11/26/13 Task Force Meeting: Minutes and Background Information

<TARGET><BILL></BILL><SUBJECT>11-26-13 Task Force Meeting Minutes and Background Information</SUBJECT><COMM>JUNM28</COMM></TARGET>

1 AGENDA
Draft bill and memos
Draft Report to Legislature

2 FAA Roadmap

3 FAA Comprehensive Plan

4 FAA Privacy Requirements

5 Commonwealth of Virginia
Law Enforcement Protocols

6 News Articles

7 Public Testimony

8 McDowell Group Economic Impact Study

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Unmanned Aircraft Systems Legislative Task Force

November 26, 2013 Meeting at Mat Su LIO

Task Force Members:

- Representative Shelley Hughes, Co-Chair
- Senator Donny Olson, Co-Chair
- Ginger Blaisdell, Staff to Rep. Hughes
- David Scott, Staff to Senator Donny Olson
- McHugh Pierre, Department of Military and Veterans' Affairs
- Greg Walker, University of Alaska Fairbanks
- Ro Bailey, University of Alaska Fairbanks
- Lieutenant Steve Adams, Commissioner Designee, Department of Public Safety
- Steve Strait, Aviation Advisory Board, Governor's Office and DOT/PF
- Steve Colligan, Representative Member for the Academy of Model Aeronautics

Guest Attendee:

- Kathleen Strasbaugh, Legislative Legal Services

AGENDA

1:00pm Welcome and Introductions — Representative Shelley Hughes

Task Force responsibilities per HCR6

The duties of the task force shall include (1) reviewing regulations and guidance from the Federal Aviation Administration regarding unmanned aircraft systems; (2) providing written recommendations, together with suggested legislation, for a comprehensive state policy for unmanned aircraft that protects privacy and allows the use of unmanned aircraft systems for public and private applications; and (3) submitting, not later than January 15, 2014, an initial report to the legislature and, not later than July 1, 2014, submitting a final report to the legislature.

Review of October 23 – 24, 2013 Task Force Meeting Minutes

Introduction of Items in Notebook and Online

Tab 1

- DRAFT Report to the Legislature (Jan 15, 2014)
- Draft legislation and accompanying memo

Tab 2 - FAA Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap
Tab 3 – FAA Unmanned Aircraft Systems (UAS) Comprehensive Plan
Tab 4 – FAA Draft Privacy Requirements
Tab 5 – Commonwealth of Virginia, Protocols for the Use of Unmanned Aircraft Systems (UAS) by Law Enforcement Agencies
Tab 6 – News articles
Tab 7 – Written public testimony

1:15pm **Public Testimony** **Representative Shelley Hughes**

In respect to the time limitation of the Task Force, public testimony will be limited to 3 minutes. We encourage anyone to provide additional testimony in writing to Rep.Shelley.Hughes@akleg.gov

2:30pm **Review of Legislation Work Draft**

Responses may be addressed by Kathleen Strasbaugh, Legislative Legal Services
Task Force recommendations to exclude any section of the bill work draft or include new section(s)

3:00pm **Review of Draft Report**

Task Force recommendations to exclude any section of report or include new information and formatting preferences.

4:00pm **Closing Remarks and Adjourn**

The Task Force will continue to finalize its report and legislation via email. The final report is due to the Legislature on January 15, 2014 and will be made available to the public at that time. The final bill will be made public at the time it is introduced to the legislature.

SITE: MatSu LIO	SUBJECT OF MEETING:	TESTIFY KEY:
COMMITTEE:	BILL#	Y = yes LO = Listen only ? = Available for questions
DATE:	UPDATE #:	

NAME	COMMUNITY	REPRESENTING/AFFILIATION	DO YOU WANT TO TESTIFY
Jamie Patterson-Simes - Public		please email info to: jsimes@alaska.net	
Public Testimony			
Mike Coons			
Dan Haam		- Citizen Review Panel	
Pat Martin			
JC Coffey		- NOAA work independent contractor	
Steve Poirot		- BP (first overland commercial operation)	

SITE: MatSu LIO	SUBJECT OF MEETING:	TESTIFY KEY:
COMMITTEE:	BILL#	Y = yes LO = Listen only ? = Available for questions
DATE:	UPDATE #:	

NAME	COMMUNITY	REPRESENTING/AFFILIATION	DO YOU WANT TO TESTIFY
Robert Hess	Palmdale, CA	Lockheed Martin, Advanced Dev. Prog.	No-LO/?

SITE: MatSu LIO	SUBJECT OF MEETING:	TESTIFY KEY:
COMMITTEE:	BILL#	Y = yes LO = Listen only ? = Available for questions
DATE:	UPDATE #:	

NAME	COMMUNITY	REPRESENTING/AFFILIATION	DO YOU WANT TO TESTIFY
JC Coffey	WASHINGTON	NOAA	Y
Kathleen Strausbaugh		Leg Liaison	

SITE: MatSu LIO	SUBJECT OF MEETING:	TESTIFY KEY:
COMMITTEE:	BILL#	Y = yes LO = Listen only ? = Available for questions
DATE:	UPDATE #:	

NAME	COMMUNITY	REPRESENTING/AFFILIATION	DO YOU WANT TO TESTIFY
David Palmer	Palmer	MatSu Aviation Adv Board / Alaska Aviation Coordination Council	LO - NO
Mike Coons	Palmer	self	Yes
Jen Hamm	Palmer	PEAK 3	~~written~~/NO
Barbara Johnson	Fairbanks	Fairbanks North Star Borough	NO
Daniel Hamm	Palmer	self	Yes
Jerri Sumpter	MATSU	Sen Lisa Murkowski Mat-Su Office	NO
Casey Steinau	Mat Su	Sen Mark Begich	NO
Patrick Martin	WASILLA	A.M.A	YES

SITE: ANC LIO COMMITTEE: JUNM DATE: 11/26/2013	SUBJECT OF MEETING: Bill # UPDATE #:	TESTIFY KEY: Y = yes LO = Listen only ? = Available for questions

NAME	COMMUNITY	REPRESENTING/AFFILIATION	DO YOU WANT TO TESTIFY
JC Coffey	Washington, DC	NOAA	Y
Sgt. Megoon	Colorado	US Airforce Base	LO
Josh Nadell	ANC	Chugach AK Native Corp	LO
Steve Perry		Peterson AFB	LO
Steve Poirot	ANC	BP	LO
Zach Wilkenson	JNU	Economic Council on Development	LO
Comm. Jason Mansour	Florida	NOAA	LO
Rep. Isaacson			
Rep. Hughes			
Cameron Eggers	ANC	Lt. Gv. Treadwell's Office	LO
David Scott	Ketchikan	Sen. Olson's Office	LO
Tracy Hegna		FAA,Congressional Liason for AK	

Carol Anderson	**ANC**		**LO**
Connie McKenzie			**LO**
Suzanna Caldwell			**LO**

Unmanned Aircraft Systems Legislative Task Force

October 24, 2013 Meeting at Anchorage LIO Room 220

Task Force Members:

- Representative Shelley Hughes, Co-Chair
- Senator Donny Olson, Co-Chair
- Ginger Blaisdell, Staff to Rep. Hughes
- David Scott, Staff to Senator Donny Olson
- McHugh Pierre, Department of Military and Veterans' Affairs
- Greg Walker, University of Alaska Fairbanks
- Ro Bailey, University of Alaska Fairbanks
- Lieutenant Steve Adams, Commissioner Designee, Department of Public Safety
- Steve Strait, Aviation Advisory Board, Governor's Office and DOT/PF
- Steve Colligan, Representative Member for the Academy of Model Aeronautics

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- Kathleen Strasbaugh, Legislative Legal Services

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LEGAL SERVICES

DIVISION OF LEGAL AND RESEARCH SERVICES
LEGISLATIVE AFFAIRS AGENCY
STATE OF ALASKA

(907) 465-3867 or 465-2450
FAX (907) 465-2029
Mail Stop 3101

State Capitol
Juneau, Alaska 99801-1182
Deliveries to: 129 6th St., Rm. 329

MEMORANDUM November 25, 2013

SUBJECT: Unmanned Aircraft Systems
(Work Order No. 28-LS1068\A)

TO: Representative Shelley Hughes
Attn: Ginger Blaisdell

FROM: Kathleen Strasbaugh
Legislative Counsel

This memo accompanies the draft bill you requested relating to legislation requested by the Task Force on Unmanned Aircraft Systems (Task Force) created by Legislative Resolve 17 (2013). I have attempted to cover the topics set out in the Task Force request -- however, for the most part, they do not lend themselves to state legislation, either because they are covered by federal law, for example, safety marking, or because legislation is not needed. For example, the University of Alaska's Center for Unmanned Aircraft Systems Integration arose from the University's already authorized research mission. Further, the issues raised by the list of topics will require substantial further policy direction. As a result, the draft is basically an outline that requires substantial detail for completion.

As requested by Ms. Blaisdell, I have also drafted two additional provisions that you would like to present to the Task Force which may be sent separately.

Encouraging a pilot training program at the University of Alaska Fairbanks.
The pilot training section encourages the University to establish a training program at the Fairbanks campus. However you may want to consider allowing the Board of Regents to determine where to place the program and whether to provide the course at more than one campus. Compare AS 14.40.080.

Establishment of a position to manage unmanned aircraft systems.
Rather than creating a particular position, I have drafted the function as a duty of the Commissioner of DOTPF. Since you want this co-ordination of functions to be performed by different state agencies, I considered placing the function in the governor's office. However, because the bill involves aircraft, and because the use of airfields is at issue, AS 02, Aeronautics, which is administered by the Department of Transportation and Public Facilities (DOTPF), seems a better fit. Because the University is already deeply engaged in the field, it too is a possibility. However, the effect of unmanned aircraft systems on other aviation operations already administered by DOTPF make

DOTPF a more appropriate choice.[1] The Task Force will need to decide what tasks will predominate and place the function accordingly. If the Task Force wants to assign certain functions to another department, additional work will be needed to assure that the assigned department has the necessary authority.

You also requested that the bill include a provision to prevent a vacancy in a particular position. The bill is currently drafted to assign the function to a commissioner who may designate a particular employee to perform the UAS manager function. The commissioner will be obligated to assure that the function is performed.

Requirement for high visibility marking; lighting requirements.
As I understand the federal regulatory scheme, unmanned aircraft systems (UAS) must meet federal marking requirements, unless the configuration of the aircraft is incompatible with existing regulations. 14 CFR 45.21. Currently the operator of a UAS must seek permission to depart from existing specifications if "due to the configuration of an aircraft, it is impossible for a person to mark it in accordance with §§ 45.21 and 45.23 through 45.33. . ." 14.CFR 45.22(d). *See* also Airworthiness Certification of Unmanned Aircraft Systems and Optionally Piloted Aircraft, FAA Order No. 8130.34C (August 2, 2013); Unmanned Aircraft Systems (UAS) Operational Approval, FAA Order No. 8900.227 (July 30, 2013), (governing the assessment of applications for certificates of airworthiness relating to, among other things, safety). I am not entirely certain, but it appears to me that any marking would be within the jurisdiction of the FAA to prescribe.

It is not clear to me whether the Task Force wanted to have safety provisions in addition to those prescribed by the FAA. This might be troublesome under the Supremacy Clause of art. VI, par. 2 of the United States Constitution, as aviation safety is an area in which Congress intends federal law to preempt state law. *Montalvo v. Spirit Airlines*, 508 F.3d 464, 470 - 71 (9th Cir. 2007). Is there some area of aviation safety not covered by federal law that the Task Force is concerned about? I assume that the Task Force did not want to duplicate federal law in this bill, but perhaps I misunderstand what is being requested.

Marketing responsibility for UAS industry; increasing business operations and educating the public.
I am not sure what the Task Force has in mind here. I included some generic language in the AS 02 provisions in the bill regarding UAS operations and promotion of the industry. Similar language is included in the mission of DOTPF in AS 44.42, and the provisions that require the affected agencies to co-operate in the endeavor.[2] I was not certain whether you wanted to specify the particulars of a marketing or educational program, or allow the department to develop a program with a general mandate. For now I have

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[1] DOTPF's current powers are duties, set out in AS 44.42, specifically include the supervision of aeronautics and air safety. *See also* AS 02.10, AS 02.15, and AS 02.30.

[2] Compare ch. 71, SLA 2013, which assigns one department responsibility for a function, and requires another department to cooperate in the endeavor.

added a provision to the powers and duties of the Department of Commerce, Community, and Economic Development related to the marketing and promotion of the UAS industry. If the task force envisions particular functions for other departments, new sections can be added to the legislation that specifically add those functions to those departments' statutory duties.

State internal review process for UAS; reporting requirements.
The draft contains a provision that requires the development of internal review of UAS missions. A section on this subject is included in proposed AS 02.45. It was not clear to me if the intention was to have reporting to a single authority, or to require an agency to have a procedure. I drafted the section on the assumption that it was the latter. You will want to decide what approvals are necessary. I included a provision requiring a commissioner's approval, but this may not be what you have in mind. Please let me know if the Task Force had a centralized review function in mind, and whether the Task Force would like to have the review performed before or after the mission. It might also be a good idea to decide whether you want to exempt emergency operations from the review if it is to occur before the mission.

Definitions relating to UAS operational technology.
I am not certain whether the Task Force wants to duplicate existing federal definitions, industry definitions, or definitions from another source. I have provided a definition of "unmanned aircraft systems" based in part on FAA terminology, but I don't have enough information to know what the Task Force wants covered. We usually don't include definitions of technical terms that do not otherwise appear in the draft.

Additional items.
The following items will be in a separate document, as you requested. For a citizen review board, I reviewed the background information you supplied from the University of North Dakota, but it addresses academic activity, and is not clear to me whether you really want to have each agency report to a single board. I drafted a bill section involving commissioner approval of activities previously reviewed under the internal review process in the main bill.

With respect to airspace over correctional facilities, I drafted a separate section and included a penalty. However, please note that a person can be charged with the more serious offenses of promoting contraband,[3] or being an accomplice to an escape or an attempted escape.[4] I have some concern that the new offense may overlap with existing law in some cases. Please advise if this is what you had in mind. The operator of a UAS may be able to challenge it as preempted by the FAA's comprehensive regulation of national airspace, but it may be that since the provision requires an intent to communicate

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[3] AS 11.56.375 and 11.56.380.

[4] AS 11.56.300 - 11.56.370. See also AS 11.16 (accomplice liability), AS 11.31.100 (attempt), AS 11.31.120 (conspiracy).

unlawfully with a prisoner, it will be upheld against a preemption challenge.

In summary, there are a number of areas where further policy direction is needed in order to develop meaningful legislation. Please let me know how I may be of further assistance.

KJS:lnd
13-372.lnd

Enclosure

28-LS1068\A
Strasbaugh
11/25/13

HOUSE BILL NO.

IN THE LEGISLATURE OF THE STATE OF ALASKA

TWENTY-EIGHTH LEGISLATURE - SECOND SESSION

BY REPRESENTATIVE HUGHES

Introduced:
Referred:

A BILL

FOR AN ACT ENTITLED

"An Act relating to unmanned aircraft systems."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

Innovation and Industry could include other industries of

*** Section 1.** AS 02 is amended by adding a new chapter to read:

Chapter 45. Unmanned Aircraft Systems.

Sec. 02.45.010. Duties and powers of department related to unmanned aircraft systems. (a) To provide for the development of an unmanned aircraft system industry and the safe use of unmanned aircraft systems in the state, the department shall cooperate with other state departments, the University of Alaska, and the Federal Aviation Administration and other agencies of the federal government for the purpose of

(1) managing the use of state facilities by unmanned aircraft systems;

(2) ensuring the safe use of unmanned aircraft systems in the state;

(3) promoting and marketing an unmanned aircraft system industry;

(4) educating the public about unmanned aircraft systems.

(b) The department may

(1) accept gifts, grants, or loans from and enter into contracts or other transactions with a federal agency, an agency or instrumentality of the state, a municipality, a private organization, or other source for the purposes set out in (a) of this section;

(2) construct, improve, and operate, in cooperation with the University of Alaska, facilities appropriate to meet the requirements of unmanned aircraft systems; and

(3) construct, provide, or improve public safety facilities related to unmanned aircraft systems.

Sec. 02.45.020. Coordination of uses of unmanned aircraft systems. (a) The commissioner shall coordinate governmental and civil uses of unmanned aircraft systems at state facilities.

(b) The commissioner may designate another employee of the department to coordinate governmental and civil uses of unmanned aircraft systems at state facilities.

Sec. 02.45.030. Internal review. The University of Alaska or a department that uses an unmanned aircraft system to conduct an activity shall develop a program for review of the activity that includes procedures for

(1) determining whether the activity is consistent with the public interest;

(2) ensuring that the activity is conducted in a manner that does not unnecessarily intrude on the privacy of a person;

(3) ensuring that the activity is carried out in a manner that is consistent with state and federal laws and regulations; and

(4) obtaining the approval of the president of the University of Alaska or the commissioner of the department using the unmanned aircraft system.

Sec. 02.45.090. Definitions. In this chapter,

(1) "commissioner" means the commissioner of transportation and public facilities;

(2) "department" means the Department of Transportation and Public Facilities;

(3) "unmanned aircraft system" means an unmanned aircraft that is

operated without direct human intervention from inside or on the aircraft and includes the associated support equipment, control station, data links, and telemetry, communications, and navigation equipment necessary to operate the unmanned aircraft.

* **Sec. 2.** AS 14.40 is amended by adding a new section to read:

Sec. 14.40.082. Unmanned aircraft pilot training. The University of Alaska may establish a training program in the operation of unmanned aircraft and unmanned aircraft systems and related fields at the Fairbanks campus.

* **Sec. 3.** AS 44.33.020(a) is amended by adding a new paragraph to read:

(46) in cooperation with the Department of Transportation and Public Facilities, assist in the development, promotion, and marketing of an unmanned aircraft system industry and the safe use of unmanned aircraft systems in the state under AS 02.45; in fulfilling that duty, the department may cooperate with other state departments, the University of Alaska, and the Federal Aviation Administration and other federal agencies.

* **Sec. 4.** AS 44.42.020(a) is amended to read:

(a) The department shall

(1) plan, design, construct, and maintain all state modes of transportation and transportation facilities and all docks, floats, breakwaters, buildings, and similar facilities;

(2) study existing transportation modes and facilities in the state to determine how they might be improved or whether they should continue to be maintained;

(3) study alternative means of improving transportation in the state with regard to the economic costs of each alternative and its environmental and social effects;

(4) develop a comprehensive, long-range, intermodal transportation plan for the state;

(5) study alternatives to existing modes of transportation in urban areas and develop plans to improve urban transportation;

(6) cooperate and coordinate with and enter into agreements with

federal, state, and local government agencies and private organizations and persons in exercising its powers and duties;

(7) manage, operate, and maintain state transportation facilities and all docks, floats, breakwaters, and buildings, including all state highways, vessels, railroads, pipelines, airports, and aviation facilities;

(8) study alternative means of transportation in the state, considering the economic, social, and environmental effects of each alternative;

(9) coordinate and develop state and regional transportation systems, considering deletions, additions, and the absence of alterations;

(10) develop facility program plans for transportation and state buildings, docks, and breakwaters required to implement the duties set out in this section, including but not limited to functional performance criteria and schedules for completion;

(11) supervise and maintain all state automotive and mechanical equipment, aircraft, and vessels, except vessels and aircraft used by the Department of Fish and Game or the Department of Public Safety; for state vehicles maintained by the department, the department shall, every five years, evaluate the cost, efficiency, and commercial availability of alternative fuels for automotive purposes, and the purpose for which the vehicles are intended to be used, and convert vehicles to use alternative fuels or purchase energy efficient vehicles whenever practicable; the department may participate in joint ventures with public or private partners that will foster the availability of alternative fuels for all automotive fuel consumers;

(12) supervise aeronautics inside the state, under AS 02.10;

(13) implement the safety and financial responsibility requirements for air carriers under AS 02.40;

(14) inspect weights and measures;

(15) at least every four years, study alternatives available to finance transportation systems in order to provide an adequate level of funding to sustain and improve the state's transportation system;

(16) provide for the development of an unmanned aircraft system industry and the safe use of unmanned aircraft systems in the state under

AS 02.45.

28-LS1068\A.1
Strasbaugh
11/25/13

AMENDMENT

OFFERED IN THE HOUSE BY REPRESENTATIVE HUGHES

TO: Work Draft 28-LS1068\A

Page 2, following line 25:

Insert a new section to read:

"**Sec. 02.45.040. Unmanned Aircraft Systems Review Board.** The Unmanned Aircraft Systems Review Board is created in the department. The board consists of

(1) the commissioner of transportation and public facilities or the commissioner's designee;

(2) the commissioner of commerce, community, and economic development or the commissioner's designee;

(3) the commissioner of military and veterans' affairs or the commissioner's designee;

(4) the commissioner of public safety or the commissioner's designee; and

(5) the president of the University of Alaska or the president's designee.

(b) A department or the University of Alaska may not use an unmanned aircraft system for an activity unless the use of unmanned aircraft systems for that activity has been reviewed and approved by the board.

(c) The Unmanned Aircraft Systems Review Board shall review an activity conducted by a department or the University of Alaska that uses an unmanned aircraft system. The board may approve the activity if

(1) the department or University of Alaska has conducted an internal review in accordance with AS 02.45.030 and approved the activity; and

(2) the board finds that the activity is in the best interest of the state."

Page 3, following line 4:

Insert a new bill section to read:

"* **Sec. 2.** AS 11.56 is amended by adding a new section to read:

Sec. 11.56.385. Unlawful flight of an unmanned aircraft system over a correctional facility. (a) A person commits the crime of unlawful flight of an unmanned aircraft system over a correctional facility if the person knowingly causes an unmanned aircraft system to fly over the airspace of a correctional facility with the intent to communicate with a prisoner in the correctional facility.

(b) In this section, "unmanned aircraft system" has the meaning given in AS 02.45.090.

(c) Unlawful flight of an unmanned aircraft system over a correctional facility is a class A misdemeanor."

Renumber the following bill sections accordingly.

LEGAL SERVICES

DIVISION OF LEGAL AND RESEARCH SERVICES
LEGISLATIVE AFFAIRS AGENCY
STATE OF ALASKA

(907) 465-3867 or 465-2450
FAX (907) 465-2029
Mail Stop 3101

State Capitol
Juneau, Alaska 99801-1182
Deliveries to: 129 6th St., Rm. 329

MEMORANDUM November 22, 2013

SUBJECT: Outline of Issues Requiring Task Force Police Choices for Legislation Concerning Unmanned Aerial Vehicles (Work Order No. 28-LS1068)

TO: Representative Shelley Hughes
Attn: Ginger Blaisdell

FROM: Kathleen S. Trasbaugh
Legislative Counsel

The draft legislation you have requested concerning unmanned aircraft systems (UAS) and the accompanying memo are in process, but as I mentioned in a voice message to Ms. Blaisdell, the estimated time of arrival is uncertain. As you will see when you receive the draft legislation and memo, there are a number of issues that cannot be fully addressed without further policy direction from the task force. This memo outlines those issues. Perhaps this outline will be of use in framing discussion of the legislation.

1. Unmanned aircraft systems manager position.

The task force requested that the bill establish a position that has the responsibility to coordinate among the federal, military, state, and private use of test sites. These functionalities should be assigned to the commissioner of a department, probably the Department of Transportation and Public Facilities (DOTPF).

a. *Where should the position be placed*?

On the assumption that the task force is concerned about managing UAS development in a coordinated fashion, you may want to establish the function in the Department of Transportation and Public Facilities, since it has statutory authority to manage aviation. However, the task force may have a different view. If the focus is on interdepartmental coordination, the governor's office may be the best place for the function. If the focus is exclusively on the test site applied for by the University of Alaska and the University's research mission, the University might be the best placement, provided any broader responsibilities are given to some other executive branch agency.

2. Requirement for high visibility marking; lighting requirements.

In my opinion, the FAA fully occupies the field of aviation safety in the national airspace, and that under the Supremacy Clause of the United States Constitution. Thus, if the state adopts safety laws addressing visibility and lighting, those laws may draw a

challenge on the basis of preemption. This is especially so where the FAA has already adopted specific rules regarding marking. However, if the task force does want to adopt standards in this area:

a. *Does the task force want a state agency to adopt regulations setting such standards, does it want particular standards enshrined in statute?*

b. *What are the standards the task force wishes to have adopted*?

3. Marketing responsibility for UAS industry; increasing business operations and educating the public.

a. *Do you want one department to manage all UAS related matters, or do you want to assign different tasks to different departments?*

DOTPF already has aviation authority, you may want to assign other functions to other departments.

b. *What functions are meant to increase business operations?*

The draft may assign marketing functions to the Department of Commerce, Community and Economic Development but it is not clear how you want the other functions performed.

4. State internal review process for UAS; reporting requirements.

a. *Do you want all agencies using UAS to submit reports to a central authority, or do you want each agency to have an internal review process?*

b. *Do you want to specify whether the review is to occur before or after the mission? If before, do you want to make an exception for emergencies?*

5. Definitions relating to UAS operational technology.

Generally, definitions are placed in statute to define terms that are used in the statute, and the topics you wish to have covered by the statute don't involve much of the technical terminology in use in the industry.

a. *Is there a technical topic you want covered in the bill?*

KJS:lnd
13-373.lnd

LEGAL SERVICES

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LEGISLATIVE AFFAIRS AGENCY
STATE OF ALASKA

(907) 465-3867 or 465-2450
FAX (907) 465-2029
Mail Stop 3101

State Capitol
Juneau, Alaska 99801-1182
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MEMORANDUM November 25, 2013

SUBJECT: Unmanned aircraft systems amendment (28-LS1068\A.1)

TO: Representative Shelley Hughes
Attn: Ginger Blaisdell

FROM: Kathleen Strasbaugh
Legislative Counsel

Regarding the provision you requested prohibiting the flight of unmanned aircraft systems over correctional facilities, there is a brief discussion of this in the main memo, but I wanted to add a note about a potential problem. It is not (to my knowledge) unlawful for a piloted vehicle (such as a helicopter, hang glider, etc.) to fly over a correctional facility with, for example, a banner, or leaflets, or otherwise communicate with a prisoner.

