FAA Has Made Progress on a UAS Traffic Management Framework, but Key Challenges Remain
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Requested by the Ranking Members of the House Committee on Transportation and Infrastructure and its Aviation Subcommittee

Federal Aviation Administration | AV2022041 | September 28, 2022

What We Looked At
Unmanned Aircraft Systems (UAS), commonly known as “drones,” are rapidly growing in number in the National Airspace System. Currently, there is limited infrastructure available to manage widespread expansion of small UAS operations in low-altitude airspace (below 400 feet) where the Federal Aviation Administration (FAA) does not provide air traffic services. Congress directed FAA to conduct activities that will allow implementation of UAS Traffic Management (UTM), including a UTM Pilot Program. Citing the importance of UAS traffic management, the Ranking Members of the House Committee on Transportation and Infrastructure and its Aviation Subcommittee requested that we evaluate FAA’s efforts to develop and implement UTM, including the pilot program and any interactions FAA has had with other Government agencies. Our objectives were to assess FAA’s (1) progress with UTM development and implementation, including results of its UTM Pilot Program, and (2) collaboration with other Government agencies regarding UTM.

What We Found
FAA has made initial progress in developing a UTM framework and testing UTM concepts through the UTM Pilot Program. For example, FAA continues to develop and refine its concept of operations and has deployed some initial UTM capabilities, such as an automated system for authorizing UAS operations near airports. However, FAA has not established milestones for implementing the policies and processes necessary to allow for UTM deployment or finalized how the Agency plans to use the UTM Pilot Program results to inform near-term efforts. While UTM stakeholders stated that the pilot program was successful, they noted common areas of concern with UTM implementation, such as slow progress, the need for additional rules for remotely identifying UAS, and lack of information on next steps. In addition, FAA has not yet completed coordination with other Government agencies.

Our Recommendations
FAA concurred with two of our four recommendations to improve FAA’s efforts to develop and implement a UTM and partially concurred with the other two. Based on FAA’s response, we consider all four recommendations resolved but open pending completion of planned actions.

All OIG audit reports are available on our website at www.oig.dot.gov.

For inquiries about this report, please contact our Office of Government and Public Affairs at (202) 366-8751.
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Unmanned Aircraft Systems (UAS), commonly known as “drones,” are rapidly growing in number in the National Airspace System (NAS). The Federal Aviation Administration (FAA) predicts that by 2024, the number of small UAS (less than 55 pounds) used for commercial purposes will increase by over 60 percent—from approximately 488,000 to 784,000 in circulation—and that there will be over 1.5 million small UAS used for recreation.

Currently, there is limited infrastructure available to manage widespread expansion of small UAS operations in low-altitude airspace (below 400 feet) where FAA does not provide air traffic services. While FAA limits operations to visual line of sight, the expected growth and expansion to more complex operations beyond visual line of sight poses a risk for accidents and incidents between UAS and other aircraft operating in the same airspace, such as helicopters. To accommodate, integrate, and provide for the evolution of UAS in the NAS while managing small UAS operations and ensuring safety for all aircraft, Congress directed FAA to conduct activities in collaboration with the National Aeronautics and Space Administration (NASA) and industry stakeholders that will allow implementation of UAS Traffic Management (UTM).¹

As required by the FAA Extension, Safety, and Security Act of 2016,² FAA established the UTM Pilot Program in April 2017 to define an initial set of industry and FAA capabilities to support low-altitude UAS operations. The FAA

¹ UTM is a traffic management ecosystem (i.e., a network of participants, services, capabilities, information flows, and other supporting architecture) that would be separate from but complementary to FAA’s Air Traffic Management system. Under UTM, FAA would establish rules for operating UAS, and UAS-industry service providers and operators would coordinate the execution of flights.

Reauthorization Act of 2018\(^3\) further directed FAA to develop a plan for the implementation of UTM services that expand beyond visual line of sight. FAA completed its UTM Pilot Program in November 2020.

Citing the importance of UAS traffic management, the Ranking Members of the House Committee on Transportation and Infrastructure and its Subcommittee on Aviation requested that we assess FAA’s efforts to develop and implement UTM, including the pilot program and any collaborations or interactions FAA has had with other Government agencies, including NASA and the Department of Defense (DoD). Accordingly, our audit objectives were to assess FAA’s (1) progress with UTM development and implementation, including results of its UTM pilot program, and (2) collaboration with other Government agencies regarding UTM.

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

We appreciate the courtesies and cooperation of Department of Transportation (DOT) representatives during this audit. If you have any questions concerning this report, please contact me or Robin Koch, Program Director.

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

Results in Brief

FAA is working to advance UTM, but challenges remain to fully developing and implementing a UTM framework.

FAA has made initial progress in developing a UTM framework and testing UTM concepts through the UTM Pilot Program. For example, FAA continues to develop and refine its concept of operations and has deployed some initial UTM capabilities, such as an automated system for authorizing UAS operations near airports. However, due to the evolving nature of UTM, FAA has not established milestones for implementing the policies and processes necessary to allow for UTM deployment that could expand UAS operations and advance integration. In addition, FAA has not determined its cost and faces a number of challenges to implementation. Further, FAA has not finalized how the Agency plans to use the UTM Pilot Program results to inform near-term efforts—including rulemaking, the UTM implementation plan, and FAA’s program that is addressing UAS integration challenges. While test site representatives and industry partners stated the pilot program was successful, they noted common areas of concern with UTM implementation, including slow progress, the need for rules to include additional methods for remotely identifying UAS, lack of information on FAA’s next steps, and the achievement of a return on their investment. Although FAA is working to update its concept of operations and issue an implementation plan, the Agency has delayed issuing these documents so that it can consider the recommendations from a rulemaking committee on operations beyond visual line of sight and better understand industry’s plans and operational proposals related to UTM concepts. Finally, a number of other technical and regulatory challenges remain before FAA can further advance UTM implementation, such as developing technical standards for detecting and avoiding other aircraft, implementing safety regulations, and protecting cybersecurity. As a result, it is unknown when robust traffic management will be in place for low-altitude UAS operations and how much it will cost.

FAA coordinated with NASA to develop UTM, but NASA’s future role is uncertain, and collaboration with other Federal agencies continues to evolve.

FAA has been coordinating with NASA to develop UTM since 2015. After completing research and testing events and collaborating with FAA on the UTM Pilot Program, NASA transferred further UTM development and implementation

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4 On October 26, 2020, FAA established the BEYOND program to continue to address UAS integration challenges, such as beyond visual line of sight operations.
to FAA in 2020. NASA has since moved on to conducting research in other transportation markets, and FAA has not yet solidified a plan to continue working collaboratively with NASA on future UTM efforts. In addition, FAA has identified a need for other Federal agencies, such as DoD and the Department of Homeland Security (DHS), to play a role in the UTM development and implementation process as well as to protect national security interests. However, FAA has not yet completed coordination with these additional agencies. Coordinating with the Federal Communications Commission (FCC) on the availability of dedicated communication channels between an unmanned aircraft and its control station or operator\(^5\) will be another focus area for FAA as UTM expands. Incomplete coordination will hinder the Agency’s ability to develop comprehensive traffic management for UAS that fully addresses the research, safety, and security interests of multiple Federal agencies.

We are making recommendations to improve FAA’s use of UTM Pilot Program results, communication with industry stakeholders, and development of its implementation plan, as well as for continued external collaboration.

