

SBIR Topic Number:
AF06-238

SBIR Title:
Unmanned Aerial Vehicle
Ground Operations
Positioning System

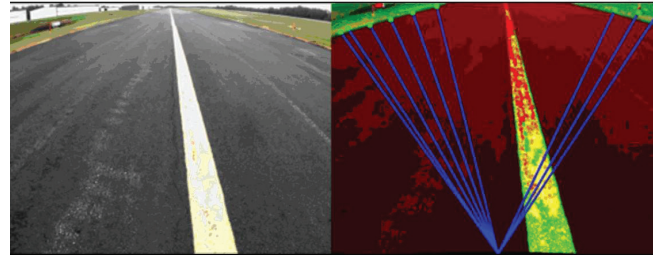
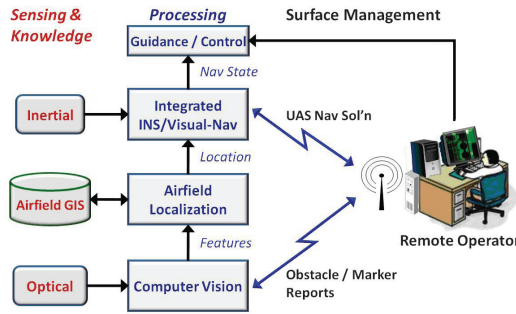
Contract Number:
FA8650-07-C-3708

SBIR Company Name:
Mosaic ATM, Inc.,
Leesburg, VA

Technical Project Office:
AFRL Air Vehicles
Directorate, Wright-
Patterson AFB, OH

This Air Force SBIR/STTR Innovation Story is an example of Air Force supported SBIR/STTR technology that met topic requirements and has outstanding potential for Air Force and DoD.

UGOMS' Onboard Technology



Left: Mosaic ATM's unmanned aircraft system (UAS) ground operations management system (UGOMS) enables non-GPS terminal area navigation and visual detection of obstacles and markers to support op-tempo employment of UAS on remote airfields. **Right:** UGOMS uses computer vision to analyze and mensurate the airfield surface around a vehicle, producing relative feature information that is used in navigation

System Enables Unmanned Aircraft System to Navigate Airfield

- The Air Force is interested in technologies to enable unmanned aerial vehicles to actively taxi with minimal supervision in formation and in environments where utilization of the Global Positioning System (GPS) may be denied or degraded
- Mosaic ATM has developed an unmanned aircraft system (UAS) ground operations management system (UGOMS) which provides technology enabling UAS safe surface transit on airfields in both the National Airspace System (NAS) and remote locations throughout the world
- The UGOMS prototype effort yielded accurate, real-time estimates of UAS airfield position and velocity without reliance on exteroceptive reference information from GPS
- UGOMS provides the UAS and remote human operator with information regarding UAS relative location on the taxiway, visually perceived obstacles, and taxiway markers, significantly reducing operator workload and supporting robust semi-autonomous UAS ground operations

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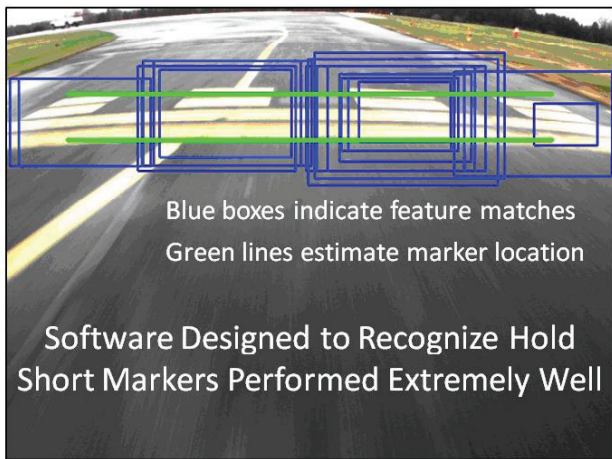
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Air Force Requirement

The Air Force is interested in technologies to enable unmanned aerial vehicles (UAVs) to actively taxi with minimal supervision in formation and in environments where utilization of the Global Positioning System (GPS) may be denied or degraded. As UAVs move away from being remotely piloted from a video signal, technology development is necessary to safely and accurately navigate the dangers of an airfield.

SBIR Technology

Mosaic ATM has developed an unmanned aircraft system (UAS) ground operations management system (UGOMS) for the Air Force Research Laboratory (AFRL) as a SBIR Phase II effort. UGOMS provides technology enabling UAS safe surface transit on airfields in both the National Airspace System (NAS) and remote locations throughout the world.



UGOMS detects surface markers, such as hold short lines, highlights them in video and reports their airfield location to remote operators.

The UGOMS prototype effort yielded accurate, real-time estimates of UAS airfield position and velocity without reliance on exteroceptive reference information from the Global Positioning System (GPS). This capability is achieved by integrating tactical-grade inertial navigation technology with statistical localization methods and advanced computer vision algorithms that classify, segment, and analyze the airfield surface viewed through a passive imaging sensor onboard the UAS. UGOMS provides the UAS and remote human operator with information regarding UAS relative

location on the taxiway, visually perceived obstacles, and taxiway markers, significantly reducing operator workload and supporting robust semi-autonomous UAS ground operations.

Potential Application

Navigation and surface management capabilities developed through UGOMS will significantly alleviate UAS operator workload and improve the safety of UAS ground operations. These benefits, combined with UGOMS' visual surface perception, will enhance the Air Force's ability to execute "Same Base, Same Time, Same Tempo" operations with manned and unmanned aircraft.

The next steps for UGOMS development include more extensive field evaluation and continued advancement of computer vision and airfield localization algorithms to achieve 24/7 operations across visibility conditions. Mosaic ATM is actively working with system integrators to provide UGOMS technology as an integral component of larger-scale solutions for autonomous terminal area operations. UGOMS will be used in conformance monitoring systems that automatically assess aircraft compliance with issued taxi clearances and to enhance the effectiveness of future counter-runway incursion systems that examine the location and speeds of vehicles operating in the vicinity of active runways.

Company Impact

"The UGOMS effort is one program within Mosaic ATM's UAS technology portfolio that is developed and managed by its Autonomous Systems Group (ASG)," states Dr. Stephen Pledge, Chief Scientist, Mosaic ATM. "A focus area for Mosaic's ASG is integration of UAS into routine operations in the NAS and abroad. The SBIR program offered Mosaic ATM the opportunity to further its research and development expertise in this focus area."

"Mosaic ATM tackles critical issues facing today's Air Traffic systems and offers solutions that simplify, automate, innovate, increase productivity, and reduce costs. Mosaic ATM projects include end-to-end services that feature analysis of current systems, creation of concepts and prototypes, development and deployment of technology, personnel training and workflow, and statistical tracking and reporting for continued refinement."



SBIR/STTR

Air Force SBIR Program
AFRL/XP
1864 4th Street
Wright-Patterson AFB OH 45433

AF SBIR/STTR Program Manager: Augustine Vu
Website: www.afsbirsttr.com
Comm: (800) 222-0336
Fax: (937) 255-2219
e-mail: afrl.xppn.dl.sbir.hq@wpafb.af.mil

