Office of Inspector General
Audit Report

**FAA FACES SIGNIFICANT BARRIERS TO
SAFELY INTEGRATE UNMANNED AIRCRAFT
SYSTEMS INTO THE NATIONAL AIRSPACE
SYSTEM**

Federal Aviation Administration
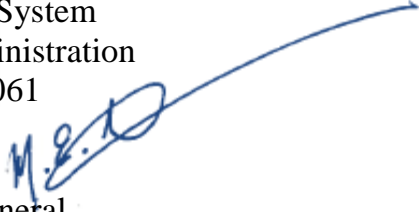
*Report Number: AV-2014-061
Date Issued: June 26, 2014*

Memorandum

U.S. Department of Transportation

Office of the Secretary
of Transportation
Office of Inspector General

Subject:	**ACTION:** FAA Faces Significant Barriers To Safely Integrate Unmanned Aircraft Systems Into the National Airspace System Federal Aviation Administration Report No. AV-2014-061	Date:	June 26, 2014
From:	Matthew E. Hampton Assistant Inspector General for Aviation Audits	Reply to Attn. of:	JA-10
To:	Federal Aviation Administrator		

The Federal Aviation Administration (FAA) forecasts there will be roughly 7,500 active Unmanned Aircraft Systems (UAS)[1] in the United States in 5 years, with over $89 billion invested in UAS worldwide over the next 10 years. Unmanned aircraft range in size from those smaller than a radio-controlled model airplane to those with a wingspan as large as a Boeing 737. These aircraft can serve diverse purposes, such as enhancing border security, monitoring forest fires, and aiding law enforcement, as well as potential commercial use, such as food and package delivery. Due in part to the safety risks associated with integrating UAS into the National Airspace System (NAS), FAA authorizes UAS operations only on a limited, case-by-case basis. While the capabilities of unmanned aircraft have significantly improved, they have a limited ability to detect, sense, and avoid other air traffic.

Concerned with the progress of integrating UAS into the NAS, Congress established specific UAS provisions and deadlines for FAA in the FAA Modernization and Reform Act of 2012.[2] These actions include publishing a 5-year roadmap, establishing six test ranges, and completing the safe integration of UAS into the NAS by September 2015. The Chairmen and Ranking Members of the Senate Commerce Committee and the House Committee on Transportation and Infrastructure, and those Committees' Aviation Subcommittees, requested that we assess FAA's progress in these efforts. Accordingly, our audit objectives were to

---

[1] UAS consist of systems of aircraft and ground control stations where operators control the movements of aircraft remotely.
[2] Pub.L. No. 112-095 (2012).

assess (1) FAA's efforts to mitigate safety risks for integrating UAS into the NAS, and (2) FAA's progress and challenges in meeting the UAS requirements cited in the act.

We conducted this review in accordance with generally accepted Government auditing standards. Exhibit A details our scope and methodology, and exhibit B lists the specific organizations we visited or contacted.

RESULTS IN BRIEF

Significant technological, regulatory, and management barriers exist to safely integrate UAS into the NAS. First, following many years of working with industry, FAA has not reached consensus on standards for technology that would enable UAS to detect and avoid other aircraft and ensure reliable data links between ground stations and the unmanned aircraft they control. Second, FAA has not established a regulatory framework for UAS integration, such as aircraft certification requirements, standard air traffic procedures for safely managing UAS with manned aircraft, or an adequate controller training program for managing UAS. Third, FAA is not effectively collecting and analyzing UAS safety data to identify risks. This is because FAA has not developed procedures for ensuring that all UAS safety incidents are reported and tracked or a process for sharing UAS safety data with the U.S. Department of Defense (DoD), the largest user of UAS. Finally, FAA is not effectively managing its oversight of UAS operations. Although FAA established a UAS Integration Office, it has not clarified lines of reporting or established clear guidance for UAS regional inspectors on authorizing and overseeing UAS operations. Until FAA addresses these barriers, UAS integration will continue to move at a slow pace, and safety risks will remain.

FAA is making some progress in meeting UAS-related provisions of the FAA Modernization and Reform Act of 2012, but the Agency is significantly behind schedule in meeting most of them, including the goal of achieving safe integration by September 2015. FAA has completed 9 of the act's 17 UAS provisions, such as selecting 6 test sites, publishing a UAS Roadmap,[3] and developing a comprehensive plan outlining FAA's UAS plans in the near- and long-term. However, the Agency missed the statutory milestones for most of these provisions, and much work remains to fully implement them. FAA is also behind schedule in implementing the remaining eight UAS provisions. For example, FAA will not meet the August 2014 milestone for issuing a final rule on small UAS operations.[4] FAA's delays are due to unresolved technological, regulatory, and privacy issues,

---

[3] The Roadmap is a guide outlining FAA's plans for integrating UAS into the NAS over a 5-year period.
[4] The rule is intended to establish operating and performance criteria for small UAS (under 55 pounds) in the NAS that are operated within line-of-sight of a pilot or ground observer below 400 feet.

which will prevent FAA from meeting Congress' September 30, 2015, deadline for achieving safe UAS integration. As a result, while it is certain that FAA will accommodate UAS operations at limited locations, it is uncertain when and if full integration of UAS into the NAS will occur.

We are making recommendations to enhance the effectiveness of FAA's efforts to safely integrate UAS into the NAS.

BACKGROUND

Although some UAS technology has existed for many years, there are currently only a limited number of UAS authorized to operate in U.S. airspace. FAA authorizes UAS operations by issuing Certificates of Waiver or Authorization (COA) for public use[5] and Special Airworthiness Certificates in the experimental and restricted categories for civil (private sector) use. Without authorization, FAA states that commercial operations are prohibited.[6] There are currently about 300 active public-use authorizations, 18 experimental special airworthiness certificates, and 2 restricted category airworthiness certificates for over 100 aircraft types.

UAS can vary widely in size and serve a variety of purposes, from military training and law enforcement to research and commercial. Figure 1 depicts examples of large and small unmanned aircraft.

Figure 1. Examples of Large and Small Unmanned Aircraft

Source: FAA

Regardless of aircraft size, significant differences between unmanned and manned aircraft make their integration into the NAS more difficult to achieve. For example, unlike manned aircraft, UAS pilots operate unmanned aircraft on the

---

[5] Public use UAS are flown by Federal, state, or local governmental agencies.

[6] In June 2013, FAA issued a civil penalty against an individual for allegedly operating a UAS for commercial purposes in a careless or reckless manner and endangering life or property. In an appeal of this case, an administrative law judge at the National Transportation Safety Board (NTSB) found that the UAS in question was a "model aircraft," not an "aircraft," and therefore not subject to any binding FAA regulation. FAA has appealed the decision to the full NTSB. OIG takes no position on the merits of the legal positions taken by the parties.

ground from either a remote control device or a ground control station, such as that depicted in figure 2.

Figure 2. Example of a UAS Ground Control Station

Source: OIG

From the ground, pilots control the movements and operation of an unmanned aircraft via a radio or satellite-based communication data link. In addition, air traffic facilities interact with UAS using various technologies, such as radar. Figure 3 details the systems that work together to form a UAS.