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**Background**

UAS represent substantial economic and technological opportunities for the United States. They can be used for diverse purposes, such as inspecting pipelines, aiding law enforcement, and delivering packages. While there are challenges to safely integrating UAS into the NAS, potential safety benefits across other transportation modes also exist with the use of UAS. For example, UAS can replace people in performing dangerous bridge inspections or removing vehicles from the roads, therefore potentially reducing the risk of accidents or loss of life.

Concerned with FAA’s progress in integrating UAS into the NAS, Congress established multiple provisions and deadlines in the FAA Modernization and Reform Act of 2012.\(^6\) The act aimed to achieve safe UAS integration into the NAS by September 2015. As we reported in June 2014,\(^7\) FAA made progress towards this goal, but was significantly behind in meeting most of the act’s requirements, including issuing the final rule for small UAS.

\(^5\) Referred to as radio-frequency spectrum.
FAA issued the final rule for small UAS in June 2016, 2 years past the act’s August 2014 goal. The rule permitted small UAS to fly commercially in certain airspace with a number of restrictions. However, the rule also allows commercial UAS operators to apply for waivers to deviate from several provisions if the Agency finds the proposed operation can be performed safely. Certain operational waiver applications—such as those for UAS operations conducted beyond visual line of sight—require more complicated, intensive analysis of the applicant’s safety case.

In addition, the small UAS rule allows operations in airspace where FAA air traffic control services are not provided (Class G). However, operations in all other “controlled” airspace requires an authorization from the Agency’s Air Traffic Organization (Class B, C, D, and E). Figure 1 illustrates UTM operations in the context of airspace classes.

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In April 2021, a new FAA rule took effect that expanded the type of operations permitted without a waiver. This rule established new requirements that would allow for operations over people, at night, and over a moving vehicle.

Since issuing regulations in 2016, UAS have rapidly grown in number in the NAS and are expected to continue to grow, as shown in figure 2. FAA predicts that by 2024, the number of small UAS (less than 55 pounds) used for commercial

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9 Operation of Small Unmanned Aircraft Systems Over People, 86 FR 4314 (Jan. 15, 2021); see also Operation of Small Unmanned Aircraft Systems Over People; Delay; Withdrawal; Correction, 86 FR 13630 (Mar. 10, 2021) (correcting the final rule and delaying the effective date from March 16, 2021 to April 21, 2021).
purposes will increase from 488,000 to 784,000 and that there will be over 1.5 million small UAS used for recreation.

Figure 2. Number of UAS Registered Aircraft* From 2016 to 2024

*FAA estimates the number of aircraft registered for recreational operators because they do not have to register each aircraft; whereas commercial operators register each aircraft.

Source: 2021 FAA Aerospace Forecast

Congress views UTM as critical to safe UAS integration and a foundational step to growth in commercial UAS activities, along with their associated public safety and economic benefits. To accommodate, integrate, and provide for the evolution of UAS in the NAS, and to help manage these operations, Congress has directed FAA to conduct activities necessary to enable UTM. In the FAA Extension, Safety, and Security Act of 2016, Congress directed FAA to develop a research plan for UTM development and deployment. To further progress FAA’s efforts to implement UTM, Congress also included additional provisions in 2016 and 2018:

- Section 2208 of the FAA Extension, Safety, and Security Act of 2016 required FAA to establish a UTM Pilot Program.

- Section 376 of the FAA Reauthorization Act of 2018 required FAA to meet certain additional objectives before completing the pilot program (see exhibit D for requirements related to the pilot program).

- Section 376 of the FAA Reauthorization Act of 2018 also required FAA to issue a UTM implementation plan a year after completing the pilot.
program, including several provisions for the plan content (see exhibit E for requirements related to the implementation plan).

- Section 377 of the FAA Reauthorization Act of 2018 required FAA to determine if certain UTM services may operate safely in the NAS before completion of the implementation plan.

As envisioned, UTM will not be a specific equipment system; rather, it will be a suite of systems and services that will be complementary to the existing air traffic management system and will not serve as a system replacement. UTM development will ultimately result in identifying the services, roles and responsibilities, information architecture, data exchange protocols, software functions, infrastructure, policies and procedures, and performance requirements needed to enable the management of low-altitude UAS operations.

In July 2021, the President emphasized the importance of emerging technologies and the need to safely integrate them in an Executive Order on promoting competition in the American economy. In the Order, the President instructed DOT to use its actions related to “low-altitude unmanned aircraft system deliveries” to “facilitate innovation that fosters United States market leadership and market entry to promote competition and economic opportunity […] while also ensuring safety.”

FAA Is Working To Advance UTM, but Challenges Remain To Fully Developing and Implementing a UTM Framework

FAA has made progress on developing a UTM framework and testing UTM concepts through the UTM Pilot Program. However, due to the evolving nature of UTM, FAA has not established milestones for implementing the policies and processes necessary to allow for UTM deployment capable of expanding UAS operations and advancing UAS integration. In addition, FAA faces a number of challenges to implementation.

10 Executive Order 14036, Promoting Competition in the American Economy, July 9, 2021.
FAA Has Made Some Initial Progress on Developing a UTM Framework

Although it is not yet known when FAA and industry will establish the various UTM elements, such as technologies, concepts of use, policies, and procedures, the Agency has taken some first steps, including developing a concept of operations and deploying some initial UTM capabilities.

**FAA Continues To Develop and Refine Its Concept of Operations for UTM**

Many factors influence decision making in developing and implementing a system for managing UAS traffic in low airspace. For example, FAA and industry partners must consider which technologies are most effective for managing air traffic, the regulations needed to best maintain safety, and the roles and responsibilities for stakeholders. Although FAA is still in the early stages of designing such a framework, the Agency has made progress in certain areas.

Specifically, FAA has created and continues to revise a UTM Concept of Operations, a document that identifies the UAS traffic management framework. FAA’s concept of operations provides a broad, high-level architectural and operational vision of how UTM would work in the real world. It also identifies the envisioned roles and responsibilities of the various stakeholders and entities that interact with UTM. The plan is for FAA and industry to share in the roles and responsibilities. For example, FAA will manage a system known as the Flight Information Management System (FIMS), while industry will provide the interface with UAS operators. FIMS is a central component of UTM that provides FAA and other airspace stakeholders with access to UTM data. FAA will also use this interface as an access point for information on active UTM operations.

Overall, FAA’s vision for the UTM framework is that UAS operators and entities providing support services—also known as UAS service suppliers—will be responsible for the coordination, execution, and management of operations, with rules established by FAA. Within the UTM framework, FAA maintains its regulatory and operational authority for airspace and traffic operations; however, the operations are not managed by FAA’s Air Traffic Control. Rather, they are organized, coordinated, and managed by various stakeholders in a distributed network of highly automated systems.

Figure 3 illustrates the high-level UTM framework that FAA has conceived. As shown, UTM comprises an interdependent relationship between FAA, operators, and service suppliers.
Figure 3. UTM Framework

FAA established this initial conceptual framework in its first UTM Concept of Operations in May 2018. FAA issued a second version of the UTM Concept of Operations in March 2020. The new version expanded on UTM operations, including descriptions of scenarios for more complex operations in dense airspace, such as operations beyond visual line of sight in controlled airspace as well as the use of remote identification (Remote ID).¹¹

FAA states that the Agency will continue to update the UTM Concept of Operations as new requirements and rules are developed and implemented. According to an FAA official, the Agency is currently engaging industry and other UTM stakeholders to mature and refine the UTM Concept of Operations for a third iteration. For example, a Federal advisory committee¹² reviewed the March 2020 Concept of Operations document and reported the need for more discussion in 12 specific areas, including FIMS, operators’ and USS responsibilities in UTM, data protection, benefits of UTM, as well as concepts known as UAS.

