THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

November 6, 2013

The Honorable John D. Rockefeller IV
Chairman
Committee on Commerce, Science
and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

As required by Section 332(a) of the FAA Modernization and Reform Act of 2012, I am pleased to provide you with the U.S. Department of Transportation's Unmanned Aircraft Systems (UAS) Comprehensive Plan. The Federal Aviation Administration's Joint Planning and Development Office developed this comprehensive plan under the guidance of the Next Generation Air Transportation System (NextGen) Senior Policy Committee, and in coordination with NextGen partner representatives. The Plan outlines the safe acceleration of the integration of civil UAS into the National Airspace System (NAS).

The UAS Comprehensive Plan includes UAS National Goals and Objectives that reflect the NextGen partner agencies' UAS mission needs. The work accomplished by the multi-agency teams in Fiscal Year 2012 provides the foundation for embarking on the path towards safe integration of UAS in the NAS. The completed work provides a common framework for evolving interagency coordination and planning and is a testament to the collaboration among representatives from the partner agencies and the UAS community.

A similar letter has been sent to the Chairman of the House Committee on Transportation and Infrastructure and the Ranking Members of the Senate Committee on Commerce, Science and Transportation and the House Committee on Transportation and Infrastructure.

Sincerely,

Anthony R. Foxx

Enclosure

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

November 6, 2013

The Honorable John Thune
Ranking Member
Committee on Commerce, Science
and Transportation
United States Senate
Washington, DC 20510

Dear Senator Thune:

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A similar letter has been sent to the Chairmen of the Senate Committee on Commerce, Science and Transportation and the House Committee on Transportation and Infrastructure and the Ranking Member of the House Committee on Transportation and Infrastructure.

Sincerely,

Anthony R. Foxx

Enclosure

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

November 6, 2013

The Honorable Bill Shuster
Chairman
Committee on Transportation
and Infrastructure
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

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Sincerely,

Anthony R. Foxx

Enclosure

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

November 6, 2013

The Honorable Nick J. Rahall, II
Ranking Member
Committee on Transportation
and Infrastructure
U.S. House of Representatives
Washington, DC 20515

Dear Congressman Rahall:

As required by Section 332(a) of the FAA Modernization and Reform Act of 2012, I am pleased to provide you with the U.S. Department of Transportation's Unmanned Aircraft Systems (UAS) Comprehensive Plan. The Federal Aviation Administration's Joint Planning and Development Office developed this comprehensive plan under the guidance of the Next Generation Air Transportation System (NextGen) Senior Policy Committee, and in coordination with NextGen partner representatives. The Plan outlines the safe acceleration of the integration of civil UAS into the National Airspace System (NAS).

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Sincerely,

Anthony R. Foxx

Enclosure

Unmanned Aircraft Systems (UAS) Comprehensive Plan

A Report on the Nation's UAS Path Forward

September 2013

PREPARED BY THE JOINT PLANNING AND DEVELOPMENT OFFICE (JPDO)

EXECUTIVE SUMMARY

The *Unmanned Aircraft Systems (UAS) Comprehensive Plan* details work that has been accomplished, along with future efforts needed to achieve safe integration of UAS into the National Airspace System (NAS). Throughout Fiscal Year 2012 (FY12), work was conducted to develop elements required to create a more complete picture of achieving safe UAS integration. The perspectives and information available from these individual activities create a framework and reveal an evolving capability for the integration of UAS into the NAS.

Representatives from the Next Generation Air Transportation System (NextGen) partner agencies – the Departments of Transportation (DOT), Defense (DoD), Commerce (DOC), and Homeland Security (DHS), the National Aeronautics and Space Administration (NASA), and the Federal Aviation Administration (FAA) – as well as industry representatives, provided through the FAA's UAS Aviation Rulemaking Committee (ARC), have actively participated in constructing this Plan. The completed work is a testament to the collaboration among representatives from the partner agencies and the UAS community.

The continued safe integration of UAS in the NAS and increased NAS access for UAS will be driven by incremental advances in: research and development (R&D) (including test ranges); rulemaking (including operational approval and airworthiness standards); and development of UAS-related technologies. Safe integration will lead us from today's need for accommodation of UAS through individual approvals to a time when standardized/routine integration into the NextGen environment is well defined.

Six high-level strategic goals that are specific, measureable, attainable, realistic, and timely were developed to reflect the principal objective of safe UAS integration into the NAS. These high-level goals – summarized below – were derived from existing goals provided by the partner agencies and should therefore resonate with the wide range of UAS stakeholders.

The overarching approach for the Goals is to allow public integration to lay the framework for civil integration. The first two Goals apply to small UAS (under 55 pounds) within visual line-of-sight (VLOS), assuming the public realm would be accomplished first and civil would follow; the third and fourth Goals apply to the other UAS, with the same process: public would occur first and civil would follow. Goal 5 was established to plan and manage growing automation capabilities through research, and Goal 6 provides the opportunity for the U.S. to remain leaders in the international forum. The sum of these Goals shows a phased-in approach for UAS integration in the NAS.

The *UAS Comprehensive Plan* sets the overarching, interagency goals, objectives, and approach to integrating UAS into the NAS. Each partner agency will work to achieve these national goals, and may develop agency-specific plans that are aligned to the national goals and objectives. The FAA's *Integration of Civil UAS in the NAS Roadmap* is an example of one such plan. It outlines, for planning purposes and within a broad timeline, the tasks, assumptions, dependencies, and considerations needed to enable UAS integration in the NAS within the wider UAS community. It will remain consistent with the *UAS Comprehensive Plan*. The FAA's UAS Concept of Operations (ConOps) reflects their desired end-state, and lays out the pathway for achieving this end-state, anticipating the technological and procedural enhancements required to make

integration happen. In addition, it begins the engineering process of incorporating UAS-specific changes into the *NextGen Implementation Plan*.

Understanding and prioritizing the R&D needs associated with each of the UAS National Goals is key to achieving robust integration of UAS in the NAS. The need for new capabilities, mitigations, and verification and validation methods to enable safe and secure operations will require the development, integration, and implementation of emerging and new technologies. Each agency presents varying needs and possesses a significant body of expertise resulting from historical investments in UAS operations. R&D-related activities undertaken in FY12 have initiated a process by which the partner agencies can share information and coordinate their research to support the UAS National Goals, maximize the return on investment dollars, and ensure that research products address the FAA's needs beyond 2015.

Two additional activities that are critical to the integration of UAS include the small UAS Rule and the test range program. First, the FAA is drafting a Notice of Proposed Rulemaking (NPRM), targeted for release in calendar year 2014 that is intended to lead to requirements and parameters for how small UAS will be integrated into the NAS. Second, a Screening Information Request (SIR) for the test site selection process was published by the FAA on February 14, 2013. The selection of the six test ranges is anticipated to be completed by the end of calendar year 2013.

