Air Traffic Management

UAS In 2017: Retooling ATC For Beyond-Visual-Line-Of-Sight Operations

Small UAVs force rapid evolution of airspace management

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Pent-up demand for commercial small unmanned aircraft will drive a massive increase in the number of vehicles taking to the air as the FAA and air navigation service providers and supporting industries globally begin to develop and deliver the technologies to enable fully integrated operations in all classes of airspace over the next three years.

Liberalization is following a crawl-walk-run template, albeit at a much faster pace than past evolutions of the air traffic control (ATC) and air traffic management (ATM) systems for manned aircraft, which can take decades to implement.

Government and Industry are promoting commercial small UAS operations by:

Providing hooks into the FAA and other ANSP automation systems

Creating operations management systems that automate commercial flights

Using a stepwise approach to full airspace integration, starting with low-density airspace first

Estimates of the magnitude of demand vary, but it is generally thought to be a half-million or more new commercial small unmanned aircraft systems (UAS) launched every year in the U.S. alone.

The FAA predicts sales of 1.9 million such vehicles in 2017, the boom made possible with the issuance of two new rules, one completed and one to come.

The first—the FAA’s Part 107 small UAS final rule issued in August 2016— allows for commercial operators who register vehicles (weighing up to 55 lb.) and obtain a remote pilots license to fly those UAVs for profit within line of sight in uncontrolled airspace during daylight hours, along with a variety of other restrictions.

Anticipated demand for small commercial delivery UAS is driving development of highly automated traffic-management architectures. Credit: Amazon Prime

The second rule—expected to be finalized in August 2017 and allowing operators to fly multiple small UAS beyond visual line of sight (BVLOS)—will cause a bigger stir in the industry. “The overall demand for commercial UAS will soar once regulations more easily enable BVLOS operations and operation of multiple unmanned aircraft by a single pilot,” says the FAA, adding, “Once a framework is enabled for BVLOS operations, the projected market sizes could be higher than the forecast.”

ATM is a key linchpin for realizing safe integrated BVLOS operations, along with surveillance and navigation, detect and avoid, spectrum management and a host of other factors. NASA has already developed an unmanned ATM framework and is creating an operational model with the FAA and industry, technology that will be transferred to the FAA in pieces through 2020.

Key to the unmanned ATM, or UTM, prototype architecture (see chart) is a notional interface NASA calls the Flight Information Management System (FIMS) that taps into legacy ATM automation systems.

FIMS functionality, which has been successfully simulated by NASA and industry, will allow for any number of UAS service providers (USS)—a new breed of third-party companies that will act as intermediaries between commercial operators and the FAA, air navigation service providers (ANSP) or the military and police forces—to provide critical information to the FAA regarding UAS operations and receive information back from the FAA or ANSP when required.

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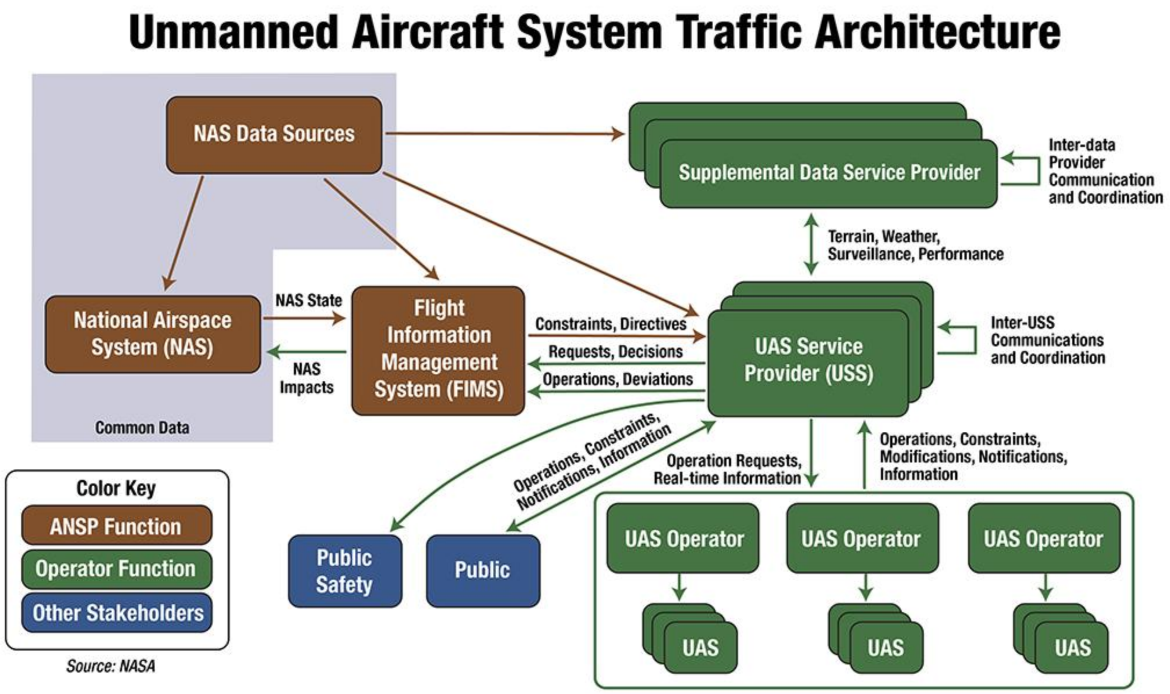
Information flowing from the USS to ATC via the FIMS could include the aircraft details, date and time for the operation, geographical area, maximum altitude and purpose of the flight, and real-time notifications when certain flight parameters change, such as the end-time of a flight. Data moving from ATC to the USS via FIMS could include whether the flight plan has been accepted and changes to the authorization status before or during the flight; for example, a real-time command to terminate a flight.