Figure 3. Example of an Unmanned Aircraft System
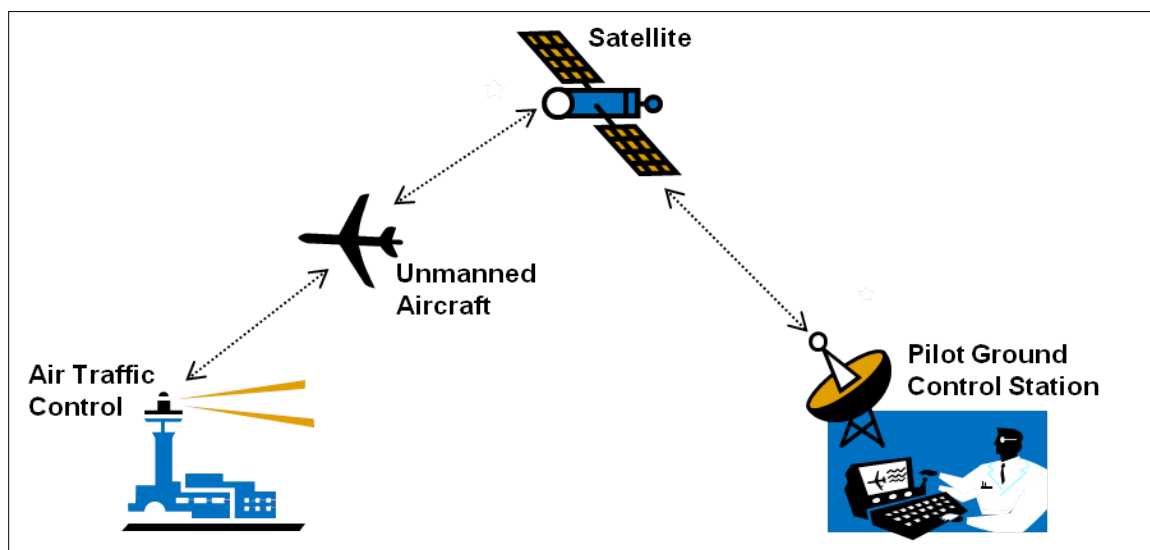
Source: OIG

Given the complex systems and data communications involved in UAS, the integrity, stability, and security of the link between the ground control station and the unmanned aircraft are critical to the safe operation of the UAS. An interruption in the data link is known as a "lost link." A lost link event, which could last for a

second or several minutes, could pose a significant safety risk because direct control of the aircraft by the pilot on the ground has been lost.

BARRIERS LIMIT PROGRESS WITH UAS INTEGRATION INTO THE NAS

Although FAA is taking steps to advance UAS operations, significant technological barriers remain, limiting FAA's progress in achieving safe integration. In addition, FAA has not yet achieved consensus on regulatory standards for integrating UAS into the NAS, including defining minimum performance and design certification standards. FAA faces further challenges because the Agency has yet to develop standardized air traffic control (ATC) procedures specific to the unique characteristics of UAS, and the Agency has not established a sufficient framework for sharing and analyzing safety data from UAS operators. Finally, organizational barriers—such as a lack of clear lines of reporting for UAS staff—are further impeding FAA's progress in integrating and overseeing UAS operations.

Technological Challenges Impede UAS Integration

FAA's efforts to integrate UAS depend on ensuring that UAS technology is advanced and robust enough to operate safely in the same airspace as manned aircraft. However, two technological barriers that pose significant UAS safety risks are delaying FAA's goals. First, because there are no pilots on board, a UAS cannot comply with the "see and avoid"[7] requirements that underpin operational safety in the NAS. However, there is currently a lack of a mature UAS technology capable of automatically detecting other aircraft operating in nearby airspace and successfully maneuvering to avoid them. Experts we interviewed stated that "detect and avoid" is the most pressing technical challenge to integration.

Second, UAS must maintain an adequate link to ground control commands to ensure that pilots never lose control of their aircraft. However, UAS still lack the adequate technology to prevent "lost link" scenarios—disruptions between the ground based operator and the aircraft—which creates significant safety challenges for both controllers and operators. For example, in August 2010, the Navy temporarily lost contact with a UAS helicopter due to a software issue, which resulted in the aircraft flying into restricted airspace surrounding Washington, DC. Additionally, according to a report from the Aviation Safety Reporting System[8] in March 2012, a UAS operating at an altitude of 20,000 feet lost the control link between the ground operator and the aircraft for several

---

[7] While FAA 14 CFR 91.113 speaks of a pilot's ability to "see and avoid" other aircraft and objects, the UAS community is using the term "detect and avoid" to describe the desired capability of UAS.

[8] The Aviation Safety Reporting System collects, analyzes, and responds to voluntarily submitted aviation safety incident reports in order to lessen the likelihood of aviation accidents.

minutes. The unmanned aircraft descended to 19,000 feet without authorization from air traffic control.

To address these technological barriers, there are several research projects underway at FAA and other agencies, such as DoD and the National Aeronautics and Space Administration (NASA). For example, FAA has research that will test communications between ground operators and unmanned aircraft as well as determine the amount of aircraft traffic information a UAS pilot needs to successfully execute a collision avoidance maneuver. Additionally, DoD is currently testing a ground-based detect and avoid system.

FAA has also conducted detect and avoid research in addition to research projects on other UAS-related topics, such as maintenance and repair, human factors, test sites, and operational assessments (see table 1). FAA budgeted $4.2 million to conduct UAS research in fiscal year 2013 and $8.6 million in fiscal year 2014.

Table 1. FAA's Technical Center UAS Research and Development Portfolio for Fiscal Year 2013–2014

Focus Area	Number of Research Tasks
Detect and Avoid	9
Control and Communications	5
UAS Maintenance and Repair	1
UAS Human Factors	1
UAS Test Sites	1
UAS Operational Assessments	2
Total for FY 2013	**19**

Source: OIG analysis of FAA data

A related unresolved issue is securing adequate radio frequencies for UAS operations. While some UAS-specific radio frequencies exist, it is uncertain how many are needed and whether there will be licensing, control and communications standards, and security vulnerabilities. FAA is currently working with industry to develop standards for UAS radio frequencies and to determine how these issues will be addressed.

FAA Has Not Achieved Consensus on Regulatory Standards Despite Several Years of Effort

FAA has not established a regulatory framework for integrating UAS into the NAS. This includes defining minimum performance and design certification standards and issuing rules describing when and how UAS are authorized to operate in U.S. airspace. Instead, FAA currently allows UAS operations only on a case-by-case basis, either under COA[9] procedures with restrictions, or Special Airworthiness Certificates in the experimental or restricted category. In both cases, the applicant submits a standardized application to FAA. FAA reviews each application to ensure that the prospective operator has mitigated safety risks to an acceptable degree. However, to move beyond case-by-case authorizations, FAA will need to establish standards and guidance in the following areas:

- **Performance Standards**—FAA has not reached consensus among Government and industry stakeholders on minimum performance standards for UAS, despite working with a special RTCA[10] advisory committee for over 9 years. According to RTCA, this lack of progress is due to the unique challenges presented by UAS and the large project scope. To help accelerate this effort, in March 2013, RTCA formed a new UAS committee with a narrower focus. This new committee will focus on more detailed standards for detect and avoid capabilities and command and control links. In the near term, the focus will be on operations at higher altitudes, which are tailored for larger UAS currently operated by the military.

- **Certification Standards**—FAA has not established standards necessary for designing, manufacturing, and certifying new UAS to operate in the NAS. Currently, FAA has no design standards for civil (private sector) UAS. As a result, FAA cannot certify any new UAS or provide guidance to UAS manufacturers regarding the design specifications required for certification.

  FAA has taken steps to begin certifying civil UAS by establishing "pathfinder" projects, through which FAA certificated the first two aircraft in July 2013. While authorizing the first commercial UAS operations was an important step, FAA's pathfinder projects used an existing certification rule aimed at repurposing surplus military aircraft for civilian use, rather than addressing some of the novel aspects of UAS, which will be needed to certify UAS for widespread operations. FAA officials told us they are evaluating the lessons

---

[9] Certificate of Waiver or Authorization: Certificates which permit UAS operated by public agencies in the NAS, with restrictions.

[10] Organized in 1935 as the Radio Technical Commission for Aeronautics, RTCA, Inc., is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management (CNS/ATM) system issues. It functions as a Federal Advisory Committee.

learned from this process to develop standards for more widespread industry use.