The work accomplished in FY12 provides the foundation for safe integration of UAS in the NAS. Valuable relationships have been established and a commitment among the NextGen partners is reflected in the UAS National Goals. Details required for UAS integration implementation are laid out in the FAA's *Integration of Civil UAS in the NAS Roadmap* which will be updated annually. These annual updates will track and report progress. The FAA's UAS ConOps begins the process of including UAS-related changes in the FAA's *NextGen Implementation Plan*. A process has been initiated for how research that enables emerging technology can be identified, prioritized, and integrated into the *NextGen Implementation Plan*. Finally, a small UAS rulemaking project has been initiated, and the test range selection process is underway.

Important non-safety related issues, such as privacy and national security, need to be taken into consideration as UAS are integrated into the NAS. The privacy requirements proposed for the UAS test sites are specifically designed for the operation of the test sites and are not intended to pre-determine the long-term policy and regulatory framework under which UAS would operate. However, the FAA anticipates that the privacy policies developed by the test site operators will help inform the dialogue among policymakers, privacy advocates, and the industry regarding broader questions concerning the use of UAS technologies in the NAS.

Collectively, the efforts described in this document represent the framework of the *UAS Comprehensive Plan*. They will continue to be refined as needed, in FY13 and beyond, until safe integration of UAS in the NAS is accomplished for both public and civil UAS users.

1. INTRODUCTION

Over the last 50 years, rapid advances in aviation technology have transformed the nation's skies. Our National Airspace System (NAS) has evolved to include a wide variety of fixed wing and rotary aircraft of various sizes, weights, and speeds, operating across the country from populated complex metropolitan areas to remote airfields supporting small communities. They operate in a range of airspace, from low-altitude to the stratosphere. Some are dependent on thermals and wind, such as gliders and balloons, and others fly faster than the speed of sound, such as supersonic planes and spacecraft. As aircraft technology expands, so do the challenges associated with maintaining a safe and integrated NAS. And, with the recent advent of and growing interest in remotely piloted aircraft – commonly known as Unmanned Aircraft Systems (UAS) – addressing these challenges in a complex, multi-layered system has never been more critical. UAS are to be integrated in an already shaped and automated NAS and Air Traffic Control (ATC) environment that was originally developed for manned aircraft.

The use of UAS has increased significantly in the United States. From agricultural monitoring and border surveillance to local crime scene investigations, search and rescue missions, disaster response (e.g., wildfires and floods), and military training, UAS provide a wide variety of operational, societal, and economic benefits to its diverse group of users. For example, according to the Teal Group, the market for government and commercial use of UAS is expected to grow, with small UAS having the greatest growth potential.[1] Teal forecasts that the worldwide expenditures on UAS and related research could be potentially as much as $89.1 billion in aggregate over the next decade, with the United States playing a leading role. However, as the demand for UAS increases, concerns regarding how UAS will impact existing aviation grow stronger, especially in terms of safety, privacy, frequency crowding, and airspace congestion.

In 2008, the Government Accountability Office (GAO) reported[2] that the U.S. must develop a clear and common understanding of what is required to safely and routinely operate UAS in the NAS. Additionally, Congress underscored the significance of UAS integration when it enacted the FAA Modernization and Reform Act of 2012. Through this legislation, Congress set forth a number of specific requirements[3] for achieving UAS integration – namely, a Comprehensive Plan and a five-year Roadmap.

This *UAS Comprehensive Plan* is expected to address the following elements:

- FAA rulemaking projects being conducted under Section 332, sub-section (b).
- Methods to enhance technologies and subsystems necessary for safe and routine operation of civil UAS.
- Phased-in approach to civil UAS integration into the NAS.
- Timeline for phased-in integration.

[1] Teal Group Corporation, *World Unmanned Aerial Vehicle Systems* (Fairfax, VA: 2012).
[2] U.S. Government Accountability Office. (2008, May) *Unmanned Aircraft Systems: Federal Actions Needed to Ensure Safety and Expand Their Potential Uses within the National Airspace System*, GAO-08-511. http://www.gao.gov/assets/280/275328.pdf
[3] See Appendix A: FAA Modernization and Reform Act of 2012 - UAS Requirements.

- Airspace designation of manned and UAS operations in a cooperative NAS environment.
- Establishment of a process to inform FAA rulemaking projects related to certification, flight standards, and air traffic requirements for civil UAS, and the process for gathering informational data from designated test ranges.
- Methods to ensure simultaneous safe operations of civil and public UAS within the NAS.
- Incorporation of the Plan into the annual *Next Generation Air Transportation System (NextGen) Implementation Plan.*

Ultimately, cost-effective and safe implementation will require multi-agency coordination to develop a national-level plan that guides routine UAS operations in the NAS.

In April 2012, under the guidance of the NextGen Senior Policy Committee (SPC), the Joint Planning and Development Office (JPDO) answered this challenge, assembling executive- and working-level teams comprised of individuals from the NextGen partner agencies – the Departments of Transportation (DOT), Defense (DoD), Commerce (DOC), and Homeland Security (DHS) as well as the National Aeronautics and Space Administration (NASA), and the Federal Aviation Administration (FAA). These individuals began the work required to develop a UAS plan. The initial objective of the collective team was to create and coordinate approval of UAS National Goals and Objectives that are reflective of the NextGen partner agencies' UAS mission needs, and predicated on data and information from existing documentation aggregated by the JPDO.[4] Ultimately, the UAS National Goals and Objectives represent the framework and foundation of the *UAS Comprehensive Plan* – an endeavor the JPDO is leading in collaboration with the NextGen partners, which is further described in detail within this document.

The *UAS Comprehensive Plan* sets the overarching, interagency goals, objectives and approach to integrating UAS into the NAS. Each partner agency will work to achieve these national goals, and may develop agency-specific plans that are aligned to the national goals and objectives. The FAA's *Integration of Civil UAS in the NAS Roadmap* is an example of one such plan. It outlines, for planning purposes and within a broad timeline, the tasks, assumptions, dependencies, and considerations needed to enable UAS integration in the NAS within the wider UAS community. It will remain consistent with the *UAS Comprehensive Plan*. The FAA's UAS Concept of Operations (ConOps) reflects their desired end-state, and lays out the pathway for achieving this end-state, anticipating the technological and procedural enhancements required to make integration happen. In addition, it begins the engineering process of incorporating UAS-specific changes into the NextGen Implementation Plan.

Additionally, this Comprehensive Plan supports the coordination and integration of research and development (R&D) necessary to achieve the UAS National Goals and the FAA's Integration Roadmap goals. Development of a *NextGen UAS Research, Development and Demonstration (RD&D) Roadmap*, prioritization methodology, and prioritization database in Fiscal Year 2012 (FY12) established initial information and a process for the JPDO and partner agencies to

[4] See Appendix B: UAS National Goals and Objectives Source Documents.

collaborate in their efforts to identify and address R&D needs for UAS capabilities beyond 2015. Assessment of R&D needs and prioritizing the activities is an essential element of the Comprehensive Plan.

The FAA's chief mission is to ensure the safety and efficiency of the NAS. This includes manned and unmanned aircraft operations. While the expanded use of UAS presents great opportunities, it also presents significant challenges as unmanned aircraft systems are inherently different from manned aircraft.

