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United States Government Accountability Office
Washington, DC 20548

March 19, 2013

The Honorable Paul Broun, M.D.
Chairman
Subcommittee on Oversight
Committee on Science, Space, and Technology
House of Representatives

Subject: *“Operating Unmanned Aircraft Systems in the National Airspace System: Assessing Research and Development Efforts to Ensure Safety”–Response to Questions for the Record*

Dear Mr. Chairman:

We appreciated the opportunity to testify before the Subcommittee on February 15, 2013, about efforts that are under way to allow unmanned aircraft systems (UAS) to safely and routinely fly in the national airspace system. On March 5, 2013, we received the Subcommittee’s questions for the record. The enclosure provides our response to the Subcommittee’s questions. If you or members of your staff have any questions about our response, please contact me at (202) 512-2834 or dillinghamg@gao.gov.

Sincerely yours,

Gerald L. Dillingham, Ph.D.
Director, Physical Infrastructure Issues

Enclosure

cc: The Honorable Dan Maffei, Ranking Member, Subcommittee on Oversight,
Committee on Science, Space, and Technology

Enclosure

Subcommittee on Oversight

Committee on Science, Space, and Technology

“Operating Unmanned Aircraft Systems in the National Airspace System: Assessing Research and Development Efforts to Ensure Safety”

February 15, 2013

Additional Questions for the Record

The Honorable Dr. Paul Broun

1. Please explain how agencies such as the Federal Aviation Administration (FAA), Department of Homeland Security (DHS), National Aeronautics and Space Administration (NASA), and the Department of Defense (DOD) coordinate to identify research and development gaps?

- **How do agencies decide who will fund projects to address these gaps?**

UAS stakeholders—including FAA, DHS, and DOD—coordinate research and development (R&D) efforts through FAA’s Joint Planning and Development Office (JPDO).¹ The JPDO provides the primary framework for coordination of UAS integration efforts and works to identify gaps in R&D. In 2012, JPDO published the *NextGen UAS Research and Development Roadmap*—a blueprint that identified stakeholders’ roles and responsibilities for R&D efforts related to UAS integration and addressed challenges that must be addressed to permit routine UAS operations in a NextGen environment.

While each agency has different missions and provides its own funding for UAS-related projects, JPDO helps to leverage R&D to avoid duplicative efforts. Furthermore, our previous work has shown that agencies benefit from having one organization coordinate multi-agency efforts.²

2. How often does the UAS Executive Committee meet to coordinate efforts?

- **How many times has it met in the last year?**

The UAS Executive Committee (Committee) meets quarterly. However, in 2012, the Committee was able to hold only three formal meetings due to scheduling conflicts, according to FAA officials. Those meetings were held on January 19, May 8, and August 28. In addition to the formal meetings, the Committee members also held several informal teleconferences to discuss UAS issues.

¹JPDO was created to plan for and coordinate a transition to the Next Generation Air Transportation System (NextGen)—a new satellite-based air traffic management system that will replace the current radar-based system. Given its unique role in managing partnerships among federal agencies for NextGen, the Office of Management and Budget tasked JPDO to coordinate UAS efforts.

²GAO, *Managing for Results: Key Considerations for Implementing Interagency Collaborative Mechanisms*, GAO-12-1022 (Washington, D.C.: September 27, 2012).

3. Are there any federal agencies or organizations that are not satisfactorily fulfilling their role in addressing UAS safety concerns?

All agencies that are involved with safely integrating UAS into the national airspace system are satisfactorily participating and fulfilling their role in addressing UAS safety concerns, according to JPDO officials; however, as I noted in my statement, coordination could be improved.³ Tasked by the Congress, FAA is the lead agency for UAS integration and its main responsibility in this area is for the safe integration of UAS.⁴ As a result, coordinating with stakeholders to ensure safety has always been a top priority for the agency. With that said, challenges have arisen. For example, FAA officials told us that while all agencies meet their participating requirements, FAA has received conflicting input and reconciling various viewpoints can be difficult.

4. Are there any organizations or agencies that should be involved that currently are not?

At this point, all agencies and organizations that should be involved in the safe integration of UAS into the national air space are participating. However, as I said in my written statement, collaboration among agencies could be improved. For example, FAA's focus has been on safety, since that is its primary mission. Thus, other agencies could take the lead to coordinate on other issues, such as privacy, for instance. FAA officials have suggested that DHS or DOJ might be better positioned to address UAS privacy issues because privacy concerns generally stem from the operational uses of UAS for surveillance and law enforcement purposes.⁵

5. Please explain the relationship between the FAA and DHS as it pertains to safety and security.

- **Understanding that you cannot speak for DHS, what is your understanding of what DHS is doing in this regard?**
- **What is the FAA responsible for? What is the DHS responsible for? How does this differ? How are decisions like this made?**
- **How involved has the Transportation Security Administration (TSA) been in the process?**

As I noted in my written statement, FAA is responsible for the safety aspects and DHS is generally responsible for the security aspects of integrating UAS into the national airspace. To accomplish its' responsibilities, DHS's efforts—through TSA—include identifying and mitigating the security risks, threats, and vulnerabilities

³See GAO, *Unmanned Aircraft Systems: Continued Coordination, Operational Data, and Performance Standards Needed to Guide Research and Development*, GAO-13-346T (Washington, D.C.: February 15, 2013).