KJS:lnd
13-375.lnd

Enclosures

Ginger Blaisdell

From: Mulligan, Ben (DFG) <ben.mulligan@alaska.gov>
Sent: Wednesday, November 13, 2013 9:32 AM
To: Ginger Blaisdell
Subject: RE: legislative request from Rep Hughes

Ginger,

In examining the use of unmanned aircraft in hunting and fishing ADF&G has found at this time that additional statutes are not necessary to regulate their use. The use of unmanned aircraft for hunting and fishing can be governed by regulation and would need to be handled by either the Board of Fisheries or Game through their process. I have broken down how manned aircraft is currently managed from the perspectives of sport fishing, commercial fishing, and hunting and how that may or may not apply to unmanned aircraft for your reference.

Sport Fishing

In discussions with the Sport Fish Division we could not come up with a way in which an unmanned aircraft would be directly used to fish. There are potential ways in which a person could use an unmanned aircraft to assist in already approved methods of sport fishing but these are all anecdotal methods coming from other states. The other way in which they could be used is in the locating of fish to then fishing for them in a conventional way. This method is currently allowed when it comes to manned aircraft so unless the Board of Fisheries feels that unmanned aircraft shouldn't be used I don't suspect they will ban its use. In general when it comes to the methods and means in which sport fishing is regulated in Alaska the Board of Fisheries has to establish regulations giving that method and mean approval for use. So if a person thinks of a way to use an unmanned aircraft to sport fish that method would have to be approved by the Board of Fisheries before it can be legally used.

Commercial Fisheries

The main way in which unmanned aircraft could be used in commercial fisheries would be to be used to spot schools of fish for commercial fishermen to harvest. This spotting of schools of fish by conventional aircraft has been addressed by the Board of Fisheries over the years as the issue arose in certain areas and fisheries. For example, in the regulations pertaining to commercial fishing in the Bristol Bay area there is a regulation, 5 AAC 06.379, that states that "A person may not use or employ an aircraft to locate salmon for the commercial taking of salmon or to direct commercial fishing operations in the Bristol Bay area one hour before, during, and one hour after a commercial salmon fishing period." There are similar regulations in place for the Alaska Peninsula, Kodiak, Cook Inlet, and Prince William Sound areas also. These regulations would most likely also encompass the use of unmanned aircraft for the purposes of locating salmon for commercial harvest and so no additional regulations would be needed.

Hunting

The first idea in how an unmanned aircraft may be used is to actually hunt using the aircraft. As we had discussed in a follow up conversation to your inquiry, you stated that the FAA has said that there are existing rules in place which already prohibit weapons from being installed on civil aircraft which would encompass unmanned aircraft. Additionally, there is already existing in state statute is AS 16.05.797 which bans computer assisted remote hunting, adding another layer to a prohibition on using an unmanned aircraft to hunt. This leaves the use of unmanned aircraft to the spotting of game animals. In the traditional use of aircraft, same day airborne hunting has been banned in Alaska with some exceptions for Board of Game approved intensive management programs . The language contained within the ban only refers to a person being airborne, not the use of aircraft, so this would not cover unmanned aircraft. The Dept. of Law and DPS have discussed as to whether or not the prohibition on using "radio communication" to aid in the taking of game might bar the use of unmanned aircraft. Unamnned aircraft use a variety of different technology to send and receive signals and data so it may depend on the nuances of the particular situation in which an unmanned aircraft is used. The use of unmanned aircraft for spotting of game is largely an issue of fair chase and is best left to the discretion

of the Alaska Board of Game, who has authority to address this issue. Allowing the Board to use their discretion will allow the establishment of regulations that are tailored to address unique problems/issues associated with the use of unmanned aircraft across the state, similar to how the Board addresses similar issues through establishment of controlled use areas.

If you have any questions or need any follow up information please let me know.

Best regards,

Ben Mulligan
Legislative Liaison
ADF&G
(907) 267-2311

From: Ginger Blaisdell [mailto:Ginger.Blaisdell@akleg.gov]
Sent: Monday, October 28, 2013 10:16 AM
To: Mulligan, Ben (DFG)
Subject: legislative request from Rep Hughes

Good morning Ben,

You may know that Rep Hughes is co-chairing the Unmanned Aircraft Task Force and we are preparing legislation for the upcoming session. We don't have anything drafted for review yet but will share it with you when available.

A question from one of the task force members: Will additional law/regulation be needed regarding unmanned aircraft and hunting/fishing? Can you provide the task force with the department's position or concerns regarding unmanned aircraft use for recreational or commercial hunting/fishing?

Thanks

ginger

Legislative Task Force on Unmanned Aircraft Systems Report to the Legislature (January 15, 2014)

DRAFT November 25, 2013

Task Force Members

Representative Shelley Hughes, Co-Chair

Senator Donny Olson, Co-Chair

Lt. Steve Adams, Department of Public Safety

McHugh Pierre / Mike O'Hare, Department of Military and Veterans' Affairs

Greg Walker and Ro Bailey, Alaska Center for Unmanned Aircraft Systems Integration at the University of Alaska Fairbanks

Steve Colligan, Academy of Model Aeronautics – Alaska Chapter

Steve Strait, Aviation Advisory Board

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EXECUTIVE SUMMARY

The Legislative Task Force on Unmanned Aircraft Systems (UAS) was formed under House Concurrent Resolution No. 6 to review regulations and guidance regarding UAS and provide recommendations for a comprehensive state policy for unmanned aircraft that protects privacy and allows the use of unmanned aircraft systems for public and private applications.

Being sensitive to public concern, the Legislative Task Force on UAS (LTFUAS) reviewed multiple potential UAS scenarios focusing on economic development, law enforcement, anticipated mission types, and safety. The Task Force evaluated existing privacy laws for Alaska without recommending duplicative law for UAS, considered ways to encourage the economic development and safe uses of UAS in Alaska, and supported public education to reduce fear and embrace UAS to be used in life safety and other beneficial applications.

The Task Force concluded that the FAA is adequately addressing the safety concerns of integrating unmanned aircraft systems in the National Air Space (NAS). Existing guidelines clearly state the requirements of the aircraft, pilot training and responsibilities, and the expectations of the Test Sites (to be selected). The rules outlined in the guidelines provided the Task Force assurance that unmanned aircraft can be operated safely in Alaska.

The Task Force recommends the following:

- Law enforcement agencies adopt the IACP guidelines
- Formation of a public review panel to establish broad categories of approved UAS use
- Require high visibility paint scheme for aircraft

As we move forward, particularly but not exclusively in the event Alaska is chosen as an FAA test site for UAS Integration, LTFUAS further recommends immediate emphasis on:

1) management of the test ranges,
2) economic development opportunities, and
3) public education regarding UAS.

Shelley Hughes

Donny Olson

INTRODUCTION

The Legislative Task Force on Unmanned Aircraft Systems (UAS) was formed under House Concurrent Resolution No. 6 and charged with the duties of:

1. reviewing regulations and guidance from the Federal Aviation Administration (FAA) regarding UAS;

2. providing written recommendations, together with suggested legislation, for a comprehensive state policy for unmanned aircraft that protects privacy and allows the use of unmanned aircraft systems for public and private applications; and

3. submitting a final report to the legislature.

The Legislative Task Force on UAS (LTFUAS) met **[include dates]** twice via teleconference and twice in person to respond to the concerns Alaskans have raised regarding unmanned aircraft use in Alaska. This *DRAFT* report presents the findings of the Task Force as required by HCR6, SLA13. The LTFUAS:

1. reviewed regulations and guidance from the FAA, International Association of Chiefs of Police, and many other recommendations for UAS operations;

2. received hours of public testimony and written public testimony; and

3. compiled recommendations and suggested legislation for the use of unmanned aircraft systems for public and private applications in Alaska that are protective of privacy.

The result of these meetings is this Executive Summary, report of findings, and documentation supporting the decisions of the LTFUAS.

The LTFUAS considered two approaches to regulating the use of UAS in Alaska:

- Restrict the industry and adopt exemptions for specific kinds of approved uses, or
- Generally allow UAS operations in Alaska and adopt the necessary privacy, operations, and other guidelines that seem necessary to protect Alaskans.

The Task Force adopted the second approach and emphasized that educating the public will be an important part of integrating this technology safely and for the benefit of Alaskans.

The Task Force concluded that the FAA is adequately addressing the safety concerns of integrating unmanned aircraft systems in the National Air Space (NAS). FAA Guideline N 8900-227 spells out the details of operating UAS by clearly stating the requirements of the aircraft, pilot training and responsibilities, and the expectations of the Test Sites (to be selected). The rules outlined in the guidelines provided the Task Force assurance that unmanned aircraft can be operated safely in Alaska.

The FAA also recently released its Final Privacy Requirements, November 2013. The privacy document from the FAA clearly identified that while it governs the NAS, local governments will assume the responsibility of addressing privacy concerns.

Alaskans are fortunate to live in a state where the constitution and state law provide some of the greatest privacy protections compared to other states. As the Task Force reviewed multiple scenarios for misuse of the UAS, we determined that existing laws would apply, are sufficiently protective of privacy, and penalties are already in place to address inappropriate behavior.

When studying the many possible scenarios for misuse, the Task Force returned repeatedly to the premise that an unmanned aircraft is a tool; the operator needs to be considered for breaches of privacy or harming another.

This report presents the findings of the LTFUAS resulting from task force meetings, public testimony, research, and information from industry experts in pursuit of the assigned duties listed above.

Background

This technology is growing rapidly worldwide, and UAS are currently used across the United States for a variety of beneficial purposes. The Task Force approach is to responsibly embrace the positive uses without overregulating the industry and thus hindering economic opportunity. In addition to accepting the use of UAS in Alaska, the Task Force recognizes that public perception is greatly influenced through media reports, such as military flights in war zones. The public appear hesitant to allow UAS in Alaska due to fear of invasion of personal privacy and overreaching law enforcement.

REVIEW SUMMARY

"Since the early 1990s, unmanned aircraft systems (UAS) have operated on a limited basis in the National Airspace System (NAS). Until recently, UAS mainly supported public operations, such as military and border security operations. The list of potential uses is now rapidly expanding to encompass a broad range of other activities, including aerial photography, surveying land and crops, communications and broadcast, monitoring forest fires and environmental conditions, and protecting critical infrastructures.

The FAA created the Unmanned Aircraft Systems Integration Office to facilitate integration of UAS safely and efficiently into the NAS. Toward that goal, the FAA is collaborating with a broad spectrum of stakeholders, which includes manufacturers, commercial vendors, industry trade associations, technical standards organizations, academic

FAA 'Roadmap'

"Ultimately, UAS must be integrated into the NAS without reducing existing capacity, decreasing safety, negatively impacting current operators, or increasing the risk to airspace users or persons and property on the ground any more than the integration of comparable new and novel technologies."

institutions, research and development centers, governmental agencies, and other regulators."[1]

SAFETY GUIDELINES

The Task Force studied the FAA Guidelines for the Operations of Unmanned Aircraft Systems and participated in a presentation of the guidelines from Ro Bailey, Deputy Director of the Alaska Center for Unmanned Aircraft Systems Integration at the University of Alaska Fairbanks and comments from representatives of the FAA. Document number N 8900.227 provides the most current guidelines for federal approval of operating unmanned aircraft.[2]

The Task Force recognizes that the FAA manages the safety of the national airspace and has adopted extensive guidelines regarding aircraft certification, pilot training and certification, and approval process for flights (or missions). N 8900.227 also provides detailed requirements for the operations of pending test sites and the current approval of flights in designated areas for specific purposes. The FAA pre-approves UAS missions and awards a Certificate of Authorization (COA) that identifies the details of the mission. This process is tightly scrutinized, and the entity flying the UAS is accountable to the FAA under the details of the COA.

The COA approval process gives the Task Force confidence that safety of the national airspace is adequately considered and that UAS missions will not invade personal privacy or operate inappropriately.

It is the opinion of the Task Force that no additional statutory or regulatory requirements are needed for FAA-approved missions.

PRIVACY CONCERNS

Federal Aviation Administration Final Privacy Requirements, November 7, 2013

The FAA recently published its Final Privacy Requirements, Nov 7, 2013 (Appendix X) regarding unmanned aircraft. The FAA recognizes that there is substantial debate and difference of opinion among policy makers, industry, advocacy groups, and members of the public as to whether UAS operations at the Test Sites will raise novel privacy issues that are not adequately addressed by existing legal frameworks.

FAA Final Privacy Requirements

On February 22, 2013 the FAA published and requested public comment on the proposed privacy requirements for UAS test sites that the FAA will establish pursuant to the FAA Modernization and Reform Act of 2012.

The FAA received 99 comments through Regulations.gov and 53 comments through the public engagement session.

The public comments were grouped into ten categories, and the FAA provided a response to each category. You can view all categories, comments and responses in the document provided in Appendix X titled ...

[1] Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap. 2013. U.S. Department of Transportation, Federal Aviation Administration. First Edition—2013.

[2] FAA documents (2) [footnote-reference – get ref data]; Notice N 8900.227, Subj: Unmanned Aircraft Systems (UAS) Operation Approval. Effective Date 7/30/13, Cancellation Date 7/30/14.

Excerpts from the FAA Final Privacy Requirements:

There was substantial difference of opinion among commenters as to whether the UAS operations and manned aircraft operations present different privacy issues that justify imposing special privacy restrictions on UAS operations at the Test Sites. In addition, there was substantial difference of opinion regarding what elements would be appropriate for a Test Site privacy policy.

The FAA has determined that it should not impose privacy requirements beyond those in the Final Privacy Requirements for the following reasons. ***First****, there are many privacy laws and applications of tort law that may address some of the privacy issues that arise from UAS operations at the Test Sites.*

Second*, the FAA believes that the Test Sites operators will be responsive to local stakeholders' privacy concerns and will develop privacy policies appropriately tailored to each Test Site.* ***Third****, if UAS operations at a Test Site raise privacy concerns that are not adequately addressed by the Test Site's privacy policies, elected officials can weigh the benefits and costs of additional privacy laws or regulations. Forty-three states have already enacted or are considering legislation regulating use of UAS.*

Conclusion:

Based on the comments submitted, the FAA intends to require each Test Site operator to comply with all of the privacy requirements included in the Draft Privacy Requirements as well as the following additional privacy requirements:

Test Site Requirements

1. *Test site operators must maintain a record of all UAS operating in the test sites;*
2. *Test site operators must require every UAS operator in the Test Site to have a written plan for the operator's use and retention of data collected by the UAS; and*
3. *Test site operators must conduct an annual review of test site operations to verify compliance with stated privacy policy and practices and share those outcomes annually in a public forum with an opportunity for public feedback.*

1. *Test site operators must maintain a record of all UAS operating in the test sites;*
2. *Test site operators must require every UAS operator in the Test Site to have a written plan for the operator's use and retention of data collected by the UAS; and*
3. *Test site operators must conduct an annual review of test site operations to verify compliance with stated privacy policy and practices and share those outcomes annually in a public forum with an opportunity for public feedback.*

It is the opinion of the Task Force that privacy policy is adequate through the FAA requirements for the use of UAS in the Test Sites.

Privacy and Civil Liberties Consideration

The FAA is implementing a UAS test site program to help the FAA gain better understanding of operational issues relating to UAS. Although the FAA's mission does not include developing or

enforcing policies pertaining to privacy or civil liberties, experience with the UAS test sites will present an opportunity to inform the dialogue in the Interagency Policy Committee (IPC) and other interagency forums concerning the use of UAS technologies and the areas of privacy and civil liberties.

> *The Fourth Amendment is central to the privacy issues with respect to government UAS operation. Although the Supreme Court has never explicitly considered the question of UAS privacy, there is a long list of relevant precedents. Among them are several cases from the 1980s that specifically considered aerial observations and the Fourth Amendment.*

Homeland Security Privacy Impact Assessment

U.S. Customs and Border Protection (CBP) is responsible for guarding nearly 7,000 miles of land border, 2,000 miles of coastal waters and 95,000 miles of maritime border. CBP employs several types of aircraft to achieve its mission objectives including UAS. COAs have been authorized in Arizona, Texas, Florida and North Dakota. When deploying resources for operations, the Office of Air and Marine must determine the availability of aircraft type and the integration of the requested activity into its flight operations.

Homeland Security addressed privacy in the Privacy Impact Assessment published September 9, 2013. A summary of privacy concerns addressed in this document includes:

Homeland Security

95,000 miles of maritime border security includes joint operations with the United States Coast Guard. Some of those miles include Alaska coastline.

1. The collection and use of data from aerial surveillance remains within the scope of its authorities to protect the border and provide support for law enforcement for law enforcement activities, while continuing to preserve a person's right to privacy.
2. UAS present a perceived risk because they are able to fly for longer periods of time and conduct surveillance relatively undetected. While UAS can fly for longer periods of time, they are equipped with the same technology to conduct surveillance that is presently deployed on manned aircraft.
3. Concern for the security of the UAS itself and the potential for hijacking of the unmanned aircraft is managed by the close monitoring of ground control and satellite communication by encrypted data. If one ground station were to lose contact, a second ground station is equipped to pick up the UAS and continue operations.

Alaska State Law and Personal Privacy

The State of Alaska and its local governments cannot dictate the use of the national airspace but can consider rules that better define the FAA guidelines, can consider legal repercussion for entities found in violation of adopted laws, and can provide for specific privacy laws regarding the use of UAS in Alaska.

The State of Alaska Constitution provides privacy protection, "although not unlimited, has been held to be broader than the protection afforded by the United States Constitution. Both the Alaska Constitution and the Fourth Amendment to the United States Constitution require a warrant by a governmental agency for the search of a place where a person has a reasonable expectation of privacy."[3]

Although much attention regarding UAS privacy focuses on government use and the Fourth Amendment, it is non-governmental use that is likely to raise some of the most significant privacy challenges in coming years. For private entities, the key constitutional question is the extent of their First Amendment privilege to gather information.

Civil use of unmanned aircraft will fall under the federal and state laws including such provisions as trespassing, invasion of privacy, intrusion upon seclusion, publication of private facts, stalking and harassment, and business privacy.

The Task Force, with guidance from Legislative Legal Services, considered many scenarios of possible violations of state and federal law that might occur with the use of unmanned aircraft. The Legal Services memo outlining the areas of statute that protect personal privacy can be found in Appendix X.

Privacy protection scenarios considered by the Task Force include but are not limited to:

Legal Services

Constitutional Protection of Privacy: *The Constitution of the State of Alaska explicitly protects the right of privacy against government intrusion. Art. I, sec. 22 provides: "The right of the people to privacy is recognized and shall not be infringed. The legislature shall implement this section."*

Alaska Statutory Protections:

AS 11.41.270 Stalking, nonconsensual conduct prohibits monitoring by technical means

AS 11.61.116 Sending an explicit image of a minor

AS 11.61.120(a)(6) Harassment: publishing or distributing certain images

AS 11.61.123 Indecent viewing or photography

AS 11.76.113 Misconduct involving confidential information in the first degree

AS 11.76.115 Misconduct involving confidential information in the second degree

1. **If data is gathered by a government agency, it is a public record. However, AS 40.20.120 provides certain protections for private information. Use of inadvertently captured information in a criminal prosecution may depend on who captures the information and whether the person whose actions have been captured has a reasonable expectation of privacy.**

It was discussed that data captured by a UAS would be treated similarly to data captured by other technology such as cell phones, manned aircraft, satellite images, voice recorders, etc. Case law is substantial in determining if the person would be considered to have a reasonable expectation of privacy and when a warrant would be required to obtain and use any data collected.

2. **As technology continues to advance beyond 'normal' application of current laws, drafting new laws must adopt a balanced approach that recognizes the inherent difficulty in predicting the future.**

[3] Legal memo [footnote-reference – get ref data]

The Task Force determined that we cannot foresee the future applications of technology (of UAS or other technologies) therefore, creating restrictions in law based on assumptions is not recommended.

3. How should Alaska manage unintentionally captured images or data?

Discussion concluded that there are adequate statute, case law and data retention guidelines that resolved the concerns of the Task Force.

Observations From Above: UAS and Privacy

This document was published in the Harvard Journal of Law and Public Privacy by John Villasenor, a senior fellow in Governance Studies and the Center for Technology Innovation, the Brookings Institution.

The Task Force discussed many of the scenarios posed by the author when considering the need for Alaska law.

4. The tie between safety and privacy is tightest with respect to rules requiring the operator of a UAS to be able to see the aircraft at all times. Public UAS operated in association with the expedited authorizations in Section 334(c)(2)(C) of FMRA have a "line of sight" requirement.

The Task Force assumes that FAA regulations adopted in the next several years will continue to require visual line of sight operation. "Sense and avoid" technology will become more mature and some non-line-of-sight missions may be permitted by the FAA. Non-line-of-sight operations and other unknown technological advances may bring new challenges that will require the legislature to review industry guidelines and state laws in the future.

5. Unmanned aircraft may bring efficient advances to law enforcement; however, the public seems to be highly sensitive to law enforcement using unmanned aircraft.

After reviewing many possible uses of UAS, the Task Force determined that existing law already affords the public with adequate protections.

- Routine Technology: The use of UAS is treated much the same as any other technological tool used to protect the public. The Department of Public Safety has adopted the IACP Guidelines for UAS, and the Task Force found those guidelines to be superior for rules of law enforcement use.
- Public Navigable Airspace: The question of what constitutes "public navigable airspace" for UAS operated by the government is central to privacy policy. The Task Force found that almost every law enforcement scenario discussed was already protected by existing law.
- Role of Imaging Technology: Rules and case law exist that protect citizens from inappropriate use of capturing data that is a "great more than the human eye could ever see."

Law Enforcement

Public protection will benefit greatly from unmanned aircraft for the purposes of search and rescue, crash scene documentation time, natural disaster monitoring, wildfire management, amber and silver alerts, hostage situations and other life safety extremes. Some efforts will require warrants to proceed and some will be allowed under a COA.

- Extended Surveillance: Law enforcement does not intend to use UAS for standard patrol activities at this time. Limiting flight hours was not seen as an acceptable control because long flights may be necessary in the event of search and rescue or natural disaster remediation operations.
- Obtaining a Warrant: After much discussion, it was decided that using UAS to gather data would require a warrant in similar situations as using any other data gathering device (such as voice recording, photography, and thermal imaging with manual technology). No additional laws are required to obtain a warrant for UAS data gathering.
- Under no circumstance would a UAS be armed. FAA guidelines do not allow anything to be dropped from an unmanned aircraft.
- Law enforcement is planning to use high-visibility marking on any UAS they will use. Application of lights and/or hi-vis paint is being considered.
- It is apparent that public education is necessary for all agencies using UAS but sensitivity is heightened for law enforcement uses.

It is the opinion of the Task Force that existing privacy laws are adequate to govern the use of unmanned aircraft.

It is the opinion of the Task Force that if Alaska is chosen as one of the FAA Test Sites, we will have the opportunity to participate in the use of UAS in a variety of ways that would put Alaska in the position to establish policy guiding the use of UAS for the rest of the United States to consider.

Voluntary Approaches

The International Association of Chiefs of Police (IACP) adopted model guidelines for the use of UAS for law enforcement purposes.

The Association for Unmanned Vehicle Systems International (AUVSI) Code of Conduct calls for a commitment to "respect the privacy of individuals."

Academy of Model Aeronautics has also adopted operational policies and guidelines for advanced flight systems used in radio controlled model aircraft.

Self-Regulation by Three National Organizations

The Task Force adopted the IACP with one modification and excerpts from the AUVSI Code of Conduct.

IACP – International Association of Chiefs of Police
Recommended Guidelines for the use of Unmanned Aircraft was adopted in August 2012. The Alaska Department of Public Safety has also adopted these guidelines as their doctrine with the exception of increasing the flight approval responsibility from a "supervisor" to the director's office.

AUVSI – Association for Unmanned Vehicle Systems International; "As an industry, it is incumbent upon us to hold ourselves and each other to a high professional and ethical standard. As with any revolutionary technology, there will be mishaps and abuses; however, in order to operate safely and gain public acceptance and trust, we should all act in accordance with these guiding themes and do so in an open and transparent manner. We hope the entire UAS industry will join AUVSI in adopting this industry Code of Conduct."

AMA – Academy of Model Aeronautics Policies for Radio Controlled Model Aircraft Operations Utilizing First Person View, Failsafe, Stabilization and Autopilot Systems guides model aircraft operators.

The same way that the FAA does not regulate model aeronautics, the Task Force does not intend to adopt requirements of hobbyist activities using UAS.

It was discussed that a notice should be provided at the time of purchase of each model aircraft to review the AMA flight operation guidelines for appropriate use of model aeronautics. The Task Force did not adopt a requirement for notice regarding hobbyists because so many aircraft are purchased outside of Alaska and would not be required to provide the notice.

[Need to add something about integrating model aeronautics and UAS policy.]

1. Should Alaska adopt some industry-relevant voluntary approaches of self-managed rules of UAS?

International Association of Chiefs of Police Guidelines for UAS, AUVSI Code of Conduct, and the Academy of Model Aeronautics rules were considered and generally accepted by the Task Force.

Technical Operations Guidelines

International Civil Aviation Organization (ICAO), a special agency of the United Nations, promotes "the safe and orderly development of international civil aviation throughout the world. It sets standards and regulations necessary for aviation safety, security, efficiency, and regularity, as well as aviation environmental protection."

The goal of the ICAO in addressing unmanned aviation is to provide the fundamental international regulatory framework to support routine operation of UAS throughout the world in a safe, harmonized, and seamless manner comparable to that of manned operations.

"A number of Civil Aviation Authorities have adopted the policy that UAS must meet the equivalent levels of safety as manned aircraft... In general, UAS should be operated in accordance with the rule governing the flight of manned aircraft and meet equipment requirements applicable to the class of airspace within which they intent to operate... To safely integrate UAS in non-segregated airspace, the UAS must act and respond as manned aircraft do. Air Traffic, Airspace and Airport standards should not be significantly changed. The UAS must be able to comply with existing provisions to the greatest extent possible."[4]

UAS Operations Guidelines

Technical rules for operating unmanned aircraft systems are clearly identified at a global and federal level. "A number of Civil Aviation Authorities have adopted the policy that UAS must meet the equivalent levels of safety as manned aircraft..."

FAA Guidelines for the Operations of Unmanned Aircraft N 8900-227 specifically sets the rules for the technical operations of flying unmanned aircraft.

The FAA has established guidelines for the certification and airworthiness of the aircraft, certification of the pilot including additional instruction in operating specific UAS, flight operations

[4] Roadmap page 11 [get footnote ref data]

with the Test Sites, management of the Test Site and certificates of authorization for particular missions.

The Task Force is confident in the FAA guidelines in protecting the safety of the national airspace.

UAF Center for Unmanned Aircraft Systems Integration, RT&D is a nationally recognized program that has shown responsible use of UAS for more than ten years. The University has applied to the FAA to be selected as one of the six federal test sites.