¹¹ Remote ID allows governmental and civil identification of UAS for safety, security, and compliance purposes.
¹² Drone Advisory Committee (DAC) is a broad-based, long-term Federal advisory committee made up of high-level participants from various companies, State and local governments, airports, and the manned aviation community to provide FAA with advice on key UAS integration issues. On October 25, 2021, FAA amended the group’s charter to rename it the Advanced Aviation Advisory Committee and to expand its membership and mission to include other emerging technologies, such as advanced air mobility.
volume reservations\textsuperscript{13} and performance authorizations.\textsuperscript{14} According to FAA, the UTM Concept of Operations 3.0 will include elements related to recreational operations, information security, public safety operations, security stakeholders, and UTM services updates.

FAA originally planned to release the UTM Concept of Operations 3.0 in fall 2021 but has since delayed its release. According to FAA, this is in part because the Agency plans to integrate pending recommendations from an Aviation Rulemaking Committee on beyond visual line of sight operations.\textsuperscript{15} FAA tasked the rulemaking committee with making recommendations to address the full spectrum of operations beyond visual line of sight with varying levels of human involvement and autonomy, as well as recommending regulatory requirements and rationale for a performance-based framework to enable these operations. In addition, FAA tasked the rulemaking committee with defining the expected future market participants and their responsibilities in these operations. According to FAA officials, the committee’s recommendations will have an impact in determining the Agency’s Air Traffic Organization’s role in the UTM system and will also influence a number of implementation decisions, such as for third-party service suppliers. According to FAA, UTM is viewed as a key way to mitigate risks beyond visual line of sight.

While the industry supports this rulemaking effort, FAA has not yet committed to issuing a rule, nor has it issued an associated rulemaking timeline. The committee issued its report on March 10, 2022, and according to FAA, the Agency has targeted the end of calendar year 2022 to issue its Concept of Operations Version 3.0 document.

**FAA Has Deployed Some Initial UTM Capabilities**

In addition to developing a Concept of Operations, FAA has begun to deploy some initial capabilities for UTM. In particular, in 2018, FAA deployed the Low Altitude Authorization and Notification Capability (LAANC), a key capability that automates the process to authorize use of airspace for UAS. Viewed as a foundational component of the UTM framework, LAANC is a significant step forward in terms of an automating system to support increasing volumes of UAS operations.

Specifically, FAA’s current rules require UAS operators to obtain authorization from FAA’s Air Traffic Control prior to operation in controlled airspace (e.g., near airports). LAANC automates this process, allowing operators to obtain near-real

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\textsuperscript{13} UAS Volume Reservations (UVRs) are designed to support operational safety during public safety activities (e.g., firefighting) by notifying UTM operators of blocks of airspace in which these activities will occur.

\textsuperscript{14} Performance authorizations will be required from FAA prior to conducting a class or type of UTM operation, in which operators substantiate their ability to meet flight performance capabilities in their intended area of operation.

\textsuperscript{15} FAA established the Beyond Visual Line of Sight Aviation Rulemaking Committee in June 2021.
time authorization prior to their operation. Before LAANC, FAA completed airspace authorizations manually, which could take operators weeks to get approved. LAANC is the first step toward implementing UTM, “a system of systems” for enabling safe, efficient low-altitude UAS operations. According to FAA, as of early February 2022, the Agency had issued 1 million airspace authorizations, and LAANC is now available at 542 air traffic facilities, providing service to over 700 airports nationwide. While FAA oversees LAANC, its structure gives a number of private companies the ability to design their own systems as long as they meet FAA requirements. As of February 2022, there are eight FAA-approved LAANC UAS service suppliers.

In July 2019, FAA expanded LAANC to provide airspace authorizations for recreational UAS operators as required by the 2018 FAA Reauthorization Act. Previously, only commercial operators were able to obtain airspace authorizations through LAANC. In 2021, the LAANC capability expanded to provide night authorizations to small UAS operators.

FAA has also implemented DroneZone, a web portal that allows pilots to register their UAS. DroneZone is also a primary way for operators to manage their waivers and authorizations and to report accidents.

In addition, FAA issued a rule\textsuperscript{16} that became effective in April 2021 for Remote ID, a key component of UTM. The rule requires UAS to remotely broadcast messages that identify them and provide location information, as the intent is to provide a “digital license plate” for drones. Once UAS are equipped with remote identification capabilities,\textsuperscript{17} public safety and national security interests will be able to identify small UAS that are authorized to fly and distinguish them from small UAS operating in possible violation of local, State, or Federal laws.

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\textbf{FAA Achieved Its Intended Goals With the UTM Pilot Program and Plans To Use the Results for Near-Term UTM Efforts}

To begin testing and refining key UTM concepts, FAA established the UTM Pilot Program in response to the FAA Extension, Safety, and Security Act of 2016. Consisting of two phases, the UTM Pilot Program’s activities included a series of preparation flights and final flight demonstrations, using live UAS flights.


\textsuperscript{17} Drone manufacturers must comply with the rule by September 16, 2022, and commercial and recreational UAS drone pilots must comply with the rule beginning September 16, 2023.
combined with simulated UTM operations. FAA used the UTM Pilot Program to demonstrate how to integrate various types of capabilities within UTM.

FAA met the congressional requirements for the pilot program and achieved its intended goals. Specifically, FAA completed its UTM Pilot Program Phase 1 in August 2019. Phase 1 included multiple demonstrations at three test sites—Virginia, North Dakota, and Nevada—that tested capabilities such as UAS volume reservations and sharing of operational intent among operators and between UTM partners and FAA. At the Virginia test site, the VA Tech Mid Atlantic Avionic Partnership (MAAP) team developed a UTM architecture that used four UAS service suppliers. Several UAS were flown using these service suppliers for UTM services. In addition, FAA’s FIMS connected to the service suppliers and provided information on UAS volume reservations. FIMS monitored the operations and was able to access historical data on the operations.

FAA initiated Phase 2 of the UTM Pilot Program in 2019 to meet additional requirements mandated in the 2018 Act. In April 2020, FAA selected two UAS test sites—Virginia and New York—to partner with the Agency for Phase 2 development, testing, and demonstration activities. Phase 2, completed in November 2020, included testing unmanned aircraft operations of increasing volumes and density in airspace above test ranges. The New York UAS test site conducted testing in an urban environment, using 13 live UAS and 3 simulated UAS. During the final demonstrations, the New York test site achieved a maximum of 15 concurrent operations.

Both Virginia and New York test site staff developed and held testing events with different parameters (use cases) to demonstrate UTM capabilities (see table).

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18 UAS Service Suppliers (USS) are third party entities that assist UAS operators with meeting UTM operational requirements that enable safe and efficient use of airspace without direct FAA involvement. USS services support operations planning, intent sharing, strategic and tactical de-confliction, conformance monitoring, remote identification, airspace authorization, and airspace management functions.

19 FAA also tested UTM at other sites outside of the UPP as part of the UAS Integration Pilot Program—a 3-year program aimed at helping with the development of new rules to enable more complex UAS operations. For example, FAA conducted a UTM exercise with the North Carolina Department of Transportation on January 24, 2020.