Safety, Privacy, Civil Rights, Civil Liberties & Security

Members of the NextGen SPC agree on the need to address privacy concerns of the public at large while safely integrating UAS in the NAS. As use of UAS by civil agencies and private industry grows, preserving the privacy, civil rights, and civil liberties of individuals becomes increasingly important. In October 2012, the SPC committed to working together on this issue and suggested that answers to privacy policy questions could be accomplished in stages.

The FAA also recognizes the importance of non-safety related issues, such as privacy and civil liberties, physical security, and potential economic opportunities, which all Federal agencies and stakeholders participating in the development of UAS policy will need to take into consideration as UAS are integrated into the NAS. Specific to privacy concerns, the FAA has proposed and is requesting public input on a privacy approach for the UAS test site program that attempts to prudently address privacy concerns by emphasizing transparency, public engagement, and compliance with existing law.

The UAS test sites authorized by Congress can provide an opportunity for development and demonstration by the test site operators and users of policies and operating approaches that would address both UAS operator mission needs and related individual privacy concerns. The lessons learned and best practices established at the test sites may be applied more generally to protect privacy in UAS operations throughout the NAS. This incremental approach will provide an example to both private and public sectors on a safe and secure way to employ UAS that is consistent with the need for privacy.

Federal agencies are mindful that national defense and homeland security measures are to be designed and performed without diminishing the privacy, civil rights, and civil liberties of individuals. There are specific laws applicable to public agencies that ensure that those agencies follow privacy principles. In addition, many agencies have their own internal privacy policies providing guidance to their employees about the importance of privacy, civil rights, and civil liberties. Robust privacy policies, privacy impact assessments, and privacy compliance reviews or audits are just some of the tools that Federal agencies may use as mechanisms to protect individual rights and liberties.

Although there is no Federal law that specifically addresses privacy concerns with respect to civil UAS operations, many states have laws that protect individuals from invasions of privacy which could be applied to intrusions committed by using a UAS.

Integrating public and civil UAS into the NAS carries certain national security implications, including cyber and communications security, domestic framework for US government operations, national airspace and defense, airman vetting/general aviation, and privacy concerns. In coordination with the National Security Staff at the White House, the FAA is working in conjunction with relevant agency partners on an Interagency Policy Committee to address these issues.

The sections that follow highlight the results of the FY12 activities and explain how these pieces are a part of or may influence the Comprehensive Plan for UAS integration in the NAS.

2. APPROACH

Several initiatives have advanced in parallel to plan for the integration of UAS in the NAS. They address the need for a common set of goals, a common understanding of how UAS will operate in the NAS, a timeline for accomplishing the activities required to allow for safe integration of UAS, and a way to evaluate research needs that enable prompt technology improvements to support the successful execution of that timeline. The highlights of these activities are included here.

2.1 UAS NATIONAL GOALS, OBJECTIVES, AND TARGETS

The JPDO developed the UAS National Goals, Objectives, and Targets in coordination with executive- and working-level representatives provided by the NextGen partner agencies. The interagency team emphasized that the UAS National Goals must represent the achievable UAS capabilities, considering user and stakeholder mission needs, type of operations, and operational boundaries.

The initial framing of the UAS National Goals and Objectives leveraged 12 key source documents,[5] including UAS roadmaps, plans, and integration efforts from various agencies. Key goals, objectives, requirements, supporting activities, and dates from applicable reference documents provided insight into agency-specific UAS initiatives. The common goals and themes reflected in the extracted data served as the basis for the development of six UAS National Goals and eight Objectives. These UAS National Goals and Objectives are not directly linked on a one-for-one basis, but rather, a specific objective could support a range of Goals.

The following assumptions frame the formulation of the UAS National Goals, Objectives, and Targets:

- Routine operations for UAS should not require exceptions or unique authorizations.
- Targets reflect the earliest start dates mandated by the FAA Modernization and Reform Act of 2012[6] for achieving initial capability in support of the UAS National Goals.
- The UAS National Goals and Objectives must align with – and not supersede – government United States Code (U.S.C.) title authorities and responsibilities (see below for further elaboration).
- Partner agency documents constitute a baseline reflecting current plans and efforts toward safe UAS integration in the NAS.[7]

[5] Ibid.

[6] The FAA Modernization and Reform Act of 2012 specifies the following UAS target dates for safe UAS integration into the NAS:

- August 14, 2014 – Publish a final rule on small UAS. Required by Section 332 (b)(1).
- September 30, 2015 – "No later than date" for safe integration of civil UAS into the NAS. Required by Section 332(a)(3).

The final set of UAS National Goals and Objectives represents the result of several iterations of refinement and review by partner agencies and approval by the UAS National Plan Partner Agency Senior-Level Executives designated by the JPDO Board.

The Comprehensive Plan does not supersede government U.S.C. title authorities and responsibilities. The UAS National Goals and Objectives provide a framework for interagency coordination and planning. Government agencies will comply with their own processes, policies, and standards regarding airworthiness, pilot, aircrew and maintenance personnel certification and recurrent training. The authority to safely conduct public aircraft operations in the NAS is derived from Title 49, United States Code (49 U.S.C. §§ 40102(a) (41) and 40125). If no government UAS processes, policies, or standards exist, it is recommended that the agency apply specific provisions of 14 Code of Federal Regulations (CFR) applicable to civil UAS operations when they are published. The appropriate public or civil authority will be responsible for establishing the requirements called out in the UAS National Objectives.

2.1.1 UAS NATIONAL GOALS

1. Routine Public Small UAS Visual Line-of-Sight (VLOS) Operations Conducted in the NAS (without special authorization; i.e., Certificate of Authorization) (2015)[8]

- Initial Capability[9]: Operations outside of Class B/C airspace and not over populated areas.
- Full Capability[10]: Operations in all applicable domestic airspace classes subject to airspace requirements.

2. Routine Civil Small UAS VLOS Operations Conducted in the NAS (without special authorization; i.e., Special Airworthiness Certificate) (2015)

- Initial Capability: Operations outside of Class B/C airspace and not over populated areas.
- Full Capability: Operations in all applicable domestic airspace classes subject to airspace requirements.

3. Routine Public UAS Operations in the NAS (2015)

- Initial Capability: Using mitigation for UAS limitations to comply with 14 CFR Part 91 requirements.
- Full Capability: UAS compliance with revised operating requirements addressing unique UAS attributes.

4. Routine Civil UAS Operations in the NAS (2020)

- Initial Capability: Using mitigation for UAS limitations to comply with 14 CFR Part 91 requirements.

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[7] See Appendix B: UAS National Goals and Objectives Source Documents.

[8] Dates assigned to the UAS National Goals indicate when the Initial Capability will be available.

[9] Initial Capability: An initial implementation available for operations that supports the planned UAS National Goal.

[10] Full Capability: A final implementation available for operations that completes the planned UAS National Goal.

- Full Capability: UAS compliance with revised operating requirements addressing unique UAS attributes.