(Was selected as one of the FAA's six Test Sites... December 31, 2013)

Benefits to Alaska

Economic Benefit

Policy Development

Expedited Timeline for Test Range Use and Approved Missions

Encourage UAF pilot training program for UAS

Hi-vis markings for law enforcement

Insurance for civil operators (license and bonding)

Education – public awareness

Market Alaska "open for business" for UAS

Audits of missions – FAA Privacy Policy requirement

Test Site operations manager position – FAA Privacy Policy requirement also requires a Chief Privacy Officer at Test Site

Incentive grants

Research appropriation to UAF

Definitions

University of Alaska Fairbanks Center for Unmanned Aircraft Systems Integration, Research Testing and Development

The University of Alaska Fairbanks has been involved in UAS missions for more than ten years. It has participated in research and data gathering operations from Prudhoe Bay to South Africa.

The Alaska Legislature indicated its support in the University's efforts by passage of HCR6 in the 2013 session. The resolution identified many of the good uses of UAS in Alaska and established this task force to recommend statutory changes.

RECOMMENDATIONS

The Task Force supports its recommendations to the legislature by considering and adopting general guidelines from the following reports from the FAA: (1) Guidelines for Operations of UAS N 8900-227, (2) Comprehensive Plan to integrate UAS in National Airspace, and (3) Final Privacy Requirements. The Task Force also adopted the International Association of Chiefs of Police (IACP) UAS Guidelines as appropriate rules for law enforcement in Alaska (Appendix A).

In addition to the FAA documents, the Task Force considered a report from Legal Services that identified Alaska's privacy laws and Constitutional protections of privacy to determine if there might be a scenario created through the use of UAS that would not be protected by existing privacy laws. The Task Force also recognized that in the event Alaska is chosen as an FAA test site for UAS Integration, an emphasis on management of the test ranges, economic development, and public education needed immediate attention.

In summary, the Task Force recommends the following:

- law enforcement agencies adopt the IACP guidelines
- form a public review panel that will establish broad categories of approved UAS use
- require high visibility paint scheme for aircraft
- If Alaska is chosen as an FAA Test Site for UAS Integration, emphasize
    - management of the test ranges,
    - economic development opportunities, and
    - public education regarding UAS.

Appendix X

Unmanned Aircraft System Operations Industry "Code of Conduct"

Unmanned Aircraft System Operations

Industry "Code of Conduct"

The emergence of unmanned aircraft systems (UAS) as a resource for a wide variety of public and private applications quite possibly represents one of the most significant advancements to aviation, the scientific community, and public service since the beginning of flight. Rapid advancements in the technology have presented unique challenges and opportunities to the growing UAS industry and to those who support it. The nature of UAS and the environments which they operate, when not managed properly, can and will create issues that need to be addressed. The future of UAS will be linked to the responsible and safe use of these systems. Our industry has an obligation to conduct our operations in a safe manner that minimizes risk and instills confidence in our systems.

For this reason, the Association for Unmanned Vehicle Systems International (AUVSI), offers this Code of Conduct on behalf of the UAS industry for UAS operation. This code is intended to provide our members, and those who design, test, and operate UAS for public and civil use, a set of guidelines and recommendations for safe, non-intrusive operations. Acceptance and adherence to this code will contribute to safety and professionalism and will accelerate public confidence in these systems.

The code is built on three specific themes: Safety, Professionalism, and Respect. Each theme and its associated recommendations represent a "common sense" approach to UAS operations and address many of the concerns expressed by the public and regulators. This code is meant to provide UAS industry manufacturers and users a convenient checklist for operations and a means to demonstrate their obligation to supporting the growth of our industry in a safe and responsible manner. By adopting this Code, UAS industry manufacturers and users commit to the following:

Safety

- We will not operate UAS in a manner that presents undue risk to persons or property on the surface or in the air.
- We will ensure UAS will be piloted by individuals who are properly trained and competent to operate the vehicle or its systems.
- We will ensure UAS flights will be conducted only after a thorough assessment of risks associated with the activity. This risks assessment will include, but is not limited to:
- Weather conditions relative to the performance capability of the system
- Identification of normally anticipated failure modes (lost link, power plant failures, loss of control, etc.) and consequences of the failures
- Crew fitness for flight operations

- Overlying airspace, compliance with aviation regulations as appropriate to the operation, and off-nominal procedures
- Communication, command, control, and payload frequency spectrum requirements
- Reliability, performance, and airworthiness to established standards
- Professionalism
- We will comply with all federal, state, and local laws, ordinances, covenants, and restrictions as they relate to UAS operations.
- We will operate our systems as responsible members of the aviation community.
- We will be responsive to the needs of the public.
- We will cooperate fully with federal, state, and local authorities in response to emergency deployments, mishap investigations, and media relations.
- We will establish contingency plans for all anticipated off-nominal events and share them openly with all appropriate authorities.

Respect

- We will respect the rights of other users of the airspace.
- We will respect the privacy of individuals.
- We will respect the concerns of the public as they relate to unmanned aircraft operations.
- We will support improving public awareness and education on the operation of UAS.

As an industry, it is incumbent upon us to hold ourselves and each other to a high professional and ethical standard. As with any revolutionary technology, there will be mishaps and abuses; however, in order to operate safely and gain public acceptance and trust, we should all act in accordance with these guiding themes and do so in an open and transparent manner. We hope the entire UAS industry will join AUVSI in adopting this industry Code of Conduct.

Appendix XX

INTERNATIONAL ASSOCIATION OF CHIEFS OF POLICE

AVIATION COMMITTEE

Recommended Guidelines for the use of Unmanned Aircraft

BACKGROUND:

Rapid advances in technology have led to the development and increased use of unmanned aircraft. That technology is now making its way into the hands of law enforcement officers nationwide.

We also live in a culture that is extremely sensitive to the idea of preventing unnecessary government intrusion into any facet of our lives. Personal rights are cherished and legally protected by the Constitution. Despite their proven effectiveness, concerns about privacy threaten to overshadow the benefits this technology promises to bring to public safety. From enhanced officer safety by exposing unseen dangers, to finding those most vulnerable who may have wandered away from their caregivers, the potential benefits are irrefutable. However, privacy concerns are an issue that must be dealt with effectively if a law enforcement agency expects the public to support the use of UA by their police.

The Aviation Committee has been involved in the development of unmanned aircraft policy and regulations for several years. The Committee recommends the following guidelines for use by any law enforcement agency contemplating the use of unmanned aircraft.

DEFINITIONS:

1. Model Aircraft - A remote controlled aircraft used by hobbyists, which is manufactured and operated for the purposes of sport, recreation and/or competition.
2. Unmanned Aircraft (UA) – An aircraft that is intended to navigate in the air without an on-board pilot. Also called Remote Piloted Aircraft and "drones."
3. UA Flight Crewmember - A pilot, visual observer, payload operator or other person assigned duties for a UA for the purpose of flight.
4. Unmanned Aircraft Pilot - A person exercising control over an unmanned aircraft during flight.

COMMUNITY ENGAGEMENT:

1. Law enforcement agencies desiring to use UA should first determine how they will use this technology, including the costs and benefits to be gained.
2. The agency should then engage their community early in the planning process, including their governing body and civil liberties advocates.
3. The agency should assure the community that it values the protections provided citizens by the U.S. Constitution. Further, that the agency will operate the aircraft in full compliance

with the mandates of the Constitution, federal, state and local law governing search and seizure.

4. The community should be provided an opportunity to review and comment on agency procedures as they are being drafted. Where appropriate, recommendations should be considered for adoption in the policy.
5. As with the community, the news media should be brought into the process early in its development.

SYSTEM REQUIREMENTS:

1. The UA should have the ability to capture flight time by individual flight and cumulative over a period of time. The ability to reset the flight time counter should be restricted to a supervisor or administrator.
2. The aircraft itself should be painted in a high visibility paint scheme. This will facilitate line of sight control by the aircraft pilot and allow persons on the ground to monitor the location of the aircraft. This recommendation recognizes that in some cases where officer safety is a concern, such as high risk warrant service, high visibility may not be optimal. However, most situations of this type are conducted covertly and at night. Further, given the ability to observe a large area from an aerial vantage point, it may not be necessary to fly the aircraft directly over the target location.
3. Equipping the aircraft with weapons of any type is strongly discouraged. Given the current state of the technology, the ability to effectively deploy weapons from a small UA is doubtful. Further, public acceptance of airborne use of force is likewise doubtful and could result in unnecessary community resistance to the program.
4. The use of model aircraft, modified with cameras, or other sensors, is discouraged due to concerns over reliability and safety.

OPERATIONAL PROCEDURES:

1. UA operations require a Certificate of Authorization (COA) from the Federal Aviation Administration (FAA). A law enforcement agency contemplating the use of UA should contact the FAA early in the planning process to determine the requirements for obtaining a COA.
2. UA will only be operated by personnel, both pilots and crew members, who have been trained and certified in the operation of the system. All agency personnel with UA responsibilities, including command officers, will be provided training in the policies and procedures governing their use.
3. All flights will be approved by a supervisor and must be for a legitimate public safety mission, training, or demonstration purposes.

4. All flights will be documented on a form designed for that purpose and all flight time shall be accounted for on the form. The reason for the flight and name of the supervisor approving will also be documented.
5. An authorized supervisor/administrator will audit flight documentation at regular intervals. The results of the audit will be documented. Any changes to the flight time counter will be documented.
6. Unauthorized use of a UA will result in strict accountability.
7. Except for those instances where officer safety could be jeopardized, the agency should consider using a "Reverse 911" telephone system to alert those living and working in the vicinity of aircraft operations (if such a system is available). If such a system is not available, the use of patrol car public address systems should be considered. This will not only provide a level of safety should the aircraft make an uncontrolled landing, but citizens may also be able to assist with the incident.
8. Where there are specific and articulable grounds to believe that the UA will collect evidence of criminal wrongdoing and if the UA will intrude upon reasonable expectations of privacy, the agency will secure a search warrant prior to conducting the flight.

IMAGE RETENTION:

1. Unless required as evidence of a crime, as part of an on-going investigation, for training, or required by law, images captured by a UA should not be retained by the agency.
2. Unless exempt by law, retained images should be open for public inspection.

2

Press Release – FAA Releases Unmanned Aircraft Systems Integration Roadmap

For Immediate Release

November 7, 2013
Contact: Les Dorr or Alison Duquette
Phone: (202) 267-3883

Also Finalizes Privacy Policy for UAS Test Sites

WASHINGTON –The U.S. Department of Transportation's Federal Aviation Administration (FAA) today released its first annual Roadmap outlining efforts needed to safely integrate unmanned aircraft systems (UAS) into the nation's airspace. The Roadmap addresses current and future policies, regulations, technologies and procedures that will be required as demand moves the country from today's limited accommodation of UAS operations to the extensive integration of UAS into the NextGen aviation system in the future.

"Government and industry face significant challenges as unmanned aircraft move into the aviation mainstream," said U.S. Transportation Secretary Anthony Foxx. "This Roadmap is an important step forward that will help stakeholders understand the operational goals and safety issues we need to consider when planning for the future of our airspace."

The Roadmap outlines the FAA's approach to ensuring that widespread UAS use is safe, from the perspective of accommodation, integration, and evolution. The FAA's main goal for integration is to establish requirements that UAS operators will have to meet in order to increase access to airspace over the next five to 10 years. The Roadmap discusses items such as new or revised regulations, policies, procedures, guidance material, training and understanding of systems and operations to support routine UAS operations.

"The FAA is committed to safe, efficient and timely integration of UAS into our airspace," said FAA Administrator Michael Huerta. "We are dedicated to moving this exciting new technology along as quickly and safely as possible."

The Roadmap also addresses the evolution of UAS operations once all requirements and standards are in place and are routinely updated to support UAS operations as the National Airspace System evolves over time. The document stresses that the UAS community must understand the system is not static, and that many improvements are planned for the airspace system over the next 15 years.

The FAA plans to select six UAS test sites to begin work on safely integrating UAS into the airspace. These congressionally-mandated test sites will conduct critical research into how best to safely integrate UAS systems into the national airspace over the next several years and what certification and navigation requirements will need to be established.

The use of UAS, both at the designated test sites and in the national airspace generally, raises the issue of privacy and protection of civil liberties. In February, the FAA asked for public comments specifically on the draft privacy requirements for the six test sites. Today, the agency sent a final privacy policy to the *Federal Register* that requires test site operators to comply with federal, state, and other laws on individual privacy protection, to have a publicly available privacy plan and a written plan for data use and retention, and to conduct an annual review of privacy practices that allows for public comment. Information about the test site selection process and final test site privacy policy is available at: http://www.faa.gov/about/initiatives/uas/

For the next several years, the FAA will continue to use special mitigations and procedures to safely accommodate limited UAS access to the nation's airspace on a case-by-case basis. The Roadmap notes that this case-by-case accommodation will decline significantly as integration begins and expands, but will continue to be a practical way to allow flights by some UAS operators in certain circumstances.

In addition to the FAA's Roadmap, as required in the 2012 FAA Reauthorization, the Joint Planning and Development Office (JPDO) has developed a comprehensive plan to safely accelerate the integration of civil UAS into the national airspace system.. That plan details a multi-agency approach to safe and timely UAS integration and coordination with the NextGen shift to satellite-based technologies and new procedures.

The UAS Roadmap (PDF) and UAS Comprehensive Plan is available on our website.

"UAS Roadmap"
Michael Huerta, Washington, DC
November 7, 2013

AIA – Unmanned Aircraft Systems Forum

Remarks as Prepared for Delivery

Good morning, Marion, and thank you for that introduction. It's great to be here today.

Aviation and aerospace hold a special place in the American consciousness. They are a symbol of American innovation. And innovation is what makes this country grow and prosper.

As we move into the second century of flight, we are transforming our airspace to take advantage of technological breakthroughs, and to maintain our position as a global leader. Through NextGen, we are transitioning from a system of ground-based radar and navigational aids, to a system that uses satellites and GPS for greater precision, more direct routes, greater fuel efficiency and better predictability.

NextGen is about taking the enormous advances that are taking place today in communications, computing and navigation, and incorporating these advances into our nation's aviation system.

With the growth of the Internet, of data-sharing, and of precise mapping, we have no choice but to leverage these benefits in the world of flight. NextGen is bringing these advances to aviation and allowing us to create the airspace of the future. And in that airspace of the future, we will have new users. We will have more commercial space launches and we'll have more unmanned aircraft systems. As you know, it requires significant work to build consensus on how to safely integrate game-changing technologies such as these.

I'm pleased to say that we have made solid progress. Today I would like to announce that the FAA has released its first Unmanned Aircraft Systems roadmap. This document, developed with key stakeholders, outlines what we need to do to safely integrate unmanned aircraft into our national airspace. It provides a five-year outlook and will have annual updates.

The roadmap addresses the policies, the regulations, the technologies, and procedures that we will need to integrate unmanned aircraft on a routine basis. To accomplish this, we must change the way we do business. We have operational goals as well as safety issues that we must consider when planning to expand the use of unmanned aircraft.

As the provider of air traffic services, we must ensure the safety and efficiency of the entire airspace, including all aircraft, people and property – both manned and unmanned – in the air and on the ground.

Unmanned aircraft are inherently different from manned aircraft. They run a very wide range, with a number of different physical and operational characteristics. Some are the size of a fist, and fly at low altitudes. Others have glider-like bodies with the wing span of a 737 and can fly above 60,000 feet. Many can fly longer and hover longer than manned aircraft. They are also lighter and slower than traditional aircraft and have more lift and not as much drag. What unites them all is that the pilot is on the ground and not on board the aircraft.

Our FAA forecast estimates that we can expect 7,500 small unmanned aircraft in our national airspace in the next five years, provided the regulations are in place to handle them.

Right now, almost all of the unmanned aircraft operations we approve for public use and research purposes are on a case by case basis.

For the last two decades, the FAA has authorized the limited use of unmanned aircraft for important missions in the public interest. These include firefighting, disaster relief, search and rescue, law enforcement, border patrol, military training, and testing and evaluation.

About 80 law enforcement agencies operate unmanned aircraft now under special certificates of authorization. Universities also use unmanned aircraft for research into weather, agriculture, and industrial uses.

And more recently, in September, the first commercial flight of an unmanned aircraft took place in the rainy skies above the Arctic Circle. A Scan Eagle completed a 36-minute flight to view marine mammals and survey ice. These surveys are needed to meet environmental and safety requirements before drilling on the sea floor.

This flight was coordinated by ConocoPhillips, the FAA, the manufacturer of the Scan Eagle, and other federal and international agencies. This Arctic region is the only area to date where we have authorized the use of small unmanned aircraft for commercial purposes.

In moving forward, we recognize that the expanded use of unmanned aircraft presents great opportunities, but it's also true that integrating these aircraft presents significant challenges.

There are operational issues that we need to address, such as pilot training. We also need to make sure that unmanned aircraft sense and avoid other aircraft, and that they operate safely if they lose the link to their pilot.

This is why developing more test data is so important. By the end of the year, we plan to choose six test sites for civil unmanned aircraft. Congress required us to do so, and we need to make sure we use these sites to obtain the best data that we can. The test sites will provide invaluable information to help us develop policies and procedures to ensure safe, responsible and transparent integration.

Today, we are also releasing the privacy policy that will apply to the UAS test sites. This policy requires operators to comply with all local, state and federal laws concerning privacy and civil liberties. We're requiring the test site operators to create a privacy policy that is available to the public. And they must require anyone operating unmanned aircraft at the test sites to have a written plan for how they will use and retain any test data acquired. On a broader level, agencies across the government are coming together to work on privacy issues that may arise with the increasing use of unmanned aircraft beyond these test sites.

Our airspace system is not static. And it's important for industry to understand that unmanned operations will evolve over time.

In addition to the roadmap, the Department of Transportation is releasing a Comprehensive Plan that dovetails with the FAA's roadmap. This Comprehensive Plan details the multi-agency approach to the safe and timely integration of unmanned aircraft. The plan establishes goals to integrate both small and larger unmanned aircraft, and to foster America's leadership in advancing this technology.

All three of these new documents – the Comprehensive Plan, the Roadmap and the privacy policy for the test sites – are available today on our web site at FAA.GOV.

We are dedicated to working with stakeholders in this growing industry and with our government partners – the Departments of Defense and Homeland Security, as well as NASA and the Joint Planning and Development Office – to define parameters to safely integrate these very diverse systems into the world's most complex airspace.

Rest assured the FAA will fulfill its statutory obligations to integrate unmanned systems. But we must fulfill those obligations in a thoughtful, careful manner that ensures safety and promotes economic growth.

While aviation is unquestionably an industry known for innovation, it is also an industry with a strong history of collaboration between government and industry. This collaboration has enabled us to achieve a position of international leadership. The U.S. is recognized as the "gold standard" for aviation safety, efficiency and technology.

And we need to keep it that way.

Together, we need to address the many areas where we need standards for these new unmanned aircraft. This includes standards for manufacturing and standards for pilot training.

We have a challenging task ahead and we all have a stake in this goal.

For us to be effective, funding for the government needs to happen in a predictable and reliable way so that we can consistently work towards the greater good. Short-term, stop-gap funding is no way to run a government or an aviation system.

We must move forward with NextGen and the rollout of new technologies, such as modern communications, navigation, and surveillance systems for our nation's airspace. The integration of unmanned aircraft relies on these kinds of NextGen advancements. We are building a complex and inter-related airspace. We need to join together again and vocally support the priorities that we have established.

By working together, government and industry will overcome the challenges that face us, and open the door to a more diverse and dynamic aviation future.

Thank you.

U.S. Department
of Transportation
**Federal Aviation
Administration**

Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap

First Edition – 2013

November 7, 2013

Dear Members of the Aviation Community:

I am pleased to present the Federal Aviation Administration's (FAA) Roadmap for *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS)*. The FAA and the UAS Aviation Rulemaking Committee (ARC) worked together for the past year to produce this roadmap. Unmanned aircraft offer new ways for commercial enterprises and public operators to increase operational efficiency, decrease costs, and enhance safety; and this roadmap will allow us to safely and efficiently integrate them into the NAS.

The FAA is committed to the safe and efficient integration of UAS into the NAS. However, as safety is our top priority, UAS integration must be accomplished without reducing existing capacity, decreasing safety, impacting current operators, or placing other airspace users or persons and property on the ground at increased risk. We have made great progress in accommodating public UAS operations, but challenges remain for the safe, long-term integration of both public and civil UAS in the NAS.

This roadmap outlines the actions and considerations needed to enable UAS integration into the NAS. The roadmap also aligns proposed FAA actions with Congressional mandates from the *FAA Modernization and Reform Act of 2012*. This plan also provides goals, metrics, and target dates for the FAA and its government and industry partners to use in planning key activities for UAS integration.

We will update the specific implementation details (goals, metrics, target dates) as we learn from our current UAS operations, leverage ongoing research, and incorporate the work of our government and industry partners in all related areas.

Thank you for your continued support and active participation in the safe and efficient integration of UAS in the NAS.

Michael P. Huerta
Administrator

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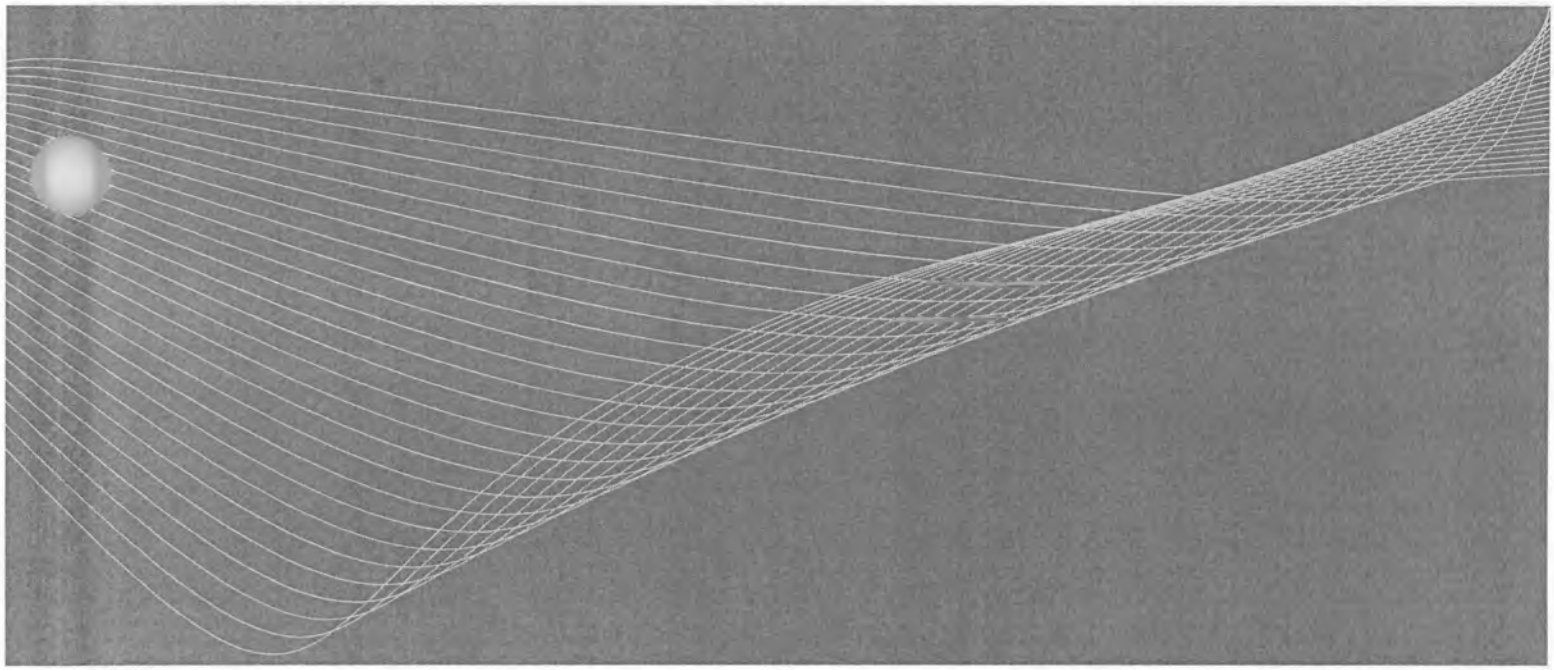


Executive Summary

Expanding Operations of Unmanned Aircraft Systems in the NAS

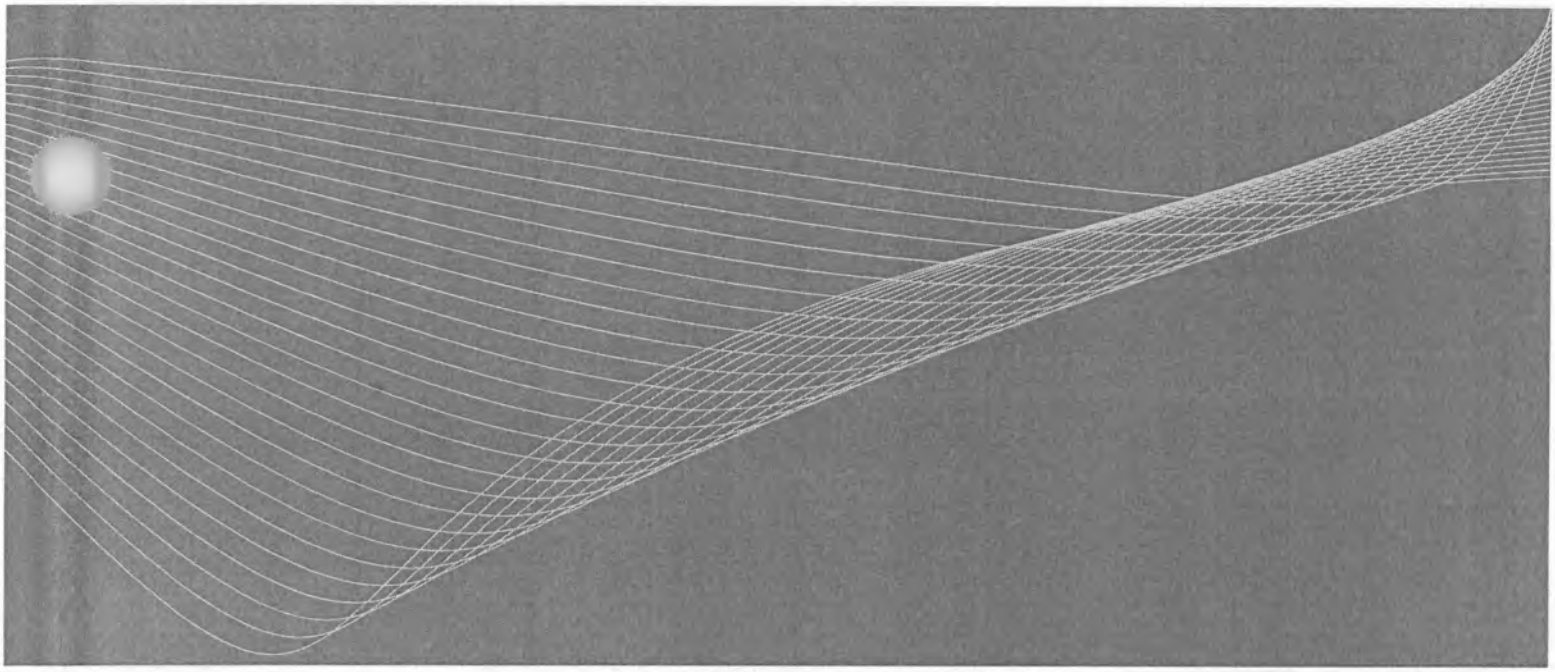
Since the early 1990s, unmanned aircraft systems (UAS) have operated on a limited basis in the National Airspace System (NAS). Until recently, UAS mainly supported public operations, such as military and border security operations. The list of potential uses is now rapidly expanding to encompass a broad range of other activities, including aerial photography, surveying land and crops, communications and broadcast, monitoring forest fires and environmental conditions, and protecting critical infrastructures. UAS provide new ways for commercial enterprises (civil operations) and public operators to enhance some of our nation's aviation operations through increased operational efficiency and decreased costs, while maintaining the safety of the NAS.

