

# Department of the Navy SBIR/STTR Transition Program

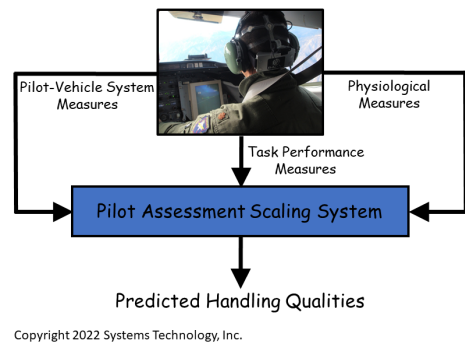
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Topic # N192-071  
Innovative Methods for Correlating Physiological Measures of Pilot Workload to Handling Qualities  
Systems Technology, Inc.

## WHO

**SYSCOM:** NAVAIR  
**Sponsoring Program:** PMA-275 V-22 Osprey  
**Transition Target:** DoD flight test centers (e.g., NAS Patuxent River and Edwards AFB)  
**TPOC:** (301) 757-5613  
**Other Transition Opportunities:** PMA-261 H-53 Heavy Lift Helicopters, PMA-268 Unmanned Carrier Aviation, PEO F-35 Lightning II Program, military test pilot schools (e.g., UASF TPS and USNTPS), private test pilot schools, and military and commercial aircraft prime contractors including new eVTOL companies

**Notes:** The diagram shows how the Pilot Assessment Scaling System (PASS) embodies task performance measures that reflect aircraft characteristics, pilot-vehicle system measures that reflects physical workload, and physiological measures that reflect mental workload to characterize and ultimately predict test pilot assigned Levels of Handling Qualities and Ratings.



## WHAT

**Operational Need and Improvement:** The U.S. Navy seeks to develop a test-enabling technology that allows quantitative measurement of pilot workload via physiological characteristics for the purposes of handling qualities evaluation and tuning and demonstrating the technology in both simulated and flight test environments. Self-assessed pilot workload is qualitative but highly dependent upon the pilot, task, conditions, etc. Correlation of physiological response to pilot workload with qualitative handling qualities remains elusive. PASS serves to fill this void by integrating disparate measures to predict handling qualities ratings.

- Specifications Required:** A sensor suite and software that can measure physiological response to pilot workload in a way that can be correlated to qualitative handling qualities. The sensor suite and associated software must:
- Allow near real-time measurement of pilot workload
  - Be capable of being deployed in both pilot simulation and flight test settings without negatively impacting the pilot's ability to control the aircraft
  - Not require significant additional support or planning on the part of the test team for incorporation into handling qualities tests
  - Be designed to address issues such as electromagnetic noise, packaging constraints, ease of use, and compatibility with aircraft gear
  - Have an option to be self-powered though it may use instrumentation power if available
  - Be removeable such that there is no lasting modification to the test aircraft once testing is complete

**Technology Developed:** Systems Technology's PASS seamlessly integrates EEG/ECG and other physiological data gathered via commercially available hardware and software that provides validated measures of workload, distraction, and high/low engagement with task performance measures and pilot-vehicle system measures to predict Levels of Handling Qualities and Ratings.

**Warfighter Value:** A validated PASS will enhance the effectiveness and reduce costs associated with flight test verification of handling qualities for new and modified aircraft by limiting requirements for repeated evaluation sorties with multiple test pilots.

## WHEN

**Contract Number:** N68335-21-C-0304      **Ending on:** Mar 17, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Feasibility study with in-house data	High	Initial development of PASS software and proof of concept of approach	4	2nd QTR FY21
Piloted simulation data gathering and algorithms/process development	Medium	Rich data set and successful assessment of the effectiveness of the approach	5	4th QTR FY22
Algorithm refinement and software development	Medium	Algorithm improvement and beta version of the software delivered to NAVAIR personnel	5	1st QTR FY25
Considerations for fixed-wing applications	Low	Process expansion to account for fixed-wing cockpit environment, test environment, MTEs, and software interface features	6	2nd QTR FY25
Flight test and software refinement	Low	Sensor integration and flight test to validate software and process	7	1st QTR FY26

## HOW

**Projected Business Model:** STI expects to generate revenue through sales of the PASS software toolbox and by providing expert consulting services on the application of the handling qualities methods defined and validated in this proposed program to the aircraft marketplace including the exploding Urban Air Mobility market. It may be expected that the exposure to industry through stakeholder meetings will naturally generate interest in purchasing the software technology and will also increase the likelihood of gaining future consulting revenue for STI by providing expert consulting services in related fields.

**Company Objectives:** With a 65-year history, STI is an industry leader in flight dynamics, flight control systems, handling qualities, human pilot modeling, piloted simulation, and flight test. This includes handling qualities evaluations of transports, fighters, and rotorcraft. The company objectives for the Forum for SBIR Transition event are to enhance visibility for the emerging PASS toolbox and technology beyond NAVAIR to the DoD flight test centers and military test pilot schools, such that a Phase III commercialization pathway can be identified and pursued.

**Potential Commercial Applications:** The initial applications for PASS are the US military aviation markets that develop and evaluate piloted aircraft. This market includes DoD flight test centers (e.g., NAS Patuxent River and Edwards AFB), military test pilot schools (e.g., UASF TPS and USNTPS), and prime and Tier 2 aircraft manufacturers. Secondary markets will be identified from these same entities in US allied countries. PASS will also find utility in the commercial marketplace where handling qualities assessments are an important part of the civilian certification process. Here, an emphasis will be placed on commercial transports, business jets, and the rapidly emerging urban air mobility market.

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