- **Categorizing UAS**—FAA currently separates UAS into only two classes—those under 55 pounds and those 55 pounds and greater, which does not adequately account for the different performance characteristics across a wide range of UAS. In contrast, DoD has five distinct classes of UAS categorized by weight and other characteristics such as speed and altitude capabilities. DoD officials we spoke with said grouping UAS into classes is an important step in setting certification standards; the most stringent standards are reserved for the heaviest and most capable UAS. In March 2013, a UAS rulemaking committee of subject matter experts[11] recommended that FAA apply weight distinctions that are currently established for manned aircraft. However, the committee did not reach consensus on the need for additional classifications. While the report recommended specific weight classifications, it also noted that further work was needed to determine what other criteria (e.g., performance and complexity) may be necessary for classifying unmanned aircraft in the future.

In addition, FAA has not resolved many other critical issues related to regulatory requirements and standards, including UAS pilot and crew[12] qualifications, ground control stations, and command and control reliability. Table 2 lists some of the areas where regulations, standards, and guidance are needed for UAS operations. Without such a regulatory framework, UAS will continue to operate with significant limitations in the NAS.

---

[11] The UAS Aviation Rulemaking Committee Terminology and Categorization Action Team was tasked with investigating and providing recommendations on the best way to classify civil UAS.
[12] Crew in addition to the pilot can include ground-based crew who assist the Pilot in Command (PIC) with determining UAS proximity to other aviation activities and assist the PIC with not operating beyond the visual line of sight limit.

Table 2. Examples of Aviation Safety Regulatory Development Needs for UAS

Unmanned Aircraft	Pilot and Crew	Control Station	Data Link
• Policy • Certification Requirements • Technical Standards • Performance Standards • Airworthiness Standards • Procedures • Regulations/ Guidance • Measures of Performance • Maintenance Requirements	• Policy • Certification Requirements • Operational Standards • Procedures • Regulations • Guidance Material • Training Requirements • Medical Standards	• Policy • Certification Requirements • Technical Standards • Airworthiness Standards • Interoperability Requirements • Guidance Material • Maintenance Requirements • Means of Compliance	• Policy • Certification Requirements • Technical Standards • Airworthiness Standards • Interoperability Requirements • Dedicated Aviation Radio Frequency Spectrum • Standardized Control Architectures • Link Security Requirements

Source: OIG analysis of FAA data

FAA Has Not Established Standardized UAS Procedures and Training for Air Traffic Controllers

Currently, although FAA has authorized some UAS to operate in the NAS at select locations, such as along the Nation's borders,[13] the Agency has not developed the procedures, training, and tools for controllers to effectively manage UAS in the same airspace as other aircraft. Controllers told us they must segregate UAS from other traffic. For example, controllers at one air traffic control facility handling large UAS operations told us that they always moved manned aircraft away from UAS because they were not aware of the specifics of individual UAS missions and performance characteristics, such as differing airspeed capabilities and rates of climb.

While FAA has provided interim guidance[14] on air traffic policies and procedures, air traffic personnel expressed concerns about the lack of training and guidance in certain areas, such as how to handle a "lost link" event. In addition to our interviews, controllers at air traffic facilities nationwide have filed similar complaints about limited UAS guidance and training through its Air Traffic Safety

---

[13] The U.S. Customs and Border Protection, within the Department of Homeland Security, deploys UAS for border and port surveillance.
[14] FAA Order N JO 7210.846, Unmanned Aircraft Operations in the National Airspace System (NAS).

Action Program (ATSAP).[15] Although FAA established a corrective action plan in January 2013 to address controllers' concerns,[16] along with rolling out an online UAS course in July 2013 to provide some preliminary training, the Agency does not expect to fully implement the corrective action plan until September 2015.

The National Transportation Safety Board (NTSB) raised similar concerns several years ago following its investigation[17] of a Customs and Border Protection UAS that crashed near a home in Arizona in 2006. Because of the lack of standardized air traffic procedures for UAS, NTSB recommended that FAA require periodic operational reviews between UAS operators and local ATC facilities to clearly define responsibilities and actions required for UAS operations. The NTSB recommendation is currently classified as "Open." In August 2013, FAA provided NTSB with actions taken to address its recommendation, such as updates to internal guidance and plans to present UAS information to controllers at a safety forum. However, in November 2013, NTSB determined these actions were not sufficient to close the recommendation and asked FAA for additional information.

Furthermore, FAA has not provided adequate automated tools for managing UAS traffic, largely because FAA's air traffic control equipment was not developed with UAS operations in mind. For example, controllers told us that the En Route Automation Modernization (ERAM) system, a controller automation system for processing flight data for high altitude flights, cannot yet adequately manage UAS flight plans because they contain an unusually large amount of navigational data. This forces controllers to implement manual and time-consuming "work-arounds" for handing off UAS between facilities and airspace sectors.

The challenges FAA faces in safely integrating UAS into the NAS were further illustrated in the results of a July 2012 study, which simulated UAS operations at small- to medium-sized airports.[18] The study found that introducing only four unmanned aircraft into the simulated airspace system had significant impacts on safety, efficiency, and controller workload. For example, controllers did not fully understand the safety consequences (e.g., potential traffic conflicts) of lost link events. Further, lost link events increased controller workload, affected the manageability of the traffic in the airspace, resulted in increased numbers of aborted aircraft landings, and appeared to reduce controllers' situational awareness. The study concluded that multiple, simultaneous UAS operations in the small- to medium-sized airport environment were not yet feasible. FAA plans to

---

[15] The Air Traffic Safety Action Program is a voluntary safety reporting program for air traffic personnel that enable them to report air traffic safety events and retain confidentiality.

[16] FAA Corrective Action Request, January 9, 2013.

[17] NTSB Safety Recommendation A-07-67. Letter to FAA dated October 24, 2007.

[18] FAA, "Multi-UAS Operational Assessment: Class D Airspace Simulation Report," July 2012. According to an FAA official, the purpose of the study was to intentionally stress the system to determine whether the Agency needs to develop new policies or perform further research. The study was conducted at the William J. Hughes Technical Center.

conduct additional simulations assessing the impact of UAS on more complex and active airspace.

FAA also has to carry out safety assessments for any change to the NAS that could affect safety, including UAS. To complete these assessments, FAA plans to complete Safety Risk Management Documents[19] for all classes of NAS airspace, which will identify the corresponding risks of UAS operations in that airspace. As of March 2014, FAA had completed only 2 of 12 planned safety risk assessments.

FAA Has Not Developed an Adequate Framework for Sharing and Analyzing UAS Safety Data

FAA's efforts to integrate UAS are further limited because the Agency has not obtained comprehensive data on UAS operations. Because integrating UAS into the NAS is in the early stages, any and all data regarding the safety of UAS operations are paramount to understanding and mitigating hazards that may arise.[20] FAA routinely collects safety data from current public use UAS operators as required by the agreements with each operator. However, the Agency does not know whether it is receiving a sufficient amount of data from UAS operators because it has not established a process to ensure that operators report all incidents as required.

In addition, FAA has not reached agreement with DoD on exchanging the most useful data. For example, FAA's Office of Accident Investigation and Prevention receives annual UAS mishap data from DoD under a Memorandum of Agreement. However, FAA's UAS integration staff told us they do not find these data useful because they lack detail. Although DoD has a wealth of other operational data, such as airworthiness data, FAA has been unable to obtain the data, despite requesting it nearly 2 years ago. DoD has been reluctant to provide some data to FAA due to concerns regarding the release of sensitive information and uncertainty over who would bear the cost of retrieving the information. FAA has now formed a data-sharing team with DoD representatives to resolve this issue. In June 2013, FAA began a series of meetings with DoD representatives to discuss obtaining pertinent DoD operational data, such as pilot training standards and air traffic control lessons learned.

