NASA's UAS-NAS Access Project

NASA's Aeronautics Research Mission Directorate (ARMD) Unmanned Aircraft Systems (UAS) Integration in the National Airspace System (NAS) Project was established in 2011. The UAS-NAS Project has been managed out of Armstrong Flight Research Center (formerly Dryden Flight Research Center) since its inception. The goal of the project is to contribute capabilities that reduce technical barriers related to the safety and operational challenges associated with enabling routine UAS civil access to the NAS. The goal is being accomplished through the development of system-level integration of key concepts, technologies and/or procedures, and demonstrations of integrated capabilities in an operationally relevant environment with the following objectives:

- Develop research findings (including validated data, algorithms, analysis, and recommendations) to support key decision makers in establishing policy, procedures, standards and regulations, enabling routine UAS access in the NAS.
- Develop UAS design and performance criteria necessary for airworthiness certification.
- Establish the infrastructure for the integrated test and evaluation (IT&E) environment for UAS Integration in the NAS simulations and flight demonstrations.

As the project moves into the fourth year, testing will integrate sense and avoid sensors/algorithms with a candidate ground control station and a prototype communication system. The project deliverables from the integrated testing will be data, analysis, and recommendations to key stakeholders based on actual flight tests in a relevant environment. The deliverables will be used to validate the RTCA Minimum Operational Performance Standards (MOPS) for Detect and Avoid (DAA) systems and Command and Control (C2) communications. The MOPS for DAA and C2 will be an industry consensus recommendation to the FAA leading to certified systems which will enable civil operations to and from Class A Airspace through Classes D, E, and possibly G Airspace.

Specific integrated testing validating MOPS will include conducting high-fidelity human-in-the-loop simulations (IHITL) during the summer of 2014, a flight test (FT3) series in the summer of 2015, and a final flight test (FT4) series early in 2016.

The IHITL conducted in the summer of 2014 will include the following objectives:

- Evaluate and measure the effectiveness and acceptability of the DAA algorithm and pilot guidance display to inform and advise UAS pilots of proximal traffic.

- Assess DAA-TCAS interoperability and the impact of communication delay on the execution of self-separation tasks.

- Assess whether or not C2 delays affect controller perceptions of unsafe conditions.

The FT3 series conducted in the summer if 2015 will build on the IHITL and include the following objectives:

- Demonstrate systems integration and evaluation of UAS concepts and supporting technologies including DAA related algorithms and sensor models, C2 Control and Non-Payload Communications (CNPC), and Human Systems Integration (HSI) impacts of pilot/operator displays and a Research Ground Control Station.

- Verify DAA sensitivity, pilot workload, and maneuver negotiation under live flight uncertainties and the integrated prototype CNPC system on a surrogate aircraft.

The FT4 series conducted early in 2016 will build on FT3 and include the following objectives:

- Under increased complexities in a realistic NAS environment, demonstrate systems integration and evaluation of controller acceptability of DAA concepts, C2 CNPC on at least two aircraft, HSI displays secondary conflicts, traffic density, and weather.
- Validate DAA sensitivity, pilot workload, and maneuver negotiation under live flight uncertainties and the integrated prototype CNPC system on at least two aircraft.

It is anticipated that by the end of 2015, the FAA will establish a rule based on safety analysis that allows civil UAS to operate within Class A Airspace. In order to establish the rule, the safety analysis will need to demonstrate that the mitigators of controlled airspace and equipage requirements will be a sufficient method of compliance for the relevant Federal Aviation Regulations (such as FAR 91.113 and 91.111) that are required to operate in Class A Airspace. By the end of 2016, the FAA rule for Class A Airspace coupled with the standards recommendations supported by the project deliverables will lead to routine access for operations to, from, and in Class A Airspace. Approval of these operations will accelerate full performance-based integration of all UAS in all Airspace Classes by the 2022 timeframe.

UAS-NAS project deliverables will also be used to determine the standards for civil ground control stations, enabling the same operations. Research conducted by the UAS-NAS Project will also lead to advances in other areas of UAS human factors challenges, and certification for restricted category operations.

The United States is making progress towards enabling UAS access, and NASA continues to play a significant role. UAS-NAS project integrated testing will be the cornerstone for verifying and validating technologies in a relevant environment that are necessary to ensure safe and efficient access for UAS into both the NAS, and international airspace.