As stated in *Destination 2025* (2011):

> *"The Federal Aviation Administration's (FAA) mission is to provide the safest, most efficient aviation system in the world. What sets the United States apart is the size and complexity of our infrastructure, the diversity of our user groups, our commitment to safety and excellence, and a history of innovation and leadership in the world's aviation community. Now we are working to develop new systems and to enhance a culture that increases the safety, reliability, efficiency, capacity, and environmental performance of our aviation system."*

Ultimately, UAS must be integrated into the NAS without reducing existing capacity, decreasing safety, negatively impacting current operators, or increasing the risk to airspace users or persons and property on the ground any more than the integration of comparable new and novel technologies.

The FAA created the Unmanned Aircraft Systems Integration Office to facilitate integration of UAS safely and efficiently into the NAS. Toward that goal, the FAA is collaborating with a broad spectrum of stakeholders, which includes manufacturers, commercial vendors, industry trade associations, technical standards organizations, academic institutions, research and development centers, governmental agencies, and other regulators. Ultimately, UAS must be integrated into the NAS without reducing existing capacity, decreasing safety, negatively impacting current operators, or increasing the risk to airspace users or persons and property on the ground any more than the integration of comparable new and novel technologies. Significant progress has been made toward UAS-NAS integration, with many challenges and opportunities ahead.



A key activity of the FAA is to develop regulations, policy, procedures, guidance material, and training requirements to support safe and efficient UAS operations in the NAS, while coordinating with relevant departments and agencies to address related key policy areas of concern such as privacy and national security. Today, UAS are typically given access to airspace through the issuance of Certificates of Waiver or Authorization (COA) to public operators and special airworthiness certificates in the experimental category for civil applicants. Accommodating UAS operations by the use of COAs and special airworthiness certificates will transition to more routine integration processes when new or revised operating rules and procedures are in place and UAS are capable of complying with them. The FAA has a proven certification process in place for aircraft that includes establishing special conditions when new and unique technologies are involved. This process will be used to evaluate items unique to UAS. In those parts of the NAS that have demanding communications, navigation, and surveillance performance requirements, successful demonstration of UAS to meet these requirements will be necessary.

The process of developing regulations, policy, procedures, guidance material, and training requirements, is resource-intensive. This roadmap will illustrate the significant undertaking it is to build the basis for the NAS to transition from UAS *accommodation* to UAS *integration*. Government and industry stakeholders must work collaboratively and apply the necessary resources to bring this transition to fruition while supporting evolving UAS operations in the NAS.

The purpose of this roadmap is to outline, within a broad timeline, the tasks and considerations needed to enable UAS integration into the NAS for the planning purposes of the broader UAS community. The roadmap also aligns proposed Agency actions with the Congressional mandate in the *FAA Modernization and Reform Act of 2012,* Pub. L. 112-95. As this is the first publication of this annual document, the FAA will incorporate lessons learned and related findings in subsequent publications, which will include further refined goals, metrics, and target dates.

The FAA is committed to the safe and efficient integration of UAS into the NAS, thus enabling this emerging technology to safely achieve its full potential.

Purpose and Background of Civil UAS Roadmap

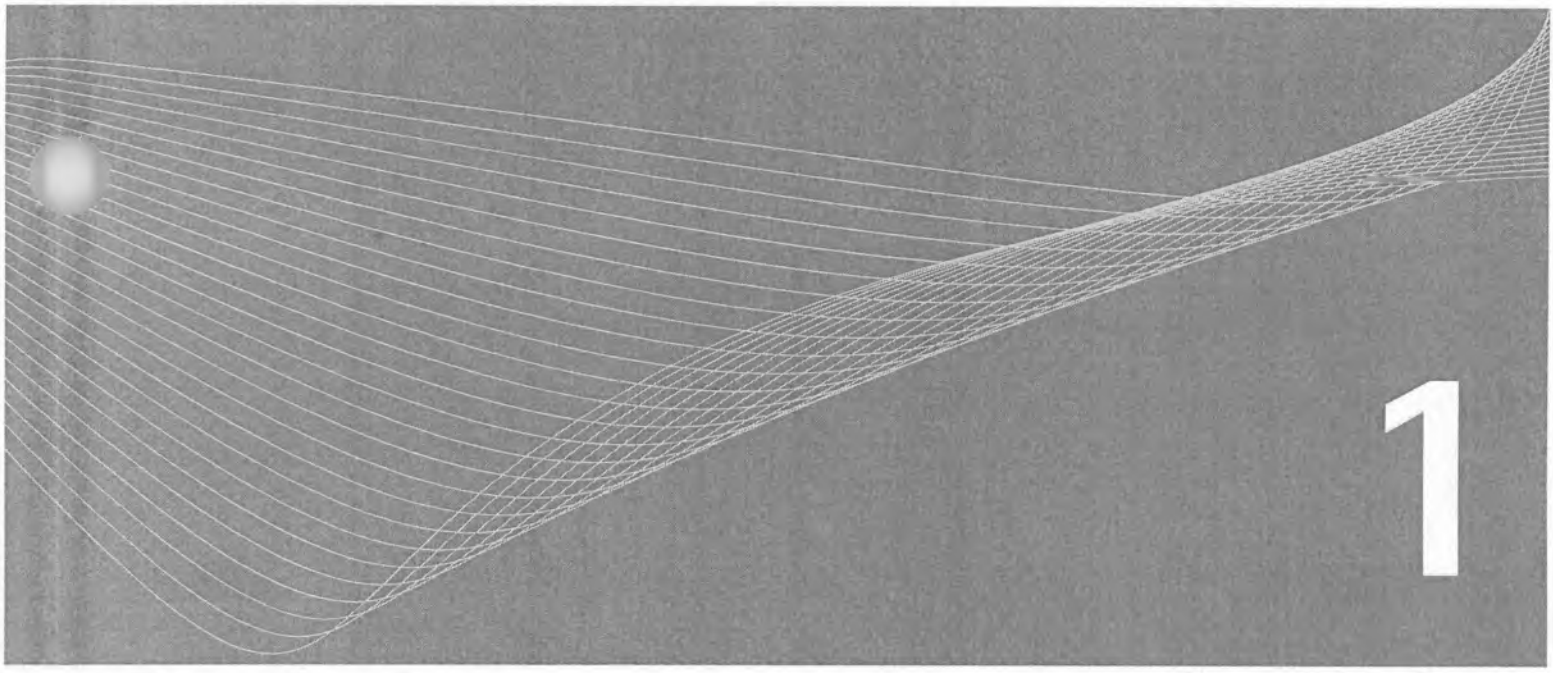
1 Purpose and Background of Civil UAS Roadmap

Unmanned aircraft systems (UAS) and operations have significantly increased in number, technical complexity, and sophistication during recent years without having the same history of compliance and oversight as manned aviation. Unlike the manned aircraft industry, the UAS community does not have a set of standardized design specifications for basic UAS design that ensures safe and reliable operation in typical civilian service applications. As a result, the UAS community often finds it difficult to apply existing FAA guidance. In some cases, interpretation of regulations and/or standards may be needed to address characteristics unique to UAS. Ultimately, the pace of integration will be determined by the ability of industry, the user community, and the FAA to overcome technical, regulatory, and operational challenges. The purpose of this roadmap is to outline, within a broad timeline, the tasks and considerations needed to enable UAS integration into the National Airspace System (NAS) for the planning purposes of the broader UAS community. The roadmap also aligns proposed Agency actions with the Congressional mandate in the *FAA Modernization and Reform Act of 2012,* Pub. L. 112-95.

To gain full access to the NAS, UAS need to be able to bridge the gap from existing systems requiring accommodations to future systems that are able to obtain a standard airworthiness certificate

This five-year roadmap, as required by the *FAA Modernization and Reform Act of 2012* (FMRA), is intended to guide aviation stakeholders in understanding operational goals and aviation safety and air traffic challenges when considering future investments. The roadmap is organized into three perspectives that highlight the multiple paths used to achieve the milestones outlined, while focusing on progressive accomplishments. These three perspectives — *Accommodation, Integration,* and *Evolution* — transcend specific timelines and examine the complex relationship of activities necessary to integrate UAS into the NAS. These three perspectives will be explored in more detail in Section 2.2.4.

Although the FMRA requires a five-year UAS roadmap, it is important to view UAS-NAS integration not only in terms of near-term activities and objectives, but also in the context of mid- and long-term timeframes. The timeframes used in this roadmap are defined in the President's National Aeronautics Research and Development Plan, which specifies less than 5 years as the near-term, 5-10 years as the mid-term, and greater than 10 years as the long-term. For this roadmap, the long-term is defined as



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2022-2026, which is consistent with the Joint Planning and Development Office (JPDO) *National Airspace System Concept of Operations and Vision for the Future of Aviation and NextGen Air Transportation System Integrated Plan.*

Integration of UAS into the NAS will require: review of current policies, regulations, environmental impact, privacy considerations, standards, and procedures; identification of gaps in current UAS technologies and regulations, standards, policies, or procedures; development of new technologies and new or revised regulations, standards, policies, and procedures; and the associated development of guidance material, training, and certification of aircraft systems, propulsion systems, and airmen. The FAA will coordinate these integration activities with other United States Government agencies, as needed, through the Interagency Planning Committee (IPC).

1.1 History of UAS

Historically, unmanned aircraft have been known by many names including: "drones," "remotely piloted vehicles (RPV)," "unmanned aerial vehicles (UAV)," "models," and "radio control (R/C) aircraft." Today, the term UAS is used to emphasize the fact that separate system components are required to support airborne operations without a pilot onboard the aircraft. Early UAS operations received little attention from the FAA and its predecessor agencies due to the infrequency of operations, which were mostly conducted in remote locations or in special use airspace and were not deemed to impact the safety of the NAS. In the past two decades, the number of unmanned aircraft operations has been increasing dramatically, highlighting the need for a structured approach for safe and efficient integration.

1.2 Proposed Civil and Commercial Applications

The use of UAS in commercial applications is expected to expand in a number of areas (see Operational Services and Environment Definition (OSED) for Unmanned Aircraft Systems (UAS), RTCA DO-320, 2010). Some of the currently proposed civil and commercial applications of UAS include:

- Security awareness;
- Disaster response, including search and support to rescuers;
- Communications and broadcast, including news/sporting event coverage;
- Cargo transport;
- Spectral and thermal analysis;
- Critical infrastructure monitoring, including power facilities, ports, and pipelines;
- And commercial photography, aerial mapping and charting, and advertising.

1.3 Definitions

Several terms used in this document are defined below as a common point of reference:

Unmanned Aircraft (UA): A device used or intended to be used for flight in the air that has no onboard pilot. This device excludes missiles, weapons, or exploding warheads, but includes all classes of airplanes, helicopters, airships, and powered-lift aircraft without an onboard pilot. UA do not include traditional balloons (see 14 CFR Part 101), rockets, tethered aircraft and un-powered gliders.

Crewmember [UAS]: In addition to the crewmembers identified in 14 CFR Part 1, a UAS flightcrew member includes pilots, sensor/payload operators, and visual observers (VO), but may include other persons as appropriate or required to ensure safe operation of the aircraft.

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. As shown in Figure 1, it consists of three elements:

- Unmanned Aircraft;
- Control Station;
- And Data Link.

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. (see Figure 2)

Next Generation Air Transportation System (NextGen): According to the FAA's *Destination 2025,* (2011):

> *"NextGen is a series of inter-linked programs, systems, and policies that implement advanced technologies and capabilities to dramatically change the way the current aviation system is operated. NextGen is satellite-based and relies on a network to share information and digital communications so all users of the system are aware of other users' precise locations."*

Unmanned Aircraft System (UAS)

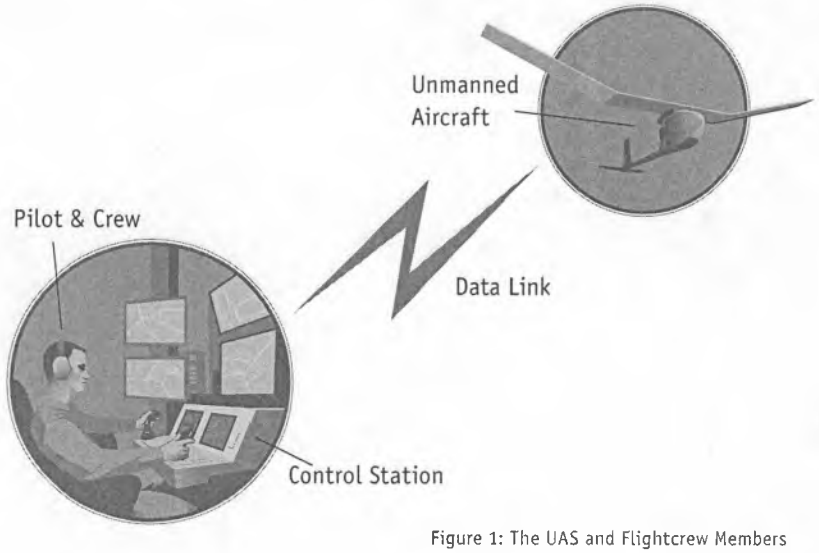


Figure 1: The UAS and Flightcrew Members

1.4 Policy

The FAA is responsible for developing plans and policy for the safe and efficient use of the United States' navigable airspace. This responsibility includes coordinating efforts with national security and privacy policies so that the integration of UAS into the NAS is done in a manner that supports and maintains the United States Government's ability to secure the airspace and addresses privacy concerns. Further, the FAA will harmonize, when appropriate, with the international community for the mutual development of civil aviation in a safe and orderly manner. Components of existing FAA and International Civil Aviation Organization (ICAO) policy are outlined below.

National Airspace System

Figure 2: The NAS

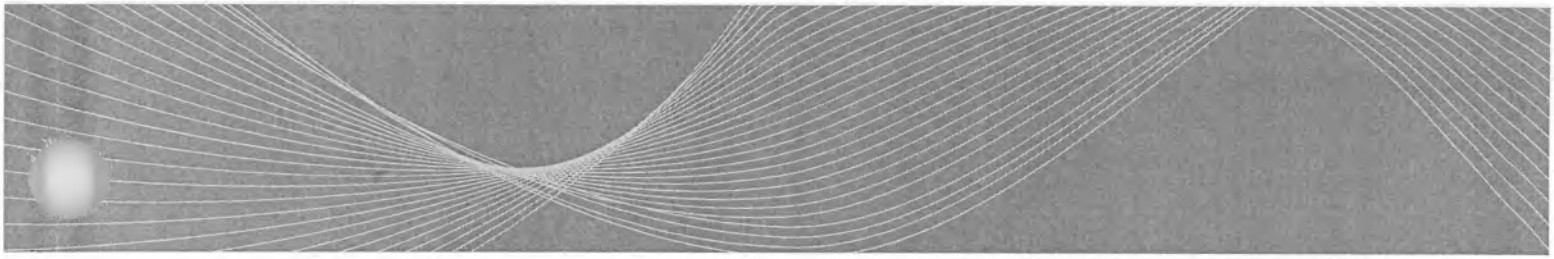
1.4.1 FAA UAS Policy Basis

Established FAA aviation policies support an acceptable level of safety for the NAS. At the core of these policies is the concept that each aircraft is flown by a pilot in accordance with required procedures and practices. This same policy applies to UAS.

Aviation policies and regulations focus on overall safety being addressed through three primary areas: equipment, personnel, and operations and procedures. Each of these areas has standards and minimum levels of safety that must be met, independent of each other. As a matter of regulation, for example, a new civil aircraft must be able to independently obtain an airworthiness certificate, regardless of the airspace class where it might be flown. However, as a result or part of this certification, new procedures may be required for flightcrew members and air traffic control (ATC) in order to maintain the minimum level of safety of the NAS while accommodating the new technology. Under special certifications and authorizations, limited operations may be authorized for equipment unable to meet current standards.

The application of these established aviation policies to UAS is summarized in the following key points excerpted from the FAA Notice of Policy: Unmanned Aircraft Operations in the National Airspace System (72 Fed. Reg. 6689 (Feb. 13, 2007)):

- Regulatory standards need to be developed to enable current technology for unmanned aircraft to comply with Title 14 Code of Federal Regulations;



- In order to ensure safety, the operator is required to establish the UAS airworthiness either from FAA certification, a Department of Defense (DoD) airworthiness statement, or by other approved means;
- Applicants also have to demonstrate that a collision with another aircraft or other airspace user is extremely improbable;
- And the pilot-in-command concept is essential to the safe operation of manned operations. The FAA's UAS guidance applies this pilot-in-command concept to unmanned aircraft and includes minimum qualification and currency requirements.

These policies have enabled the accommodation of UAS into the NAS on a limited basis on the foundation that operations are conducted safely, present an acceptable level of risk to the general public, and do no harm to, or adversely impact, other users. To gain full access to the NAS, UAS need to be able to bridge the gap from existing systems requiring accommodations to future systems that are able to obtain a standard airworthiness certificate. These UAS will also need to be flown by a certified pilot in accordance with existing, revised, or new regulations and required standards, policies, and procedures.

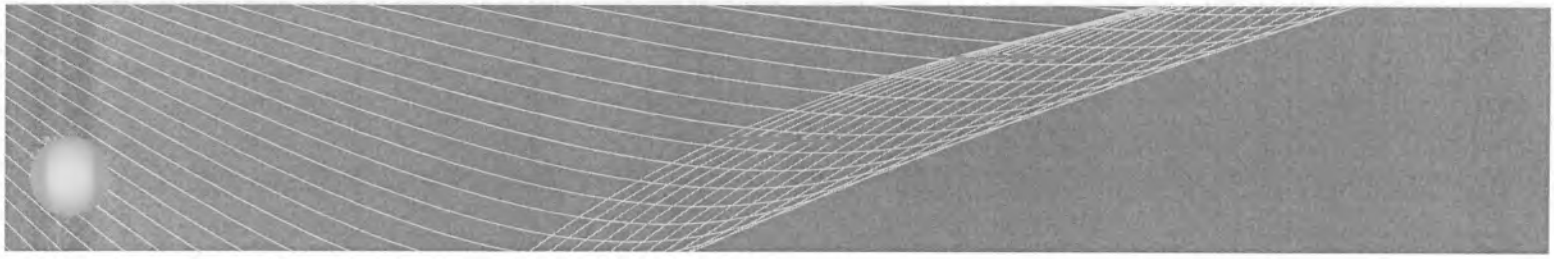
1.4.2 International Civil Aviation Organization (ICAO) Policy

ICAO, a special agency of the United Nations, promotes "the safe and orderly development of international civil aviation throughout the world. It sets standards and regulations necessary for aviation safety, security, efficiency, and regularity, as well as aviation environmental protection."

The goal of ICAO in addressing unmanned aviation is to provide the fundamental international regulatory framework to support routine operation of UAS throughout the world in a safe, harmonized, and seamless manner comparable to that of manned operations. Current ICAO guidance material for UAS is published in ICAO Circular 328, "Unmanned Aircraft Systems (UAS) Circular," which provides basic guidelines for Member States to introduce and integrate UAS into airspace in a consistent manner, to ensure global interoperability and regulatory compatibility, when possible. The document's guiding policy on UAS is:

> *"A number of Civil Aviation Authorities (CAA) have adopted the policy that UAS must meet the equivalent levels of safety as manned aircraft... In general, UAS should be operated in accordance with the rule governing the flight of manned aircraft and meet equipment requirements applicable to the class of airspace within which they intend to operate...To safely integrate UAS in non-segregated airspace, the UAS must act and respond as manned aircraft do. Air Traffic, Airspace and Airport standards should not be significantly changed. The UAS must be able to comply with existing provisions to the greatest extent possible."*

ICAO develops Standards and Recommended Practices (SARP), which are generally followed by national civil aviation authorities of the Member States. The United States is an ICAO Member State, and the FAA plans to harmonize with international efforts and adhere to ICAO SARPs when possible.



1.4.3 Industry Policy Recommendations

RTCA, Inc. is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management system issues. RTCA functions as a Federal Advisory Committee, and the FAA considers RTCA recommendations when making policy, program, and regulatory decisions. RTCA Special Committee 203 (SC-203) was established in 2004 to help assure the safe, efficient, and compatible operation of UAS with other aircraft operating within the NAS. This Special Committee has developed and documented guiding principles for UAS integration, which are summarized below:

- UAS must operate safely, efficiently, and compatibly with service providers and other users of the NAS so that overall safety is not degraded;
- UAS will have access to the NAS, provided they have appropriate equipage and the ability to meet the requirements for flying in various classes of airspace;
- Routine UAS operations will not require the creation of new special use airspace, or modification of existing special use airspace;
- Except for some special cases, such as small UAS (sUAS) with very limited operational range, all UAS will require design and airworthiness certification to fly civil operations in the NAS;
- UAS pilots will require certification, though some of the requirements may differ from manned aviation;
- UAS will comply with ATC instructions, clearances, and procedures when receiving air traffic services;
- UAS pilots (the pilot-in-command) will always have responsibility for the unmanned aircraft while it is operating;
- And UAS commercial operations will need to apply the operational control concept as appropriate for the type of operation, but with different functions applicable to UAS operations.

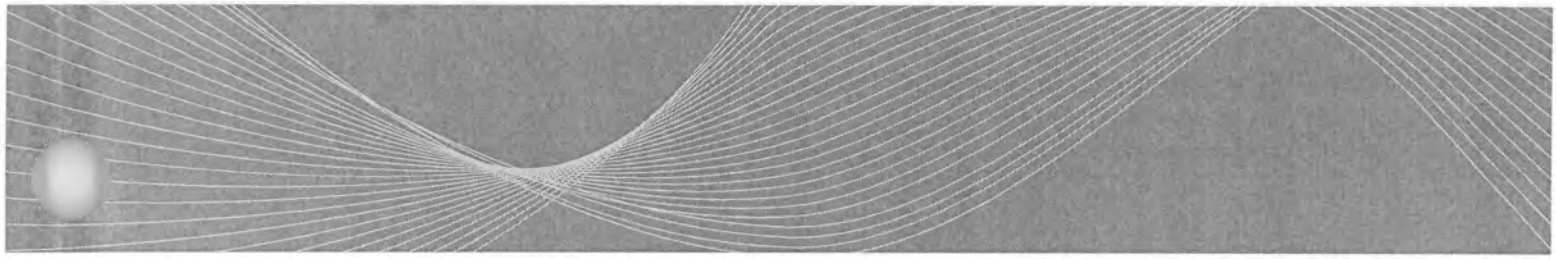
Through an FAA-established UAS Aviation Rulemaking Committee (ARC), the FAA continues to collaborate with government and industry stakeholders for recommendations regarding the path toward integration of UAS into the NAS. This effort will harmonize with the work being done by international organizations working toward a universal goal of safe and efficient UAS airspace operations.

1.4.4 Privacy and Civil Liberties Considerations

The FAA's chief mission is to ensure the safety and efficiency of the entire aviation system. This includes manned and unmanned aircraft operations. While the expanded use of UAS presents great opportunities, it also raises questions as to how to accomplish UAS integration in a manner that is consistent with privacy and civil liberties considerations.

As required by the FMRA, the FAA is implementing a UAS test site program to help the FAA gain a better understanding of operational issues relating to UAS. Although the FAA's mission does not include developing or enforcing policies pertaining to privacy or civil liberties, experience with the UAS test sites will present an opportunity to inform the dialogue in the IPC and other interagency forums concerning the use of UAS technologies and the areas of privacy and civil liberties.