In addition, recognizing that the Agency needs a better data management strategy, FAA tasked MITRE[21] to develop a system to collect and better analyze UAS

---

[19] Safety Risk Management Documents are formal documentation of a completed Safety Risk Management process.
[20] In manned aircraft operations, tracking and analyzing operational failures and malfunctions of aircraft or ground systems has provided valuable insight into and has improved the effectiveness of both design and operational safety controls; it also has aided in root-cause investigations.
[21] MITRE Corporation manages a Federally Funded Research and Development Center (FFRDC) for the FAA known as the Center for Advanced Aviation System Development (CAASD). CAASD is a unique organization that assists FAA with scientific research and analysis.

safety data. According to FAA, it expects MITRE to complete this initiative in September 2015.

Organizational Barriers Impede FAA's Progress in Integrating and Overseeing UAS Operations in the NAS

Integrating UAS operations into the NAS presents significant organizational and management challenges, in part because many stakeholders, both internal and external, must collaborate to bring about UAS integration, as shown in table 3.

Table 3. Key UAS Stakeholders

Internal Stakeholders	External Stakeholders
Flight Standards (AFS)	RTCA
Air Traffic Organization (ATO)	Industry
Aircraft Certification (Design and Manufacturing)	Other Government Agencies
NextGen Organization	MITRE
William J. Hughes Technical Center	Academia
Joint Planning Development Office (JPDO)	International Civil Aviation Organization (ICAO)

Source: OIG analysis of FAA data

In March 2012, due to the increasing demands for expanded UAS integration, FAA appointed a new senior executive position to head a new UAS office—the UAS Integration Office within its Flight Standards division. This office consolidates Aviation Safety and Air Traffic Organization (ATO) personnel with UAS expertise into a single organization. However, while ATO personnel were assigned and actively working in the office, it took well over a year to complete the internal agreement necessary to establish roles and responsibilities between ATO and the UAS Integration Office and to establish administrative authority with the senior executive in charge. In addition, the office is not yet fully staffed— it has lost 6 people since November 2012 and has identified the need for an additional 20 positions.

Assuming these issues are resolved, the UAS Integration Office will still need to interface with personnel in ATO who must develop airspace policy that considers the operational needs of both manned and unmanned aircraft. Beyond the ATO, the office will also have to reach out across other FAA lines of business and offices, such as Aircraft Certification and Next Generation Air Transportation System (NextGen) organizations.

Questions remain regarding the placement, authority, and structure of the new UAS Integration Office, which is currently located within FAA's Office of Aviation Safety (AVS). Government and industry stakeholders expressed concerns about the Office's ability to coordinate and align resources and to make decisions within its current structure. These actions will become more important as the integration of UAS advances, and as FAA moves from planning to implementation. A UAS rulemaking working group[22] recently recommended that the UAS Integration Office be placed at a higher level within FAA in order to have the necessary authority and access to other FAA lines of business and offices.

Another unresolved organizational issue relates to managing UAS oversight, particularly for regional UAS safety inspectors. These inspectors receive work assignments from the UAS Integration Office, but report to the Regional Flight Standards Division Managers, resulting in competing priorities for the same resources. In addition, regions are inconsistent regarding how they review and process COA applications. For example, one region has developed its own tools to better depict airspace and expedite the approval process. Although FAA officials stated that at least one other office is using a similar tool now, none of the other regions we reviewed use this tool.

Further, regional UAS safety inspectors do not conduct onsite inspections of UAS operations for various reasons, such as resource constraints and unclear guidance regarding oversight authority. While FAA issued guidance in January 2013 that provides necessary policies for evaluating proposed UAS operations and describes the details a COA applicant should have in place, the guidance does not clearly detail what actions an inspector should take in overseeing a UAS operator.

FAA DEVELOPED A ROADMAP FOR UAS INTEGRATION BUT IS STILL BEHIND IN MEETING STATUTORY PROVISIONS

In the FAA Modernization and Reform Act of 2012, Congress established multiple provisions for integrating UAS and set a deadline of September 30, 2015, for UAS integration. FAA recently reached an important milestone by issuing its UAS Roadmap—a guide outlining FAA's plans for integrating UAS into the NAS over a 5-year period. However, the Agency is behind schedule on most of the act's UAS provisions, and the magnitude of unresolved safety and privacy issues will prevent FAA from meeting Congress' September 2015 deadline for UAS integration.

---

[22] This group, known as the Implementation Plan Working Group (IPWG), consists of subject matter experts from the UAS Aviation Rulemaking Committee. The IPWG Civil UAS Integration Plan, May 2013, details implementation steps for FAA's Civil UAS Integration Roadmap.

Overall, the act cited a total of 17 UAS-related provisions with corresponding deadlines. See exhibit C for details on FAA's progress on all 17 provisions. The established deadlines for 9 of these 17 provisions have already passed. While FAA has now met these nine provisions, much work remains to fully implement the initiatives. For example:

- **UAS Test Sites**—FAA reviewed proposals from 25 applicants in 24 States, and announced the selection of 6 test sites in December 2013. However, FAA has not developed goals for what it intends to accomplish with the test sites once they are established. According to FAA, the Agency cannot direct the research activities of the six test sites and specify outcomes because there is no Federal funding. Moreover, FAA was late meeting a related milestone—to have at least one test range operational by February 2013. Due to the delays in selecting test sites and evaluating applicants, the first range did not become operational until April 2014.

- **UAS Roadmap**—FAA issued its UAS Roadmap in November 2013—an important step toward UAS integration. However, while the Roadmap contains goals, metrics, and target dates, it lacks the detail or authority of a formal implementation plan, and FAA states that the dates are "targets" rather than "commitments." FAA plans to update these details as the Agency learns more from ongoing UAS operations and research.

- **Comprehensive plan**—The act called for a comprehensive UAS plan to be submitted to Congress by February 2013 that sets the overarching, interagency goals, objectives, and approach for integrating UAS into the NAS. The Joint Planning and Development Office (JPDO)[23] issued a UAS comprehensive plan in November 2013, 9 months behind schedule. According to JPDO management, these delays were due to difficulties coordinating FAA internal documents with other JPDO member agencies.[24]

- **Simplified COA process**—FAA has changed the COA process to an online application system and established goals for reduced approval times, which, according to FAA, has shortened the process from over 200 days to as little as 60 days. FAA also signed a memorandum of understanding with the Department of Justice on March 4, 2013, which streamlined the process for

---

[23] JPDO was created to manage the partnerships that will implement the NextGen transportation system. NextGen includes satellite navigation and control of aircraft, advanced digital communications, and enhanced connectivity between all components of the national air transportation system. JPDO stakeholders include private industry, academia, and governmental departments and agencies.

[24] JPDO member agencies are: White House Office of Science and Technology, Department of Defense, Department of Commerce /National Oceanic and Atmospheric Administration, Department of Homeland Security, National Aeronautics and Space Administration, Federal Aviation Administration, Office of the Director of National Intelligence.

State and local law enforcement agencies to operate UAS legally and safely.[25] However, work remains to develop agreements with other agencies.

- **Arctic plan**—The act also called for FAA to develop a plan to designate permanent areas in the Arctic where small UAS could conduct 24-hour operations for research and commercial purposes. FAA published its plan in November 2012.[26] However, there are a number of policies, procedures, and details yet to be specified before flights can become widespread, such as establishing a "coordinating body" to manage traffic in the Arctic operational areas.

Of the eight remaining provisions with future deadlines, FAA has experienced delays. Most notably:

- **Issue a final rule on "Small UAS" by August 2014**—FAA officials told us that they will not meet the act's August 2014 deadline for issuing a rule to establish operating and performance criteria for small UAS operated within the line-of-sight of a pilot or ground observer below 400 feet. In June 2011, FAA planned to issue a Notice of Proposed Rulemaking, which is required in advance of a final rule. However, the Agency has not yet done so, nearly 3 years later. FAA officials indicated that privacy concerns have been the primary contributor to this recent delay. In the fiscal year 2014 Omnibus Appropriations Act,[27] Congress directed FAA to conduct a study of the impact of UAS integration on individual privacy and submit a report on its findings.