20 Use cases cover a range of predominantly nominal operations, as well as off-nominal scenarios, and the main conceptual elements and interactions within them in a UTM environment. Each use case details a set of possible sequences and/or interactions between the system and its users that occur to achieve the operational goals defined for the environment being explored.
### Table. UTM Pilot Program Events at the VA and NY Test Sites

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<tr>
<th>Event #1</th>
<th>VA Tech MAAP</th>
<th>New York UAS Test Site</th>
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<tr>
<td>FAA and the test site conducted this event from April 22-April 23, 2019 to test various UTM functionalities.</td>
<td>FAA and the test site conducted this event at the Griffiss International Airport and at a park in the City of Rome, NY, from August 31-September 4, 2020. Industry partners were able to test some functionalities, including those implemented in accordance with recently developed standards, such as Remote ID and Tracking.</td>
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<table>
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<tr>
<th>Event #2</th>
<th>VA Tech MAAP</th>
<th>New York UAS Test Site</th>
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<tr>
<td>FAA and the test site conducted this event from June 10-12, 2019 and the UTM Pilot Program demonstration occurred on June 13, 2019. During this combined test event, a total of 108 live flights were performed for a total of 12.6 flight hours. Testing included several use cases that simulated real world UAS operations, including UAS Volume Reservations imposed on operations.</td>
<td>FAA and the test site conducted this event at same locations executed from October 5-9, 2020. New York Test Site integrated a number of capabilities to form a more complete picture of future UTM operations. For example, the test site was able to test a query for additional details after receiving broadcast Remote ID.</td>
<td></td>
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Source: OIG analysis

Following the completion of both phases of the UTM Pilot Program, FAA compiled the results into two reports, issuing the Phase 1 final report in May 2020 and the Phase 2 final report in July 2021. According to an FAA official, the Agency has no plans to complete more phases of the program. While FAA did not initiate a third phase of the pilot program, the Agency announced on February 11, 2022, that it is beginning a UTM Field Test in the spring of 2022 to continue improving standards, data-exchange methods, and cybersecurity capabilities.

FAA reported that the results of the pilot program will be used to inform near-term efforts including rulemaking, the UTM implementation plan, Concept of Operations Version 3.0, and the FAA BEYOND program. However, the Agency has yet to complete these efforts, and it is still too early to determine if and how the UTM pilot program results will be considered in FAA’s plans. According to

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21 On October 26, 2020, FAA established the BEYOND program as a follow-on to the Integrated Pilot Program to continue to address UAS integration challenges such as beyond visual line of sight operations and community engagement to address community concerns.
FAA, the Agency has not used the UTM Pilot Program results directly in the BEYOND program because the Agency issued the UTM Pilot Program Phase 2 report 9 months after it created the BEYOND program.

Test site representatives who participated told us they agreed that the goals and objectives of the UTM Pilot Program were successfully met. However, they mentioned that there was a lack of communication with regards to what the other test sites were doing in their testing and evaluation of UTM capabilities. In its *Standards for Internal Control in the Federal Government* (Internal Control Standards), the Government Accountability Office (GAO) relays that effective information and both internal and external communication are vital for an entity to achieve its objectives. However, one test site stated that it was not aware of work completed at the other test sites. In addition, although FAA stated that delivering implementation plans was not a role of the pilot program, test site and industry partners expressed concern that FAA has not communicated how the program’s results will be used given that the Agency completed the program in 2020. As a result, these representatives lacked clarity on the next steps regarding FAA’s plans for further UTM development and implementation.

### FAA Lacks Milestones for Implementing UTM and Has Not Yet Resolved Major Implementation Challenges

Despite FAA’s initial progress on developing a UTM framework and completing the UTM Pilot Program, much work remains before FAA will be able to implement UTM as envisioned. FAA has not yet finalized its implementation plan and will need to address industry concerns and priorities, determine how to allocate costs associated with deployment and use of UTM, and resolve a number of implementation challenges.

### FAA Has Not Yet Published Its Implementation Plan or Established a Long-Term Timeline

FAA has not determined a specific timeline for UTM to be operational and is still working on developing an implementation plan. As required by the 2018 Reauthorization Act, FAA has 1 year from the conclusion of the UTM Pilot Program to develop an implementation plan. FAA initially expected to issue its implementation plan in January 2022 but has subsequently delayed its issuance. According to FAA, this delay is because FAA plans to consider the implications of

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23 Includes costs to FAA, industry, or the public to enable UTM.
the recommendations from the beyond visual line of sight rulemaking committee on the implementation plan. In addition, the Agency stated that it needs industry to bring forth operational proposals to learn the direction industry is taking with UTM concepts. FAA stated that this information will drive the analyses necessary to implement policies and procedures that will enable UTM. According to FAA, the Agency plans to provide the implementation plan to the Advanced Aviation Advisory Committee in October 2022 (formerly known as the Drone Advisory Committee) for industry coordination. However, FAA does not have a current projected date for completing the effort.

According to the 2018 FAA Reauthorization Act, the implementation plan should include several items, such as an assessment of the manner in which FAA will provide oversight of UTM, and establish an application process for UTM providers. While FAA is addressing the congressional mandates in its implementation plan, areas may only be a discussion of a particular area and the work that remains to achieve it, rather than prescribing how it will work and milestones given all the steps, decisions, and regulations still to come. For example, FAA has yet to determine the manner in which it will provide UTM oversight, including which office will be responsible for overseeing UTM.

In addition, Congress directed FAA to determine, within 120 days of the 2018 Reauthorization Act and upon request of a UTM service provider, whether certain UTM services may operate in the NAS before completion of its plan for implementing UTM. As of February 2022—nearly 4 years later—FAA had not made these determinations. FAA noted that given the lack of a regulatory framework that would provide an opportunity for UTM service providers to make requests, FAA has been challenged in receiving requests. However, FAA is working on a concept for a near-term approval process for supplemental data service providers.24

Moreover, FAA does not plan to establish performance measures in its implementation plan. In January 2021, GAO recommended that FAA develop performance goals and measures for its UTM implementation plan.25 In its Internal Control Standards, GAO states that for qualitative objectives, management may need to design performance measures that indicate a level or degree of performance, such as milestones. In response to GAO’s recommendation, FAA stated that the Agency will not incorporate performance goals and measures because the implementation plan will focus on responding to the 2018 Reauthorization Act’s requirements. FAA will consider an alternative vehicle for the performance goals and metrics and initially stated it planned to

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24 Operators and service suppliers can access Supplemental Data Service Providers for essential or enhanced services, including terrain and obstacle data, specialized weather data, surveillance, and constraint information.

develop and publish the goals and measures by April 30, 2022. According to FAA, the Agency is now developing a revised target date to address the recommendation.

As a result of FAA’s delays in issuing the implementation plan, stakeholders have expressed concerns about overall UTM progress. According to an FAA official, issuing the implementation plan is critical to making progress with UTM and securing stakeholder buy-in. The implementation plan can serve as a communication vehicle to inform industry stakeholders regarding FAA’s next steps for UTM. Industry representatives stated that the lack of a plan has created uncertainty about UTM priorities and timeframes.

**Test Sites and Industry Stakeholders Acknowledged FAA Met Its UTM Pilot Program Goals but Cited Concerns With Overall Progress**

Although FAA is responsible for developing the UTM framework, including the rules and regulations necessary to ensure safety, UTM operations will largely be managed and run by private companies. As such, one of FAA’s challenges is partnering with industry to secure their continued investment and support.