As part of the test site program, the FAA will authorize non-federal public entities to establish and operate six test sites in the United States. The FAA recognizes that there are privacy considerations regarding the use of UAS at the test sites. To ensure that these concerns are taken into consideration at the test sites, the FAA plans to require each test site operator to establish a privacy policy that will apply to operations at the test site. The test site's privacy

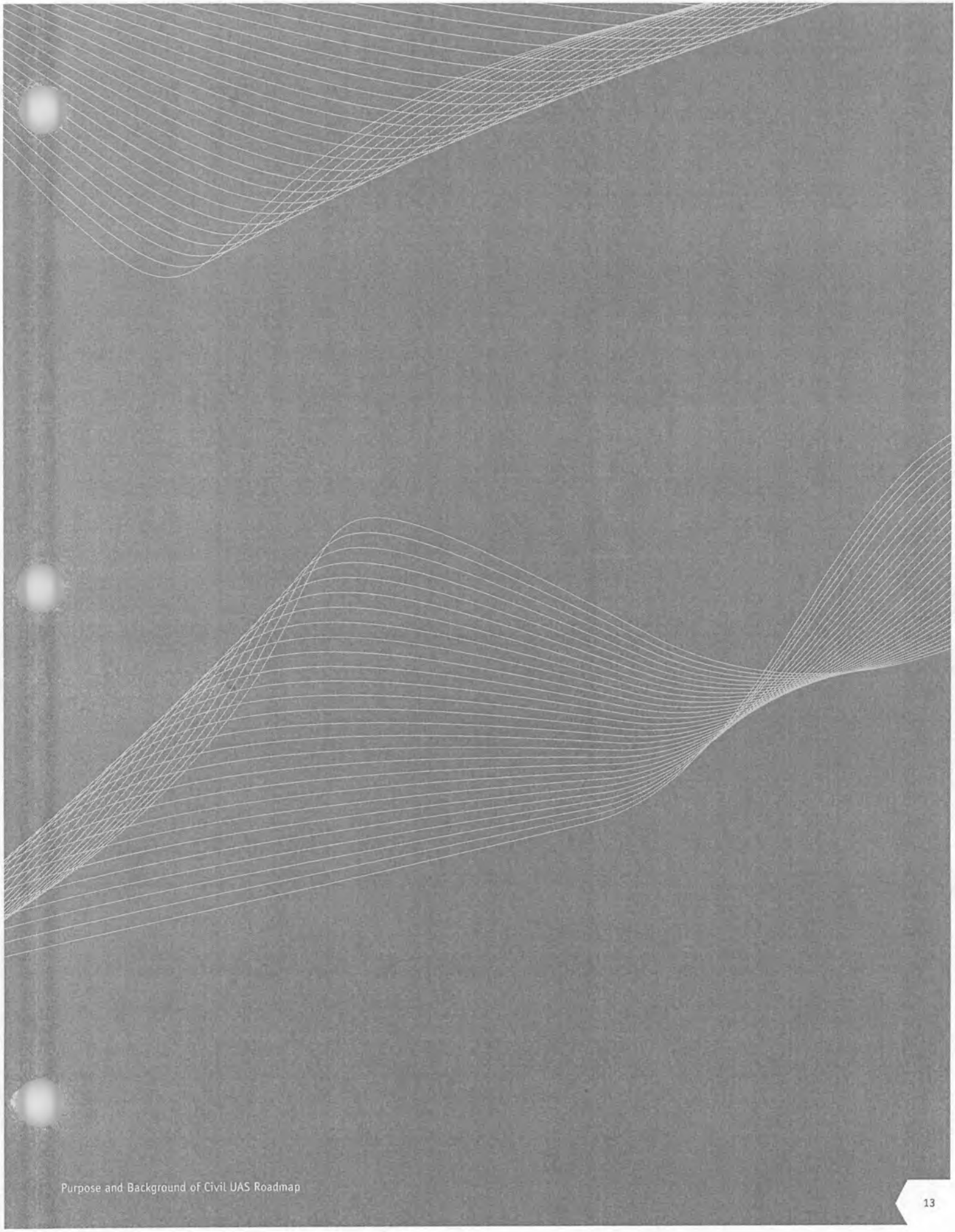


policy must be publicly available and informed by Fair Information Practice Principles. In addition, each site operator must establish a mechanism through which the operator can receive and consider comments on its privacy policy.

The privacy requirements proposed for the UAS test sites are specifically designed for the operation of the test sites and are not intended to predetermine 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.

1.4.5 National Security Issues

Integrating public and civil UAS into the NAS carries certain national security implications, including security vetting for certification and training of UAS-related personnel, addressing cyber and communications vulnerabilities, and maintaining/enhancing air defense and air domain awareness capabilities in an increasingly complex and crowded airspace. In some cases, existing security frameworks applied to manned aircraft may be applicable. Other security concerns may require development of new frameworks altogether. The FAA will continue to work with relevant United States Government departments and agencies, and with stakeholders through coordinating bodies such as the IPC and JPDO, to proactively address these areas of concern.



UAS Operations in the NAS

This roadmap focuses on civil UAS access to the NAS. To this end, the FAA and the UAS community are working to address the myriad challenges associated with this effort.

2.1 FAA's Dual Role for UAS Integration

For UAS, as with all aircraft, the FAA acts in a dual role. As the regulator, the FAA ensures aviation safety of persons and property in the air and on the ground. As the service provider, the FAA is responsible for providing safe and efficient air traffic control services in the NAS and the other portions of global airspace delegated to the United States by ICAO.

As part of its regulator role, the Office of Aviation Safety (AVS) efforts are led by the UAS Integration Office. The main focus of the UAS Integration Office is to provide, within the existing AVS structure, subject matter expertise, research, and recommendations to develop policy, regulations, guidance, and procedures for UAS airworthiness and operations in support of safe integration of UAS into the NAS.

As the service provider, the Air Traffic Organization (ATO) efforts are led by the Air Traffic Emerging Technologies Group, which considers operational authorizations for UAS flights that are unable to meet current regulations and procedures. A Certificate of Waiver or Authorization (COA) is issued with limitations and provisions that mitigate the increased risks resulting from the use of uncertified technology. The ATO is responsible for the safe and efficient handling of aircraft and the development of the airspace rules, procedures, and air traffic controller training to support routine operations in the NAS.

2.2 UAS Challenges

A number of issues that impact the integration of UAS into the NAS are being considered across the regulatory and service provider roles of the FAA. To ensure the FAA meets the goals set forth in this roadmap, these offices will be addressing the challenges as outlined in the following subsections.

2.2.1 Policy, Guidance, and Regulatory Product Challenges

To ensure the FAA has the appropriate UAS framework, many policy, guidance, and regulatory products will need to be reviewed and revised to specifically address UAS integration into the NAS. UAS technology and operations will need to mature, and new products may be required in order to meet applicable regulations and standards. Figure 3 depicts policy, guidance, and regulatory product areas requiring research and development. This information is derived from the RTCA notional architecture and is primarily related to airmen and UAS certification.

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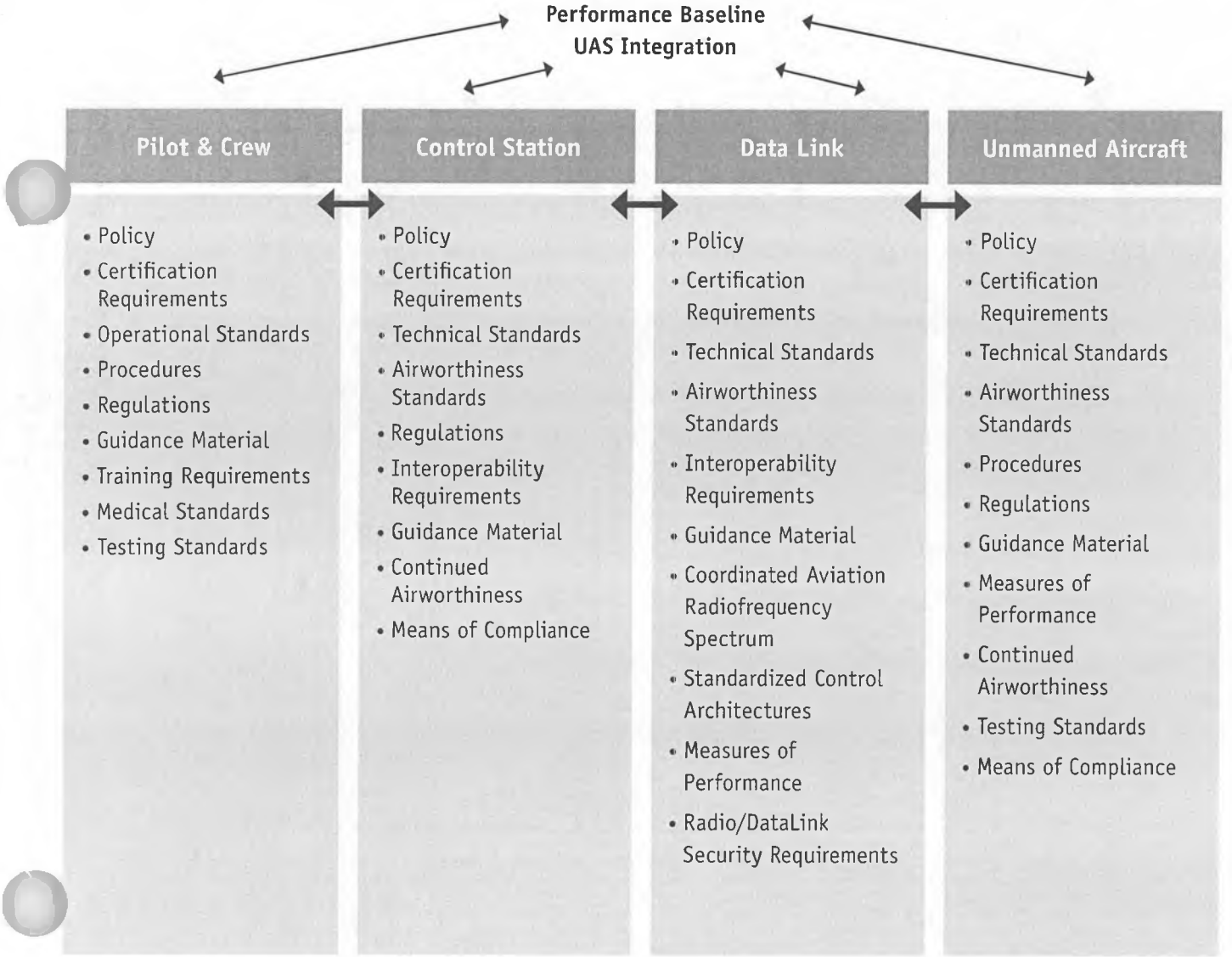


Figure 3: AVS Products to Regulate UAS Operations

The challenge is to identify and develop the UAS regulatory structure that encompasses areas listed in Figure 3. Other regulatory drivers include:

- Developing minimum standards for Sense and Avoid (SAA), Control and Communications (C2), and separation assurance to meet new or existing operational and regulatory requirements for specified airspace;
- Understanding the privacy, security, and environmental implications of UAS operations and working with relevant departments and agencies to proactively coordinate and align these considerations with the UAS regulatory structure;
- And developing acceptable UAS design standards that consider the aircraft size, performance, mode of control, intended operational environment, and mission criticality.

Although aviation regulations have been developed generically for all aircraft, until recently these efforts were not done with UAS specifically in mind. This presents certain challenges because the underlying assumptions that existed during the previous efforts may not now fully accommodate UAS operations. As an example, current regulations address security requirements for cockpit doors. However, these same regulations lack a legal definition for what a "cockpit" is or where it is located. This presents a challenge for UAS considering that the cockpit or "control station" may be located in an office building, in a vehicle, or outside with no physical boundaries. Applying current cockpit door security regulations to UAS may require new rulemaking, guidance, or a combination of both.

The regulatory process is designed to provide transparency to the public and an opportunity to understand and comment on proposed rules before being issued. Additional checks and balances are in place to ensure that final regulations are not unnecessarily burdensome to the public. Because of these requirements, and lacking any exceptions, an average regulatory effort might span a number of years. These timeframes may be longer for high visibility or complex regulations. FAA experience to date with the development of a Notice of Proposed Rulemaking (NPRM) for small UAS indicates that UAS rulemaking efforts may be more complex, receive greater scrutiny, and require longer development timeframes than the average regulatory effort.

2.2.2 Air Traffic Operational Challenges

Numerous Air Traffic products, policies, and procedures also need to be reviewed and refined or developed through supporting research to permit UAS operations in the NAS. The UAS Integration Office coordinates efforts with the ATO to complete these tasks.

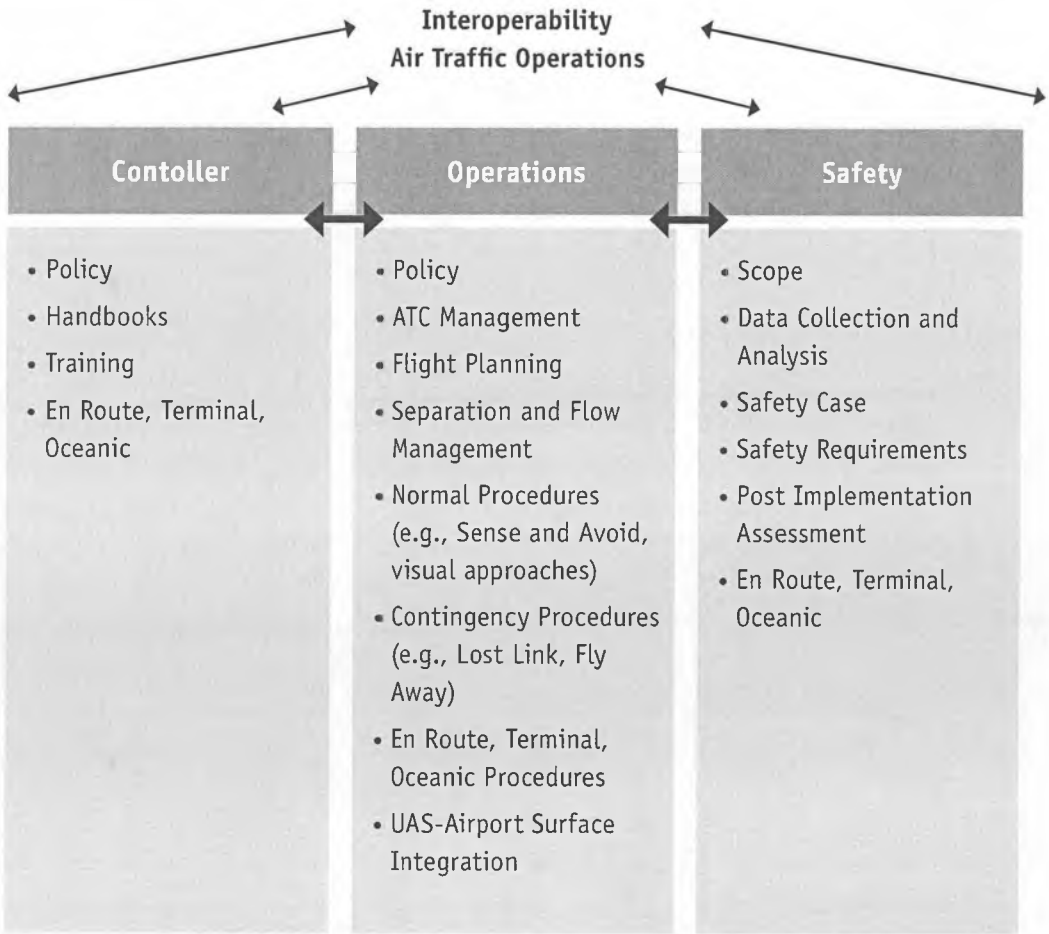


Figure 4: ATO UAS Operational Area

The goal of safely integrating UAS without segregating, delaying, or diverting other aircraft and other users of the system presents significant challenges in the areas outlined in Figure 4 above. For NAS integration, this also includes:

- Identifying policies and requirements for UAS to comply with ATC clearances and instructions commensurate with manned aircraft (specifically addressing the inability of UAS to comply directly with ATC visual clearances or to operate under visual flight rules);
- Establishing procedures and techniques for safe and secure exchange of voice and data communication between UAS pilots, air traffic controllers, and other NAS users;
- Establishing wake vortex and turbulence avoidance criteria needed for UAS with unique characteristics (e.g., size, performance, etc.);
- And reviewing environmental requirements (e.g., the National Environmental Policy Act).

2.2.3 Technological Challenges

The FAA recognizes that current UAS technologies were not developed to comply with existing airworthiness standards. Current civil airworthiness regulations may not consider many of the unique aspects of UAS operations. Materials properties, structural design standards, system reliability standards, and other minimum performance requirements for basic UAS design need to be evaluated against civil airworthiness standards for existing aircraft. Although significant technological advances have been made by the UAS community, critical research is needed to fully understand the impact of UAS operations in the NAS. There has also been little research to support the equipment design necessary for UAS airworthiness certification. In the near- to mid-term, UAS research will need to focus on technology deemed necessary for UAS access to the NAS.

As UAS are introduced, their expected range of performance will need to be evaluated for impact on the NAS. UAS operate with widely varying performance characteristics that do not necessarily align with manned aircraft performance. They vary in size, speed, and other flight capabilities. Similarly, the issue of performance gap between the pilot and the avionics will impact NAS operations. For example, a quantitative time standard for a pilot response to ATC directions (such as "turn left heading 270, maintain FL250") does not exist – there is an acceptable delay for the pilot's verbal response and physical action, but there is no documented required range of acceptable values. Avionics that perform the corresponding function cannot be designed and built without these performance requirements being established.

Existing standards ensure safe operation by pilots actually on board the aircraft. These standards may not translate well to UAS designs where pilots are remotely located off the aircraft. Removing the pilot from the aircraft creates a series of performance considerations between manned and unmanned aircraft that need to be fully researched and understood to determine acceptability and potential impact on safe operations in the NAS. These include the following considerations:

- The UAS pilot is not onboard the aircraft and does not have the same sensory and environmental cues as a manned aircraft pilot;
- The UAS pilot does not have the ability to directly comply with see-and-avoid responsibilities and UAS SAA systems do not meet current operational rules;
- The UAS pilot must depend on a data link for control of the aircraft. This affects the aircraft's response to revised ATC clearances, other ATC instructions, or unplanned contingencies (e.g., maneuvering aircraft);
- UAS cannot comply with certain air traffic control clearances, and alternate means may need to be considered (e.g., use of visual clearances);
- UAS present air traffic controllers with a different range of platform sizes and operational capabilities (such as size, speed, altitude, wake turbulence criteria, and combinations thereof);

Removing the pilot from the aircraft creates a series of performance considerations between manned and unmanned aircraft that need to be fully researched and understood to determine acceptability and potential impact on safe operations in the NAS.

- And some UAS launch and recovery methods differ from manned aircraft and require manual placement and removal from runways, a lead vehicle for taxi operations, or dedicated launch and recovery systems.

Therefore, it is necessary to develop new or revised regulations/ procedures and operational concepts, formulate standards, and promote technological development that will enable manned and unmanned aircraft to operate cohesively in the same airspace. Specific technology challenges include two critical functional areas:

- **"Sense and Avoid" (SAA) capability** must provide for self-separation and ultimately for collision avoidance protection between UAS and other aircraft analogous to the "see and avoid" operation of manned aircraft that meets an acceptable level of safety. SAA technology development is immature. In manned flight, see and avoid, radar, visual sighting, separation standards, proven technologies and procedures, and well-defined pilot behaviors combine to ensure safe operation. Unmanned flight will require new or revised operational rules to regulate the use of SAA systems as an alternate method to comply with "see and avoid" operational rules currently required of manned aircraft. SAA system standards must be developed to assure both self-separation and collision avoidance capability for UAS. Interoperability constraints must also be defined for safe and secure interactions between SAA-enabled UAS and other airborne and ground-based collision avoidance systems. While SAA may be an independent system, it must be designed to be compatible across other modes (e.g., ATC separation services). See Appendix C.3 and C.4 for specific goals and metrics.

Unmanned flight will require new or revised operational rules to regulate the use of SAA systems as an alternate method to comply with "see and avoid" operational rules currently required of manned aircraft.

- **Control and Communications (C2) system performance requirements** are needed and RTCA is developing consensus-based recommendations for the FAA to consider in C2 policy, program, and regulatory decisions. The resulting C2 requirements need to support the minimum performance required to achieve higher-level (UAS level) performance and safety requirements. Third-party communication service providers are common today (e.g., ARINC, Harris, etc.) and the FAA has experience with setting and monitoring performance of third parties. The use of third parties is dependent on the UAS architecture chosen, but these are still being evaluated in terms of feasibility from a performance, cost, and safety perspective. See Appendix C.5 for specific goals and metrics.

2.2.4 Managing the Challenges

To provide the UAS community insight into the FAA process for fostering UAS flight in the NAS, Figure 5 highlights the intended shift in focus over time from Accommodation to Integration, and then to Evolution. This method is consistent with the approach used for new technologies on manned aircraft introduced into the NAS.

Current design standards reflect the focus in the COA process on allowing existing designs, embodying some experimental design philosophies, to fly in the NAS. Progress toward standard airworthiness will also increase as design standards mature, but not before.

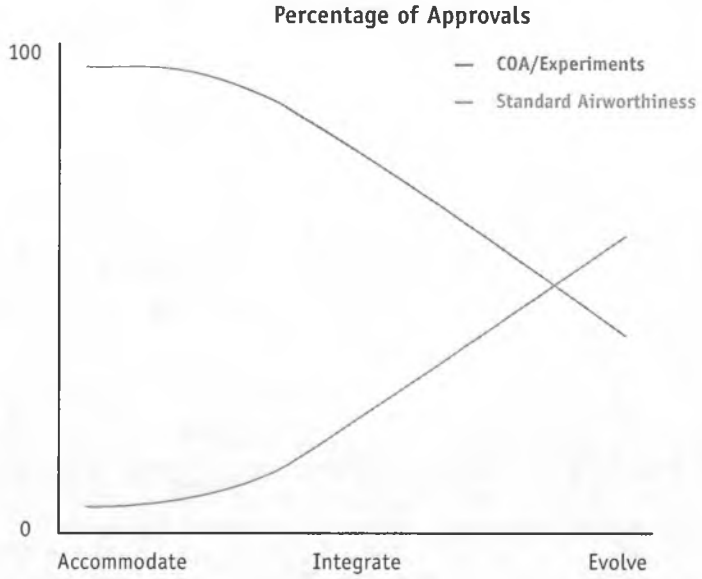


Figure 5: Transition from COA/Experimental to Standard Airworthiness Approvals

Recognizing the challenges and the complex coordination required for integration, the UAS roadmap addresses the efforts needed to move forward incrementally toward the goal of full NAS integration.

Timely progress on products, decisions, research, development, testing, and evaluation will be needed to successfully move from accommodation to integration in the evolving NAS.

The approach to managing the challenges discussed in this section focuses on the following interdependent topics:

- Standards;
- Rules and Regulations;
- Certification of the UAS;
- Procedures and Airspace;
- Training (Pilot, Flightcrew Member, Mechanic, and Controller);
- And Research and Development (R&D) and Technology.

The roadmap discusses the activities and transitions for the above interdependent topic areas from the vantage point of Accommodation, Integration, and Evolution, as summarized below and described in more detail in subsequent sections of this roadmap. These perspectives transcend the near-, mid-, and far-term timeframes and provide additional insight into the task of integrating UAS into the NAS.

Perspective 1: Accommodation. Take current UAS and apply special mitigations and procedures to safely facilitate limited access to the NAS. UAS operations in the NAS are considered on a case-by-case basis. Accommodation will predominate in the near-term, and while it will decline significantly as integration begins and expands in the mid-term, it will continue to be a viable means for NAS access with appropriate restrictions and constraints to mitigate any performance shortfalls. During the near-term, R&D will continue to identify challenges, validate advanced mitigation strategies, and explore opportunities to progress UAS integration into the NAS.

Perspective 2: Integration. Establishing threshold performance requirements for UAS that would increase access to the NAS is a primary objective of integration. During the mid- to far-term, the Agency will establish new or revised regulations, policies, procedures, guidance material, training, and understanding of systems and operations to support routine NAS operations. Integration is targeted to begin in the near- to mid-term with the implementation of the sUAS rule and will expand further over time (mid- and far-term) to consider wider integration of a broader field of UAS.

Perspective 3: Evolution. All required policy, regulations, procedures, guidance material, technologies, and training are in place and routinely updated to support UAS operations in the NAS operational environment as it evolves over time. It is important that the UAS community maintains the understanding that the NAS environment is not static, and that there are many improvements planned for the NAS over the next 13-15 years. To avoid obsolescence, UAS developers will need to maintain a dual focus: integration into today's NAS while maintaining cognizance of how the NAS is evolving.

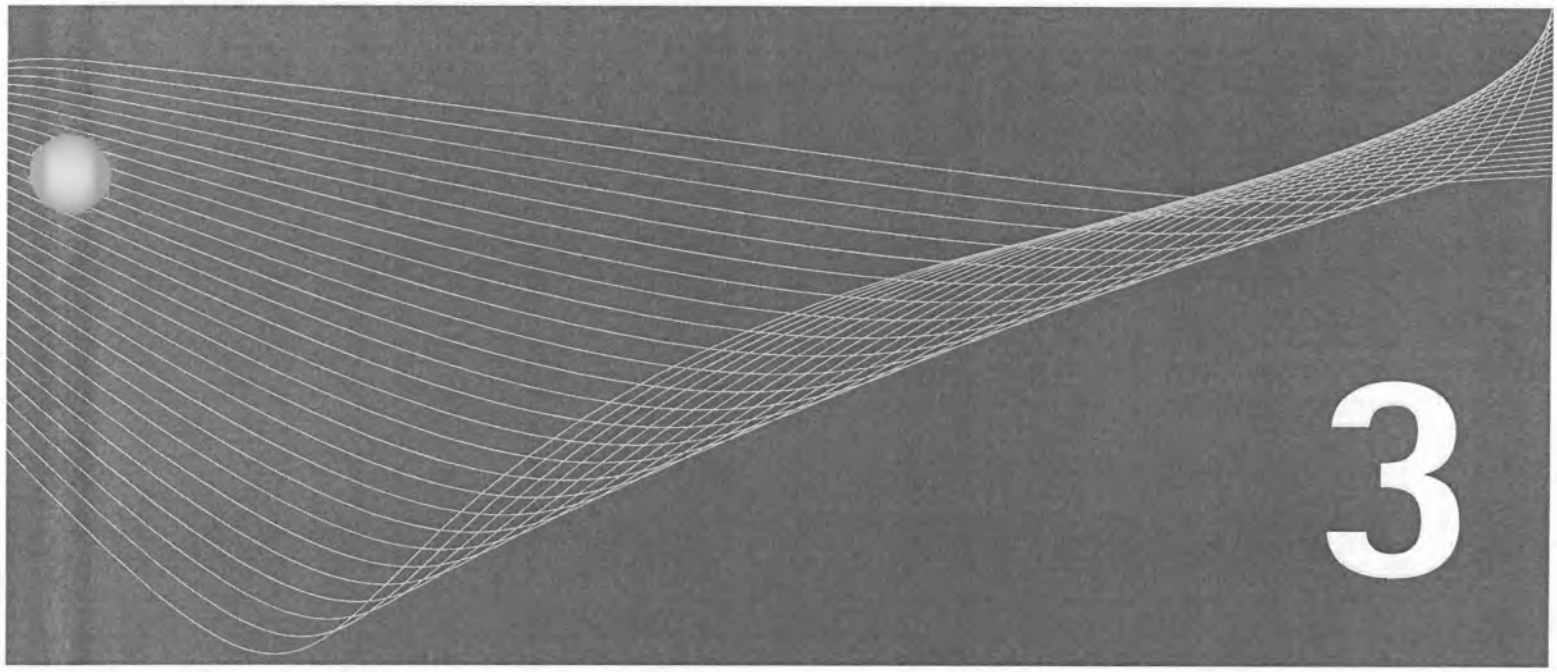
Perspective 1: Accommodation

3.1 Overview

The FAA's near-term focus will be on safely allowing for the expanded operation of UAS through accommodation. Enhanced procedures and technology, over time, will increase access to the NAS through accommodation made possible by improvements to current mitigations and the introduction of advanced mitigations. The need to maintain this avenue for NAS access will continue. Research and development on current and advanced mitigations is necessary to maintain this avenue for access with appropriate restrictions and constraints to mitigate performance shortfalls and address privacy, security, and environmental concerns. The consideration and planning for integration of UAS into the NAS will continue simultaneously.