- **Safely integrate civil UAS into the NAS by September 2015**—The act directs FAA to ensure the "safe integration of civil UAS into the NAS" by September 2015. FAA officials told us that by 2015 they expect to issue their rule for small UAS, approve a ground-based detect and avoid system, and have operational test ranges. However, these actions do not represent full, safe integration. FAA has not prioritized what needs to be done to achieve integration or established metrics to evaluate its progress. As a result, it remains unclear when FAA will achieve safe and full integration of UAS in U.S. airspace.

---

[25] The standard COA process was not meeting the needs of law enforcement, which tend to operate their UAS more spontaneously than other UAS users.

[26] FAA, "Expanding Use of Small Unmanned Aircraft Systems in the Arctic Implementation Plan," November 11, 2012.

[27] Pub.L. No. 92-313 (2014).

CONCLUSION

FAA's primary mission remains ensuring the safety of the NAS. As such, the FAA Modernization and Reform Act's goal of integrating unmanned aircraft into the NAS by 2015 presents unique and complex safety challenges for the Agency. Now is the time, while UAS operations are currently still limited, for FAA to build critical knowledge by collecting and analyzing UAS safety data and better managing its oversight through the UAS integration office. However, as the number of UAS operating in domestic airspace increases, safety risks will persist until FAA establishes performance, air traffic control, and certification standards to regulate UAS use. Until FAA is successful in establishing these standards and adhering to a comprehensive integration plan with other public and private stakeholders, it will remain unclear when, and if, FAA can meet its goals to safely integrate UAS.

RECOMMENDATIONS

To enhance the effectiveness of FAA's efforts to safely integrate UAS into the NAS, we recommend that FAA:

1. Publish a report annually detailing ongoing research activities and progress FAA and other entities are making in their respective areas of responsibility to resolve technical challenges to safe integration of UAS.

2. Establish milestones for the work needed to determine the appropriate classification system for unmanned aircraft as a basis for developing the UAS regulatory framework.

3. Establish a timeline for developing standardized training and procedures for air traffic controllers responsible for UAS operations.

4. Assess and determine the requirements for automated tools to assist air traffic controllers in managing UAS operations in the NAS.

5. Create a standardized framework for data sharing and analysis between FAA and UAS operators by:

   a. validating a sample of the data it currently receives from UAS operators;

   b. finalizing an agreement with DoD for pertinent UAS operational data; and

   c. completing development of a sharing and analysis database.

6. Develop and implement a consistent process to review and approve COAs across FAA regions, adopt measures that increase process efficiency and oversight, and provide necessary guidance and training to inspectors.

7. Complete airspace simulation and safety studies of the impact of UAS operations on air traffic control across all segments of the NAS.

8. Develop a mechanism to verify that the UAS Integration Office, all FAA lines of business, and field safety inspectors are effectively coordinating their UAS efforts.

9. Determine the specific types of data and information needed from each of the six planned test ranges to facilitate safe integration of UAS into the NAS.

10. Establish a more detailed implementation plan with milestones and prioritized actions needed to advance UAS integration in the near, mid, and long term.

11. Establish metrics to define progress in meeting implementation milestones as a basis for reporting to Congress.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

We provided our draft report to FAA on May 7, 2014, and received its response on June 12, 2014, which is included in its entirety as an appendix. FAA concurred with all 11 recommendations. FAA proposed appropriate actions and completion dates for recommendations 2, 3, 4, 6, 7, and 10, and we consider them resolved but open pending completion of the planned actions. We are requesting FAA expand its actions for recommendation 1 and provide additional information for recommendations 5, 8, 9, and 11 as detailed below.

For recommendation 1, FAA agreed to publish a report by November 30, 2014, detailing ongoing research activities and progress FAA and other entities are making to resolve UAS technical challenges. However, the Agency plans to only publish it internally. We request that FAA consider making the information publically available, such as publishing it on the Agency's public Web site to provide transparency and ensure that all stakeholders, such as DoD and NASA, have access to the information.

For recommendation 5, FAA requested that we close subparts 5a and 5b, stating that the Agency has validated DoD mishap data and reached data sharing agreements with DoD. However, for 5a, FAA did not include its planned actions for validating a sample of the data received by the UAS Integration Office through COA agreements, as we recommended. For 5b, we recognize that FAA has

agreements to receive some data from DoD. However, as we noted in our report, FAA officials told us these data are not yet useful because they lack detail. Our intent was for FAA to finalize an agreement with DoD to collect additional data, such as airworthiness and pilot training data. FAA and DoD have been discussing arrangements to obtain these data since June 2013. Therefore, we request that FAA provide additional information on how and when it plans to finalize an agreement with DoD to collect the remaining data it needs.

FAA requested that we close recommendation 8, stating that the Agency plans to add agenda items to executive-led UAS meetings and weekly staff meetings to solicit feedback on the effectiveness of coordination. While this action may meet the intent of our recommendation, FAA did not provide sufficient information to close it. Therefore, we request additional information on FAA's process for validating that its proposed actions address our recommendations and a target date for when this action will be completed.

For recommendation 9, FAA stated that the Agency is working with each test site to understand planned research activities. Additionally, FAA stated that if the research is applicable and available, the Agency will determine what data should be collected and request results of studies and relevant data from the test sites. FAA stated this would be an ongoing activity and the results would be available by December 31, 2017. However, our recommendation was specifically aimed at encouraging FAA to determine the data it needs early in the process so it can more effectively use the test sites to identify and reduce UAS integration risks. Therefore, we request the Agency provide information on actions it will take to more timely identify the specific types of data and information needed from each of the six test sites, as we recommended.

FAA requested that we close recommendation 11, stating that beginning in 2014, annual updates to the UAS Roadmap will include adjustments to goals, metrics, and target dates. However, it is not possible to assess whether FAA's planned actions meet the intent of our recommendation until FAA publishes the next update of the UAS Roadmap. Therefore, we request that the Agency provide us with documentation that this action has been implemented. In addition, FAA did not provide a specific target date for when this action will be completed.

ACTIONS REQUIRED

FAA provided appropriate planned actions and completion dates for recommendations, 2, 3, 4, 6, 7, and 10, and we consider these recommendations resolved but open pending completion of the planned actions. We are requesting FAA to expand its planned actions in response to recommendation 1 and provide additional information for recommendations 5, 8, 9, and 11, as detailed above. In

accordance with DOT Order 8000.1C, please provide this information within 30 days of this report. Until we receive this additional information, we consider these recommendations open and unresolved.

We appreciate the courtesies and cooperation of FAA representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-0500 or Robin P. Koch, Program Director, at (404) 562-3770.

<div align="center">#</div>

cc: DOT Audit Liaison, M-1
     FAA Audit Liaison, AAE-100

EXHIBIT A. SCOPE AND METHODOLOGY

We conducted this audit between October 2012 and April 2014 in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. Our audit objectives were to assess: (1) FAA's efforts to mitigate safety risks for integrating UAS into the NAS, and (2) FAA's progress and challenges in meeting the UAS requirements cited in the act.

To obtain information about FAA's efforts to mitigate safety risks as it seeks to integrate UAS into the NAS and to determine the status of FAA's UAS-related milestones in the FAA Modernization and Reform Act of 2012, we met with FAA UAS Integration Office officials, including the office manager as well as program managers for UAS safety, airworthiness, data management, and operational initiatives. We collected data from the UAS Integration Office to verify fulfillment of UAS milestones as mandated by the act. We examined documentation verifying all UAS integration projects as well as planning documents that outline FAA's plans to integrate UAS safely into the NAS, including drafts of the UAS Roadmap and Concept of Operations. We also visited the William J. Hughes Technical Center to obtain information on FAA's UAS research.

