

WHO

**SYSCOM:** NAVAIR

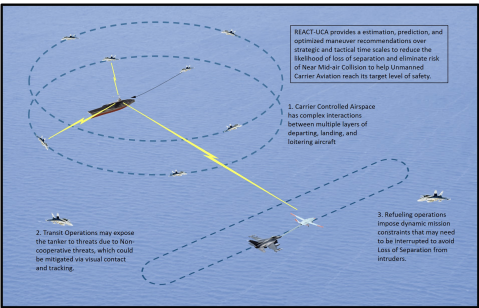
**Sponsoring Program:** PMA-268 NAVAIR

**Transition Target:** MQ-25

**TPOC:** (301) 995-2038

**Other Transition Opportunities:** REACT is designed with all Loss of Separation (LoS) events in mind. It has been funded here for Unmanned Carrier Aviation (UCA), and is directly applicable to small UAS operating under PMA-263. Pertinent systems requiring Sense and Avoid (SAA) capability include the MQ-8 FireScout and the MQ-9 Reaper.

**Notes:**



REACT-UCA applies SSCI's Probabilistic Reachable Sets to evaluate likelihood of Loss of Separation, then uses a series of analyses to refine the maneuver recommendation based upon mission, rules of the road, and perception of safety from the manned counterpart.

WHAT

**Operational Need and Improvement:** Robust Encounter Avoidance and Conflict Resolution for Unmanned Carrier Aviation (REACT-UCA) provides a Sense and Avoid solution for MQ-25 autonomous tanking operations when flying in densely-populated airspace around an aircraft carrier (CVN) and during aerial refueling operations. Such a capability aids unmanned systems in achieving system safety equivalent to manned flight when sharing the airspace with Navy F/A-18 Super Hornet missions and during refueling events by mitigating collision risk to other vehicles in the airspace.

**Specifications Required:** Integration of Group 5 UAS into mixed manned-unmanned airspace requires innovative approaches to the strategy and tactics of collision avoidance. UCA tanker challenges include: Flight in dense traffic (Carrier Control Area/Zone); Transit to and from recovery and mission tanking areas in unplanned airspace; Operations in different classes of airspace that often overlap the CCA airspace (i.e., ICAO flight information region (FIR) airspace, etc.) mixing in cooperative and uncooperative aircraft separation responsibilities; and the "tanker hawk" operation in which a tanker must descend and navigate through dense airspace, close in to the CVN to get in formation with an aircraft dangerously low on fuel.

**Technology Developed:** "Robust Encounter Avoidance and Conflict Resolution for Unmanned Carrier Aviation" (REACT-UCA) is a collision avoidance capability for UAS in Carrier Controlled Airspace (CCA). Its component parts are a tool to fuse tracks of vehicles near the tanker, assess the risk of collision, and avoid collisions through a combination of strategic separation (mission planning) and tactical collision avoidance (real-time response).

**Warfighter Value:** REACT resolves risk of collision due to unmanned vehicles sharing the dense airspace in the carrier environment, reduces the demands on UAS operators tasked with monitoring and planning trajectories around potential threat aircraft, and enables Unmanned Carrier Aviation to perform aerial refueling without introducing additional risk to the manned aircraft in the shared airspace.

WHEN

**Contract Number:** N68335-21-C-0352

**Ending on:** Apr 26, 2023

| Milestone                        | Risk Level | Measure of Success                                   | Ending TRL | Date         |
|----------------------------------|------------|------------------------------------------------------|------------|--------------|
| Monte Carlo Test Results         | Low        | Loss of Separation Rate, Near Mid-Air Collision Rate | 4          | 2nd QTR FY23 |
| SAFESEE Integration Test Results | Low        | percent NMAC resolved                                | 5          | 2nd QTR FY23 |
| Technical Package Delivered      | Low        | On-time delivery                                     | 5          | 3rd QTR FY23 |

HOW

**Projected Business Model:** SSCI seeks to provide REACT-UCA as a Sense and Avoid software as a service, to be tightly integrated with the autonomy supplier aboard the target vehicle of interest. We anticipate working with the autonomy supplier, with SSCI as the SAA supplier. Alternately, we can work with the autonomy company to integrate the system as a single package.

**Company Objectives:** SSCI has been in the Detect and Avoid realm for UAS over the past 10+ years, and we consider vehicle flight safety a critical part to our general approach as a one-stop autonomy provider. SSCI has an AI-enabled autonomy approach "for every mission", which has been deployed and tested for air/space/sea/land/undersea missions. We seek to maintain our reputation as a technology innovator for autonomous systems. This objective of providing safe and effective autonomous systems has been evident in our control system designs for fault-tolerant control, autonomous prognostics, learning systems, and increasing trust in autonomy.

**Potential Commercial Applications:** REACT-UCA is well-suited to large UAS, and is generally transferable to other systems with detection and threat tracking sensors onboard (ADS-B, radar, camera, etc). The technology itself also has applicability to small UAS, which will require safe separation from air traffic as well as airspace utilization increases. SSCI could adapt REACT-UCA for the general UAS market, potentially as part of the UAS Traffic Management system.