5. Define, Determine, and Establish Acceptable Levels of Automation for UAS in the NAS (TBD)[11]

6. Foster U.S. International Leadership in UAS Capabilities and in Standards Development (Ongoing)

- Initial Capability: UAS operations in airspace where the U.S. has the responsibility for the provision of Air Traffic Services (ATS).
- Full Capability: Harmonized UAS operations in accordance with International UAS Standards and Recommended Practices (SARPs).

2.1.2 UAS NATIONAL OBJECTIVES

1. Establish Applicable Certification and Training Requirements for Pilots/Crew Members, Other UAS Operational Personnel, and Appropriate Air Navigation Service Provider (ANSP) Personnel

1.1. Determine the roles and responsibilities of applicable pilots/crew members, other UAS operational personnel, and appropriate ANSP personnel for safe UAS integration.
1.2. Develop and propose regulatory changes, as required, to define licensing (certification) and training requirements for pilots/crew members, other UAS operational personnel, and appropriate ANSP personnel (address in 14 CFR Part 61, 63, 65, and 141-147).
1.3. Publish, if required, final rule requirements for applicable pilots/crew members, other UAS operational personnel, and appropriate ANSP personnel.
1.4. Begin training and certification initiatives for pilots/crew members, other UAS operational personnel, and appropriate ANSP personnel.

2. Approve Applicable Medical Requirements and Standards (e.g., address 14 CFR Part 67)

2.1. Develop and propose regulatory changes, as required, to define draft medical requirements and standards.
2.2. Publish, if required, a final rule establishing medical requirements and standards.

3. Establish Applicable Airworthiness Certification Requirements

3.1. Facilitate the initiation of applicable classification and basis of airworthiness certification.
3.2. Facilitate the development of draft airworthiness design standards.
3.3. Develop applicable draft airworthiness certification advisory circulars.
3.4. Approve and publish final system airworthiness certification advisory circulars.
3.5. Ensure that a robust and integrated test environment is available to develop, test, and evaluate UAS.
3.6. Administer certification, including Advisory Circular (AC) guidance and oversight.

[11] A roadmap will be developed in 2015 which will help determine when this goal will be accomplished.

4. Implement Small UAS Rules

4.1. Develop and publish small UAS Rules for operations within VLOS of the pilot or observer.

4.2. Issue permits to operate as applicable to small UAS (FAA).

5. Approve the Use of Ground Based Sense and Avoid (GBSAA) for UAS Operations

5.1. Define GBSAA performance requirements for access to all applicable domestic airspace classes subject to airspace requirements and classes of aircraft.

5.2. Define GBSAA equipment and operating requirements for access to all applicable domestic airspace classes subject to airspace requirements and classes of aircraft.

5.3. Test GBSAA equipment and procedures.

5.4. Approve GBSAA operations for routine use.

6. Approve the Use of Airborne Sense and Avoid (ABSAA) for UAS Operations

6.1. Define ABSAA performance requirements for access to all applicable domestic airspace classes subject to airspace requirements and classes of aircraft.

6.2. Define ABSAA equipment and operating requirements for access to all applicable domestic airspace classes subject to airspace requirements and classes of aircraft.

6.3. Test ABSAA equipment and procedures.

6.4. Amend 14 CFR 91.113 (Right-of-way-rules) to allow ABSAA

6.5. Approve ABSAA operations for routine use.

7. Develop and Integrate UAS Enabling Technologies within the NAS Infrastructure to Support Appropriate Levels of Automation

7.1. Coordinate, develop, and refine existing and/or emerging ontologies for automation. Baseline the ontology(ies) in order to provide standard terminology, roles, responsibilities, modes, and levels for usage in: requirements analysis, standards development, modeling and simulations assessments, systems development, procedures development, testing, certification processes, training documentation, and research specifications. Maintain consistency and interoperability with other automation systems to enable future systems of systems integration.

7.2. Develop a UAS Automation Roadmap (UAR) that evaluates the use of increasing levels of automation within the context of FAA NextGen infrastructure and stakeholder R&D capabilities. Continue to coordinate and update the UAR along with the NextGen UAS RD&D Roadmap.

7.3. Determine the requirements and develop, certify, and field UAS enabling technologies to support enhanced automation capabilities.

8. Approve Integrated Operations for Manned Aircraft and UAS in the NAS

8.1. Develop UAS agency-specific Integration Transition Plans.

8.2. Develop Airspace Integration Safety Case/Assessment.

8.3. Develop and publish operational standards, procedures, and guidance for UAS airspace operations (Regulations, Policy Documents, Advisory Circulars, Orders, Notices, Handbooks, and Manuals).

8.4. Develop and publish operational standards, procedures, and guidance relative to airport facilities and UAS surface operations (Regulations, Policy Documents, Advisory Circulars, Orders, Notices, Handbooks and Manuals).

2.2 INTEGRATION OF CIVIL UAS IN THE NAS ROADMAP (FAA'S INTEGRATION ROADMAP)

The FAA's Integration Roadmap contains FAA-developed goals, metrics (activities), and target dates (or date ranges), and incorporates many related UAS Aviation Rulemaking Committee (ARC) recommendations. The FAA's Integration Roadmap is a five-year plan, and target dates are generally limited to this horizon. The FAA will reflect necessary changes to the existing set of goals, metrics, and target dates in yearly updates to the FAA's Integration Roadmap. These annual updates enable tracking and progress reporting as recommended by the GAO.

The goals are, for the most part, intended to be addressed concurrently. The metrics help establish and maintain common government and industry expectations, and enable objective assessments of the progress made toward accomplishing each goal. The goals and metrics collectively reflect the incremental approach to UAS certification and integration, and establish a set of strategic objectives that can guide the definition of lower-level activities, schedules, and resource requirements.

Goals and metrics were developed for each of the following UAS focus areas:

(1) Certification Requirements (Airworthiness)
(2) Certification Requirements (Pilot/Crew)
(3) Ground Based Sense and Avoid (GBSAA)
(4) Airborne Sense and Avoid (ABSAA)
(5) Control and Communications (C2)
(6) Small UAS and Other Rules
(7) Test Ranges
(8) Air Traffic Interoperability
(9) Miscellaneous

These focus areas represent the elements that should be addressed to enable UAS integration in the NAS. Figure 1 is an example of the information contained in the FAA's Integration Roadmap.

