Command and Control Software for Single-Operator Multiple UAS Missions, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

Existing command and control (C2) paradigms for UAS platforms are extremely limited and cumbersome, requiring at least a single operator per UAS, if not more than one operator for each UAS (as is the case with many scientific and commercial UAS platforms). For example, UAS platforms such as the ScanEagle or the Sierra require at least one operator to handle the routing / navigation tasks for the aircraft and another operator to handle and operate the mission-specific payload. In this setting, the UAS platforms actually become a force-divider instead of a force-multiplier. The requirement of multiple operators for each individual UAS platforms is problematic for commercial applications where the high cost of human operators would inhibit many key applications such as package delivery from becoming financially viable. To address these issues, Opto-Knowledge Systems Inc (OKSI) and Analytical Graphics Inc (AGI) are joining forces to design, demonstrate, and deliver a robust multiple Unmanned Aerial System (UAS) semi-autonomous command and control tool that will enable a single human operator to manage multiple UAS platforms concurrently. Though there has been significant research into the single-operator multiple UAS control paradigm, there are currently no existing commercially available tools for this application. This work is aimed at shoring up this gap by creating the Single-Operator Multiple Autonomous Vehicle (SOMAV) command and control tool that will be integrated with AGI�s Systems Tool Kit (STK) software and sold commercially at the end of the Phase-II program.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: NAS Integration and Air Traffic Control (NASA NextGen Program): For the past decade, NASA has been working to develop NextGen Air Traffic Control (ATC) Management capabilities that will provide

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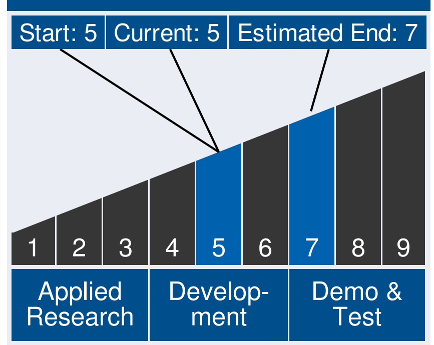
Technology Maturity



Management Team

Program Executives:
- Joseph Grant
- Laguduva Kubendran

Program Manager:
- Carlos Torrez

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increased efficiency and throughput of the National Air Space (NAS) to meet growing system demands. The SOMAV STK module for multiple-UAS command and control directly promotes these efforts in several ways. First, it provides a high-fidelity simulation environment for testing potential ATC routing algorithms, particularly those for systems of UAS platforms. Second, our tool reduces human operator workload by pushing much of the low-level control onto the UAV platforms themselves and having the routing/coordination performed autonomously. Reducing operator burden is listed as a specific goal of within Topic A2.02 Unmanned Aircraft Systems Technology of this SBIR effort. Third, our UAS routing and coordination tool will automatically optimize separation assurance for the UAS platforms in each team, which relates to the goal of safely and seamlessly integrating UAS platforms into NextGen. Fourth, the proposed module directly promotes autonomous operation for systems of UAS platforms using machine intelligence for decision-making. Finally, the UAS coordination tool addresses NASA�s goal of advancing the state-of-the-art in autonomous navigation under uncertain conditions (e.g., collision/hazard avoidance) and cooperative task completion.

To the commercial space industry:

Potential Non-NASA Commercial Applications: UAS Communication Networks): Recent advancements (e.g., Aerial Communications Node platforms) have resulted in UAS-based aerial communications platforms that are able to provide up to 10 times more coverage than traditional ground-based communications towers, and that are able to dynamically move to address changing customer needs. There has recently been a great deal of talk about bringing these capabilities to the civilian communications sector. This forms a complex UAS route coordination problem: Given a set of UAS platforms and a dynamic set of customers that have changing bandwidth requirements and move throughout the environment (e.g., traveling from work to home, or 50,000 people being packed into a stadium on game day), how should the UAS platforms