Along with interfacing with the FIMS, USS will manage traffic for operators, taking requests (or flight plans) and resolving conflict issues between operators before departure, as well as providing operators with terrain, weather, surveillance and performance information. Amit Ganjoo, chief executive officer for ANRA Technologies, a builder of cloud-based operation platforms, says the deconfliction process is similar to internet domain registration companies that share data to find out which domain names are taken.

ANRA Technologies recently introduced a drone Operational System and Services (OSS) platform that will fulfill the role of the USS (if and when the FAA implements the proposed architecture), while more broadly providing a fully automated operating system for commercial UAS. Using a cell-phone tower inspection as an example, Ganjoo says OSS would take care of the flight-planning aspects and handle the command and control of the vehicles during the inspection flight. Video and sensor information would then be analyzed, with a report sent back to the operator a short time later.

For flights in uncontrolled airspace below 500 ft., the FAA's initial position is that controllers should only be alerted to UAS operations (via the FIMS) when there is an anomaly such as an excursion or a fly-away from a flight plan. ATC would contact a USS via FIMS in cases where controllers need to ground an aircraft or relocate the operation for security reasons. For UAS flights in controlled airspace, the FIMS would become the essential communications port for ensuring that the FAA or ANSP safely integrates manned and unmanned aircraft.



Thales, the dominant provider of automation systems to ANSPs globally, is in a “vision stage” in developing its own version of a fused manned and unmanned air traffic management system that would be created in large part to handle commercial package-delivery UAS and potentially automated personal air vehicles as proposed by Uber and others. “We have some system architectures and prototypes, but we’re really trying to make sure our vision is shared,” says Mark Palmer, innovation director for ATM with Thales. “Visions” for how best to integrate manned and unmanned aircraft vary among proponents, from having no UTM (UAS self-managing and flying the way cars drive on the road) to those favoring the concept of ANSPs controlling every UAS no matter where it flies, he says.

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UAS Development For Military Uses Continues In 2017

Thales's vision is somewhere in the middle—it includes a flight-plan-based operating scenario, with portions of airspace "handed over" to the UTM system for UAS operations, and areas of low-altitude airspace where hobbyists can fly with no oversight. The system would clear or adjust a flight plan based on what others are doing and take into account—via big data inputs—weather conditions on a microscopic scale that could influence drone performance. Flexibility would be required for times when there are potential conflicts with manned aircraft based on unplanned events. "If you have a helicopter that has to come down through it, it will have to change to allow for that," says Palmer.

For efficiency, Thales favors a combined ATM and UTM. "If we build two different systems, then we're going to have to pass that data on," says Palmer. "Our plan is to put the UTM system on the same cloud platform and data-sharing system as ATM." The company's new ECOsystem decision-support platform, launched in March 2016, is cloud-based. Its legacy automation platform, TopSky, is in use with 140 ATC centers for control tower, approach, en route and oceanic control centers.

The resulting traffic management system, out of necessity, will also be highly autonomous, with unmanned aircraft being controlled by an operations center that would be responsible for commanding individual vehicles if required to do so by the fused ATM/UTM system. "We're talking about the system controlling 10,000 drones, and the controllers, or supervisors, looking at the exceptions," says Palmer. "If we operate it like manned aviation, having a controller for every 20 or every 50 drones, it's not going to work. When there is an issue with the flight plan and you have to modify it or stop it, that command will have to be issued directly to the flight operator."

He says commercial operators have embraced Thales's vision so far. "There will be money and people involved, and they don't want damage," he says. "They want ATM."

Whatever form Thales ultimately decides to choose, it will be informed by lessons learned from the field. South Africa's Air Traffic Navigation Services (ATNS) has been experimenting with integrated airspace for several years using manual inputs to a Thales-built tool called the central airspace management unit (CAMU), a module that is integrated with the Eurocat X ATM system and in the context of UAS flights, is fulfilling the role of a FIMS.

To fly a UAS (called a remotely piloted aircraft system, or RPAS, in South Africa) in controlled airspace, an operator makes a flexible use of airspace (FUA) request to the CAMU through a process defined in the country's aeronautical information publication. The CAMU software predicts air traffic flow based on calculated takeoff times and elapsed mission times, sharing information with the arrival and departure management software.

"We get the details of what you want to do," says Hennie Marais, chief of air traffic services for ATNS. "Then we do the processing and the approval for the flight to take place."

Processing will consider potential safety issues and what special restrictions might be required; for example, acceptable lost-communications procedures. He says requests for flights in low-density airspace are “easy to accommodate”; the operator is assigned a “box of a certain size and height” to fly in. Flights in higher- density airspace may require communications and vehicle surveillance input from the operator in addition to the restraints levied on flights in low-density airspace.

“If it’s a fairly simple request, you can do it today and fly tomorrow,” says Marais. “If it’s matter of life and death, we can probably go quicker.” He says it also depends where the flight is to take place. “If it’s near Johannesburg International Airport, you can ask in advance and we’ll probably tell you to go away anyway. Other places, we can do it with a little thinking and managing.”

While the RPAS management method is adequate for the one or two requests per week that ATNS receives, largely for test and demonstration flights, Marais admits such a system will not be adequate for high-density operations.

Regardless, he says the FUA method is a good first step to build experience with RPAS. “If we allow people to demonstrate capabilities, as we go along we’ll also learn and discover that the drone is not going to pose a danger to your traffic willfully. It is doing what it needs to do.”