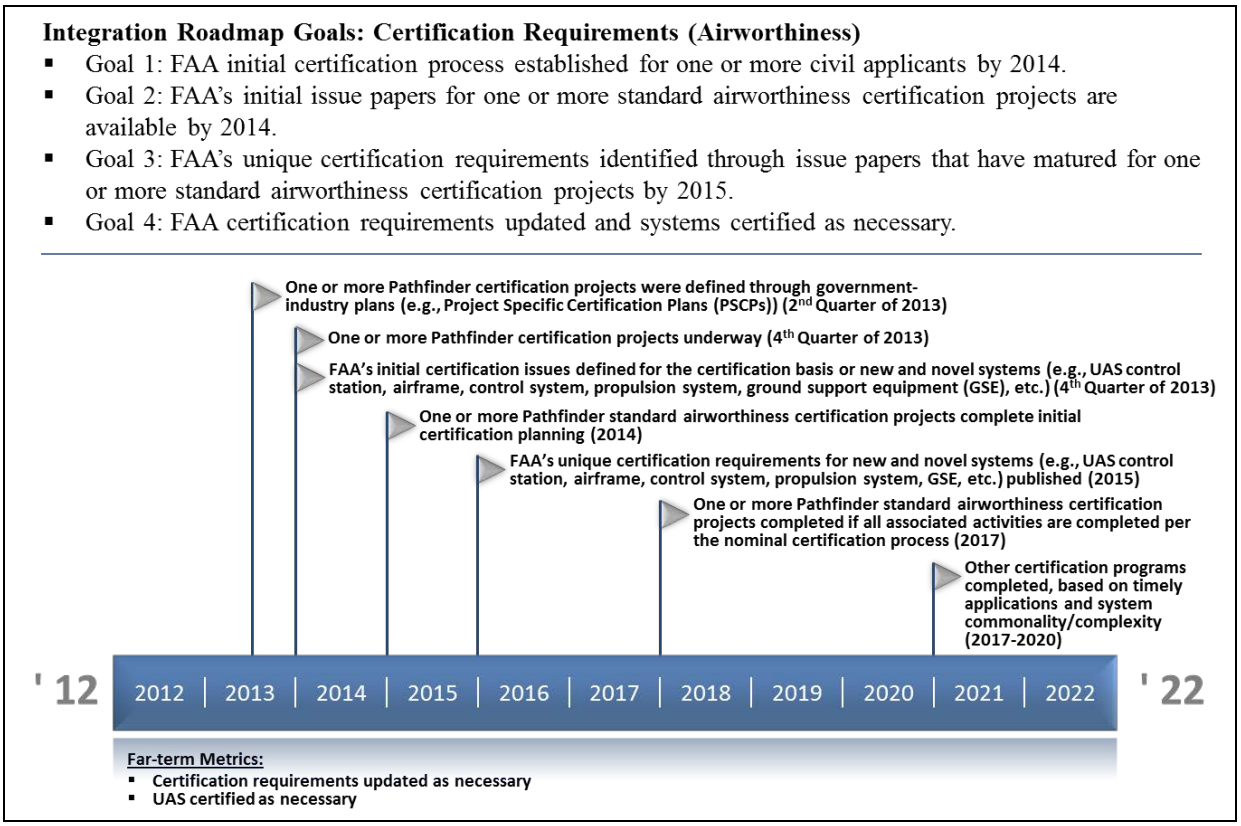


Figure 1 – Example: Airworthiness Certification Requirements Activities (Metrics)

2.3 UAS RESEARCH AND DEVELOPMENT (R&D) PRIORITIZATION

The FAA has established R&D priorities to successfully achieve UAS capabilities envisioned in 2015. However, the UAS National Goals to be achieved after initial integration in 2015 require technology solutions that are not fully available today. Understanding and prioritizing R&D needs associated with each of the UAS National Goals is critical to achieving robust integration of UAS in the NAS. Each partner agency brings unique needs and possesses a significant body of expertise resulting from historical investments in UAS operations. As a result, R&D-related activities undertaken in FY12 have established a process by which the partner agencies can share information and coordinate their research to support the UAS National Goals, maximize the return on investment dollars, and ensure that research products address the FAA's needs beyond 2015.

The FY12 UAS R&D efforts, focused on establishing a basis for identifying and prioritizing R&D needs, include the following:

- Developing and issuing a *NextGen UAS RD&D Roadmap*, which provided a catalog of R&D efforts.
- Establishing JPDO and multi-agency teams to facilitate coordination of R&D-related efforts.
- Developing an approach for prioritizing R&D topics based on the UAS National Goals.

The prioritization of R&D topics began with the *NextGen UAS RD&D Roadmap*.[12] Developed in 2011 and signed in 2012, the Roadmap is a catalog of ongoing and planned R&D efforts being conducted by the NextGen partners to support the integration of UAS operations in the NAS. Additionally, the process established a means for partner agencies to exchange information and coordinate with the FAA. Subject matter experts from the partner agencies – FAA, NASA, DoD, DHS, and DOC – contributed to the *NextGen UAS RD&D Roadmap*, identifying planned and ongoing work and critical R&D challenges in their areas of expertise. The *NextGen UAS RD&D Roadmap* defined 23 challenges within the four technical tracks of Communications, Airspace Operations, Unmanned Aircraft, and Human Systems Integration.

The FY12 R&D effort used the *NextGen UAS RD&D Roadmap* and other studies to establish a prioritization approach linked to the UAS National Goals. This activity established prospective R&D topics, prioritization categories, a UAS R&D database, and an initial list of proposed high-priority R&D needs to achieve the UAS National Goals. Representatives from partner agencies participated in developing and reviewing the methodology and the preliminary results.

The methodology incorporates four steps:

- Use the UAS National Goals to represent the requirements driving R&D needs.
- Develop a detailed list of prospective R&D topics (the FY12 effort identified 244 topics addressing 52 aspects of UAS integration in the NAS).
- Assign a priority category (Safety Critical, Necessary, Enhances, Not Applicable) to each of the R&D topics with respect to each of the UAS National Goals beyond initial integration in 2015.
- Summarize the prioritized topics associated with each of the 23 R&D challenges identified in the *NextGen UAS RD&D Roadmap*.

One of the major outcomes of the FY12 effort includes development of an initial UAS R&D prioritization database created by a team of subject matter experts working with partner agency representatives. The database documents the relationships among identified R&D needs, R&D challenges, UAS National Goals, and relative priorities. It will be used as a basis for more extensive FY13 UAS R&D prioritization work.

2.3.1 INTERAGENCY RESEARCH COLLABORATION

In addition to the JPDO-led research collaboration, the FAA has been increasing its research collaboration with the NextGen partner agencies. Details of those efforts are listed in the paragraphs below.

The FAA is providing subject matter experts to support NASA's "UAS Integration in the NAS" project to review research objectives and assumptions. The FAA and NASA have shared UAS research project plans and analysis results, and have identified the need to minimize duplicative

[12] Joint Planning and Development Office, (2012, March)
http://www.jpdo.gov/library/20120315_UAS%20RDandD%20Roadmap.pdf

efforts and determine how UAS research, expertise, and assets can be leveraged between them. There is an umbrella interagency agreement for UAS research between the FAA and NASA, which will allow the FAA to centralize and focus its collaboration with NASA while capitalizing on expertise across all NASA research centers. Specific focus with NASA is in the areas of Human Systems Integration, Communications, Certification, Separation Assurance/Sense and Avoid Interoperability, and Integrated Test and Evaluation.

