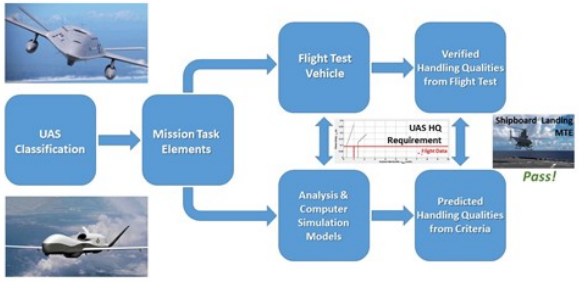
# Department of the Navy SBIR/STTR Transition Program



Topic # NASA16-A105
Defining Handling Qualities of Unmanned Aerial Systems
Systems Technology, Inc.

## WHO

**SYSCOM:** NAVAIR
**Sponsoring Program:**
**Transition Target:** MQ-25 Stingray, MQ-4C Triton, MQ-8B/C Fire Scout, RQ-21 Blackjack, and MQ-9 Reaper
**TPOC:**
(301)757-5613
**Other transition opportunities:** CQ-24B K-MAX (Follow-on to CQ-24A)
MUX Medium-Altitude Long-Endurance (MALE) Demonstrator
MUX Family of Systems (FoS)
AURA Future Vertical Lift (FVL) CS3 (Optionally Piloted)
Maritime Strike FVL CS2 FoS




## WHAT

**Operational Need and Improvement:** The burgeoning UAS arena includes traditional airframers, established UAS manufacturers, hobbyists, academic institutions, and many newcomers who see opportunity to use UAS to serve their customers in new ways. Many issues continue to slow the development of verification, validation, and certification methods for these systems. This work does not propose to tame the entire problem, but instead tackles the important need to define UAS handling qualities in piloted, pilot monitoring, and autonomous UAS operations as part of a UAS certification framework. A mission-oriented approach is applied to guide applicants and regulators considering a myriad of UAS configurations to pertinent handling qualities requirements.

**Specifications Required:** Designing UAS to existing manned handling qualities specs over-constrain the UAS design space
Manned aircraft specs do not apply to UAS that are an order of magnitude smaller, nor to UAS of equivalent size that no longer have to accommodate pilot comfort and control methods.
Appropriate test techniques that represent actual UAS missions and flight capabilities are needed to decrease the cost, schedule, and technical risk associated with efficient flight testing.
Supporting tools are needed to easily and repeatedly conduct analyses and simulations for UAS against design specifications and associated test maneuvers.

**Technology Developed:** The transitioning product is the UAS Handling Qualities Assessment software toolbox (UAS-HQ) and corresponding digital specification and test guide that will direct UAS stakeholders through a systematic evaluation process to support safe operation of UAS in increasingly complicated operating environments. The toolbox will guide users through the application of metrics that predict handling qualities and analysis of flight test data for UAS performing selected mission task elements that verify handling qualities via quantitative task performance requirements.

**Warfighter Value:** There is an immediate need for the UAS-HQ technology at not only NAVAIR, but also in the wider Department of Defense. For programs that have already been procured (e.g., MQ-25 Stingray, MQ-4C Triton, etc.), UAS-HQ will serve as guidance, while a verified and validated UAS-HQ will be used to support the procurement of future programs.

## WHEN

**Contract Number:** N68335-19-C-0614 **Ending on:** August 14, 2022

| Milestone | Risk Level | Measure of Success | Ending TRL | Date |
|---|---|---|---|---|
| Demonstrate applicability of UAS HQ analysis process to UAS | Low | Assessed approach against previously collected test data | 3 | December 2016 |
| Exercise and validate complete UAS HQ process | Low | Developed and flew multiple mission task elements | 5 | April 2019 |
| Create a draft specification and UAS HQ analysis toolset | Low | Review and establish baseline with technical monitor | 5 | April 2019 |
| Conduct rotary wing flight test in support of draft specification | Med | Successful collection of system identification and mission task element data | 6 | December 2021 |
| Tailor UAS HQ draft specification to Navy applications | Low | Successful update based on collected/analyzed test data | 6 | August 2022 |
| Deliver final prototype version of UAS-HQ analysis software | Low | Updated software analysis tools and metrics based on collected/analyzed test data | 6 | August 2022 |

## HOW

**Projected Business Model:** In this application, STI expects to generate revenue through sales of the UAS-HQ software toolbox and by providing expert consulting services on the application of the UAS handling qualities methods defined and validated in this program to the exploding UAS market. Based on our 63 year history of providing commercial consulting services to industry, STI further anticipates that productizing services around the application of UAS-HQ will ultimately lead to revenues that dwarf those generated by the software application alone.

**Company Objectives:** STI has for 63 years maintained a consistent position and has an established reputation in the broad areas of aircraft handling qualities, control systems design, vehicle dynamics, manual control, and system identification. This long history includes work with many unmanned systems and ongoing UAS projects that directly apply to our current business segment of expert consulting services and specialized products including analysis software such as UAS-HQ. This effort continues to enhance and build upon that established position.

This specific application supports STI's goal to productize services around SBIR-developed technologies including the UAS-HQ toolbox as a means to bring additional value to our government and commercial customers. This added value derives from our expertise built over decades in the handling qualities arena including the development and application of handling qualities requirements, standards, and specifications.

**Potential Commercial Applications:** UAS-HQ will be introduced to the commercial UAS markets where mission effectiveness is a significant concern (e.g., infrastructure inspections, precision agriculture, and autonomous operations within dense urban environments) to guide the assessment and verification of the mission readiness of the UAS. Further, the software plus productized service will be offered to prime military UAS contractors as a means to enhance mission effectiveness as they proceed through the design process.

**Contact:** David H. Klyde, Vice President and Technical Director, Engineering Services
dklyde@systemstech.com (310) 679-2281 x5127