We interviewed FAA aviation safety inspectors assigned with UAS oversight duties in four of seven randomly selected FAA regions to discern their UAS responsibilities, their interactions with COAs, and their supervisory structure. We also interviewed FAA air traffic controllers and management in three FAA ATC centers that routinely handle UAS operations to determine the amount of UAS they work and the challenges UAS pose to their regular air traffic procedures. We reviewed COA applications, data requirements, and review processes along with FAA interim guidance on UAS operational approval and air traffic control policies and procedures. We also examined prior reports and studies, conducted by FAA and other organizations, on the unique challenges posed by UAS and the existing impediments to their safe integration into congested airspace.

We met with representatives from other Federal agencies and offices involved in UAS integration, including DoD, NASA, and NTSB, and analyzed documentation of their UAS-related work and research. We also met with JPDO officials regarding their efforts at creating the Comprehensive Plan, and with officials from RTCA to discuss UAS standards development. We analyzed drafts of the Comprehensive Plan and RTCA's Terms of Reference. We met with non-government UAS stakeholders, including representatives from INSITU and AeroVironment, to gather information about their work to certify UAS through FAA's Pathfinder initiative and reviewed their project plans and type certificates.

We interviewed representatives from MITRE and the Massachusetts Institute of Technology to obtain information on UAS research projects and their coordination with FAA. We spoke with officials at New Mexico State University to obtain information on their UAS test site and the challenges they faced as a test site operator in the NAS. We also spoke with representatives of the Association for Unmanned Vehicle Systems International and the National Air Traffic Controllers Association to obtain their views on FAA's UAS integration efforts.

The scope of work on internal controls was limited to gaining an understanding of the status of FAA's efforts to mitigate safety risks to integrating UAS into the NAS, their progress in meeting UAS requirements in the FAA Modernization and Reform Act of 2012, and FAA's process for approving COAs. No deficiencies in internal controls were found during our examination.

Exhibit A. Scope and Methodology

EXHIBIT B. ORGANIZATIONS VISITED OR CONTACTED

Federal Aviation Administration

Headquarters

FAA Headquarters	Washington, DC
Unmanned Aircraft Systems Integration Office	Washington, DC
FAA Airspace Service	Washington, DC
Joint Planning and Development Office	Washington, DC

FAA Technical Center

FAA William J. Hughes Technical Center	Atlantic City, NJ

Air Traffic Organization

Albuquerque Air Route Traffic Control Center	Albuquerque, NM
Los Angeles Air Route Traffic Control Center	Palmdale, CA
Minneapolis Air Route Traffic Control Center	Farmington, MN
Eastern Service Center	College Park, GA

Flight Standards Service

Central Region	Kansas City, MO
Southern Region	College Park, GA
Western Pacific Region	Lawndale, CA
Northwest Mountain Region	Renton, WA

Other Organizations

National Air Traffic Controllers Association	Washington, DC
United States Air Force	Washington, DC
RTCA	Washington, DC
Association For Unmanned Vehicle Systems International	Arlington, VA
New Mexico State University	Las Cruces, NM
MITRE	McLean, VA
National Transportation Safety Board	Washington, DC
National Aeronautics and Space Administration	Edwards, CA
AeroVironment, Inc.	Simi Valley, CA
Insitu, Inc.	Bingen, WA
Massachusetts Institute of Technology	Cambridge, MA

EXHIBIT C. STATUS OF FAA'S IMPLEMENTATION OF HR 658 UAS MILESTONES (AS OF JANUARY 2014)

Section	Description	Deadline	Progress	Status
334c	Establish agreements to simplify process for issuing COAs for public UAS in the NAS.	5/14/2012	🟢 🟡	Met — FAA made changes to the COA process to shorten the timeframes needed for approval. Implemented Late – FAA completed a streamlined COA process via MOUs with DoD, NASA, and DOJ in March 2013.
332c(1)	Establish program for integrating UAS into the NAS at six test ranges.	8/12/2012	🟡	Implemented Late – On December 30, 2013, FAA announced the test-site applicants chosen for the six test ranges.
332d	Develop plan to designate permanent areas in the Arctic where small UAS may operate 24 hours/day for research and commercial purposes.	8/12/2012	🟡	Implemented Late – FAA's Arctic Plan was signed on November 1, 2012, and was made available to the public on FAA's Web site on December 6, 2012.
333	Determine if certain UAS may operate safely in the NAS before completion of the comprehensive plan and rulemaking.	8/12/2012	🟡	Implemented Late – FAA issued type certificates (using the 21.25 restricted category certification) to ScanEagle and Puma UAS to operate in the Arctic in July 2013, stipulating that certain UAS could operate in restricted areas of the NAS prior to the issuance of the comprehensive plan.
332a(1)	Develop a comprehensive plan to safely accelerate the integration of UAS into the NAS.	11/10/2012	🟡	Implemented Late – JPDO was assigned to develop the comprehensive plan. However, the document had to undergo substantial revisions during an interagency review process.
334a	Issue guidance regarding the operation of public-use UAS including expediting the UAS approval process.	11/10/2012	🟡	Implemented Late – On January 22, 2013, the FAA issued notice N8900.207, which provides policies necessary for reviewing and evaluating the safety and interoperability of proposed UAS flight operations in the NAS, and outlines best practices and procedures that FAA has used in prior UAS approvals.
332a(4)	Submit copy of comprehensive plan to Congress.	2/14/2013	🟡	Implemented Late – After an extended executive coordination and interagency review process, FAA submitted the plan on November 6, 2013.

🟢 - Provision Implemented and Statutory Deadline Met

🟡 - Provision Implemented but Missed Statutory Deadline

🔴 - Provision Not Implemented and Statutory Deadline Missed

⚪ - Deadline in Future

Exhibit C. Status of FAA's Implementation of HR 658 UAS Milestones (as of January 2014)

Section	Description	Deadline	Progress	Status
332c(4)	Make operational at least one project at a test range.	2/14/2013	🟡	Implemented Late – FAA announced the six test sites in December 2013. The first test site became operational in April 2014.
332a(5)	Develop and make publically available 5-year roadmap for the introduction of UAS into the NAS.	2/14/2013	🟡	Implemented Late – OMB required FAA to make substantial revisions to its Roadmap, and the document underwent a Legislative Referral Memorandum process. FAA published the Roadmap on November 7, 2013.
332b(3)	Issue an update to the Administration's policy statement on UAS.	8/14/2014	⚪	Deadline in future.
332b(1)	Issue the Final Rule on small UAS.	8/14/2014	⚪	Deadline in future. FAA officials stated that the Agency will be unable to meet this deadline.
332b(2)	Issue a NPRM to implement recommendations of the comprehensive plan.	8/14/2014	⚪	Deadline in future.
332a(3)	The safe integration of civil UAS into the NAS.	9/30/2015	⚪	Deadline in future. FAA officials stated that, by this date, they plan to have the test sites operational, issue the small UAS rule, and approve a ground-based detect-and-avoid system available for certain UAS.
332b(2)	Issue final rule on integration of all UAS into the NAS.	12/14/2015	⚪	Deadline in future.
334b	Develop and implement operational and certification requirements for the operation of public UAS in the NAS.	12/31/2015	⚪	Deadline in future.
332c(1)	Termination of program for integrating UAS into the NAS at six test ranges.	2/14/2017	⚪	Deadline in future.
332c(5)	Submit report of findings and conclusions concerning projects from six test ranges.	5/15/2017	⚪	Deadline in future.