The FAA and DoD have collaborated on the Defense Department's UAS – Airspace Integration (UAS-AI) Quick Reaction Test. The FAA is also collaborating with DoD/USNORTHCOM on the follow-on Joint Test, which commenced at the end of calendar year 2012. In addition, the FAA conducted an evaluation of the DoD Joint ConOps for UAS-AI, which focuses on near-term advanced accommodation of UAS in the NAS. The suite of proposed flight profile tests will potentially serve as an incremental step to inform the FAA's Integration Roadmap.

The FAA and DHS collaborated on the FAA's Demo 4. Demo 4's high-level research objectives were to assess the ability for an independent Ground-Based Voice Communication System to restore communication between the UAS pilot and ATC in the event of a lost link/lost communication scenario. The objectives also tested the viability of providing an independent Cockpit Display of Traffic Information system to aid a UAS pilot in tracking own-ship information in the event of a lost link/lost communication scenario. The UAS Demonstration Team successfully completed Demo 4 by observing a Customs and Border Protection operational flight in October 2012.

2.4 TEST RANGES

During FY12, the FAA initiated a program for test ranges in accordance with the FAA Modernization and Reform Act of 2012. This effort successfully generated a Screening Information Request (SIR) after a public comment period and public webinars, with almost 800 registrants, to address questions on the test ranges. All comments were adjudicated and the final SIR soliciting applications was published on February 14, 2013. The deadline for submitting applications was May 6, 2013. The FAA is currently evaluating the applications and anticipates that the test sites will be selected by the end of calendar year 2013. As part of the test range agreements, the FAA will be collecting information that will help inform future rulemaking activities and other policy decisions related to safety, privacy, and economic growth. In addition, NextGen partner agencies will leverage their individual and networked laboratory facilities and test infrastructure, as appropriate, to advance the goals and objectives of this plan.

2.5 SMALL UAS RULE

A Notice of Proposed Rulemaking (NPRM) on small UAS is under development with the intent to provide safe small UAS access to the NAS. The NPRM for small UAS is being drafted and is targeted for release in 2014.

3. INTEGRATED APPROACH AND THE PATH FORWARD

As described in the previous section, many parallel activities have been conducted to support the generation of this Comprehensive Plan. Each of these pieces plays a critical role in ultimately achieving the safe integration of UAS in the NAS.

Achieving approval of the UAS National Goals and Objectives by the NextGen partners was a key accomplishment, since this allowed the stakeholders to work in unison.[13] With six approved National Goals and eight Objectives, there is a common framework and timeline to begin the UAS integration work. The overarching approach for the Goals is to allow public integration to lay the framework for civil integration. The first two Goals apply to small UAS (under 55 pounds) within VLOS, assuming the public realm would be accomplished first and civil would follow; the third and fourth Goals apply to the other UAS, with the same process: public would occur first and civil would follow. Goal 5 was established to plan and manage growing automation capabilities through research, and Goal 6 provides the opportunity for the U.S. to remain leaders in the international forum. The sum of these Goals shows a phased-in approach for UAS integration in the NAS.

The FAA's UAS ConOps provides the mechanism to enable integration of UAS needs into the FAA's *NextGen Implementation Plan*. Assessment of R&D needs to support the UAS ConOps and prioritizing the activities is an essential element of the Comprehensive Plan. Since the FAA has already defined critical research to support what is required for 2015, the FY13 R&D prioritization effort addresses R&D efforts in support of UAS integration beyond 2015. The FY13 R&D prioritization activity will develop these needs and identify ongoing research efforts in close coordination with the partner agencies.

The need for new capabilities, mitigations, and verification and validation methods to enable safe operations will require the development, integration, and implementation of emerging and new technologies. Advanced planning is essential, since lead times for developing technology for full implementation of UAS National Goals beyond 2020 can span many years. The scope of issues involved in UAS integration in the NAS dictates that R&D activities must be well understood within an integrated framework in terms of relevance, timeliness, and relationships among related research activities. Using the draft methodology generated in FY12 as guidance, the JPDO will lead a more extensive UAS research prioritization activity in FY13. The NextGen *UAS RD&D Roadmap* and prioritization of R&D needs to represent significant steps toward planning and coordinating the R&D required to achieve the UAS National Goals. The JPDO and its partners plan to continue this activity with the following next steps:

- Refine the prioritization methodology.
- Update and refine the UAS R&D prioritization database, including incorporation of R&D needs associated with policy decisions and mitigation of identified risks.
- Update the UAS R&D inventory established in the *NextGen UAS RD&D Roadmap*.
- Conduct a gap analysis comparing the inventory in an updated *NextGen UAS RD&D Roadmap* to validated R&D needs identified by the R&D prioritization activity.
- Work with the partner agencies to establish R&D Community of Interest that addresses integration of UAS in the NAS.

[13] Partner agency approval is in final coordination.

- Identify further steps to fill the gaps and plan, coordinate, and assess progress of R&D associated with the UAS National Goals.

The FAA's Integration Roadmap lays out a rolling five-year plan for implementing UAS integration in the NAS. It supports the UAS National Goals and Objectives and anticipates the technology and procedural enhancements required to make integration happen. In general, it provides a timeline for phased-in integration of UAS in the NAS. The FAA's Integration Roadmap was shaped by industry recommendations received through the FAA's UAS ARC and implementation details will be added through FY13.

In addition to the activities listed above, two other activities are underway that are critical to the successful integration of UAS in the NAS. The small UAS Rule is under development, and is expected to begin to address the first two UAS National Goals. Also, the test range program has been defined and initiated. The FAA anticipates the selection will be announced by the end of calendar year 2013. The small UAS Rule and the test range program activities are included in the FAA's Integration Roadmap.

4. CONCLUSION

UAS play a unique role in the safety and security of many U.S. military and civil missions. Due to the diverse utility that UAS offer, their use is expected to increase exponentially once safe and efficient integration in the NAS is accomplished. As a result, developing a safe and efficient way for UAS to operate in the NAS with manned aircraft has become a critical issue – particularly in the planning and implementation of NextGen.

In 2008, the GAO reported that the U.S. must develop a clear and common understanding of what is required to safely and routinely operate UAS in the NAS. Congress then enacted the FAA *Modernization and Reform Act of 2012*, which laid out a number of requirements for achieving UAS integration, namely, a Comprehensive Plan and a five-year Roadmap. In early 2012, the JPDO addressed this challenge by assembling executive- and working-level teams comprised of individuals from the NextGen partner agencies. Ultimately, the work accomplished by these multi-agency teams in FY12 provided the foundation for embarking on the path towards safe integration of UAS in the NAS. The JPDO will continue to convene partner agency teams to address such issues as security, privacy, civil rights, and civil liberties as the opportunity is presented, enabling integration across several key policy areas of interest.

Specifically, valuable relationships have been established and the commitment shared by the NextGen partners is reflected in the UAS National Goals. Details required for UAS integration implementation are described in the FAA's Integration Roadmap, which will be updated annually. Also, the overarching process has been defined for how research priorities to enable emerging technology will be identified and integrated into the FAA's *NextGen Implementation Plan*. The test ranges will be positioned to provide data to assist with engineering activities that will support integration.

