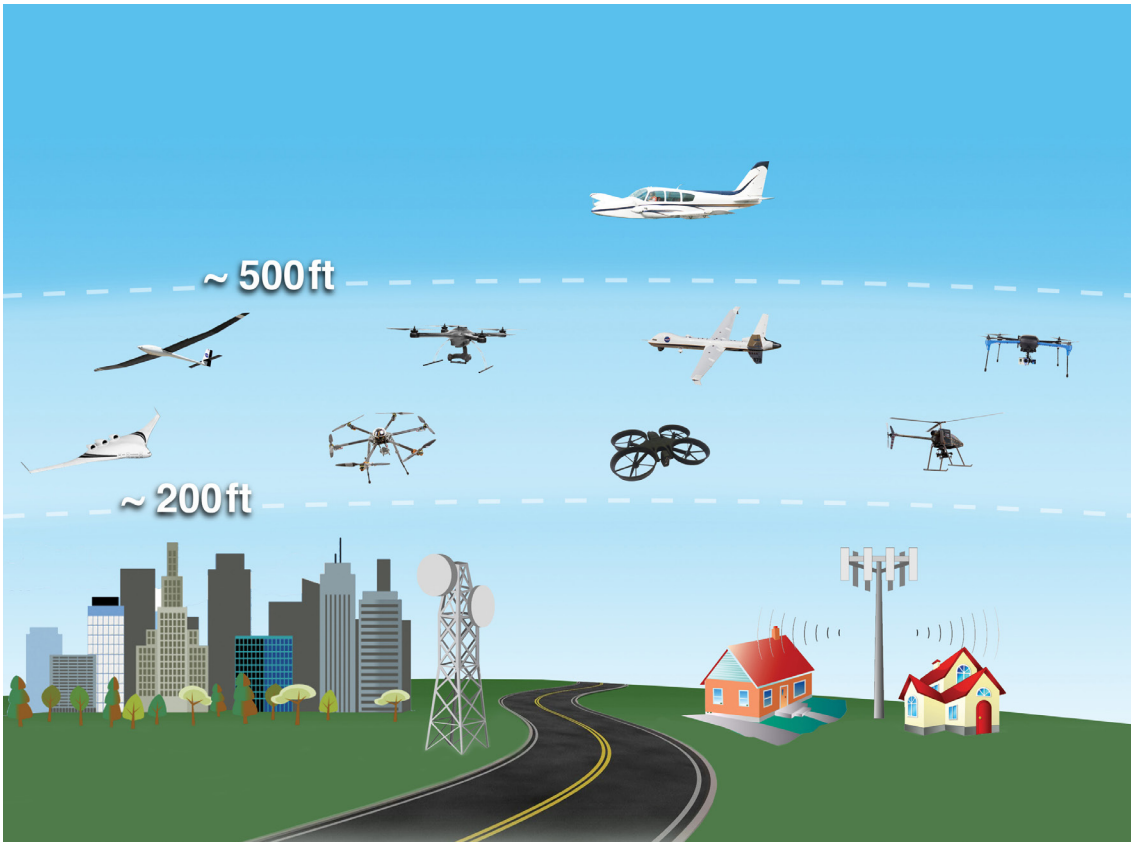
NASAfacts

UTM: Air Traffic Management for Low-Altitude Drones

Long before stories of Unmanned Aircraft Systems (UAS), commonly known as “drones,” were frequent in the news, NASA and the Federal Aviation Administration (FAA) recognized the need for a way to safely manage UAS flying at low altitudes in airspace not currently managed by the FAA.

For more than 25 years, NASA has conducted air traffic management system research in partnership with the FAA, providing a variety of computer-based tools that help improve flight efficiency, reduce delays, and reduce fuel use and emissions all while maintaining safety in increasingly crowded skies.

Today, with innovators constantly identifying new, beneficial applications for UAS – goods delivery, infrastructure inspection, search and rescue, agricultural monitoring – a safety system may be needed to help ensure this newest entrant into the skies does not collide with buildings, larger aircraft, or one another. Building on its legacy of work in air traffic management for crewed aircraft, NASA is researching prototype technologies such as airspace design, dynamic geofencing, congestion management and terrain avoidance for a UAS Traffic Management (UTM) system that could develop airspace integration requirements for enabling safe, efficient low-altitude operations.



NASA’s concept for a possible UTM system would safely manage diverse UAS operations in the airspace above buildings and below crewed aircraft operations in suburban and urban areas.