There has been a growing interest in a wide variety of civil uses for unmanned aircraft. A number of paths can be used to apply for airworthiness certification of UAS. One method that the UAS civil community is currently using to access the NAS is with a special airworthiness certificate in the experimental category, which requires specific, proven capabilities to enable operations at a constrained level. Each application is reviewed for approval on a case-by-case basis that allows a carefully defined level of access that is limited and dependent on risk mitigations that ensure safety and efficiency of the NAS is not diminished. The use of special airworthiness certificates for UAS is similar to their use for manned aircraft and they are normally issued to UAS applicants for the purposes of research and development, crew training or market surveys per 14 CFR 21.191(a), (c), and (f).

Through August 2012, the FAA had issued 114 special airworthiness certificates (i.e., 113 experimental certificates and one special flight permit) to 22 different models of civil aircraft. Of these 22 different models, 16 are unmanned aircraft and 6 are Optionally Piloted Aircraft (OPA). These experimental certificates have been useful for UAS research and development (R&D), and as R&D efforts subside, the use of experimental certificates may decrease. While the FAA continues to accommodate special access to the NAS, existing airworthiness standards are also an avenue for full-type certification. The FAA is working with the UAS ARC to gain feedback to potential changes to airworthiness standards for UAS, as necessary. In the long-term, UAS that are designed to a standard and built to conform to the design may be integrated into the NAS as fully certificated aircraft.



3.2 Standards

If UAS are to operate routinely in the NAS, they must conform to an agreed-upon set of standards. Requirements will vary depending on the nature and complexity of the operation, aircraft or component system limitations, pilot and other crewmember qualifications, and the operating environment.

A technical (or operational) standard is an established norm or requirement about a technical (or operational) system that documents uniform engineering or technical criteria, methods, processes, and practices. A standard may be developed privately or unilaterally, by a corporation, regulatory body, or the military. Standards can also be developed by organizations such as trade unions and associations. These organizations often have more diverse input and usually develop voluntary standards that may be adopted by the FAA as a means of regulatory compliance.

To operate an aircraft safely and efficiently in today's NAS, a means of complying with applicable parts of Title 14 of the Code of Federal Regulations must be developed. Aircraft certification standards govern the design, construction, manufacturing, and continued airworthiness of aircraft used in private and commercial operations. These standards were developed with an underlying assumption that a person would be onboard the aircraft and manipulating the controls. This has led to numerous requirements that make aircraft highly reliable and safe for their intended operations and flightcrew protection.

While UAS share many of the same design considerations as manned aircraft, such as structural integrity and performance, most unmanned aircraft and control stations have not been designed to comply with existing civil airworthiness or operational standards. Beyond the problem of meeting existing aircraft certification standards, other components of the UAS, such as the equipment and software associated with the data link (control and communications) and the launch and recovery mechanisms, are not currently addressed in civil airworthiness or operational standards.

Since 2004, the FAA has developed close working relationships with several standards development organizations. Most of these organizations plan to complete their UAS standards development efforts in the near- to mid-term timeframe. When accepted, these standards development products may provide a means of compliance for rules established in the mid-term. The FAA has also been either the lead or an important participant in cross-agency efforts that influence standards development and has coordinated and harmonized these activities with international efforts such as the ICAO UAS Study Group.

Standardization efforts have already produced a number of useful definitions, guidance documents, and considerations that provide common understanding and add insight and data to UAS integration efforts:

- RTCA/SC-203's Guidance Material (DO-304) and numerous position papers
- RTCA/SC-203's Operational Services and Environment Definition For Unmanned Aircraft Systems (OSED, DO-320), which documents definitions and operating scenarios for different UAS operations in the NAS
- RTCA Air Traffic Management Advisory Committee, Requirements and Planning Work Group Report "Airspace Considerations for UAS Integration in the National Airspace System," March 26, 2008
- SAA Workshop Reports that have documented SAA timelines and definitions

Standards development will continue with the goal of producing Minimum Aviation System Performance Standards (MASPS) by the end of the near-term. RTCA products will be taken under consideration by the FAA in the development of policy and guidance products such as Advisory Circulars. Minimum Operational Performance Standards (MOPS) may be used to define Technical Standard Orders (TSO) in the mid- to long-term timeframe.

Additional coordination and input from the stakeholder community (industry and trade associations, manufacturers, academia, research organizations, and public agencies) is being provided with the recent establishment of the UAS ARC.

Although the need to develop standards cannot be overstated, detailed policy, guidance, technical performance requirements, and operational procedures are also needed to enable manned and unmanned aircraft to fly safely and efficiently in the NAS. See Appendix C for specific goals and metrics.

3.3 Rules and Regulations

Unmanned aircraft operations have significantly increased in number, technical complexity, and sophistication during recent years without specific regulations to address their unique characteristics. For a person wishing to design, manufacture, market, or operate a UAS for a commercial mission and seeking FAA approval for that aircraft, its pilot and the operations, existing rules have not been fully tailored to the unique features of UAS.

The FAA has published a Notice which replaced the previous interim operational guidance material used to support UAS accommodation. Since accommodation is not envisioned to be eliminated entirely, this Notice will need to be updated periodically, even as progress continues simultaneously on development of UAS rules and regulations for integration.

The FAA is also developing an NPRM to allow sUAS to conduct operations. This rulemaking effort includes an associated industry effort to develop consensus standards needed for rule implementation. Assuming the sUAS NPRM effort proceeds to a final rule, associated guidance will also be completed to allow the FAA to approve operations and civil and public UAS operators to apply for and safely implement these sUAS operations. All sUAS rule development and implementation will be in accordance with the FMRA.

During this period, the appropriate regulations are also being reviewed for applicability to UAS operations by the FAA, industry groups, and the

The emphasis will be on the need for new or revised rules for UAS to operate under instrument flight rules (IFR), including rules to allow UAS operations analogous to manned aircraft using visual capabilities.

UAS ARC. The results of this review will determine any regulatory gaps that need to be addressed in the development of specific UAS guidance and rulemaking. The emphasis will be on the need for new or revised rules for UAS to operate under instrument flight rules (IFR), including rules to allow UAS operations analogous to manned aircraft using visual capabilities. Based on the findings of this review, a determination will be made regarding the need to modify, supplement, or create specific new regulations to support UAS beyond the near-term. UAS rulemaking will follow these steps.

3.4 Airworthiness Certification of the UAS

Airworthiness certification is a process that the FAA uses to ensure that an aircraft design complies with the appropriate safety standards in the applicable airworthiness regulations. FAA type design approval indicates the FAA has evaluated the safety of the unmanned aircraft design and all its systems, which is more rigorous than simply making a determination that the UAS is airworthy.

Airworthiness standards for existing aircraft are codified in Title 14 of the Code of Federal Regulations, with processes described for FAA type certification in FAA Order 8110.4 and airworthiness certification in FAA Order 8130.2. The FAA has the authority and regulations in place to tailor the design standards to specific UAS applications, and plans to use this authority until further experience is obtained in addressing the design issues that are unique to UAS.

Civil UAS are currently accommodated with experimental certificates under FAA Order 8130.34. The FAA and the UAS industry will need to work together to move away from the existing experimental or expendable design philosophy, toward a design philosophy more consistent with reliable and safe civilian operation over populated areas and in areas of manned aircraft operation.

Existing airworthiness standards have been developed from years of operational safety experience with manned aircraft and may be too restrictive for UAS in some areas and inadequate in others. For example, existing structural requirements that ensure safe operation in foreseeable weather conditions that are likely to be encountered represent an example of well-established design requirements that existing UAS designs will most likely need to consider. Structural failures have nearly been eliminated from manned aircraft operations and must be mitigated to a similar level of likelihood in UAS operations.

Detailed consideration of UAS in the certification process will be limited in number until such time as a broad and significant consideration is given to existing standards, regulations, and policy. This will be facilitated by UAS manufacturers making application for type design approval to the FAA. For type design approval, UAS designers must show they meet acceptable safety levels for the basic UAS design, and operators must employ certified systems that enable compliance with standardized air traffic operations and contingency/emergency procedures for UAS.

The FAA believes that the UAS community will be best served by the use of an incremental approach to gaining type-design and airworthiness approval. This incremental approach (see Figure 6) could involve the following steps:

- First, allowing existing UAS designs to operate with strict airworthiness and operational limitations to gain operational experience and determine their reliability in very controlled circumstances, as under the existing COA concept or through regulations specific to sUAS;
- Next, developing design standards tailored to a specific UAS application and proposed operating environment. This step would enable the development of useful unmanned aircraft and system design and operational standards for the UAS to facilitate safe operation, without addressing all potential UAS designs and applications. This would lead to type certificates (TC) and production certificates with appropriate limitations documented in the aircraft flight manual;

- And lastly, defining standards for repeatable and predictable FAA type certification of a UAS designed with the redundancy, reliability, and safety necessary to allow repeated safe access to the NAS, including seamless integration with existing air traffic.

Because the UAS community is well established under its current operational assumptions, it is unlikely the FAA or UAS industry will establish an entire set of design standards from scratch. As additional UAS airworthiness options are considered and UAS airworthiness design and operational standards are developed, type certification may be more efficiently and effectively achieved. The UAS industry will continue to build capabilities into the mid- and long-term timeframes. See Appendix C.1 for specific goals and metrics.

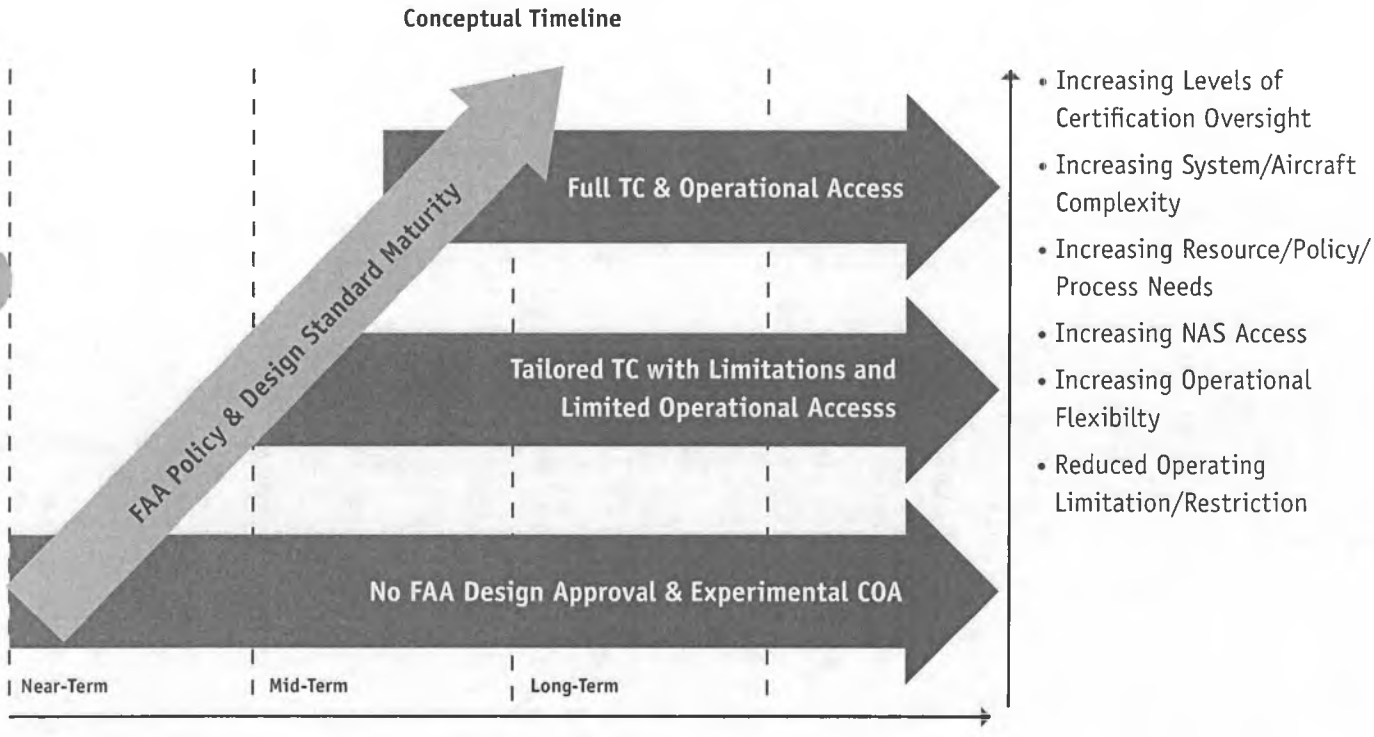


Figure 6: Potential Airworthiness Path for UAS Industry

3.5 Procedures and Airspace

A procedure is a series of actions or operations that have to be executed in the same manner to always obtain the same result under the same circumstances (for example, emergency procedures). The NAS depends on the structure of its airspace and the use of standard procedures to enable safe and efficient operations. ATO directives and other FAA policy and guidance define how UAS are permitted to operate in the NAS today:

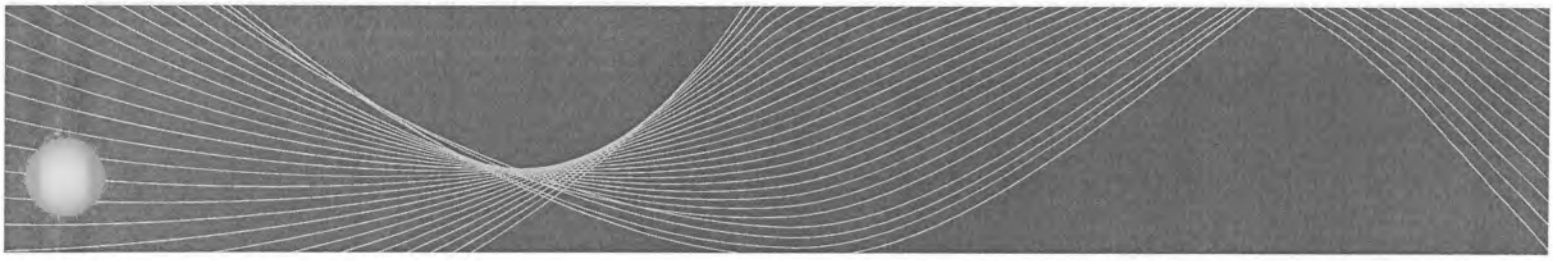
- COAs for public access to the NAS – Notice 8900.207 has been released for these operations;
- Experimental Certificates for civil access to the NAS;
- AND AC 91-57 for modeler (recreation) access to the NAS (June 1981) and Section 336 (Special Rule for Model Aircraft) of FMRA.

Experimental certificates and COAs will always be viable methods for accessing the NAS, but typically come with constraints and limitations. Expanded, easier access to the NAS will occur after new or revised operational rules and UAS certification criteria are defined and the FAA develops specific methods for appropriately integrating UAS into NAS operations.

Another requirement is the baselining activity to assess the applicability of existing air traffic control regulations and orders to UAS operations. Any identified gaps will need to be analyzed, and decisions on accommodation or changes to UAS or regulations will be completed. Some sample differences that affect UAS interoperability with the air traffic system are:

- En Route—Current UAS are not able to meet requirements to fly in reduced vertical separation minimum (RVSM) airspace. They do not fly traditional trajectory-based flight paths and require non-traditional handling in emergency situations.
- Terminal—UAS cannot comply with ATC visual separation clearances and cannot execute published instrument approach procedures.
- Facilities—The introduction of UAS at existing airports represents a complex operational challenge. For the near-term, it is expected that UAS will require segregation from mainstream air traffic, possibly accommodated with UAS launch windows, special airports, or off-airport locations where UAS can easily launch and recover. Initial rulemaking for UAS may not address the requirements for UAS at airport facilities, since sUAS are not expected to routinely use airports for takeoff and landing. However, as civil UAS are developed that require airport access, airport integration requirements will need to be developed. These requirements will include environmental impact and/or assessments (when required) concerning noise, emissions, and any unique fuels and other associated concerns. The current Airport Cooperative Research Project (ACRP 03-30) will address the impacts of commercial UAS on airports. The results of the study will be a publication to help airports and communities gain an understanding of UAS, including a description of how various areas of the aviation system, particularly airports, could be affected. The results should be helpful in addressing the airport integration requirement.

ICAO has issued guidance requiring Member States to implement Safety Management System (SMS) programs. These programs are essential to manage risk in the aviation system. The FAA supports this and is a leader in the design and implementation of SMS. Technical challenges abound, including the ability to analyze massive amounts of data to provide useful information for oversight and assessment of risk.



A key input to a Safety Management methodology is the use of safety data. Valuable data collection is underway, but development of a safety-reporting database is currently limited to reporting requirements from existing COAs and experimental certificate holders. Data collection will expand when additional agreements are finalized for sharing public UAS data and new rules and associated safety data reporting requirements are implemented for sUAS. The strategy will use UAS incident, accident, and operational data from public, experimental, and sUAS operations to iteratively support the basis for and define appropriate UAS operating requirements. The availability and quality of this data may directly determine how fast or slow UAS are integrated into the NAS.

3.6 Training (Pilot, Flightcrew Member, Mechanic, and Air Traffic Controller)

UAS training standards will mirror manned aircraft training standards to the maximum extent possible, including appropriate security and vetting requirements, and will account for all roles involved in UAS operation. This may include the pilot, required crew members such as visual observers or launch and recovery specialists, instructors, inspectors, maintenance personnel, and air traffic controllers. See Appendix C.2 and C.8 for specific goals and metrics.

Accident investigation policies, processes, procedures, and training will be developed near-term, and will be provided to Flight Standards District Offices (FSDO) for implementation. Existing manned procedures will be leveraged as much as possible, though differences will need to be highlighted and resolved (e.g., when an unmanned aircraft accident occurs, there may be a need to impound the control station as well as the aircraft).

3.7 Research and Development (R&D) / Technology

Research in the areas of gaps in current technology and new UAS technologies and operations will support and enable the development of airworthiness and operational guidance required to address new and novel aspects of UAS and associated flight operations. The FAA will continue to establish requirements for flight in the NAS so R&D efforts are not duplicative. Additionally, the FAA's research needs are considered within the JPDO NextGen Research Development and Demonstration Roadmap to prevent overlap and provide opportunities for research collaboration.

R&D efforts with industry support the establishment of acceptable performance limits in the NAS and enable the development of performance parameters for today's NAS, while evaluating future concepts, technologies, and procedures for NextGen. The UAS Technical Community Representative Group (TCRG) is sponsoring broad-based UAS research (SAA, C2, and control station studies) aimed at integration with NextGen and validation of concepts. Near-term expected progress is described here:

Sense and Avoid:

Significant research into SAA methods is underway by both government and industry through a variety of approaches and sensor modes. Specifically the FAA is researching:

- Establishment of Sense and Avoid system definitions and performance levels;
- Assessment of Sense and Avoid system multi-sensor use and other technologies;
- And Minimum Sense and Avoid information set required for collision avoidance maneuvering.

Some public agencies and commercial companies are seeking to develop advanced mitigations, such as Ground Based Sense and Avoid (GBSAA) systems, as a strategy for increased access. Concept-of-use demonstrations are underway at several locations to use GBSAA as a mitigation to see-and-avoid requirements for public UAS COA operators in limited operational areas. GBSAA research and the test evaluations will help develop the sensor, link, and algorithm

requirements that could allow GBSAA to function as a partial solution set for meeting the SAA requirement and will help build the overall SAA requirements in the long-term. Additionally, as GBSAA technology matures, GBSAA could be used to provide localized UAS NAS integration in addition to being used as an advanced accommodation tool. See Appendix C.3 for specific goals and metrics.

Research is underway on Airborne Sense and Avoid (ABSAA) concepts. Due to complexity, significant progress in ABSAA is not expected until the mid-term. Research goals for the near-term include a flight demonstration of various sensor modes (electro-optic/infrared, radar, Traffic Alert and Collision Avoidance System (TCAS) and Automatic Dependent Surveillance-Broadcast (ADS-B)). Actual fielding of a standardized ABSAA system is a long-term objective. See Appendix C.4 for specific goals and metrics.

Control and Communications:

A primary goal of C2 research is the development of an appropriate C2 link between the unmanned aircraft and the control station to support the required performance of the unmanned aircraft in the NAS and to ensure that the pilot always maintains a threshold level of control of the aircraft. Research will be conducted for UAS control data link communications to determine values for latency, availability, integrity, continuity, and other performance measures.

UAS contingency and emergency scenarios also require research (e.g., how will a UAS in the NAS respond when the command link is lost either through equipment malfunction or malicious jamming, etc.). This research will drive standards that are being established through:

- Development and validation of UAS control link prototype
- Vulnerability analysis of UAS safety critical communications
- Completion of large-scale simulations and flight testing of initial performance requirements

Spectrum and civil radio frequency (RF) identification requires global coordination. The International Telecommunication Union (ITU) through the 2015 World Radiocommunication Conference (WRC-2015) will consider spectrum for UAS beyond-line-of-sight (BLOS) applications. Within the United States, the Federal Communications Commission (FCC) manages and authorizes all non-federal use of the radio frequency spectrum, including state and local government as well as public safety. The National Telecommunications and Information Administration (NTIA) manages and authorizes all federal use of the radio frequency spectrum. UAS spectrum operations within the United States need either the approval of the FCC or NTIA and shall not transmit without being properly authorized. Government agencies and industry need to investigate link security requirements, such as protection against intended and unintended jamming, RF interference, unauthorized link takeover, and spoofing. See Appendix C.5 for specific goals and metrics.

Modeling and Simulation:

The FAA is working with other government agencies and industry to develop a collaborative UAS modeling and simulation environment to explore key challenges to UAS integration. The near-term modeling goals are to:

- Validate current mitigation proposals;
- Establish a baseline of end-to-end UAS performance measures;
- Establish thresholds for safe and efficient introduction of UAS into the NAS;
- And develop NextGen concepts, including 4-dimensional trajectory utilizing UAS technology.

These modeling and simulation efforts will address NAS integration topics for UAS, such as latency in executing ATC clearances, inability to accept ATC visual clearances or comply with visual flight rules, priority and equity of NAS access, lost link, and flyaway scenarios.

Human Factors:

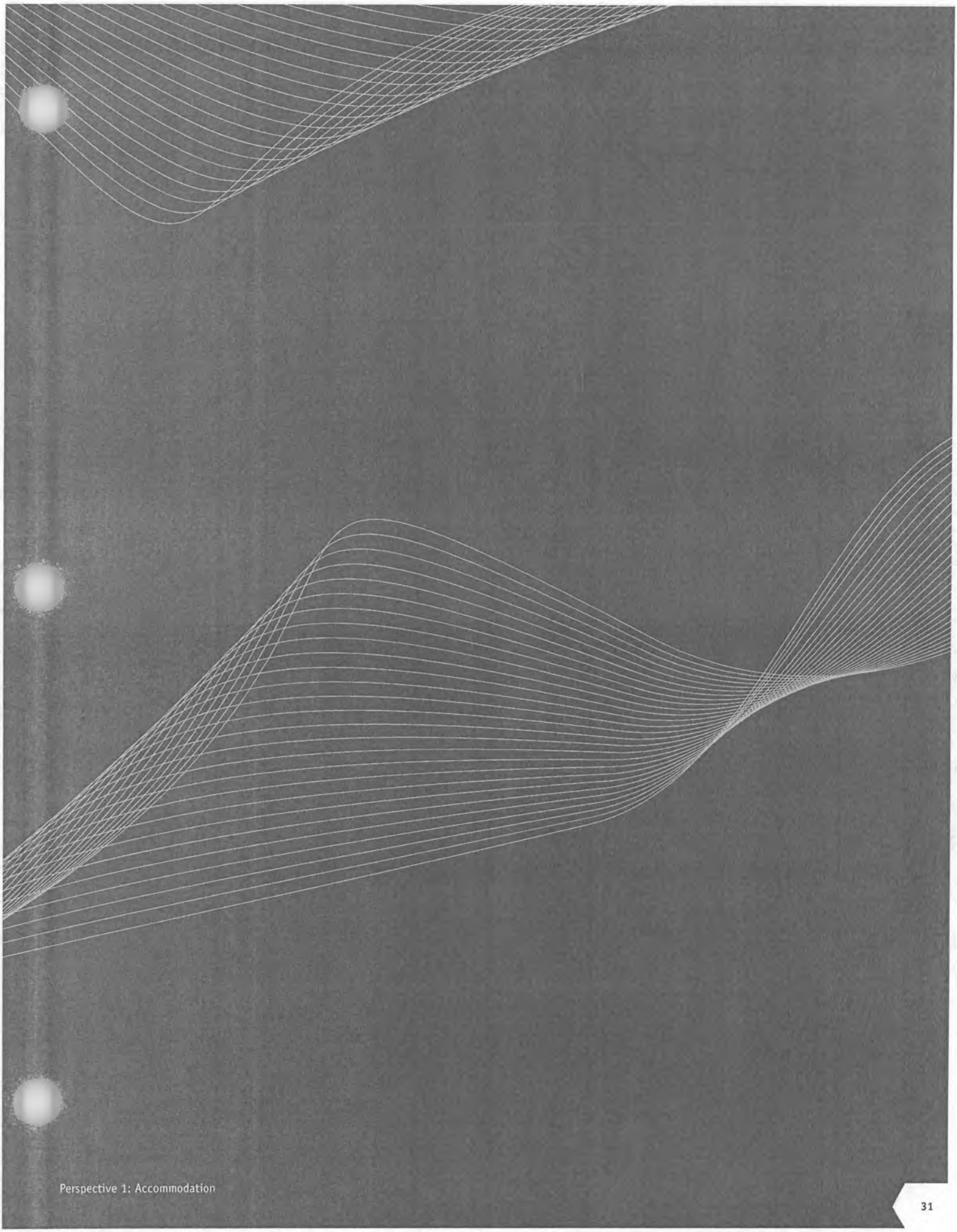
With the pilot controlling the aircraft from beyond the aircraft, several human factors issues emerge related to both the pilot and ATC, and how they will interact to safely operate unmanned aircraft in the NAS. Human factors issues in manned aviation are well known, but there needs to be further analyses regarding integration of UAS into the NAS. In the near-term, data will be collected to permit analysis of how pilots fly UAS, how controllers provide service involving a mix of manned aircraft and UAS, and how pilots and controllers interact with each other, with the goal of developing pilot, ATC, and automation roles and responsibilities concepts. The JPDO, in collaboration with government, academia, and industry researchers, identified several interrelated research challenges:

- Effective human-automation interaction (level; trust; and mode awareness);
- Pilot-centric ground control station design (displays; sensory deficit and remediation; and sterile cockpit);
- Display of traffic/airspace information (separation assurance interface);
- Predictability and contingency management (lost link status; lost ATC communication; and ATC workload);
- Definition of roles and responsibilities (communication flow among crew, ATC, and flight dispatcher);
- System-level issues (NAS-wide human performance requirements);
- And airspace users' and providers' qualification and training (crew/ATC skill set, training, certification, and currency).

