

Topic: N161-056

Systems Technology, Inc.

Intuitive, High Confidence Human-Machine Interface Symbology for Carrier Landing

There is a critical need to improve Navy aircraft shipboard recoveries in degraded visual environments and high sea state conditions. Systems Technology, Inc. (STI) is developing The Jet Aircraft Shipboard landing Man-machine Interface for Naval Environments (JASMINE) that combines enhanced head-up display symbology and advanced flight director modes with the NAVAIR-developed MAGIC CARPET control laws to guide strike fighter pilots to carrier landings while reducing pilot workload and enhancing safety. With a 60-year history, STI is an industry leader in the design, analysis, and pilot testing/evaluation of manual and automatic flight control systems and related technologies. Development risk is diminished through simulation evaluations conducted by Navy strike fighter test pilots. Rockwell Collins, developer of head-up displays, will provide support and guidance for fleet integration of JASMINE.

Technology Category Alignment:

EO/IR Components for sensing, transmission and communication

Fixed Wing Vehicles (includes UAS)

Human/Autonomous System Interaction and Collaboration

System Interfaces & Cognitive Processes

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SYSCOM: ONR

Contract: N00014-18-C-1009

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N00014-18-C-1009

Department of the Navy SBIR/STTR Transition Program

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Intuitive, High Confidence Human-Machine Interface Symbolology for Carrier Landing Systems Technology, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: Sea-based Automated Landing Recovery System (SALRS)

Transition Target: F/A-18 E/F/G

TPOC:

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Other transition opportunities: The primary transition path in the Navy for the Jet Aircraft Shipboard landing Man-machine Interface for Naval Environments (JASMINE) is through the F/A-18E/F/G via PMA-265. Within the Navy other transition opportunities include the F-35C Lightning II Joint Strike Fighter Program. This opportunity will require a transition of the technology from the cockpit head-up display (HUD) of the F/A-18 to the helmet-mounted display (HMD) of the F-35. This transition is the focus of the proposed Phase II Option. Participating in the Phase II Option will be Rockwell Collins, manufacturer of the F-35C HMD. If proven successful in this application, the participation of Rockwell Collins provides a direct transition path to the F-35 fleet.

Notes: JASMINE is designed to integrate with the NAVAIR-developed Maritime Augmented Guidance and Integrated Controls for Carrier Approach and Recovery Precision Enabling Technologies (MAGIC CARPET) that have been successfully integrated into Super Hornet fleet aircraft.



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WHAT

Operational Need and Improvement: There is an urgent need to improve shipboard recoveries in degraded visual environments with high sea state conditions wherein these Navy aircraft are often required to operate. The Systems Technology, Inc. team is working directly with ONR, NAVAIR including the Manned Flight Simulator facility, and NAWCTSD to develop a pathway to increased TRL that will ultimately lead to fleet integration. The current Phase II Base program will conclude with piloted simulation evaluations of JASMINE at the Manned Flight Simulator facility at Patuxent River NAS using a F/A-18 representative cockpit environment. If successful, pathways to flight test integration and assessment will be pursued next.

Specifications Required: As stated in N161-056, the objective of this topic is to “develop and demonstrate Head-Up Display symbology for pilots to perform tactical jet landings on an aircraft carrier in highly degraded visibility and deck motion conditions, using advanced flight control augmentation and precision ship-relative navigation.” The display must be easily interpretable, matching display dynamics with aircraft dynamics and flight control, and provide high confidence situational awareness, including ship deck motion and landing area dimensions. The display must be compatible with existing HUD displays that are used throughout the flight envelope, to avoid any disorienting or difficult to learn transformations when transitioning from mission operations to landing approach. Finally, the aircraft should fly a standard Case III (straight-in) approach to landing.

Technology Developed: The Jet Aircraft Shipboard landing Man-machine Interface for Naval Environments (JASMINE) meets Navy requirements via a software solution that is compatible with the existing cockpit head-up display technology of the F/A-18E/F, thereby allowing for rapid fleet integration.

Warfighter Value: The combination of the MAGIC CARPET flight control modes with JASMINE's advanced symbology and guidance algorithms will direct pilots to safe shipboard recoveries regardless of visibility conditions or sea state. JASMINE will provide the Naval Aviator with advanced visual cues that enhance situational awareness of aircraft and ship relative position thereby reducing pilot workload when outside visual references are not available. Ultimately, JASMINE will enhance safety under the most challenging environmental conditions.

WHEN

Contract Number: N00014-18-C-1009 **Ending on:** November 22, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototype Display Symbology Development	Med	Symbology and underlying guidance algorithms operate as intended and validated via analysis.	3	1st QTR FY19
Engineering Simulator Evaluations	Med	Down select to best performing symbology options and guidance algorithm parameters.	4	2nd QTR FY19
Display Integration/Checkout at NAVAIR/MFS	High	Display fully integrated in real-time environment with all features functional.	5	4th QTR FY19
Test Pilot Evaluations	High	Quantitative task performance and qualitative pilot opinion metrics.	6	1st QTR FY20

HOW

Projected Business Model: JASMINE will meet Navy objectives via a software solution that is compatible with the existing cockpit head-up displays of the F/A-18E/F/G thereby allowing for rapid fleet integration. STI plans to transition this technology through a military HUD provider based on the needs and requirements established by PMA-265. Rockwell Collins, a military supplier of HUDs and the F-35 HMD, will be participating in the Phase II Option of this program. This provides STI with a pathway to fleet integration through an industry leader in military cockpit avionics and displays thereby providing a distinct competitive advantage.

Company Objectives: With 60+ year history, STI is an industry leader in the design, analysis, and pilot testing/evaluation of manual and automatic flight control systems and related technologies. The company objectives for the Forum for SBIR Transition event are to enhance visibility for the emerging JASMINE technology beyond ONR and NAVAIR to the fleet, in general, and the strike fighter PMA's, in particular, such that a Phase III commercialization pathway can be identified and pursued. To demonstrate the capabilities of JASMINE, a real-time simulation will be available to Forum attendees that will allow forum attendee "pilots" to safely land a Super Hornet on an aircraft carrier under severely degraded visual conditions.

Potential Commercial Applications: As all travelers understand, weather continues to be a factor in air travel delays and cancellations. To address these issues, the JASMINE technology can be re-hosted for airport-based operations. Here, the opportunities will benefit the commercial, business, and general aviation markets by providing a means to perform and/or improve approach and landing performance with enhanced safety when operating in Category III instrument meteorological conditions. In these applications, the JASMINE carrier reference symbology will be replaced by an airport specific runway reference.

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