⁴See, e.g., section 332 of the FAA Modernization and Reform Act of 2012, Pub. L. 112-95, 126 Stat. 11.

⁵GAO, *Unmanned Aircraft Systems: Measuring Progress and Addressing Potential Privacy Concerns Would Facilitate Integration into the National Airspace System*, GAO-12-981 (Washington, D.C.: September 14, 2012).

related to non-military UAS. TSA has been performing work related to UAS security since 2004. GAO has previously recommended that TSA examine the security implications of future, non-military UAS operations in the national airspace system and take any actions deemed appropriate.^{6,7}

Security remains a significant issue that could be exacerbated with an increase in the number of UAS. TSA's practices might be sufficient in the current UAS environment of limited operations taking place under closely controlled conditions, but these controlled conditions will evolve as FAA and others continue to work toward allowing routine UAS operations in the national airspace system.

6. RTCA's Special Committee 203 has been working on Minimum Aviation System Performance Standards (MASPS) and Minimum Operational Performance Standards (MOPS) for unmanned aircraft. How critical are these processes in advising us what research and development work is needed?

- **When are these standards likely to be finalized?**

The development of standards, such as MASPS and MOPS, is a critical step in supporting R&D efforts to safely integrate UAS into the national airspace system, but it remains unclear when the standards will be finalized. Setting standards, identifying certification criteria and procedures for sense and avoid systems, as well as protocols to be used for the certification of command, control, and communication systems will guide R&D efforts and identify and measure progress toward goals. It is unclear when standards will be finalized because of the complexities of the issues to be addressed and because the lack of operational and safety data have hindered the standards development process.

7. Many who follow this issue argue that a "one-size-fits-all" approach to regulation will not be effective given the wide range of systems.

- **What is your recommendation for categorizing the systems? By size (i.e. weight)? Payload? Capabilities? Mission? Complexity?**
- **How does this impact R&D investments? Do you see a greater need for R&D on smaller or larger systems?**
- **What is your understanding of the status of a final rule regarding the certification and operation of small (i.e., ultralight, low-speed, short-life) UAS?**
- **What sort of training or certification will be required of civilian UAS operators?**
 - **Would certification be universal or system-specific?**
 - **What training opportunities currently exist for want-to-be civilian UAS operators?**

⁶While TSA agreed that security of UAS is important, the agency believes that existing procedures are sufficient and does not intend to implement GAO's recommendation.

⁷GAO, *Unmanned Aircraft Systems: Federal Actions Needed to Ensure Safety and Expand Their Potential Uses within the National Airspace System*, GAO-08-511 (Washington, D.C.: May 15, 2008).

- **Will proof of training be required to purchase a UAS? Would there be penalties (e.g. fines, revocation of license) for operating a UAS without proper credentials?**
- **Will current air traffic controllers require any new or supplemental training to familiarize themselves with UAS operations?**

For our reporting purposes, GAO has used two broad categories of “small” and “large” to categorize UAS. A “small” UAS is less than 55 pounds; a “large” UAS is 55 pounds or more.⁸ It will be up to FAA and other agencies, such as DHS, to determine how to categorize UAS for various regulatory and operational purposes. Alternatively we also heard from a NASA official that NASA’s UAS Integration in the National Airspace System (NAS) Project is currently evaluating UAS categorization by size, payload, capabilities, mission, and complexity in coordination with FAA and expect to release a report in fiscal year 2016.

Investment in R&D and the identification of any R&D gaps is necessary to support the safe and routine integration of UAS into the national airspace regardless of size or categorization. For example, according to a NASA official, NASA does not see differences in the sense-and-avoid R&D needs between small or large UAS.

FAA has efforts under way supporting a rulemaking for the operation of small UAS, but it is unlikely that FAA will meet the August 2014 deadline for the final rule on small UAS required by the FAA Modernization and Reform Act of 2012. The agency’s rulemaking efforts date back more than 5 years, when it established the small UAS Aviation Rulemaking Committee in 2008. FAA officials told us in January 2013 that FAA is still internally reviewing and finalizing the language of its draft Notice of Proposed Rulemaking (NPRM) for the regulation of small UAS.⁹ FAA has not determined when it might issue the NPRM.

The training and certification requirements of civilian UAS operators have not yet been fully determined, though, according to FAA officials, training is required to operate a UAS in the NAS and penalties exist for operations without proper certification. FAA is in the process of formalizing aircrew certification and medical requirements, which could mirror requirements for operators of manned aircraft, as appropriate. For small UAS operators, FAA’s rulemaking will likely establish what, if any, certification standards are needed for UAS operators.

