperature, brake torque, strain gauges from landing gear load pins. Additional capabilities could also include tire pressure/temperature, wheel speed, or accelerometer inputs.

Warfighter Value: The P-8 DOLFIN system provides the following benefits to the warfighter: 1) Strut Servicing: Eliminate schedule based maintenance via P-8 DOLFIN condition based maintenance prognostic/diagnostic capabilities; 2) Fatigue: Damage tracking through direct loads monitoring--satisfying Individual Aircraft Tracking (IAT) requirements; 3) Life Extension: Extending life of landing gear components through fatigue damage tracking; 4) Weight and Balance: Improve safety via real-time measurements of aircraft weight and balance; and 5) Hard Landing: Detection of hard landing and identification of component needs for inspection.

WHEN

Contract Number: N68335-18-C-0036 **Ending on:** April 6, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Define System Requirements	Med	System Requirements Review	6	August 2018
Final System Development	Low	Critical Design Review	6	October 2018
Qualification	Low	Qualification Test Reports	7	July 2019
On-Aircraft Ground and Flight Demonstration	Med	On-Aircraft Ground and Flight Demonstration Reports	8	March 2020

HOW

Projected Business Model: ES3 intends to manufacture the P-8 DOLFIN system. 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 P-8 DOLFIN system.

Components of the P-8 DOLFIN system have been utilized on a commercial effort with form, fit, and virtually identical function that is entering into full rate production in July 2018. Therefore, timing for production ramp up for P-8 is greatly reduced. ES3 estimates that low-rate initial production capability would be available in 3 months with full rate production in 6-months after completion of the qualification effort.

ES3 is capable of a direct sale to the Government for retrofit of the P-8 DOLFIN system into the current PMA-290 fleet. However, sale to Boeing (Aircraft OEM and Prime Integrator) for retrofit and production insertion may be required.

Company Objectives: ES3 objectives for the forum are to identify additional Navy operational needs and platforms that could utilize the P-8 DOLFIN components for a tailored solution to improve their existing capability. ES3 is already working with P-8 (PMA-290) and F/A-18 (PMA-265), but desires additional insertion of the technology into other Navy programs.

Potential Commercial Applications: ES3 is entering full rate production on a rotorcraft Onboard Weight And Balance System (OWABS) in July 2018--with plans to target additional rotorcraft customers. In addition, as the P-8 is a commercial derivative of the Boeing 737-Next Generation aircraft, ES3 is targeting commercial applications for an OWABS in the near future.

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