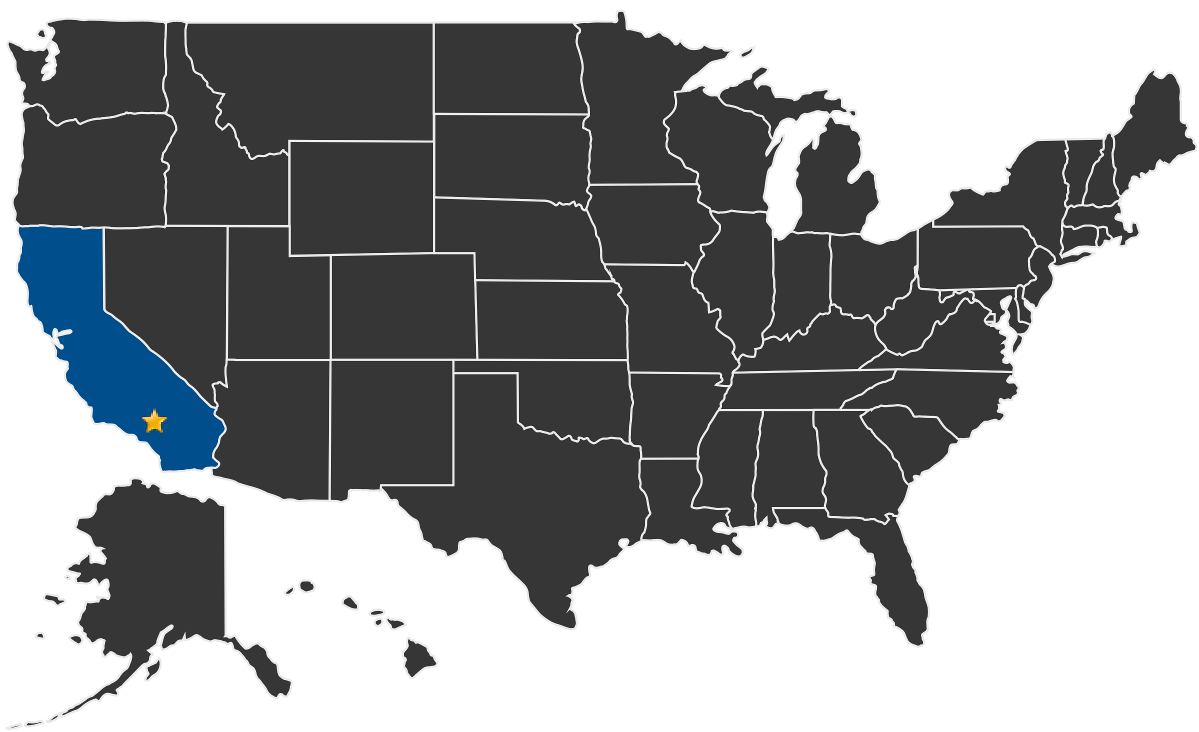
Management Team *(cont.)*

Principal Investigator:

- Chris Holmesparker

optimize their routes and coverage areas in order to optimize the total bandwidth coverage available to customers? The SOMAV module will readily address this routing and coordination problem in a way that concurrently maximizes coverage over a mobile set of customers and minimizes the total fuel consumed by the fleet of UAS communications nodes. SOMAV will provide high fidelity simulation and modeling of the entire UAS fleet and the RF communications links between the ground-based users and the UAS communications nodes including effects due to radio and antenna characteristics, weather, terrain, and communication protocol.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Armstrong Flight Research Center

Other Organizations Performing Work:

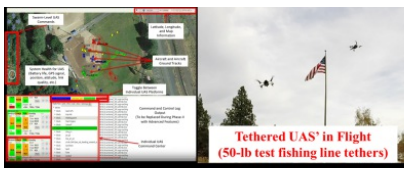
- Opto-Knowledge Systems, Inc. (OKSI) (Torrance, CA)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23338)

IMAGE GALLERY



Command and Control Software for Single-Operator Multiple UAS Missions, Phase II

DETAILS FOR TECHNOLOGY 1

Technology Title

Command and Control Software for Single-Operator Multiple UAS Missions, Phase II

Potential Applications

NAS Integration and Air Traffic Control (NASA NextGen Program): For the past decade, NASA has been working to develop NextGen Air Traffic Control (ATC) Management capabilities that will provide increased efficiency and throughput of the National Air Space (NAS) to meet growing system demands. The SOMAV STK module for multiple-UAS command and control directly promotes these efforts in several ways. First, it provides a high-fidelity simulation environment for testing potential ATC routing algorithms, particularly those for systems of UAS platforms. Second, our tool reduces human operator workload by pushing much of the low-level control onto the UAV platforms themselves and having the routing/coordination performed autonomously. Reducing operator burden is listed as a specific goal of within Topic A2.02 Unmanned Aircraft Systems Technology of this SBIR effort. Third, our UAS routing and coordination tool will automatically optimize separation assurance for the UAS platforms in each team, which relates to the goal of safely and seamlessly integrating UAS platforms into NextGen. Fourth, the proposed module directly promotes autonomous operation for systems of UAS platforms using machine intelligence for decision-making. Finally, the UAS coordination tool addresses NASA�s goal of advancing the state-of-the-art in autonomous navigation under uncertain conditions (e.g., collision/hazard avoidance) and cooperative task completion.