Regarding air traffic controller training, FAA officials told us that as with all new technologies (e.g. NextGen systems) the Air Traffic workforce will require updated training on system capabilities, new procedures or work processes, as well as new standards or performance characteristics as they relate to UAS operations.

⁸UAS are typically described in terms of weight, endurance, purpose of use, and altitude of operation. We have distinguished between small and large UAS because a number of rules and requirements apply specifically to aircraft that weigh less than 55 pounds.

⁹An NPRM, which is published in the *Federal Register* allows interested persons an opportunity to comment on the rulemaking process by providing written data, views, or arguments and gives the public an opportunity to provide information to agencies on the potential effects of a rule or to suggest alternatives for agencies to consider.

8. Dr. Dillingham, you testified that “ensuring uninterrupted command and control for both small and large UAS remains a key obstacle for safe and routine integration into the national airspace.” Your testimony also states that “UAS currently use unprotected radio spectrum and, like any other wireless technology, remain vulnerable to unintentional or intentional interference. This remains a key security and safety vulnerability...”

- **Who is responsible for ensuring that command and control and navigational links are secure, reliable, and robust”?**

FAA is responsible for ensuring that both command and control and navigational links are safe for UAS use. To accomplish this, FAA is working with RTCA SC 203 to develop MASPS and MOPS in the areas of operational and navigational performance; command and control communications; and sense and avoid capabilities.

9. There are a lot of misconceptions and associated fears with regard to UAS. What can be done to change that?

Mitigating misconceptions and fears associated with UAS will require public education and outreach. A main concern for the public regarding UAS is the privacy issue. Specifically, we have previously reported that concerns—by members of Congress, a civil liberties organization, and others—include the potential for increased amounts of government surveillance using technologies placed on UAS as well as the collection and use of such data.¹⁰ While JPDO and FAA haven’t done work in these areas, the Association for Unmanned Vehicle Systems International (AUVSI) and local UAS users, such as local law enforcement agencies, have started reaching out to the public through the media and community events. For example, AUVSI has recently published an industry code of conduct, which discusses privacy issues, safety, and professionalism. Some local law enforcement agencies have started reaching out to the public through the media and community events. For example, local law enforcement agencies have invited local media to a UAS demonstration with a question and answer period and held community acceptance panels when new technologies are deployed.

The possibility that the rate of technology advancements has outpaced regulations has exacerbated privacy fears regarding the use of UAS. For example, FAA has indicated that it will address privacy concerns in its’ rule on small UAS and has yet to issue an NPRM soliciting comments regarding privacy concerns about the operation of small UAS. Through the rulemaking process, FAA will be able to solicit input through public comments and use that public input to craft its rules affecting privacy issues. Technology outpacing regulations is not a problem unique to UAS; similar privacy concerns have arisen over Smartphones and global positioning devices.

Finally, while the Supreme Court has not addressed privacy issues related to governmental UAS surveillance, the Court has upheld several instances involving

¹⁰GAO-12-981.

government aerial surveillance from manned aircraft. At this time, it is uncertain how such cases would be applied to governmental UAS surveillance.

10. Is current funding sufficient to meet the Congressional mandate for full integration of UAS by 2015? Is the current timetable reasonable?

None of the UAS stakeholders we spoke with identified funding as a key challenge for safely integrating UAS into the national airspace system. However, full UAS integration by 2015 will be challenging for FAA. As we stated in our September 2012 report, the FAA Modernization and Reform Act of 2012 set an aggressive timeframe for FAA to safely integrate UAS because many of the Act's requirements entail significant work on the part of FAA and its stakeholders. This work involves developing detailed steps for achieving safe and routine access to the national airspace system, including defining the characteristics of safe integration, identifying needed R&D to achieve integration, and identifying the information needed to issue regulations, among other tasks.

11. Is it important for the FAA to regularly update its report titled "NextGen UAS Research, Development and Demonstration Roadmap?" How often would you recommend this roadmap be updated? Do you believe this document is sufficient to coordinate R&D investments?

FAA's R&D roadmap provides a framework for interagency and private sector coordination on UAS R&D efforts, but the document lacks mechanisms and metrics that allow for regular monitoring to assess progress, as we recommended in September 2012. Including these metrics and regularly updating stakeholders on their progress will help build stakeholder confidence in FAA's UAS integration efforts.¹¹ Determining the frequency with which the Roadmap—or any other tracking document—will be updated should be done in consultation with stakeholders and focus on what would be necessary including, for example, identifying metrics and completion dates, to keep the Congress and stakeholders informed of progress and any related challenges. According to JPDO—which led the development of the roadmap for FAA—there initially were plans to upgrade the roadmap because JPDO realized that including performance metrics and completion dates would be needed to track progress. However, as of March 2013, JPDO has no formal plans to update the roadmap.

¹¹While FAA concurred with our recommendation, because these documents were not publically available as of January 2013, it remains unclear whether they include mechanisms for monitoring progress.