Other research in this phase includes activities to support safety case validation and the associated mitigations. This includes case-by-case assessments to determine the likelihood that a system/operation can achieve an acceptable safety level. The research will consider UAS operational and technical risks including:

- Inability to avoid a collision;
- Inability to maintain positive control;
- Inability to meet the operational environment's expected behavior (e.g., self-separate);
- And Inability to safeguard the public.

Summary of "Accommodation" Priorities
Accommodation of UAS in the NAS through evaluation and improvement of safety mitigations
Work with industry and the ARC to review the operational, pilot, and airworthiness regulations
Development of required standards to support technological solutions to identified operational gaps (MOPS)
Safety case validation for UAS operations in NAS—collect/analyze operational and safety data
Robust research, modeling, and simulation for UAS Sense and Avoid, C2, and human factors



Perspective 2: Integration

4.1 Overview

In the mid-term, emphasis will shift significantly from accommodation to integration. For the residual accommodation requirements, it is expected that operational lessons learned and technological advances will lead to more sophisticated mitigations with increased safety margins. Thus, COAs and experimental certificates will remain avenues for accessing the NAS with appropriate restrictions and constraints. Emphasis will shift toward integration of UAS through the implementation of civil standards for unmanned aircraft pilots and new or revised operational rules, together with necessary policy guidance and operational procedures.

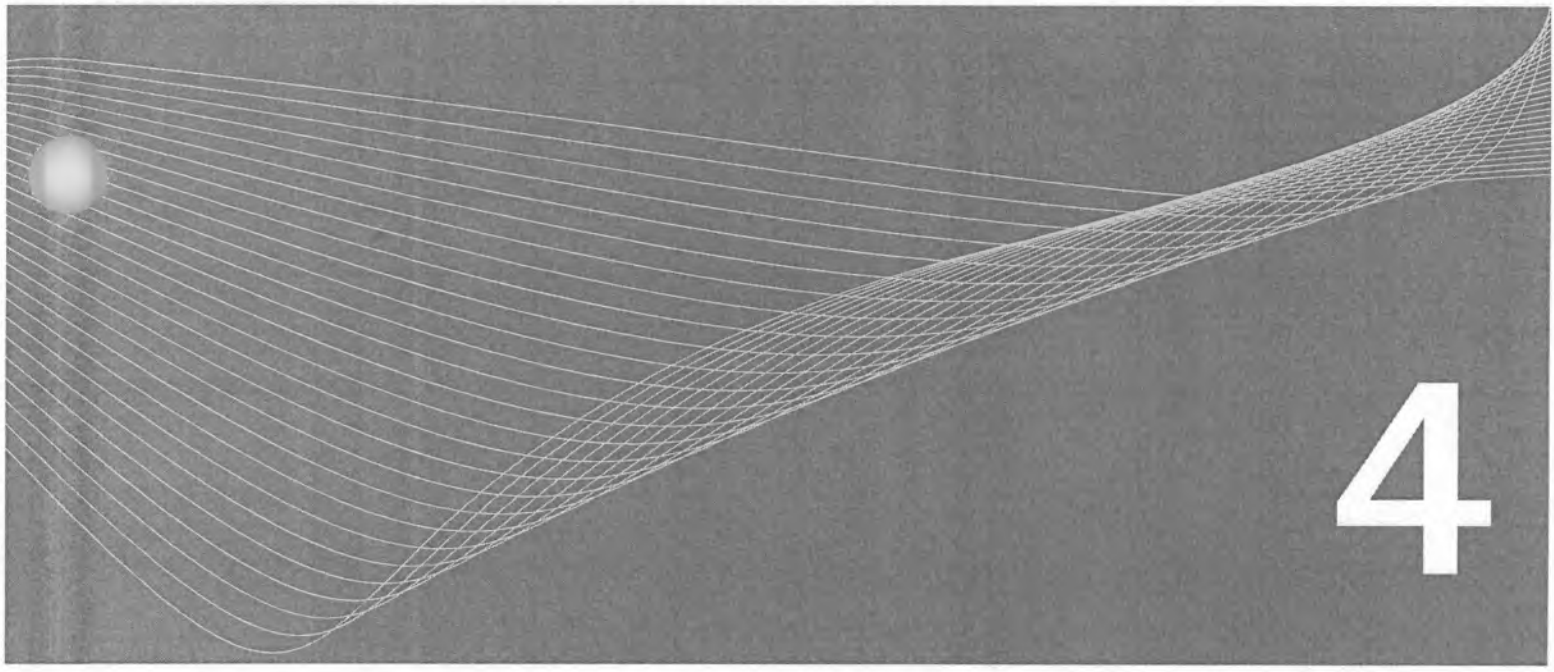
Integration efforts will focus on sequentially developing and implementing the UAS system requirements established by the FAA as a result of R&D and test range outputs:

- Finalize the integrated set of FAA rulemaking, policy, operational guidance, procedures, and standards;
- Define continued airworthiness methodologies;
- Complete training and certification standardization;
- Continue the research and technology development and assessment work that underpins the ability of UAS to operate safely and efficiently in the NAS;
- And address the privacy, security, and environmental implications of UAS operations.

To receive civil certification under existing or adapted/expanded regulations, guidance, and standards, research is needed that will assist in defining the certification basis for unique UAS features. While current regulations, guidance, and standards ensure safe operation of aircraft with pilots in the cockpit, these current regulations may not represent the necessary and sufficient basis for the design criteria and operation of UAS.

Integration efforts will provide a foundation for creating and modifying FAA policies and procedures to permit more routine forms of UAS access and bridge the gap to the long-term goal of developing the policy, guidance, and operational procedures required to enable manned and

Integration efforts will focus on sequentially developing and implementing the UAS system requirements established by the FAA as a result of R&D and test range outputs.



unmanned aircraft to fly together in an environment that meets or exceeds today's level of safety and efficiency. As new UAS evolve, more specific training will be developed for UAS pilots, crew members, and certified flight instructors. See Appendix C.2 for specific goals and metrics.

UAS operations comingled at airports with manned aircraft is one of the more significant challenges to NAS integration. The UAS must be able to operate within airport parameters and comply with the existing provisions for aircraft. As with airspace operational requirements, the airport standards are not expected to change with the introduction of UAS, and their operation must be harmonized in the provision of air traffic services.

The following general requirements and assumptions will pertain to all UAS operations that are integrated into the NAS (with the exception of sUAS operating exclusively within visual line-of-sight (LOS) of the flight crew):

1. UAS operators comply with existing, adapted, and/or new operating rules or procedures as a prerequisite for NAS integration.
2. Civil UAS operating in the NAS obtain an appropriate airworthiness certificate while public users retain their responsibility to determine airworthiness.
3. All UAS must file and fly an IFR flight plan.
4. All UAS are equipped with ADS-B (Out) and transponder with altitude-encoding capability. This requirement is independent of the FAA's rule-making for ADS-B (Out).
5. UAS meet performance and equipage requirements for the environment in which they are operating and adhere to the relevant procedures.
6. Each UAS has a flight crew appropriate to fulfill the operators' responsibilities, and includes a pilot-in-command (PIC). Each PIC controls only one UA.*
7. Autonomous operations are not permitted.** The PIC has full control, or override authority to assume control at all times during normal UAS operations.
8. Communications spectrum is available to support UAS operations.
9. No new classes or types of airspace are designated or created specifically for UAS operations.
10. FAA policy, guidelines, and automation support air traffic decision-makers on assigning priority for individual flights (or flight segments) and providing equitable access to airspace and air traffic services.

11. Air traffic separation minima in controlled airspace apply to UA.
12. ATC is responsible for separation services as required by airspace class and type of flight plan for both manned and unmanned aircraft.
13. The UAS PIC complies with all ATC instructions and uses standard phraseology per FAA Order (JO) 7110.65 and the Aeronautical Information Manual (AIM).
14. ATC has no direct link to the UA for flight control purposes.

* This restriction does not preclude the possibility of a formation of UA (with multiple pilots) or a "swarm" (one pilot controlling a group of UA) from transiting the NAS to/from restricted airspace, provided the formation or swarm is operating under a COA.

** Autonomous operations refer to any system design that precludes any person from affecting the normal operations of the aircraft.

4.2 Standards

After MASPS are completed, the emphasis of standards activities will be geared toward the development of MOPS, which will contribute to the basis for regulatory changes and the equipment standards for UAS-specific systems and equipment. The development of MOPS may provide requirements the FAA may invoke as TSO to support airworthiness approval on certificated unmanned aircraft and may lead to the development of improved systems, potentially applicable to all civil aircraft. See Appendix C for specific goals and metrics.

4.3 Rules and Regulations

Recognizing that the UAS community might be better served by specific rules, the FAA is initially proposing to amend its regulations to adopt specific rules for the operation of sUAS in the NAS. These changes will address the classification of sUAS, certification of sUAS pilots, registration of sUAS, approval of sUAS operations, and sUAS operational limits.

Operations of sUAS under new regulations may have operational, airspace, and performance constraints, but will provide experience for pilots and additional data to inform subsequent rulemaking, standards, and training development for safe and efficient integration of other UAS in the NAS.

When the final rule is published and in effect, it will reduce the need for sUAS operators to conduct operations under either a COA or the constraints of an experimental certificate. This will allow operators and the FAA to shift the focus of resources to solutions that will better enable UAS integration. See Appendix C.6 for specific goals and metrics.

As integration continues, new or revised operational rules and associated standards and policies will allow compliant UAS to access additional airspace throughout the NAS.

4.4 Airworthiness Certification of the UAS

The FAA will work with the UAS community in defining policy and standards that facilitate agreement on an acceptable UAS certification basis for each applicant. This may involve the development of new policy, guidance, rulemaking, special conditions, and methods of compliance. See Section 3.4 for a more detailed discussion and Appendix C.1 for specific goals and metrics.

4.5 Procedures and Airspace

There will be incremental increases in NAS access based on rigorous safety mitigations of current UAS that were previously developed and built without approved industry or governmental standards. As integration begins, there will be approved airspace and procedures for sUAS, which will provide a basis for developing plans for increased NAS access as UAS are certified. As integration continues, new or revised operational rules and procedures, and associated standards and policies, will allow compliant UAS to access additional airspace throughout the NAS. The ATO will use procedures with these UAS similar to those used for manned aircraft, but may also delegate separation responsibility to UAS for some operations. To support this, ATO goals will be:

- Standardize air traffic operations and contingency/emergency procedures for UAS operators to ensure certified aircraft systems are interoperable with air traffic procedures and airspace requirements;
- Develop airport facility integration plans. This will require research and the development of procedures that address critical issues such as low visibility, taxi spacing, light gun signals, and compatibility with NextGen operations;
- Establish UAS operating requirements with associated ATC procedures for airport conditions;
- And coordinate with the Department of Defense (DoD) and all other appropriate departments and agencies on the development of any new parallel procedures and requirements for air domain awareness and defense.

See Appendix C.8 for specific goals and metrics.

4.6 Training (Pilot, Flightcrew Member, Mechanic, and Air Traffic Controller)

The FAA's role in training is to establish policy, guidance, and standards. Airmen training standards are under development and will be synchronized with the regulatory guidance. Civil operators normally develop a training regimen that allows pilots and flight support to meet regulatory standards. For any UAS operation, training regimens analogous to those that exist for manned aircraft will need to be considered, including relevant areas such as written tests, practical examinations, and currency and proficiency requirements.

Standards for airmen will proceed following the sUAS regulation. The FAA will issue UAS airman certificates and support activities to enable UAS operations to include:

- Development of practical test standards (PTS) and UAS airmen knowledge test question banks;
- Development of a UAS handbook for airmen;
- Training of aviation safety inspectors (ASI) at the FSDO level to provide practical test oversight;
- Identification of designated pilot examiners (DPE) to assist the FSDOs;
- Development of a UAS handbook for pilot and instructors;
- Development of PTS and UAS pilot knowledge test question banks;
- Development of UAS mechanic training and certificate process;
- And development of flight crew security requirements by the relevant United States Government agencies.

Pilot endorsements may be developed for specific UAS makes and models to permit commercial operations. Pilot qualifications by make and model will be built into training and will be expanded based on pilot experience.

Training standards development will be more complex for UAS with unique operating parameters and will continue into the long-term as these UAS are certified.

Regardless of the UAS platform, similar types of training regimens are expected, consisting of a written knowledge test, practical test standards, and a flight evaluation. There will be a requirement for currency and proficiency; qualified ASIs will be fielded to regional offices across the country.

With the introduction of UAS into the NAS, additional training requirements specific to different types of UAS characteristics will probably be required for ATC personnel, including UAS performance, behavior, communications, unique flight profiles, ATC standardized procedures, lost link/fly away profiles, operating limitations, and emergency procedures. Controller training will include differences in interoperability between manned and UAS flights, with a focus on specific handling issues of the aircraft. This training must be administered to ATC facilities throughout the NAS. It is expected that controllers will handle UAS the same as manned aircraft; therefore, no special ATC certification would be required. See Appendix C.2 and C.8 for specific goals and metrics.

4.7 Research and Development (R&D) /Technology

Sense and Avoid:

Research on SAA sensor performance, data communication, and algorithms must provide solutions for safe separation for integration of UAS into the NAS. Research to develop separation algorithms will be accomplished with the JPDO R&D plan goals of:

- Flight demonstration of self-separation and collision avoidance algorithms, with multiple sensors and intruders;
- Assessment of the performance of various self-separation concepts as a function of surveillance data configurations, and evaluation of risk-based self-separation algorithms and policy issues;
- Assessment of the performance of various separation assurance concepts, and flight demonstration of separation assurance algorithms, with criteria-based separation;
- And assessment of UAS performance for delegated spacing applications (e.g., defined interval clearances).

Although research will continue, fully certified UA-based collision avoidance solutions may not be feasible until the long-term and are deemed to be a necessary component for full UAS NAS integration. This will include research on safe and efficient terminal airspace and ground operations, followed by ground demonstrations of autonomous airfield navigation and ATC interaction. See Appendix C.4 and C.8 for specific goals and metrics.

Control and Communications:

Advanced research is required in data link management, spectrum analysis, and frequency management. Efforts will focus on completing development of C2 link assurance and mitigation technologies and methods for incorporating them into the development of certification of the UAS. This will include:

- Identification of satellite communication spectrum from the ITU through its WRC;
- Verification and validation of control communication final performance requirements;
- Establishment of UAS control link national/international standards;
- And development and validation of technologies to mitigate vulnerabilities.

Complete characterization of the capacity, performance, and security impacts of UAS on ATC communication systems will be completed. See Appendix C.5 and C.8 for specific goals and metrics.

Human Factors:
Human factors research will continue in the areas of human-machine interface (both control station displays and ATC displays), automation, and migration of control. Human factors data collected in the near-term and mid-term will be analyzed to determine the safest technologies and best procedures for pilots and ATC controllers to interact with each other and with the aircraft; these results will influence technology and operations research. For separation and collision avoidance capability, the contribution of human decision making versus automation must be identified. See Appendix C.8 for specific goals and metrics.

4.8 Test Ranges

Per the FMRA, the FAA will establish six test ranges. The test ranges will take into consideration climate and geographic diversity, the location of ground infrastructure and research needs. See Appendix C.7 for specific goals and metrics.

The test range program will address and account for:

- Manned-unmanned operations,
- Certification standards and air traffic requirements,
- Coordination and leveraging of National Aeronautics and Space Administration (NASA) and DoD resources,
- Civil and public unmanned aircraft systems,
- And coordination with NextGen.

The test ranges will help provide a verification mechanism for safe operations before unmanned aircraft are integrated into the NAS.

The FAA anticipates test range operator privacy practices, as discussed in their privacy policies, will help inform the dialogue among policymakers, privacy advocates, and the industry regarding broader questions concerning the use of UAS technologies. Transparency of privacy policies associated with UAS test range operations will engage all stakeholders in discussions about which privacy issues are raised by UAS operations and how law, public policy, and the industry practices should respond to those issues in the long run.

Summary of "Integration" Priorities
New operational rules and associated standards, policies, and procedures established for small UAS
New operational rules and associated standards, policies, and procedures established for other UAS
C2 link standards defined for integrity, latency, and continuity
FAA acceptance of MASPS to enable development of detailed MOPS
Published FAA policy and operational guidance to define acceptable methods to comply with operational rules in accordance with an acceptable UAS certification basis for each applicant
Published FAA flightcrew training and certification standards

Perspective 3: Evolution

5.1 Overview

Overlaying the integration of UAS is the need to remain aware of the changing characteristics and requirements of the evolving NAS. The long-term focus for UAS operations is the refinement and updating of regulation, policy, and standards. The end-state is to implement streamlined processes for the continued integration of UAS into the NAS.

These efforts will include:

- Policy, operational guidance, and standards for civil aircraft airworthiness and NAS operations and with consideration for privacy and security concerns and frameworks;
- Continued airworthiness methodologies;
- Training and certification standardization;
- And certification of key technologies to enable continued operations of UAS in the NAS.

5.2 Standards

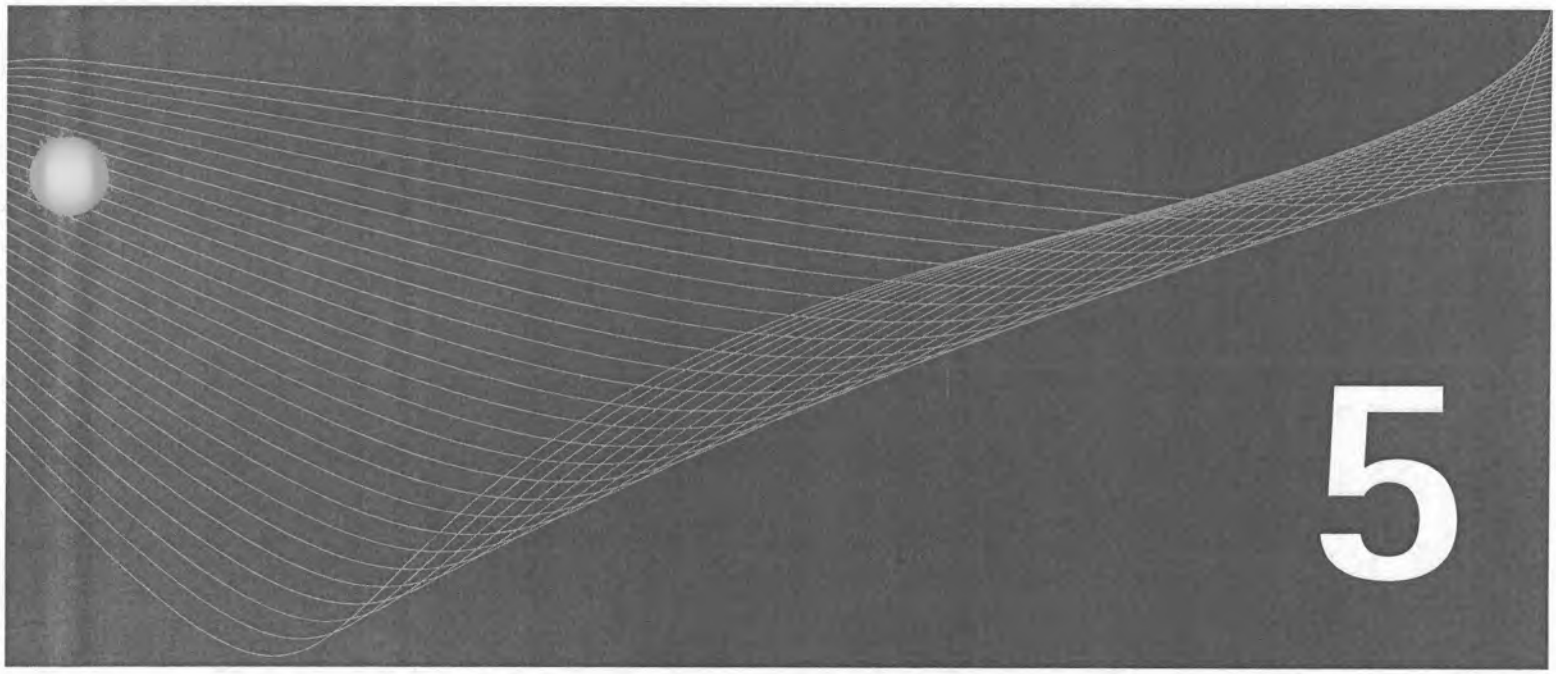
Unique UAS certification requirements will have been determined. MASPS, MOPS, and TSOs will support the regulations and certification of key systems for each UAS. Additionally, all standards will be evaluated and modified, as needed. See Appendix C.1 for specific goals and metrics.

5.3 Rules and Regulations

Lessons learned from previous rulemaking efforts may be applicable to the development of new UAS regulations. The process should become more efficient as UAS experience is gained and data analysis proves safety cases more quickly. UAS rulemaking activities will be more likely to involve revisions to existing rules, as needed, rather than the creation of new rules.

5.4 Airworthiness Certification of the UAS

Certification of UAS will evolve as future technologies evolve and will be consistent with all other aircraft airworthiness and operational approval processes, adding more capability to the UAS through data analyses and trending, which will identify areas for change and improvement in operations, human factors, communication links, and maintenance. See Section 3.4 for a more detailed discussion and Appendix C.1 for specific goals and metrics.



5.5 Procedures and Airspace

Certified pilots and UAS will be permitted access into the NAS under seamless operating procedures. The need to accommodate special NAS access will be dramatically reduced, and will be limited to research and development or test operations.

UAS operations will continue to evolve based on NextGen requirements. See Appendix C.8 for specific goals and metrics.

5.6 Training (Pilot, Flightcrew Member, Mechanic, and Air Traffic Controller)

As new UAS evolve, more specific training will be developed for UAS pilots, crew members, and certified flight instructors based on lessons learned and data collection. See Appendix C.2 and C.8 for specific goals and metrics.

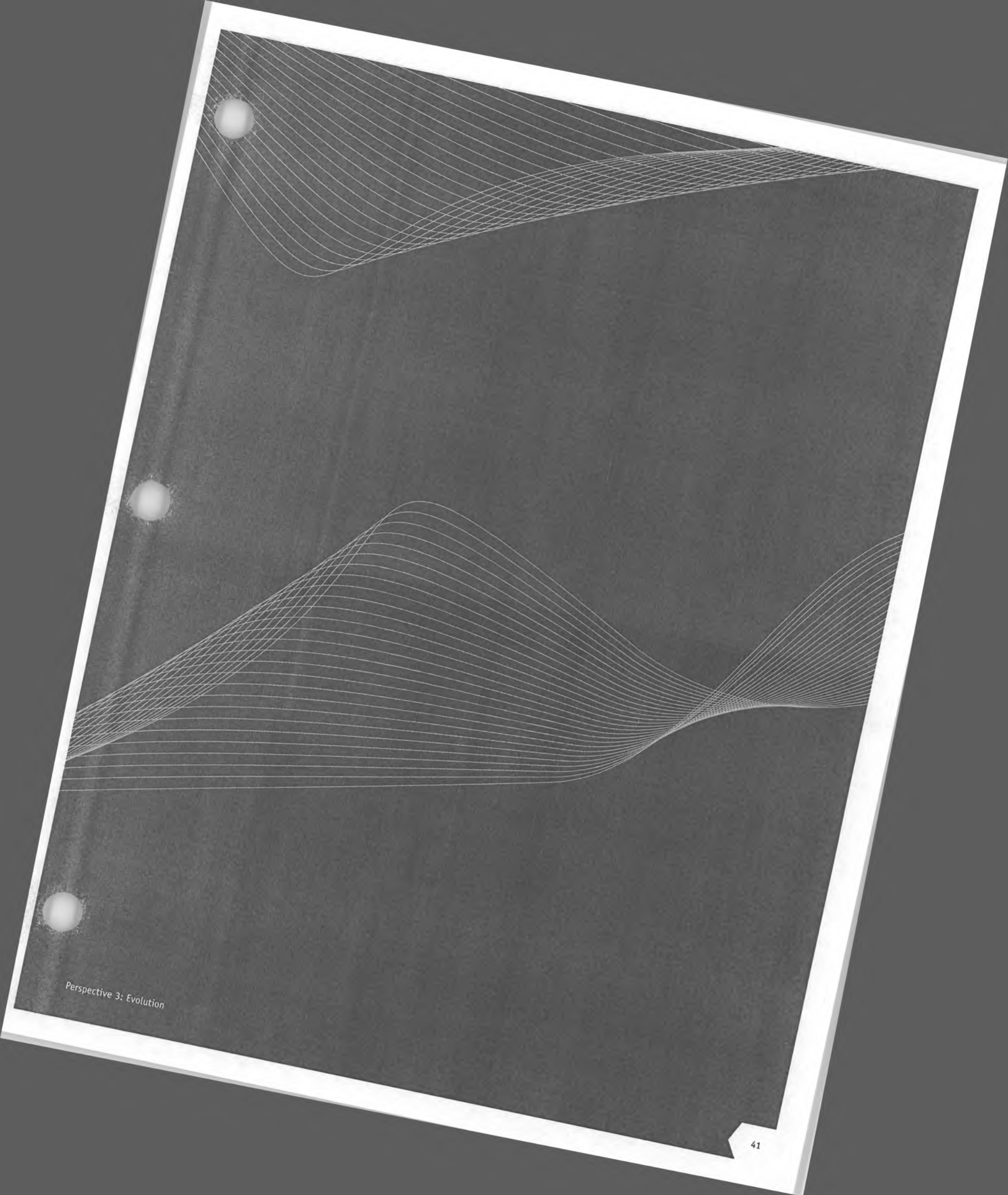
5.7 Research and Development (R&D) / Technology

Identified limitations and gaps will be closed via research and development of required technologies that meet standards established by the FAA. Planned activities include:

- Sense and Avoid research that focuses on algorithm development and compatibility with current and future manned aircraft collision avoidance systems such as TCAS II/ACAS X and surveillance systems (e.g., ADS-B), as well as compatibility with ATC separation management procedures and tools;
- Research on UAS system safety and levels of automation for the improvement of UAS into the future;
- Examination of potential concepts for the widespread integration of UAS into the future NextGen environment;
- AND research on new tools and techniques to support avionics and control software development and certification, to ensure their safety and reliability.