🟢 - Provision Implemented and Statutory Deadline Met

🟡 - Provision Implemented but Missed Statutory Deadline

🔴 - Provision Not Implemented and Statutory Deadline Missed

⚪ - Deadline in Future

Exhibit C. Status of FAA's Implementation of HR 658 UAS Milestones (as of January 2014)

EXHIBIT D. MAJOR CONTRIBUTORS TO THIS REPORT

Name	Title
Robin Koch	Program Director
Marshall Jackson	Project Manager
Mark Perrill	Senior Analyst
Curt Boettcher	Senior Analyst
Andrew Farnsworth	Senior Analyst
Audre Azuolas	Writer/Editor

Federal Aviation Administration

Memorandum

Date: June 12, 2014

To: Matthew E. Hampton, Assistant Inspector General for Aviation

From: H. Clayton Foushee, Director, Office of Audit and Evaluation, AAE-1

Subject: Federal Aviation Administration's (FAA) Response to Office of Inspector
                    General (OIG) Draft Report: Integration of Unmanned Aircraft Systems (UAS)
                    into the National Airspace System (NAS)

Since its inception in 2013, the UAS Integration Office (AFS-80) has been responsible for the
oversight of all Agency UAS activities. Tasked with fulfilling the mandates set forth in the
FAA Modernization and Reform Act of 2012 (the Act), the office has accomplished many
goals, despite facing the numerous challenges that come with an entirely new undertaking. In
2013 – 2014, the FAA established six UAS test sites, published the "Integration of Civil
Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap",
published the "Unmanned Aircraft Systems (UAS) Comprehensive Plan", simplified the
Certificate of Waiver or Authorization (COA) process, and published the "Expanding Use of
Small Unmanned Aircraft Systems in the Arctic Implementation Plan."

The Small UAS Rule is one of the FAA Administrator's top priorities, and the Notice of
Proposed Rulemaking is expected to be published later this year. Rulemaking is very complex,
and the FAA wants to ensure that the Agency strikes the right balance of requirements for
small UAS to help foster growth in this emerging industry. Finally, it is important to note that
the Act requires safe – not full – integration of UAS into the NAS by September 2015.
Integrating UAS into the complicated U.S. airspace requires an incremental approach, and one
that will allow the NAS processes currently in place, as well as those under development, to
effectively ensure safety both in the air and on the ground.

AFS-80 continues to work on a number of issues which require resolution in order for safe
integration to occur. First, work is being done in conjunction with the Department of Defense
(DoD), the National Aeronautics and Space Administration (NASA), and the MITRE
Corporation (MITRE) on Detect and Avoid systems and the establishment of performance and
certification standards. Processes regarding the collection of safety data continue to improve
and will evolve as the six test sites provide additional data collected during their operations.
Safety risk management documents are being developed regarding all classes of airspace and
will aid in the understanding and mitigation of potential hazards that may arise as integration

continues. Additionally, work is underway to develop training programs and procedures for air traffic controllers, and the COA process continues to be streamlined. It is anticipated that limited commercial UAS operations will be authorized in advance of the Small UAS Rule, using provisions granted within Section 333 of the Act as a basis for authorization.

Our mission is the safe, efficient, and timely integration of UAS into the NAS. Though there have been delays in the completion of tasks mandated in the Act, many accomplishments have occurred. Safely integrating UAS into the NAS is a huge undertaking, and despite a number of challenges, including the identification of staff and other resources, as well as the impact of furloughs during the government shutdown, significant progress has been made in UAS integration.

Recommendations and Responses

Recommendation 1: Publish a report annually detailing ongoing research activities and progress FAA and other entities are making in their respective areas of responsibility to resolve technical challenges to safe integration of UAS.

Response: Concur. AFS-80 is developing a detailed inventory of past and ongoing research activities, leveraging the Joint Planning and Development Office's (JPDO)[1] research inventory and feedback from other government partners. The inventory will include the relevant UAS integration research of DoD, NASA, and other government and industry partners. This inventory will be updated by the FAA and its research partners as changes to the research occur.

AFS-80 is also a member of the DoD's Science and Research Panel (SARP), and is collaborating with NASA and DoD through this panel to prioritize key research tasks. These priorities will be updated as needed after each SARP meeting and documented in the detailed research inventory outlined above. Research progress will be summarized in this inventory, in addition to being documented in research reports and other artifacts. The initial research inventory will be available on the AFS-80 internal SharePoint site by November 30, 2014. This will enable effective sharing and collaboration from all research partners and AFS-80 will make this information available to the OIG.

Recommendation 2: Establish milestones for the work needed to determine the appropriate classification system for unmanned aircraft as a basis for developing the UAS regulatory framework.

Response: Concur. It is envisioned that UAS classification for the purposes of design and airworthiness approvals will be approached in two phases. The first phase would be to develop the comprehensive type and airworthiness certification approach into groups of UAS based on the pre-existing diversity and variation within the UAS operational community, likely differentiated by the operational risk of introducing them into the NAS. The second phase would add appropriate classification within the type and airworthiness certification framework in order to categorize like-featured systems (e.g., complex, non-complex, airplane, rotorcraft) and

---

[1] Congress eliminated funding for JPDO earlier this year. It has been replaced by the 'Interagency Planning Office' within the Next Generation Air Transportation System (NextGen) Office.

Appendix. Agency Comments

establish certification criteria in each of those UAS categories to maximize the effectiveness of FAA certification resources.

The formal establishment of these milestones and the tasks associated with implementing them require acceptance from organizational stakeholders involved in type design and airworthiness approval processes within the FAA in addition to the international community. This will provide confidence that the classification criteria are broadly accepted conceptually, prior to formalizing program plans and milestones associated with developing the technical underpinnings of the concepts into processes, policies, guidance and regulations. This will also provide recognition of those regulatory artifacts supporting international access to UAS. AFS-80 anticipates completion of Phase 1 by September 30, 2015 and Phase 2 by September 30, 2016.

Recommendation 3: Establish a timeline for developing standardized training and procedures for air traffic controllers responsible for UAS operations.

Response: Concur. Establishment of a timeline is already underway and is scheduled for completion by October 30, 2014. AFS-80 is working closely with the offices of primary responsibility (OPR), Air Traffic Organization's (ATO) Safety and Technical Training (AJI), and the Air Traffic Procedures Directorate, to establish a timeline to support this effort. To date, there have been two e-Learning Management System (eLMS) courses created (in 2009 and 2013) that have provided training for UAS operating characteristics and terminology for the controller workforce. Research is also underway at the FAA's William J. Hughes Technical Center to address UAS contingency operating procedures in the NAS (e.g., lost link). This research will inform decision-makers on the correct direction and areas of emphasis for UAS procedural development and implementation. Additionally, the FAA is working with the DoD (USNORTHCOM research initiative) in formulating potential UAS procedures for specific DoD airframes.

Recommendation 4: Assess and determine the requirements for automated tools to assist air traffic controllers in managing UAS operations in the NAS.

Response: Concur. This work is already underway and is scheduled for completion by October 31, 2015. AFS-80 is working with the OPR, the ATO's Operational Concepts, Validation and Requirements Directorate, to identify operational requirements, which include automation tools, to assist the controller in providing a service. To date, successful deployment of specific UAS information has been accomplished and is now available to controllers through the En Route Information Display System. Additional requirements are being identified through concept validation work based on FAA's UAS Concept of Operations.

Recommendation 5: Create a standardized framework for data sharing and analysis between FAA and UAS operations by:
    a. Validating a sample of the data it currently receives from UAS operators;
    b. Finalizing an agreement with DoD for pertinent UAS operational data; and
    c. Completing development of a sharing and analysis database.

Appendix. Agency Comments

Response a: Concur. The Office of Accident Investigation and Prevention (AVP) receives annual UAS mishap data from DoD under the Memorandum of Agreement (MOA) for the Sharing of Mishap Information. AVP completed validation of the data in a standardized framework for sharing and analysis on September 14, 2012. AVP can leverage this framework for completion of the development of a sharing and analysis database within 60 days of completion of recommendation 5c. The FAA requests that recommendation 5a be closed.