While FAA met its goal of the UTM Pilot Program, industry also identified concerns with overall progress. In our interviews, industry partners, test sites, and an industry group noted several common concerns, including:

- **FAA’s progress has been slow.** According to industry representatives, the Agency’s progress concerning UTM development has been slow. For example, FAA and NASA have been working with industry on UTM since 2013, and the UTM Pilot Program was slow in getting started—the Secretary of Transportation did not announce the pilot program test sites until over 1.5 years after establishing the program. Industry representatives expressed concern that FAA’s progress in establishing UTM has been slower than they would like, especially since, in their view, the European regulatory framework for UTM is further along. For example, the Europeans have established a proposed regulation for a UTM framework, known as U-Space. The European Commission adopted the U-Space regulatory package in April 2021, and it will become applicable in January 2023. However, FAA stated that the European and U.S. airspaces are different, and it is difficult to compare them. FAA also stated they are aware of the European regulatory effort and attend related meetings. Five of 10 test site and industry representatives we interviewed stated that FAA needs to make UTM operational so operators can begin using the service. They also commented that FAA needs to follow through with actual implementation.
• **FAA’s Remote ID rule is limited.** Three of the 10 industry and test site representatives we spoke with expressed concern that FAA’s Remote ID rule did not go far enough to advance UTM. For example, the regulations for Remote ID are focused exclusively on using broadcast technologies rather than networked communications,26 which allow for more sophisticated communications among drone operators and UAS Service Suppliers. The final rule included only broadcast technologies due to concerns about privacy and the need for availability to all operators. However, industry partners we spoke with stated that they preferred network over broadcast because it allows for restricted access to data, thus providing for improved security. They were disappointed that the final rule did not also include network capability, which they viewed as a lack of support for advancing UTM. However, according to FAA, the omission of network technologies in the rule did not reflect that FAA was abandoning UTM, and the Agency remains committed to UTM deployment and to continuing to explore how network sharing can support safe integration.

• **Costs may outweigh benefits for UAS Service Suppliers.** Participating in UTM requires significant investments for companies to develop, implement, and operate UTM infrastructure. Five of the 10 industry and test site representatives we interviewed stated they are facing challenges in justifying these investments. For example, an industry partner we interviewed stated that they did not see a viable business case to continue as a UAS service supplier through LAANC unless they offer other UTM services. An FAA official commented that once the beyond visual line of sight rulemaking committee is complete, and policy and regulations are in place, then industry will be able to know which technologies and capabilities are worth their investment.

**FAA Has Not Yet Determined How Costs Will Be Allocated for the Deployment and Use of UTM**

In addition to uncertain timelines, FAA is also uncertain about the total costs for developing, implementing, operating, and maintaining UTM. Ultimately, the total cost for operating and maintaining UTM is unknown, but industry will likely bear most of the cost. FAA officials stated that it is too early to determine future costs of UTM considering the many unknowns regarding what services and capabilities will ultimately be implemented.

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26 Broadcast Remote ID is based on the transmission of radio signals directly from a UAS to receivers in the UAS’s vicinity. Network Remote ID is based on communication by means of the internet from a network Remote ID service provider that interfaces directly or indirectly with the UAS, or with other sources in the case of non-equipped network participants.
At the request of Congress, GAO performed a review of UAS costs, including determining the total annual UAS costs and the appropriate fee mechanisms to recover these costs, such as use of a UTM system. In December 2019, GAO recommended that FAA ensure it has complete and reliable information on UAS-related costs and include steps in its planning efforts to consider potential future user fee designs. In response, FAA stated that it is developing a survey for UAS owners that will provide data on overall UAS usage and usage patterns. FAA stated that it expects to complete the first full survey in fall 2022, with data published in the Aerospace Forecast in 2023. According to FAA, the results from this survey will help determine the UAS activities that will drive FAA cost.

In addition, FAA completed a cost allocation study for the Air Traffic Organization, which is currently being reviewed and validated by our office, as required by Congress. However, according to FAA, this study is based on 2018 data and will not include UAS costs from across all FAA organizations involved in supporting UAS activities. In addition, FAA has not made any determinations regarding recommendations from the advisory committee on drones related to funding mechanisms to support UAS activities. FAA is required to update the cost allocation study every 2 years for a period of 8 years, using a validated model to determine costs and revenues for each segment of air traffic service users. According to FAA, future cost allocation updates could include UAS costs as the industry evolves and significant costs to air traffic emerge for this airspace user.

**Other Regulatory, Safety, and Technical Challenges Will Affect Implementation**

A number of other technical and regulatory challenges remain before FAA can further advance UTM implementation. According to FAA’s draft implementation plan, these include:

- **Developing technology standards.** There are a number of technological challenges to integrating UAS within the NAS that must be resolved to implement UTM. To address some of these challenges, numerous standards are underway in various industry organizations, including ASTM

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28 Congress requested that we determine the status of FAA’s efforts to collect UAS-related cost data (as recommended by GAO in December 2019) and develop a method by which UAS operators will contribute to the operation and maintenance of a UTM system.

Below are examples of some of the standards that are currently being developed for UTM-related services.

- **Detect and Avoid.** Technology that enables UAS to automatically detect other aircraft operating in nearby airspace and successfully maneuver to avoid them is essential to ensure UAS remain well clear of all hazards, including traditional aircraft and other UAS. This technology is needed to enable routine UAS flights operating beyond visual line of sight without the aid of visual observers, especially for long-range flights. There are three standards related to this technology in various phases of development that are intended to streamline its use for small UAS. These standards are limited to low- and medium-risk airspace.

- **UTM/USS Interoperability.** The primary emphasis of the first version of this standard is to define a service that strategically recognizes conflicts between UAS operations, so that operators can change their operational intent.

- **Weather.** An ASTM workgroup is focused on addressing present-day gaps in weather data and suitability for UAS operations. Such UTM services would aid operators by providing forecast and present weather conditions, helping operators ensure that they can avoid weather risks and account for changing wind conditions in their flight profiles.

- **Remote ID and Tracking.** This specification will define message formats, transmission methods, and minimum performance standards for two forms of Remote ID: broadcast and network.

- **Overseeing safety.** FAA must ensure the safety of UTM operations, particularly for operations near traditional aircraft. According to FAA, all UTM participants must build their own internal Safety Management System processes that are proportional to the level of risk of their operations or the operations that their services enable.

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30 ASTM International, founded as the American Society for Testing and Materials, is a nonprofit organization that develops and publishes approximately 12,000 technical standards, covering the procedures for testing and classification of materials of every sort. ASTM standards are used worldwide, with its membership consisting of over 30,000 members representing 140 countries.

31 RTCA, Inc. (formerly known as Radio Technical Commission for Aeronautics) is a United States non-profit organization that develops technical guidance for use by government regulatory authorities and by industry. It was founded in 1935 and was re-incorporated in 1991 as a private not-for-profit corporation.

32 Referred to as Detect and Avoid.
• **Creating additional regulations.** There are a number of challenges to implementing UTM from a regulatory standpoint. Congressional language requires the Agency to develop a plan that includes safety standards to permit, authorize, or allow the use of UTM services, even before specific rulemaking is complete. Foundational to UTM is the concept of interoperability, the ability for many services to exchange information and make decisions in safe and consistent ways. Most notably, the current regulatory construct does not provide for an approval or certification basis for UTM services, nor does it enable proper oversight of such services—including determining whether they are sufficiently interoperable with each other to support safe operations.