Collectively, the efforts described in this document represent the framework of the *UAS Comprehensive Plan*. They will continue in FY13 and beyond, as needed, until safe integration of UAS in the NAS is accomplished for both public and civil UAS users.

APPENDIX A – FAA MODERNIZATION AND REFORM ACT OF 2012: UAS REQUIREMENTS

To amend title 49, United States Code, to authorize appropriations for the Federal Aviation Administration for fiscal years 2011 through 2014, to streamline programs, create efficiencies, reduce waste, and improve aviation safety and capacity, to provide stable funding for the national aviation system, and for other purposes.

TITLE III—SAFETY
Subtitle B—Unmanned Aircraft Systems

SEC. 332. INTEGRATION OF CIVIL UNMANNED AIRCRAFT SYSTEMS INTO NATIONAL AIRSPACE SYSTEM

(a) REQUIRED PLANNING FOR INTEGRATION.—

(1) COMPREHENSIVE PLAN.—Not later than 270 days after the date of enactment of this Act, the Secretary of Transportation, in consultation with representatives of the aviation industry, Federal agencies that employ unmanned aircraft systems technology in the national airspace system, and the unmanned aircraft systems industry, shall develop a comprehensive plan to safely accelerate the integration of civil unmanned aircraft systems into the national airspace system.

(2) CONTENTS OF PLAN.—The plan required under paragraph (1) shall contain, at a minimum, recommendations or projections on—

(A) the rulemaking to be conducted under subsection (b), with specific recommendations on how the rulemaking will—

(i) define the acceptable standards for operation and certification of civil unmanned aircraft systems;

(ii) ensure that any civil unmanned aircraft system includes a sense and avoid capability; and

(iii) establish standards and requirements for the operator and pilot of a civil unmanned aircraft system, including standards and requirements for registration and licensing;

(B) the best methods to enhance the technologies and subsystems necessary to achieve the safe and routine operation of civil unmanned aircraft systems in the national airspace system;

(C) a phased-in approach to the integration of civil unmanned aircraft systems into the national airspace system;

(D) a timeline for the phased-in approach described under subparagraph (C);

(E) creation of a safe[14]

(F) airspace designation for cooperative manned and unmanned flight operations in the national airspace system;

(G) establishment of a process to develop certification, flight standards, and air traffic requirements for civil unmanned aircraft systems at test ranges where such systems are subject to testing;

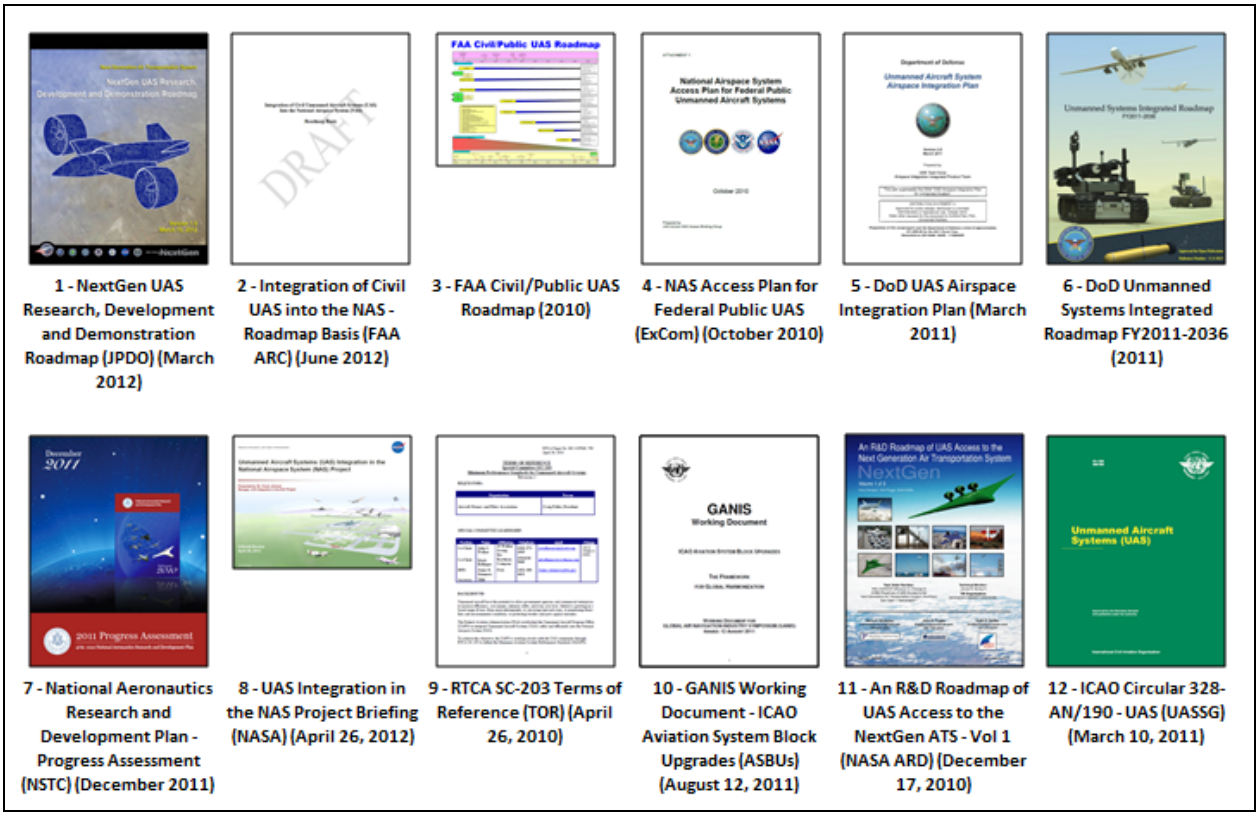
[14] Additional wording for this requirement may have been inadvertently omitted from this Bill (H.R.658).

(H) the best methods to ensure the safe operation of civil unmanned aircraft systems and public unmanned aircraft systems simultaneously in the national airspace system;
(I) incorporation of the plan into the annual NextGen Implementation Plan document (or any successor document) of the Federal Aviation Administration.

(3) DEADLINE.—The plan required under paragraph (1) shall provide for the safe integration of civil unmanned aircraft systems into the national airspace system as soon as practicable, but not later than September 30, 2015.
(4) REPORT TO CONGRESS.—Not later than 1 year after the date of enactment of this Act, the Secretary shall submit to Congress a copy of the plan required under paragraph (1).
(5) ROADMAP.—Not later than 1 year after the date of enactment of this Act, the Secretary shall approve and make available in print and on the Administration's Internet Web site a five-year roadmap for the introduction of civil unmanned aircraft systems into the national airspace system, as coordinated by the Unmanned Aircraft Program Office of the Administration. The Secretary shall update the roadmap annually.

APPENDIX B – UAS NATIONAL GOALS AND OBJECTIVES SOURCE DOCUMENTS

The documents that were used to extract UAS National Goals and Objectives pertaining to safe UAS integration in the NAS are depicted below.