Response b: Concur. DoD has agreed to provide pertinent data via two separate but complimentary reporting processes. The primary process used for data reporting and collection is via the COA. The COA issued by the FAA to DoD proponents in order to accommodate their operations in the NAS include clearly defined and detailed operational, incident, and accident reporting data elements. The data reporting requirements contained in the COA represents a finalized agreement to report pertinent safety-related data. DoD has been reporting this information since 2010. Should the requirements for data as required by the COA process change, FAA will coordinate the changes through established processes with the UAS Executive Committee and/or DoD's Policy Board on Federal Aviation. Additionally, the DoD Safety Centers provide mishap data to AVP as required by the FAA-DoD MOA for the Sharing of Mishap Information. As identified in Response 5a, AVP has validated the data received as a result of the agreement; thus, the FAA request that recommendation 5b be closed.

Response c: Concur. AFS-80 is developing a fully integrated data sharing and analysis system that provides data acquisition and querying functions; thereby providing the foundation for in-depth root cause analysis of accident/incident data, improved COA tracking process and quality of safety data, and enhanced mitigation strategies in support of AFS-80's Safety Management System Integration Plan. Currently, the transmission of data is provided by public operators through COA Online, an automated web-based process. Proponents populate the pre-determined formatted report templates and then transmit the report electronically via e-mail. Once the data is received from the proponents, AFS-80 personnel manually enter it into a secure Access database where it is stored for future analysis. The database gives AFS-80 the capability to track specific operational and safety data, run queries based on selected criteria, and create reports. This methodology was chosen as an interim process while AFS-80 works with MITRE Center for Advanced Aviation System Development (CAASD) to develop a more sophisticated database structure, including a secure online site. This database will meet AFS-80's specifications and will include merging all existing AFS-80 databases, reducing or eliminating manual data entry, and improving analytic querying capabilities. The database prototype is currently in the development stage, and is scheduled for completion by October 31, 2014.

Recommendation 6: Develop and implement a consistent process to review and approve COAs across FAA regions, adopt measures that increase process efficiency and oversight, and provide necessary guidance and training to inspectors.

Response: Concur. AFS-80, in coordination with the Flight Standards Training Division, has completed and deployed three training courses. An introductory course (Introduction to UAS; Course # 27100179) was released on September 30, 2013, and is available online in eLMS. This course provides basic knowledge of the UAS elements and FAA oversight of UAS activities in the NAS. Two courses for Aviation Safety Inspectors (ASI) were released in April 2014: UAS-

Appendix. Agency Comments

Initial, Course # 27100222; and UAS-Practical Application Workshop (PAW), Course # 21000049.

During the next three years, AFS-80 will work with MITRE CAASD to engineer an integrated solution to efficiently accommodate increasing numbers of applications, rules, and complex dependencies of the multi-step COA approval process. MITRE CAASD has assessed the current COA process, collected and evaluated the needs of various users, and determined gaps. It will identify operational and functional requirements, develop a prototype, provide design and system requirements, and assess the process by using the prototype as an interim solution.

AFS-80 has also established a COA Standardization Working Group comprised of both ASI and Air Traffic Control (ATC) Specialists located throughout the U.S. The group's purpose is to promote and ensure a nationally standardized process for COA processing by re-ordering the process and paralleling the UAS COA process with that of manned aircraft. The new process will establish a repeatable risk assessment process for like activities. By September 30, 2015, the team will also produce new guidance for Flight Standards and Air Traffic personnel which clearly delineates areas of responsibilities and eliminates duplication of work.

Recommendation 7: Complete airspace simulation and safety studies of the impact of UAS operations on air traffic control across all segments of the NAS.

Response: Concur. This work is already underway. AFS-80 is working closely with AJI to prioritize and conduct safety risk management panels (SRMPs) that best address airspace integration needs. To date, three SRMPs have been completed and one is in progress. AFS-80 has identified the airspace classes (A, B, C, E, and G)[2] that will need to be completed, and is working to complete a SRMP on each class of airspace as quickly as current staffing levels will allow. Additionally, AFS-80 led a team to conduct site visits to four En Route facilities to collect data on the impact of current UAS operations to ATC facilities. A detailed report was written on the site visits and was used to validate current issues impacting ATC facilities. This report can be used to support future safety studies and analysis when applicable. AFS-80 is on schedule to have all SRMPs completed by October 31, 2015.

Recommendation 8: Develop a mechanism to verify that the UAS Integration Office, all FAA lines of business, and field safety inspectors are effectively coordinating their UAS efforts.

Response: Concur. In June 2013, the FAA established the UAS Working Group (UASWG); an ongoing, executive-led forum that reviews strategic Agency-wide UAS matters. The UASWG is chaired by the Associate Administrator for Aviation Safety (AVS-1). The UASWG aims to ensure cross-Agency decision-makers are aware of UAS-related integration activities, provide an opportunity to collect input and to address issues in specific areas of responsibility, and ensure UAS integration activities are coordinated on behalf of the Agency as a whole. In order to verify that effective coordination is occurring, AVS-1 will solicit feedback from the UASWG members at the end of each meeting. This will be implemented as an agenda item starting in June 2014.

---

[2] http://www.faa.gov/air_traffic/publications/atpubs/aim/aim0301.html#aim0301.html.1

Appendix. Agency Comments

The UAS Safety and Data Management Section Manager holds weekly staff meetings that includes all of the field safety inspectors supporting UAS integration efforts. Topics of discussion at these meetings vary widely from general status updates to specific problem areas encountered by inspectors. This forum provides AFS-80 and the field safety inspectors the opportunity to hold open conversations on diverse areas of relevance and ensures that activities are coordinated between Headquarters and the Regions. In order to verify that effective coordination is occurring, the AFS-80 Manager will solicit feedback from the staff meeting participants at the end of each meeting. This will be implemented as an agenda item starting in June 2014. The FAA requests that this recommendation be closed.

Recommendation 9: Determine the specific types of data and information needed from each of the six planned test ranges to facilitate safe integration of UAS into the NAS.

Response: Concur. Agreements with each UAS test site require them to provide operational safety data (i.e., the same data required by a COA) to the FAA. The FAA is working with each test site to understand their planned research activities. Based on the research conducted throughout the life of the test site, the FAA will determine if and how the results will drive integration activities and supplement the FAA's UAS research and development portfolio. If the research is applicable and available (i.e., not intellectual property or trade secrets), the FAA will determine what data should be collected and request results of studies and relevant data from the test sites. This will be an ongoing activity as test sites develop. The FAA anticipates completion no earlier than 2017 and will provide the results by December 31, 2017.

Recommendation 10: Establish a more detailed implementation plan with milestones and prioritized actions needed to advance UAS integration in the near, mid, and long term.

Response: Concur. AFS-80 is working with MITRE CAASD to develop a UAS Integration Strategy to assist with the development of a UAS Program Plan that identifies the goals, dependencies, issues, and specific milestones of a phased implementation approach for UAS integration into the NAS over a five year implementation period. The strategy will depict the management/governance goals, structure, and activities, as well as the system engineering and integration mission, roles, and responsibilities. Finally, the strategy will define a clear path to external agency and industry engagement and consensus-building. The anticipated completion date for this plan is August 31, 2014.

Recommendation 11: Establish metrics to define progress in meeting implementation milestones as a basis for reporting to Congress.

Response: Concur. Five-year goals, metrics, and target dates for UAS integration into the NAS have been established and are contained in the FAA's "Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap" Appendix C. The Act requires the Roadmap to be updated and published annually. The Roadmap is available online at http://www.faa.gov/about/initiatives/uas/. Starting with the 2014 (second) edition, accomplishments from the previous year and updates to the Appendix C goals, metrics, and target dates will be noted in a separate Roadmap appendix. The FAA recommends closing this

Appendix. Agency Comments

recommendation as this activity has been completed and progress will be reported annually, per requirements in the Act.

Appendix. Agency Comments