• **Protecting cybersecurity.** There are significant cybersecurity risks and vulnerabilities that must be taken into consideration. A robust security framework must be established to address potentially malicious attacks to communications systems, including communication link disruptions, Global Navigation Satellite System jamming or spoofing attacks, and the manipulation of information exchanged between UAS and between UAS and UTM systems, which may result in erroneous advisories, unwanted changes in flight paths, and increased risk of collision.

As a result of these and other complex challenges, it will likely be many years until robust traffic management is in place for low-altitude UAS air operations. Moreover, as operations increase, FAA will be challenged to fully mitigate risks of accidents and incidents between UAS and other aircraft operating in the same airspace.

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**FAA Has Coordinated With NASA To Advance UTM, but Collaboration With Other Federal Agencies Remains in the Early Stages**

While FAA collaborated with NASA regarding UTM development, the Agency has also identified a need for other Federal agencies to play a role in the process as well to protect national security interests. However, FAA has not yet completed coordination with additional agencies.

**FAA Has Collaborated With NASA on UTM but Has Not Finalized a Joint Plan for Future Collaboration**

FAA’s collaboration with NASA began in 2015, when NASA led UTM’s research, development, and testing in collaboration with FAA and over 100 industry, academia, and public agency partners. FAA helped NASA coordinate a series of
four research and testing events called UTM Technical Capability Levels (TCLs), each increasing in complexity.

In 2015, FAA and NASA formed a UTM Research Transition Team to further advance UTM. The research team’s goal was to jointly identify, quantify, conduct, and effectively transfer UTM capabilities and technologies to FAA and to provide guidance and information to UTM stakeholders to facilitate an efficient implementation of UTM operations.

Results of NASA’s research have been incrementally transferred to FAA. In August 2019, NASA concluded UTM TCL 4. After completing TCL 4, NASA also transferred FIMS, a key UAS data exchange platform, to FAA for further development and deployment. In 2020, NASA completed all tasks and milestones for its UTM project, which resulted in a final technology transfer to FAA.

Specific examples of FAA’s coordination with NASA include:

- **Expanding the UTM Concept of Operations.** To discuss the development of FAA’s third UTM concept of operations document, FAA planned to conduct three interactive discussions with NASA and industry starting at the end of 2020. The goal was to address feedback from the Federal advisory committee on drones about the second concept of operations document. Topics of discussion included UAS and traditional aircraft operators’ participation in UTM, data protection, and Remote ID. However, FAA halted these discussions after the second meeting in February 2021 due to the establishment of the rulemaking committee on beyond visual line of sight operations in June 2021.

- **Conducting the UTM Pilot Program.** FAA, in collaboration with NASA, established the UTM Pilot Program in response to the 2016 FAA Extension, Safety, and Security Act of 2016. FAA collaborated with NASA for both Phase 1 and Phase 2 of the programs. According to NASA, while the Agency made great progress by defining and collaboratively testing a completely new approach to manage small UAS traffic, there is still significant work to be done to make UTM operational.

While NASA has shifted its focus from UTM to other transportation markets, such as advanced air mobility, FAA’s goal is to continue communicating with NASA in a formal manner about UTM. According to an FAA official, the Agency will be looking for opportunities to leverage NASA’s current work back into UTM. This official also stated that if there are any new UTM-related actions for FAA and NASA to accomplish jointly, then FAA will capture them in an updated Joint Management Plan.
FAA Has Not Yet Completed Its Coordination With Other Federal Agencies

FAA has also identified a need to collaborate with other Federal agencies to establish UTM. Multiple Federal agencies have a stake in helping FAA develop the UTM framework because they operate UAS for their missions, such as law enforcement, search and rescue, and fighting wildfires (e.g., DHS, Department of Justice [DOJ], and Department of the Interior [DOI]). Law enforcement agencies will also need to access UTM operations data as a means to ensure public safety and security (e.g., DHS and DOJ). These public safety agencies also provide input on developing key UTM capabilities, such as Remote ID. Other agencies, such as the FCC, will enable UTM capabilities by helping to provide dedicated communication channels for UAS.

In particular, DoD is involved with broad UAS integration issues as part of the UAS Executive Committee, which is a high-level UAS policy decision-making group. According to FAA, the Agency also held discussions with DoD during its joint NASA engagement activities. However, FAA stated that DoD did not play an active role in FAA’s UTM Pilot Program testing. FAA stated that while multiple agencies operate drones, it was challenging engaging with them as operators during the pilot program tests.

In its draft UTM implementation plan, the Agency recognizes that it must also consider other Federal stakeholders who will drive UTM expansion, such as DHS, DOJ, and DOI. FAA stated these Agencies will provide input to support fundamental requirements for services deployed for national security interests. While FAA has begun to collaborate with other Federal agencies on security-related data sharing, Agency officials agreed that continued collaboration is needed as UTM evolves.

FAA also recognizes that FCC is a critical Agency for managing the availability of radio frequency spectrum—dedicated communication channels between an unmanned aircraft and its control station or operator. As UAS operations increase, inadequate frequency, spectrum, and bandwidth availability will challenge traffic management. Coordinating with FCC on spectrum usage will be another area for FAA’s focus as UTM expands.

However, FAA’s coordination with these other agencies remains in the early stages, and it is not yet clear when these partnerships and processes will be established or completed. Incomplete coordination will hinder the Agency’s ability to develop comprehensive traffic management for UAS that fully addresses the research, safety, and security interests of multiple Federal agencies.
Conclusion

The safe integration of small UAS into the NAS is a multifaceted endeavor, requiring coordinated efforts within FAA, across multiple agencies, and with industry. To reach the end-state of UTM implementation, FAA faces challenges in ensuring that the systems, infrastructure, policies, rulemaking, regulations, and other requirements are all in place. While FAA successfully completed its UTM Pilot Program and is developing a plan for implementing UTM, the lack of a timeline for UTM implementation has resulted in uncertainty for industry stakeholders because they need to plan and align their efforts with FAA’s rollout of UTM capabilities. Key steps to make further progress and maintain industry support will be establishing processes to communicate and incorporate UTM testing results into follow-on efforts, as well as setting clear milestones for the next steps in UTM development and implementation.

Recommendations

To improve FAA’s use of UTM Pilot Program results, communication with industry stakeholders, and development of its implementation plan, as well as for continued external collaboration, we recommend that the Federal Aviation Administrator:

1. Establish a process that requires FAA to review the UTM Pilot Program and Field Test results and determine whether the results can inform rulemaking, the final implementation plan, concept of operations documents, and the FAA BEYOND program.

2. Implement enhanced processes for communicating UTM information to update industry stakeholders on FAA’s plans for UTM implementation as well as ongoing efforts.

3. Develop milestones for near-term UTM efforts and broader timelines for when FAA expects to implement policies and processes for reviewing and approving UTM technologies and capabilities, and establish a process for measuring and updating progress with achieving the milestones.

4. Document FAA’s plan for continued collaboration with NASA and other Federal agencies regarding ongoing and future UTM activities.
Agency Comments and OIG Response

We provided FAA with our draft report on August 4, 2022, and received its formal response on September 2, 2022. FAA’s response is included in its entirety as an appendix to this report.

FAA concurred with recommendations 3 and 4 and provided appropriate planned actions and completion dates. FAA partially concurred with recommendations 1 and 2 and provided proposed alternative actions and completion dates. The Agency’s proposed alternative actions meet the intent of recommendations 1 and 2. Accordingly, we consider all recommendations as resolved but open pending completion of the planned actions.