1. NextGen UAS Research, Development and Demonstration Roadmap (JPDO) (March 2012)
2. Integration of Civil UAS into the NAS – Roadmap Basis (FAA UAS ARC) (June 2012)
3. FAA Civil/Public UAS Roadmap (2010)
4. NAS Access Plan for Federal Public UAS (ExCom) (October 2010)
5. DoD UAS Airspace Integration Plan (March 2011)
6. DoD Unmanned Systems Integrated Roadmap FY2011-2036 (2011)
7. National Aeronautics Research and Development Plan - Progress Assessment (NSTC) (December 2011)
8. UAS Integration into the NAS Project Briefing (NASA) (April 26, 2012)
9. RTCA SC-203 Terms of Reference (TOR) (April 26, 2010)

10. GANIS Working Document - ICAO Aviation System Block Upgrades (ASBUs) (August 12, 2011)

11. An R&D Roadmap of UAS Access to the NextGen ATS - Vol 1 (NASA ARD) (December 17, 2010)

12. ICAO Circular 328-AN/190 - UAS (UASSG) (March 10, 2011)

APPENDIX C – UAS COMPREHENSIVE PLAN DEFINITIONS

Term	Definition
Civil Aviation	Civil aviation includes two major categories:[15] (1) Air transport, including all passenger and cargo flights operating on regularly scheduled routes, as well as on demand flights. (2) General aviation (GA), including all other civil flights, private or commercial. All air transport is commercial, but general aviation can be either commercial or private. Normally, the pilot, aircraft, and operator must all be authorized to perform commercial operations through separate commercial licensing, registration, and operation certificates.
Class A Airspace	Generally, that airspace from 18,000 feet MSL up to and including FL 600, including the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska. Unless otherwise authorized, all persons must operate their aircraft under IFR.
Class B Airspace	Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of airport operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers (some Class B airspaces areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is "clear of clouds."
Class C Airspace	Generally, that airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually consists of a surface area with a five nautical mile (NM) radius, a circle with a 10NM radius that extends no lower than 1,200 feet up to 4,000 feet above the airport elevation, and an outer area that is not charted. Each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace. VFR aircraft are only separated from IFR aircraft within the airspace.
Class D Airspace	Generally, that airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures. Arrival

[15] Federal Aviation Regulations FAR Part 91, 110, 121, 125, 135.

	extensions for instrument approach procedures may be Class D or Class E airspace. Unless otherwise authorized, each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace. No separation services are provided to VFR aircraft.
Class E Airspace	Generally, if the airspace is not Class A, Class B, Class C, or Class D, and it is controlled airspace, it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Also in this class are Federal airways, airspace beginning at either 700 or 1,200 feet AGL used to transition to/from the terminal or en route environment, en route domestic, and offshore airspace areas designated below 18,000 feet MSL. Unless designated at a lower altitude, Class E airspace begins at 14,500 MSL over the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska, up to, but not including 18,000 feet MSL, and the airspace above FL 600.
Class G Airspace	That airspace not designated as Class A, B, C, D or E.
Full Capability	A final implementation available for operations that completes the planned UAS National Goal.
Goal	Statement of an end result or outcome desired by stakeholders.
Initial Capability	An initial implementation available for operations that supports the planned UAS National Goal.
Milestone	A significant point in time or event for achieving a specific result.
National Airspace System (NAS)	The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.[16]
National Goal	A statement of an end result or outcome desired by stakeholders that enables the accomplishment of the overarching mission. It is a top-level, strategic outcome that one wishes to achieve.
Objective	Statement of necessary achievement to meet the goal.
Public Aviation	Public Aircraft Operation (PAO) is limited by the statute to certain government operations within U.S. airspace. Although these operations must comply with certain general operating rules (including those applicable to all aircraft in the NAS), other civil certification and safety oversight regulations do not apply. Whether an operation may be considered public is determined on a flight-by-flight basis, under the terms of the statute (49 U.S.C. 40102 and 49 U.S.C. 40125) and depends on

[16] FAA Order 7110.65, Air Traffic Control, Pilot/Controller Glossary, Change 2.

	factors such as aircraft ownership, operator, the purpose of the flight and the persons on board the aircraft.[17]
Stakeholders	Individuals or organizations that stand to gain from the success or failure of a system/initiative.
Strategic	A perspective that is mission-oriented rather than tactical or operational.
Strategy	Overall plan of action to achieve an objective. Ties together objectives, approaches, and actions.
Unmanned Aircraft System (UAS)	An unmanned aircraft and its associated elements related to safe operations, which may include control stations (ground, ship, or air-based), control links, support equipment, payloads, flight termination systems, and launch/recovery equipment.

[17] FAA Order 8900.1, Flight Standards Information Management System.

APPENDIX D – UAS COMPREHENSIVE PLAN ACRONYMS

Term	Definition
4D	Four-Dimensional
ABSAA	Airborne Sense and Avoid
AC	Advisory Circular
ADS-B	Automatic Dependent Surveillance-Broadcast
AIM	Aeronautical Information Manual
ANSP	Air Navigation Service Provider
ATC	Air Traffic Control
ATS	Air Traffic Services
BLOS	Beyond Line-of-Sight
C2	Control and Communications
CDTI	Cockpit Display of Traffic Information
COA	Certificate of Waiver or Authorization
CFR	Code of Federal Regulations
ConOps	Concept of Operations
DHS	Department of Homeland Security
DOC	Department of Commerce
DoD	Department of Defense
DOJ	Department of Justice
DOT	Department of Transportation
ExCom	UAS Executive Committee
FAA	Federal Aviation Administration
FAA ARC	FAA Aviation Rulemaking Committee
FAR	Federal Aviation Regulations
FPV	First Person View
FY	Fiscal Year
GA	General Aviation
GAO	Government Accountability Office
GBSAA	Ground Based Sense and Avoid
ICAO	International Civil Aviation Organization
ICAO ASBUs	ICAO Aviation System Block Upgrades
ICAO UASSG	ICAO Unmanned Aircraft Systems Study Group
IFR	Instrument Flight Rules
JPDO	Joint Planning and Development Office
LOS	Line-of-Sight
MASPS	Minimum Aviation System Performance Standards

Term	Definition
MOPS	Minimum Operational Performance Standards
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NASA ARD	NASA Aeronautics Research Mission Directorate
NextGen	Next Generation Air Transportation System
NOAA	National Oceanic and Atmospheric Administration
NSTC	National Science and Technology Council
NPRM	Notice of Proposed Rulemaking
PIC	Pilot-in-Command
QRT	Quick Reaction Test
R&D	Research and Development
RD&D	Research, Development and Demonstration
RF	Radio Frequency
SAA	Sense and Avoid
SARPs	Standards and Recommended Practices
SFAR	Special Federal Aviation Regulation
SPC	Senior Policy Committee
TOR	Terms of Reference
U.S.C.	United States Code
UA	Unmanned Aircraft
UAR	UAS Automation Roadmap
UAS	Unmanned Aircraft System
UAS-AI	Unmanned Aircraft Systems – Airspace Integration
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VLOS	Visual Line-of-Sight