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NASA's Ames Research Center in Moffett Field, Calif., with its extensive experience in autonomous systems and air traffic management, is leading the UTM research in close collaboration with NASA's Armstrong Flight Research Center in Edwards, Calif.; NASA's Glenn Research Center in Cleveland; and NASA's Langley Research Center in Hampton, Va. Ames has a history of conducting research in autonomy-related topics, and is experienced at developing systems that can adapt their behavior to environments that are complex, rapidly changing and incompletely understood.

To test UTM technologies, NASA works with many partners that provide vehicles and other subsystems, with NASA responsible for airworthiness, and range and flight safety. To conduct UTM tests with its public, academic and private partners, NASA uses its Memorandum of Agreement (MOA) with the FAA for UAS testing and operations in certain types of remote airspace. When testing requires operations beyond the scope of the MOA, NASA applies for Certificates of Waiver or Authorization (COAs) from the FAA. These FAA-authorized operations mutually benefit NASA and the partners involved. Aircraft operated under COAs and the MOA are flown as NASA aircraft.

While negotiating additional arrangements, NASA already has a number of partner agreements on UTM research in place:

- Aerospace Technologies, Inc.
- Airware*
- Amazon
- Analytical Graphics, Inc.
- Avision, Inc.
- Board of Regents of the Nevada System of Higher Education on behalf of the Desert Research Institute
- DroneDeploy
- Exelis
- Google, Inc.*
- Gryphon Sensors
- Higher Ground, LLC
- Lockheed Martin Corporation – Information Systems and Global Solutions
- Lone Star UAS Center of Excellence & Innovation at Texas A&M University- Corpus Christi*
- ne^{3}rd, LLC*
- Neurala, Inc.
- Precision Hawk*
- Simulyze
- SkySpecs, Inc.*
- SkyWard IO, Inc.
- SmartC2, Inc.
- United States Department of the Interior, Office of Aviation Services
- UAV Collaborative*
- University of Cincinnati
- University of Nevada, Reno*
- Unmanned Experts*
- United States Geological Survey
- Verizon
- Virginia Tech

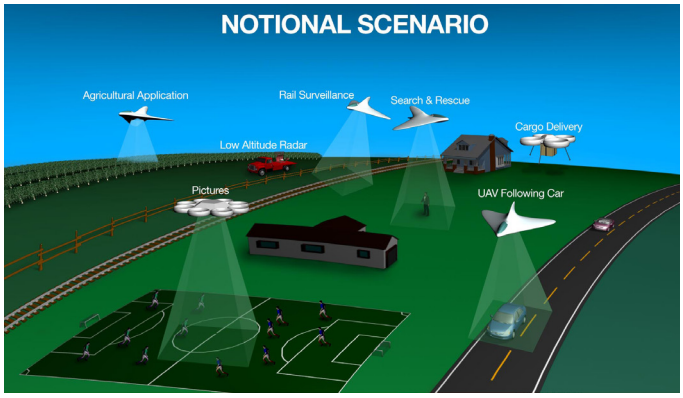
NASA is also collaborating with federal entities such as Department of Homeland Security, Department of the Interior, and National Weather Service. Additional collaborators will be added to ensure that technologies being tested address the public need for safety, security and privacy.

NASA's development and demonstration of technologies for a possible future UTM system take place during four Technology Capability Level (TCL) activities:

- UTM TCL 1: Concluded field testing in August 2015/ ongoing testing at FAA site. Addressed rural UAS operations for agriculture, firefighting and infrastructure monitoring. In this TCL, the UAS ground pilot reserved the airspace and adjusted the flight plan if notified of a conflict.
- UTM TCL 2: Tests in October 2016 to address beyond-visual line-of-sight operations in sparsely populated areas, and provide flight procedures and traffic rules for longer-range applications.
- UTM TCL 3: Tests in January 2018 to include cooperative and uncooperative UAS tracking capabilities to ensure collective safety of manned and unmanned operations over moderately populated areas.
- UTM TCL 4: Test dates to be determined. Would involve UAS operations in higher-density urban areas for tasks such as news gathering and package delivery, and large-scale contingency mitigation.

NASA's UTM technologies research results and development is taking place in collaboration with the FAA. Research results in the form of airspace integration requirements are expected to be transferred from NASA to the FAA in 2019 for their further testing.

** Conducts flights under NASA COA or MOA.*



NASA's concept for a possible UTM system would not require human operators to continuously monitor every vehicle. Two types of UTM systems could be developed: Portable *-- would move between geographical areas and support operations such as precision agriculture or disaster relief;* Persistent *-- Would provide continuous coverage for a specific geographical area. Human managers would use data to make strategic decisions about initiating, continuing and terminating UAS flights to ensure that only authenticated UAS are in the airspace.*

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