Actions Required

We consider recommendations 1 through 4 resolved but open pending completion of planned actions.
Exhibit A. Scope and Methodology

This performance audit was conducted between April 2021 and August 2022. We conducted this audit 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. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

To assess FAA’s progress with developing and deploying UTM capabilities from 2015 to present, including the results of its UTM Pilot Program, we met with representatives in FAA Headquarters offices who are involved in the development and implementation of UTM and its pilot program. For example, we interviewed key FAA officials from the Flight Standards Service, Office of Next Generation Air Transportation System, Air Traffic Organization, and other FAA offices that have oversight and responsibility of FAA’s UTM efforts. Additionally, we reviewed and analyzed Federal laws and regulations pertaining to small UAS and UTM as well as pilot program documents, including test site agreements, test site reports, and FAA reports. We also reviewed FAA UTM planning and strategic documents, such as the concept of operations and draft implementation plan. To determine if FAA met the intent of the congressional mandates related to UTM, we reviewed pilot program results and interviewed key FAA officials. We also reviewed past OIG reports and meeting minutes from FAA’s Advanced Aviation Advisory Committee (formerly known as the Drone Advisory Committee) and the Beyond Visual Line of Sight rulemaking committee final report that provides recommendations to FAA on key UTM integration issues.

In addition, to gain insight into industry stakeholders’ involvement with the UTM Pilot Program, we interviewed personnel at two of the four UTM pilot program test sites and eight randomly sampled industry partners that participated in the pilot program. Further, we interviewed personnel from NASA and the Small UAV Coalition to ascertain their contributions to and perspectives on the UTM system and pilot program. To determine which test sites to select, we obtained a list from the UTM Pilot Program Phase 1 and the Phase 2 reports as well as reviewed FAA’s website for UAS test site information. We reviewed the Virginia Tech Mid-Atlantic Partnership (VT-MAAP) Test Site because representatives we interviewed from the Small UAV Coalition had participated in the VT-MAAP Test Site and this test site was represented in both pilot program phases. We reviewed the New York UAS Test Site based on our random sample of industry partners that had participated at this test site.

We conducted interviews with 8 out of 39 industry partners, consisting of 4 service suppliers and 4 operators/technology providers that participated in the
UTM pilot program. From a stratified random sample, we identified the first eight industry partners. However, we had to substitute four of them because we were unable to establish communication with one partner and learned that the remaining three did not ultimately participate in the New York UAS test site due to COVID-19 pandemic travel restrictions. We conducted these interviews to learn about their experiences in the UTM Pilot Program, their interactions with FAA, and lessons learned. Our results from these interviews are not generalizable.

Furthermore, we followed up on GAO's January 2021 recommendations for FAA to develop performance goals and measures for its implementation plan and provide industry stakeholders with additional information regarding the Agency's future plans for UTM testing and implementation efforts. Additionally, Congress requested that we determine the status of FAA's efforts to collect UAS-related cost data (as recommended by GAO in December 2019) and develop a method by which UAS operators will contribute to the operation and maintenance of a UTM system. We met with the appropriate FAA offices to follow up on the Agency's efforts to address GAO's recommendations.

To assess FAA's level of collaboration with NASA regarding the development and integration of UTM, we interviewed a representative from NASA to obtain information on its involvement and collaboration with FAA in the planning, development, and testing of UTM operational scenarios and technologies. We also interviewed this NASA representative about any plans for future collaborations beyond the UTM Pilot Program. Additionally, we obtained and analyzed various planning documents between FAA and NASA, such as the research transition team plan and meeting minutes, NASA's UTM Pilot Program Close Out Report, and other pertinent documentation. To ascertain FAA's collaboration with other Federal agencies, we reviewed FAA's draft implementation plan and interviewed an FAA official to obtain a status update.
Exhibit B. Organizations Visited or Contacted

Federal Aviation Administration

FAA Headquarters, Washington, DC

Air Traffic Organization

Office of Next Generation Air Transportation System

Office of Safety Standards, Flight Standards Service

UAS Integration Office, Safety and Integration Division

Other Department

The National Aeronautics and Space Administration

Other Organizations

New York Unmanned Aircraft Systems Test Site

Virginia Tech, Mid-Atlantic Aviation Partnership

Small Unmanned Aerial Vehicle Coalition Group

Test Site Partner – ResilienX

Test Site Partner – L3 Harris Technologies

Test Site Partner – Echodyne Corp.

Test Site Partner – ANRA Technologies

Test Site Partner – Avision

Test Site Partner – WING

Test Site Partner – AviSight

Test Site Partner – AirMap, Inc.
### Exhibit C. List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AAAC</td>
<td>Advanced Aviation Advisory Committee</td>
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<tr>
<td>AAM</td>
<td>Advanced Air Mobility</td>
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<tr>
<td>API</td>
<td>Application Programming Interface</td>
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<tr>
<td>ARC</td>
<td>Aviation Rulemaking Committee</td>
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<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
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<tr>
<td>ATO</td>
<td>Air Traffic Organization</td>
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<tr>
<td>BVLOS</td>
<td>Beyond Visual Line of Sight</td>
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<tr>
<td>DAC</td>
<td>Drone Advisory Committee</td>
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<tr>
<td>DHS</td>
<td>Department of Homeland Security</td>
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<tr>
<td>DoD</td>
<td>Department of Defense</td>
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<tr>
<td>DOI</td>
<td>Department of Interior</td>
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<td>DOJ</td>
<td>Department of Justice</td>
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<tr>
<td>DOT</td>
<td>Department of Transportation</td>
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<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
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<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
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<tr>
<td>FIMS</td>
<td>Flight Information Management System</td>
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<tr>
<td>GAO</td>
<td>Government Accountability Office</td>
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<tr>
<td>JMP</td>
<td>Joint Management Plan</td>
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<tr>
<td>LAANC</td>
<td>Low Altitude Authorization and Notification Capability</td>
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<tr>
<td>MAAP</td>
<td>Mid Atlantic Avionic Partnership</td>
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<tr>
<td>NAS</td>
<td>National Airspace System</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<tr>
<td>OIG</td>
<td>Office of Inspector General</td>
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<tr>
<td>RID</td>
<td>Remote Identification</td>
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<tr>
<td>RTCA</td>
<td>Radio Technical Commission for Aeronautics</td>
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<td>RTT</td>
<td>Research Transition Team</td>
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<tr>
<td>SDSP</td>
<td>Supplemental Data Service Providers</td>
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<tr>
<td>TCL</td>
<td>Technical Capability Level</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>UAS</td>
<td>Unmanned Aircraft Systems</td>
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<tr>
<td>UAV</td>
<td>Unmanned Aerial Vehicle</td>
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<td>UPP</td>
<td>UAS Traffic Management Pilot Program</td>
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<tr>
<td>USS</td>
<td>UAS Traffic Management Service Suppliers</td>
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<td>UTM</td>
<td>Unmanned Aircraft Systems Traffic Management</td>
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<tr>
<td>UVR</td>
<td>Unmanned Aircraft Systems Volume Reservation</td>
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</tbody>
</table>
## Exhibit D. Major Contributors to This Report

