

CONTRIBUTING ORGANIZATIONS

NMSU-PSL-TAAC

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UAS RDT&E and the Flight Test Center

New Mexico State University's Physical Science Laboratory (NMSU/PSL) has operated the Technical Analysis and Applications Center (TAAC) since 1999. It was formed to facilitate the safe integration of unmanned aircraft systems (UAS) into the national airspace system (NAS). This year, the emphasis has been on research, development, test, and evaluation (RDT&E) activities and establishing the UAS Flight Test Center that was created as a result of a Cooperative Research and Development Agreement (CRDA) with the Federal Aviation Administration (FAA).

An abundance of RDT&E activities are taking place at NMSU. NMSU employees are involved in operator research, engine test cell research, trust in automation research, small UAS test and evaluation research, to name a few. The ultimate goal of all this research is to help facilitate safe «file and fly» flight for UAS in the NAS.

Ongoing operator research includes RDT&E to ultimately support an understanding of the UAS operator, and training requirements for operators. This research includes validation studies relevant to operator requirements for various classes of UAS, applicable to all classes of airspace.

Another area of research concerns engine testing. Since many unmanned aircraft engines did not start out in the aviation domain, a need exists for research on their reliability/availability, fuel usage, and power/performance parameters. Also, engine data are sparse, so research is necessary to facilitate development of power plant standards for unmanned aircraft operations. Work toward creation of an engine test cell for small UAS engines will have value added to Federal agencies and to industry. NMSU/PSL has created an Engine Test Cell with the following test capabilities and services:

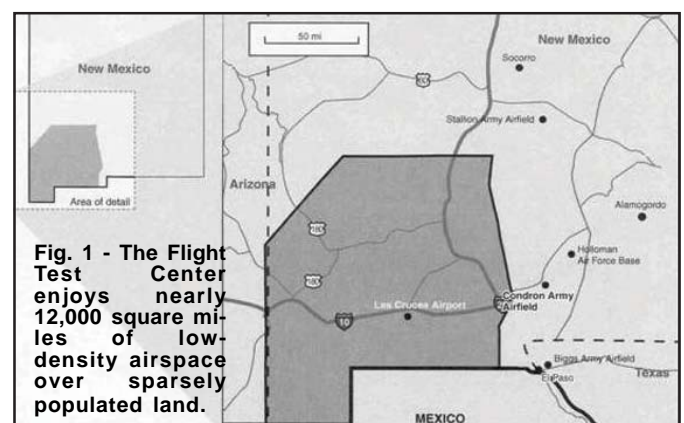
- Reliability testing and verification
- Assessment of fuel consumption
- Power measurements
- Dynamometer capacity to 100 hp
- Long-duration testing
- Internal combustion and electric drive test capability
- Power cycle testing
- Component analysis
- Design and execution of testing programs
- Failure analysis
- Assessment of maintenance requirements

Many levels of automation exist with UAS. Automation extremes range from Global Hawk-type platforms to those with human-in-the-loop automation. Automation introduces a number of human factors, reliability, training, and other issues. To help understand trust in automation, NMSU researchers in the Psychology Department conducted a number of experiments designed to measure human performance. This ongoing research may help establish guidelines for operator task loading, or currency definition.

Another research task that TAAC personnel are working on is defining classes of micro UAS, accounting for the variety of

means of propulsion and control. Researchers are defining performance characteristics that are common to each class of micro UAS, with the goal of developing a matrix of micro UAS by class, by UAS design attributes, and by test and evaluation (T&E) requirements. These researchers also are working on developing a general test plan that indicates whether the T&E category will be assessed by design review, analysis, or demonstration. Tools will be identified to best accomplish T&E functions whether equipment, models, or algorithms. The researchers also will develop an approach to verify the T&E design plan for micro UAS.

These RDT&E tasks are possible because the UAS Flight Test Center (FTC) is now operational. The CRDA was signed by the FAA in February 2008. After the CRDA was signed, TAAC personnel began working on procedures by which the FTC would operate. These procedures were approved by the FAA and they are used to assess system capabilities, identify and mitigate risks, and establish operating limits tailored to UAS capabilities. The FTC also is collecting and archiving data for the FAA, including system and component information, flight performance. These data will assist the FAA in developing UAS standards and regulation. In addition, FTC personnel have developed a Web-based data management system, which is serving as a central repository for all UAS FTC data. It has security features to protect proprietary information and a two-level quality control process. A flight planning guide, safety assessments and operational reviews, and flight records are included in the data management system.



A large volume of airspace (more than 15,000 square miles) is available to the FTC (see Figure 1). In addition to the Las Cruces International Airport, which is the headquarters for the FTC, numerous public airports and private airfields are available for UAS flights. The FTC also has access to military airspace slightly smaller than Connecticut available for flights.

FTC personnel have performed the first analysis and conducted the first flight. The MLB BAT 3 UAS is a mini system with a special-purpose operations capability in short range surveillance and remote sensing. The BAT 3 is a small UAV (23 lbs. maximum gross weight), capable of fully autonomous operations (launch, flight to predetermined waypoints, and landing) and designed for short-range surveillance and

Figure 2 - MLB BAT 3



monitoring (Figure 2). The aircraft is a pusher design configuration with an aft-mounted engine and propeller, inverted empennage, and quad landing wheels mounted to the fuselage. The mission and flight testing at the NMSU FTC was to demonstrate and acquire high-resolution imagery for rangeland vegetation mapping. The mission was based near the headquarters of the U.S. Department of Agriculture's Jornada Experimental Range with an objective to fly over rangelands at an altitude of 700 ft AGL to acquire imagery at a resolution of approximately 3 to 5 cm.

Other systems are being evaluated prior to more test flights. Twenty systems are in the queue for the FTC.

The FTC provides precoordinated flight areas with the FAA in civil airspace. These areas are available to Federal users, Federal prime contractors, and industry. These flight areas include local and regional civil airspace. The FTC performs as a one-stop shop for users coordinating mission planning (within the CRDA airspace), FAA interaction, and logistics (fuel, hangar, etc.). Mission planning, operations, concepts of operation, test and

evaluation, and safety are the products, processes, and tools that have been developed for the FTC.

The NMSU/PSL UAS FTC is configured and operated with safety as its highest goal. The airspace associated with the FTC is not special-use airspace; therefore, processes and procedures are in place to protect the public and all air traffic.

Finally, this year, the TAAC will sponsor two conferences. The first is a UAS Operator Training Workshop, which will be held June 24-25 in Albuquerque, NM. This year's UAS TAAC 2009 Conference will be held December 8-10, 2009 at the Tamaya Hyatt Regency Resort at the Santa Ana Pueblo, New Mexico. As usual, this year's conference will have exciting speakers and interesting panels. We hope you will plan to attend.

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