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROBIN KOCH</td>
<td>PROGRAM DIRECTOR</td>
</tr>
<tr>
<td>COLETTA TREAKLE</td>
<td>PROJECT MANAGER</td>
</tr>
<tr>
<td>GALEN STEELE</td>
<td>SENIOR AUDITOR</td>
</tr>
<tr>
<td>MY PHUONG LE</td>
<td>SENIOR ANALYST</td>
</tr>
<tr>
<td>GRACE ITA-CICCELLI</td>
<td>ANALYST</td>
</tr>
<tr>
<td>AUDRE AZUOLAS</td>
<td>SENIOR WRITER-EDITOR</td>
</tr>
<tr>
<td>ALLISON DUKAVAS</td>
<td>WRITER-EDITOR</td>
</tr>
<tr>
<td>CELESTE VERCHOTA</td>
<td>ATTORNEY ADVISOR</td>
</tr>
<tr>
<td>MAKESI ORMOND</td>
<td>STATISTICIAN</td>
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</table>
### Exhibit E. Requirements for the UTM Pilot Program—Section 376 of the FAA Reauthorization Act of 2018

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Legislative Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>In coordination with the National Aeronautics and Space Administration (NASA) and in consultation with UAS industry stakeholders, FAA shall develop a plan to allow for the implementation of UTM services that expand operations beyond visual line of sight, have full operational capability, and ensure the safety and security of all aircraft.</td>
</tr>
<tr>
<td>(b)</td>
<td>Completion of UTM System—FAA shall ensure that the UTM system pilot program, as established in section 2208 of the FAA Extension, Safety, and Security Act of 2016, is conducted to meet the following objectives:</td>
</tr>
<tr>
<td>(b)(1)</td>
<td>Allow testing of unmanned aircraft operations, of increasing volumes and density.</td>
</tr>
<tr>
<td>(b)(2)</td>
<td>Permit the testing of various remote identification and tracking technologies evaluated by the Unmanned Aircraft Systems Identification and Tracking Aviation Rulemaking Committee.</td>
</tr>
<tr>
<td>(b)(3)</td>
<td>Where the particular operational environment permits, permit blanket waiver authority to allow any unmanned aircraft approved by a UTM system pilot program selectee to be operated under conditions currently requiring a case-by-case waiver under part 107, title 14, Code of Federal Regulations, provided that any blanket waiver addresses risks to airborne objects as well as persons and property on the ground.</td>
</tr>
</tbody>
</table>
### Exhibit F. Requirements for the UTM Implementation Plan—Section 376 of the FAA Reauthorization Act of 2018

<table>
<thead>
<tr>
<th>Requirement No.</th>
<th>Legislative Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>(c) (1)</td>
<td>...include the development of safety standards to permit, authorize, or allow the use of UTM services</td>
</tr>
<tr>
<td>(c) (2)</td>
<td>...outline the roles and responsibilities of industry and government in establishing UTM services that allow applicants to conduct commercial and noncommercial operations</td>
</tr>
<tr>
<td>(c) (3)</td>
<td>...include an assessment of various components required for necessary risk reduction and mitigation including... Remote identification of both cooperative and noncooperative UAS...</td>
</tr>
<tr>
<td>(c) (3) (A)</td>
<td>Remote identification of both cooperative and non-cooperative unmanned aircraft systems in the national airspace system.</td>
</tr>
<tr>
<td>(c) (3) (B)</td>
<td>...deconfliction of cooperative unmanned aircraft systems</td>
</tr>
<tr>
<td>(c) (3) (C)</td>
<td>...the manner in which the FAA will conduct oversight of UTM systems, including interfaces between UTM service providers and air traffic control</td>
</tr>
<tr>
<td>(c) (3) (D)</td>
<td>...the need for additional technologies to detect cooperative and non-cooperative aircraft</td>
</tr>
<tr>
<td>(c) (3) (E)</td>
<td>...management services and technologies to ensure the safety oversight of manned and unmanned aircraft</td>
</tr>
<tr>
<td>(c) (3) (E) (i)</td>
<td>[FAA] responsibilities to collect and disseminate relevant data to UTM service providers</td>
</tr>
<tr>
<td>(c) (3) (E) (ii)</td>
<td>data exchange protocols to share UAS operator intent, operational approvals, operational restraints, and other data necessary to ensure safety or security of the National Airspace System.</td>
</tr>
<tr>
<td>(c) (3) (F)</td>
<td>the potential for UTM services to manage [UAS] carrying either cargo, payload, or passengers, weighing more than 55 pounds, and operating at altitudes higher than 400 feet AGL</td>
</tr>
<tr>
<td>Requirement No.</td>
<td>Legislative Language</td>
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<td>----------------</td>
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</tr>
<tr>
<td>(c) (3) (G)</td>
<td>cybersecurity protections, data integrity, and national and homeland security benefits</td>
</tr>
<tr>
<td>(4) (A)</td>
<td>establish a process for accepting applications for operation of UTM services in the National Airspace System;</td>
</tr>
<tr>
<td>(4) (B)</td>
<td>... setting the standards for independent private sector validation and verification that the standards for UTM services... have been met by applicants</td>
</tr>
<tr>
<td>(4) (C)</td>
<td>...notifying the applicant, not later than 120 days after the Administrator receives a complete application, with a written approval, disapproval, or request to modify the application.</td>
</tr>
</tbody>
</table>
Memorandum

Date: September 2, 2022
To: Nelda Z. Smith, Acting Assistant Inspector General for Aviation Audits
From: Erika Vincent, Acting Director, Office of Audit and Evaluation, AAE-1

The integration of Unmanned Aircraft Systems (UAS) into the National Airspace System (NAS) is a high priority for the Federal Aviation Administration (FAA). The FAA is working closely with industry, relevant government agencies, and other stakeholders to identify, develop, and implement various Unmanned Aircraft System Traffic Management (UTM) capabilities. The FAA continues to refine concepts, architecture, and implementation strategies to safely integrate large-scale UAS operations into the NAS.

The FAA is analyzing the lessons learned from the UTM Pilot Program to develop the components of the UTM Field Test and the UTM Implementation Plan. The FAA plans to share information more formally at the UAS Symposium, Advanced Aviation Advisory Committee, and standards organizations (e.g., American Society for Testing and Materials International).

Upon review of the draft report, the FAA partially concurs with recommendations 1 and 2, as they are already components of current program plans. We fully concur with recommendations 3 and 4.

For recommendations 1 and 2, the FAA understands and agrees with the importance of ensuring that research is utilized to inform decision-making and planning. Additionally, the FAA understands and agrees with the importance of communicating UTM information to industry stakeholders. However, we do not believe that the establishment of new processes is necessary. The execution of information sharing for recommendations 1 and 2 is tied to existing organizational functions.

For recommendation 3, the FAA will provide milestones for near-term UTM efforts and a broader timeline for when FAA expects to implement policy and process for reviewing and approving...
UTM technologies and capabilities by December 31, 2022. The agency will determine the best means (e.g. collaborative digital tools) to transparently track and update progress against milestones, improving visibility across affected lines of business and staff offices.

For recommendation 4, the FAA continues to pursue ways to collaborate with other Federal agencies. Based on available resources across the government, those agencies may not be limited to NASA, to which FAA has had a variety of ties, but also the Federal Communications Commission (FCC), the National Telecommunications and Information Administration (NTIA), the Department of Homeland Security (DHS) and multiple branches of the Department of Defense (DoD). FAA plans to update its activities with other Federal agencies by June 30, 2023.

We appreciate this opportunity to offer additional perspective on the OIG draft report. Please contact Pierre McLeod, FAA Audit Liaison, at Pierre.McLeod@faa.gov if you have any questions or require additional information about these comments.
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