Organized studies will continue to investigate the evolution of UAS operations into the NextGen environment. Detailed research on SAA flight operations, using certified sensor systems, could allow aircraft to maintain safe distances from other aircraft during flight conditions that would not be appropriate for visual flight in a manned aircraft. This capability would rely heavily on network-enabled information, precision navigation, and cooperative surveillance, and would require the development and integration of NextGen-representative technologies for traffic, weather, and terrain avoidance. This conceptual model will be enlarged with sensors that expand the ability to maintain separation from other aircraft past the current visual spectrum and flight conditions restrictions. See Appendix C.8 for specific goals and metrics.

Summary of "Evolution" Priorities
Seamless operations of certified UAS and crew members in the evolving NAS
Published FAA TSOs based on system level MOPS
Certified Sense and Avoid algorithms for collision avoidance and self-separation that are interoperable with evolving NextGen ATC systems and manned collision avoidance systems



Conclusions

6.1 Summary

The safe integration of unmanned aircraft into the NAS is a significant challenge. The FAA is dedicated to developing the technical and regulatory standards, policy guidance, and operational procedures on which successful UAS integration depends.

The application of financial and human resources by academia and industry to support critical FAA initiatives will shorten the time required to develop technical and regulatory standards. Together, all stakeholders can overcome the challenge of integrating UAS into the NAS and leverage UAS and associated technologies for the greater benefit of society.

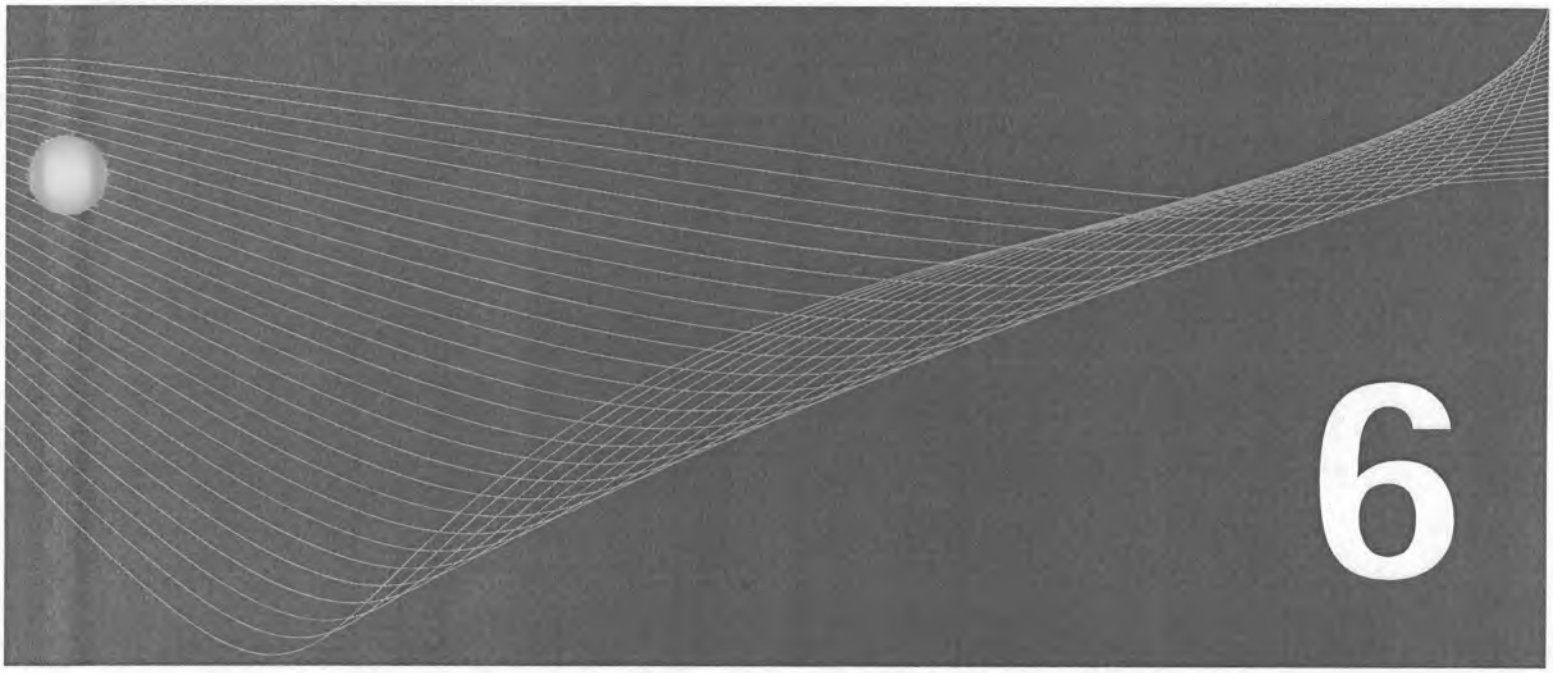
6.2 Outlook

Based on FAA policy and the challenges that need to be addressed, this roadmap has focused on the activities required to achieve integration of UAS into the evolving NAS. Throughout the process, the key messages below reflect the basis for the FAA's consideration of requirements to integrate civil UAS into the NAS:

1) **Government-industry collaboration is paramount to success and must focus on process, quality, and timely results.**
   The FAA expects to gain experience in applying the existing airworthiness regulations during the type certification process with early UAS adopters. We also expect input from industry and the ARC. Taking into account industry and ARC inputs, and future experience with UAS type certification projects, the FAA will review and revise as necessary the existing airworthiness regulations to ensure UAS safety.

2) **The FAA must remain committed to the development of technical and regulatory standards, policy guidance, and operations procedures on which successful UAS integration depends.**
   With this roadmap, the FAA has outlined initiatives that must be accomplished. Because unmanned aircraft are considered aircraft that are flown by pilots, existing regulations and procedures are largely applicable. However, the complete integration of UAS at airports and in the various airspace classes may necessitate the development of new or revised regulations and supplemental procedures. These will be developed and implemented in coordination with relevant agencies to address related security and privacy implications.

3) **Global standards encourage harmonization and yield cost-effective development.**
   The FAA is not bound by international policies and standards. However, harmonizing efforts with the international aviation community will allow for more seamless operations of UAS across national boundaries. Synchronizing



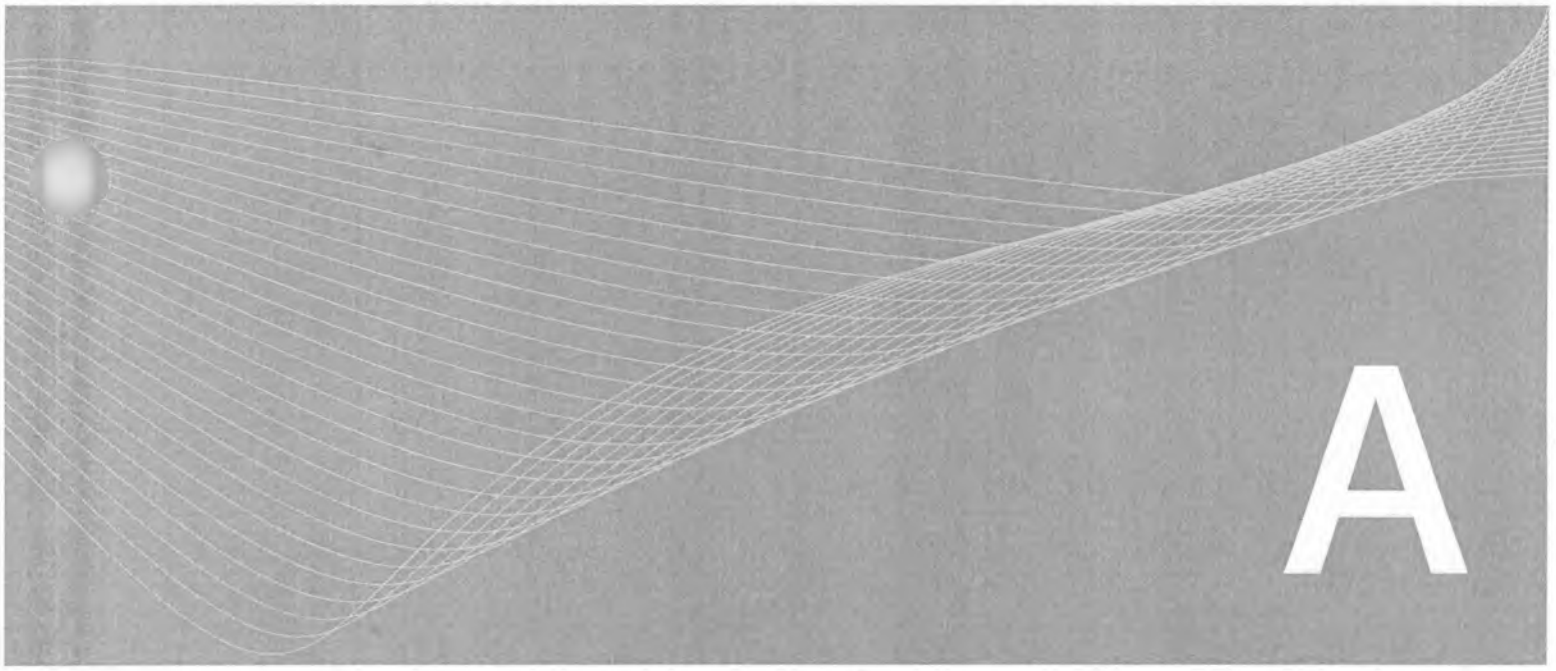
efforts within the aviation community will also permit better use of limited human and fiscal resources, thereby reducing the time required to produce regulatory guidance, policy, and standards.

4) **The FAA is focused on increased access for UAS without impacting the safety or efficiency of the NAS, while managing environmental impacts.**
The FAA has placed a high priority on the development of rules for small UAS that will increase access to the NAS and provide an initial opportunity for commercial operations. In the long-term, the principal objective of the aviation regulatory framework is to achieve and maintain the highest possible uniform level of safety while maintaining or increasing the efficiency and the environmental performance of the NAS. In the case of UAS, this means ensuring the safety of all airspace users as well as the safety of persons and property on the ground.

5) **Progress must be made on the development of technology to enable NAS access.**
Because of many distinct differences between UAS and manned aircraft, there are required technologies that must be matured to enable the safe and seamless integration of UAS in the NAS. Research will be focused in the areas of sense and avoid, control and communications, and human factors.

Appendix A: Acronyms

ABSAA	Airborne Sense and Avoid
ACAS X	Airborne Collision Avoidance System X
ADS-B	Automatic Dependent Surveillance–Broadcast
AIM	Aeronautical Information Manual
AMA	Academy of Model Aeronautics
ARC	Aviation Rulemaking Committee
ASI	Aviation Safety Inspector
ASTM	American Society for Testing and Materials
ATC	Air Traffic Control
ATO	Air Traffic Organization
AVS	Office of Aviation Safety
BLOS	Beyond-Line-of-Sight
C2	Control and Communications
COA	Certificate of Waiver or Authorization
DAA	Detect and Avoid
DHS	Department of Homeland Security
DoD	Department of Defense
DOJ	Department of Justice
DPE	Designated Pilot Examiner
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FMRA	FAA Modernization and Reform Act of 2012
FSDO	Flight Standards District Office
GBSAA	Ground Based Sense and Avoid
GSE	Ground Support Equipment
IFR	Instrument Flight Rules
ICAO	International Civil Aviation Organization
IPC	Interagency Planning Committee
ITU	International Telecommunication Union
JPDO	Joint Planning and Development Office
LOS	Line-of-Sight
MASPS	Minimum Aviation System Performance Standard
MOPS	Minimum Operational Performance Standard
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NextGen	Next Generation Air Transportation System
NIJ	National Institute of Justice
NOAA	National Oceanic and Atmospheric Administration



NPRM	Notice of Proposed Rulemaking
NTIA	National Telecommunications and Information Administration
OPA	Optionally Piloted Aircraft
OSED	Operational Services and Environmental Definition
PIC	Pilot-in-Command
PTS	Practical Test Standards
R/C	Radio Control
R&D	Research and Development
RF	Radio Frequency
RPV	Remotely Piloted Vehicle
RVSM	Reduced Vertical Separation Minimum
SAA	Sense and Avoid
SARP	Standards and Recommended Practices
SMS	Safety Management System
S&T	Science and Technology
sUAS	Small Unmanned Aircraft Systems
TC	Type Certificate
TCAS	Traffic Alert and Collision Avoidance System
TCRG	Technical Community Representative Group
TSO	Technical Standard Order
UAS	Unmanned Aircraft System
UAV	Unmanned Aerial Vehicle
VO	Visual Observer
WRC	World Radiocommunication Conference
14 CFR	Title 14 of the Code of Federal Regulations

Appendix B: Glossary

The following definitions were obtained from several sources, including:

1. Title 14 of the Code of Federal Regulations, Part 1.1
2. FAA Pilot/Controller Glossary (P/CG)
3. RTCA DO-320: Operational Services and Environmental Definition for Unmanned Aircraft Systems
4. Notice 8900.207, "Unmanned Aircraft Systems (UAS) Operational Approval," January 22, 2013
5. FAA Modernization and Reform Act of 2012
6. "Sense and Avoid (SAA) for Unmanned Aircraft Systems (UAS)" – Second Caucus Workshop Report 2013
7. FAA Order 8130.34B – Airworthiness Certification of Unmanned Aircraft Systems and Optionally Piloted Aircraft

Note: Applicable sources are shown at the end of each definition in parentheses (e.g. (1), (2), etc.). Terms without a specific source definition are defined in this Roadmap.

Terminology	Definition
Air Traffic Control	A service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic. (1)
Aircraft	A device that is used or intended to be used for flight in the air. (1)
Airspace	Any portion of the atmosphere sustaining aircraft flight and which has defined boundaries and specified dimensions. Airspace may be classified as to the specific types of flight allowed, rules of operation, and restrictions in accordance with International Civil Aviation Organization standards or State regulation. (3)
Airworthiness Certification	A process that the FAA uses to ensure that an aircraft design complies with the appropriate safety standards in the applicable airworthiness regulations.
Certificate of Waiver or Authorization	An FAA grant of approval for a specific flight operation. The authorization to operate a UAS in the National Airspace System as a public aircraft outside of Restricted, Warning, or Prohibited areas approved for aviation activities. (4)

B

Terminology	Definition
Civil Aircraft	Aircraft other than public aircraft. (4)
Collision Avoidance	The Sense and Avoid system function where the UAS takes appropriate action to prevent an intruder from penetrating the collision volume. Action is expected to be initiated within a relatively short time horizon before closest point of approach. The collision avoidance function engages when all other modes of separation fail. (6)
Communication Link	The voice or data relay of instructions or information between the UAS pilot and the air traffic controller and other NAS users. (3)
Control Station	The equipment used to maintain control, communicate with, guide, or otherwise pilot an unmanned aircraft. (3)
Crewmember [UAS]	In addition to the crewmembers identified in 14 CFR Part 1, a UAS flightcrew member includes pilots, sensor/payload operators, and visual observers, but may include other persons as appropriate or required to ensure safe operation of the aircraft. (4)
Data Link	A ground-to-air communications system which transmits information via digital coded pulses. (3)
Detect and Avoid	Term used instead of Sense and Avoid in the Terms of Reference for RTCA Special Committee 228. This new term has not been defined by RTCA and may be considered to have the same definition as Sense and Avoid when used in this document.
International Civil Aviation Organization	A specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport. (2)
Manned Aircraft	Aircraft piloted by a human onboard. (3)
Model Aircraft	An unmanned aircraft that is capable of sustained flight in the atmosphere; flown within visual line-of-sight of the person operating the aircraft and flown for hobby or recreational purposes. (5)

Terminology	Definition
National Airspace System	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. (2)
Optionally Piloted Aircraft	An aircraft that is integrated with UAS technology and still retains the capability of being flown by an onboard pilot using conventional control methods. (7)
Pathfinder	An initial UAS airworthiness certification program that will aid the FAA in the establishment of certification requirements.
Pilot-in-Command	Pilot-in-command means the person who: 1) has final authority and responsibility for the operation and safety of the flight; 2) has been designated as pilot-in-command before or during the flight; and 3) holds the appropriate category, class, and type rating, if appropriate, for the conduct of the flight. (1)
Public Aircraft	An aircraft operated by a governmental entity (including federal, state, or local governments, and the U.S. Department of Defense and its military branches) for certain purposes as described in 49 U.S.C. §§ 40102(a)(41) and 40125. Public aircraft status is determined on an operation by operation basis. See 14 CFR Part 1, § 1.1 for a complete definition of a public aircraft. (4)
RTCA	RTCA, Inc. is a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management system issues. RTCA functions as a Federal Advisory Committee. Its recommendations are used by the FAA as the basis for policy, program, and regulatory decisions and by the private sector as the basis for development, investment and other business decisions. (www.rtca.org)
See and Avoid	When weather conditions permit, pilots operating instrument flight rules or visual flight rules are required to observe and maneuver to avoid another aircraft. Right-of-way rules are contained in 14 CFR Part 91. (2)
Self-Separation	Sense and Avoid system function where the UAS maneuvers within a sufficient timeframe to remain well clear of other airborne traffic. (6)
Sense and Avoid	The capability of a UAS to remain well clear from and avoid collisions with other airborne traffic. Sense and Avoid provides the functions of self-separation and collision avoidance to establish an analogous capability to "see and avoid" required by manned aircraft. (6)
Small Unmanned Aircraft	An unmanned aircraft weighing less than 55 pounds. (5)

Terminology	Definition
Special Airworthiness Certificate – Experimental Category (UAS)	Airworthiness certification for experimental UAS and optionally piloted aircraft.
Test Range	A defined geographic area where research and development are conducted in accordance with Sections 332 and 334 of the FMRA. Test ranges are also known as test sites in related documents such as the FAA's Screening Information Request. (5)
Unmanned Aircraft	1) A device used or intended to be used for flight in the air that has no onboard pilot. This devise excludes missiles, weapons, or exploding warheads, but includes all classes of airplanes, helicopters, airships, and powered-lift aircraft without an onboard pilot. UA do not include traditional balloons (see 14 CFR Part 101), rockets, tethered aircraft and un-powered gliders. (4) 2) An aircraft that is operated without the possibility of direct human intervention from within or on the aircraft. (5)
Unmanned Aircraft System	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. (4) An unmanned aircraft and associated elements (including communications links and the components that control the unmanned aircraft) that are required for the pilot-in-command to operate safely and efficiently in the national airspace system. (5)
Visual Line-of-Sight	Unaided (corrective lenses and/or sunglasses exempted) visual contact between a pilot-in-command or a visual observer and a UAS sufficient to maintain safe operational control of the aircraft, know its location, and be able to scan the airspace in which it is operating to see and avoid other air traffic or objects aloft or on the ground. (4)

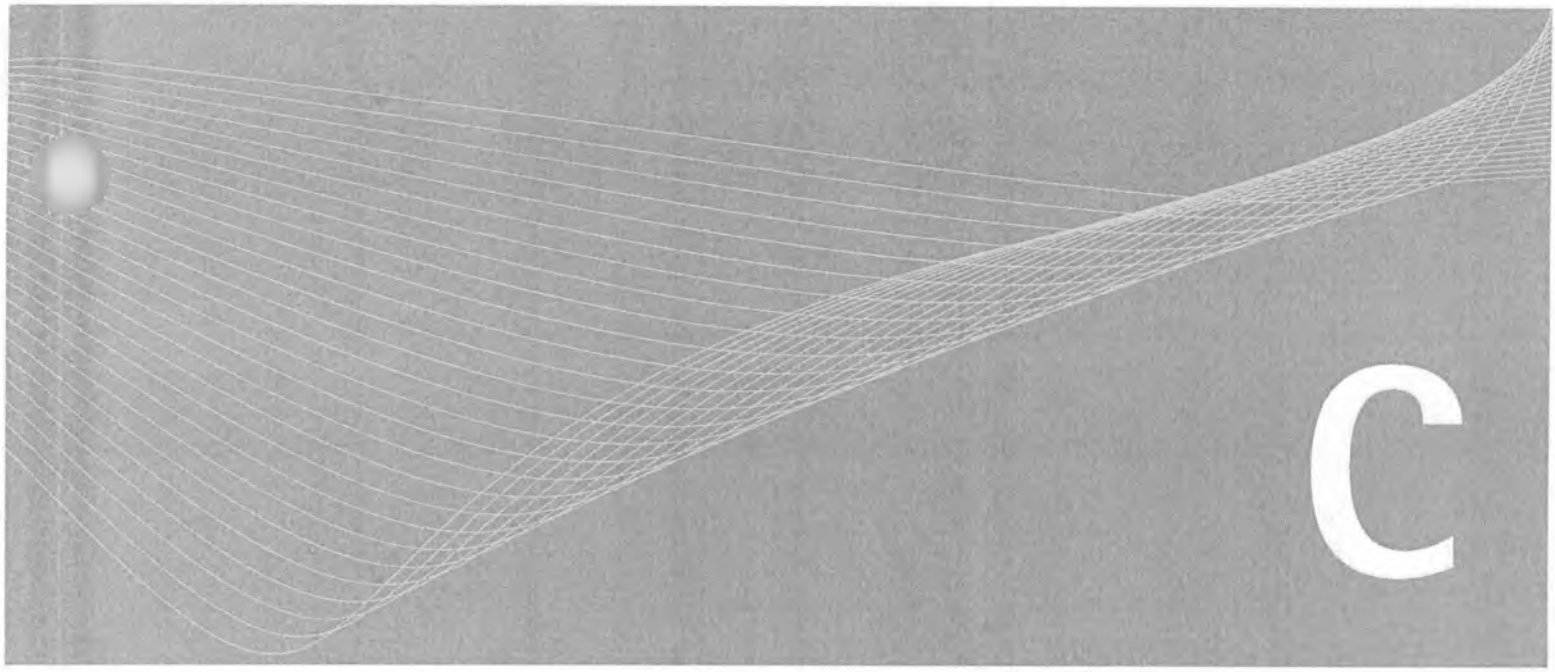
Appendix C: Goals, Metrics, and Target Dates

This appendix contains FAA-developed goals, metrics, and target dates (date ranges) and incorporates many related Unmanned Aircraft Systems (UAS) Aviation Rulemaking Committee (ARC) recommendations. The target dates in this appendix are generally limited to a five-year planning horizon. The FAA will continue its effective dialogue with the UAS ARC as it makes changes to the existing set of goals, metrics, and target dates in yearly updates to this roadmap. These annual updates will track and report progress, as recommended by the Government Accountability Office.

The following material identifies the key goals and related activities to be accomplished in accommodating, integrating, and evolving UAS operations in the National Airspace System (NAS). The goals are, for the most part, intended to be addressed concurrently. For each goal, a set of metrics (i.e., well-defined milestones with target completion dates) is defined. The metrics help establish and maintain common government and industry expectations, and enable objective assessments of the progress made toward the accomplishment of each goal. The goals and metrics reflect the incremental approach to UAS certification and integration described in this roadmap.

The goals and metrics in and of themselves do not constitute a UAS integration roadmap implementation plan; however, they do establish a set of strategic objectives that can guide the definition of activities, schedules, and resource requirements in such a plan. Many of the goals and metrics are not under the FAA's direct control and are dependent upon industry efforts such as participation in civil UAS standards development activities and execution of initial certification (a.k.a. "Pathfinder") programs to aid the establishment of certification requirements. Goals and metrics addressing FMRA requirements are identified and the FMRA Subtitle B (Unmanned Aircraft Systems) is included as a reference in Appendix D.

Target dates for near-term metrics (i.e., those with dates prior to October 2015) are identified by the calendar quarter and year targeted for metric completion (e.g., "3rd Quarter of 2014" means targeted for completion by the end of September 2014). Mid-term metrics may only have a target year or year range specified. In this case, "2016" means the metric's completion target is the end of calendar year 2016. Far-term metrics are outside the five-year horizon of this roadmap and have no target dates. Target dates shown as "from 201x to 201y" indicate related activity is expected throughout this time period. Unless the target dates are required by law (e.g., FMRA), they are exactly that – targets. They are not commitments, either by the FAA, other government organizations, or industry. The target dates consider ongoing and planned government and industry activities and schedules; however, they are not always constrained by these activities and schedules. Some of the target dates are aggressive and will require additional industry or government resources if they are to be met.



C

Although this roadmap is focused on the integration of civil UAS in the NAS, some of the recommended goals and metrics address public UAS integration activities – primarily those of the Department of Defense (DoD). Public entities may have their own certification processes, but the requirements typically build upon those established by the FAA for civil aviation. The DoD's significant activities to develop public UAS that meet airspace and regulatory requirements can and should be leveraged in the FAA's establishment of civil UAS certification requirements.

C.1 Certification Requirements (Airworthiness)

Note: The term "Operator" is used here as defined by the FAA for passenger/cargo carrying and other "for hire and compensation" operations. Not all UAS operations conducted for hire and compensation will require an Operator Certificate. One outcome of this effort will be to establish which UAS operations will or will not require an Operator Certificate.

Goal 1: FAA initial certification process established for one or more civil applicants by 2014.

A. One or more Pathfinder certification projects were defined through government-industry plans (e.g., Project Specific Certification Plans (PSCP)) in the 2nd Quarter of 2013.

- Explanation. Three UAS manufacturers have already applied for type certification and two of these applications were released from delayed sequencing to proceed with restricted category airworthiness certification. Restricted category type certifications for these two applicants have now been completed. Completion of these type certification projects under appropriate, existing certification regulations, will act as a catalyst to establish the process to be used for similar UAS type certification projects. Note: Some UAS type certifications may be in the restricted category with operating restrictions to maintain an equivalent level of safety for the public, but the goal is to certify the respective UAS to meet all integration requirements, if practical.

B. One or more Pathfinder standard airworthiness certification projects complete initial certification planning by 2014.

- Explanation. If the FAA and one or more industry partners complete initial certification planning as recommended in The FAA and Industry Guide to Product Certification, the groundwork will be in place for an efficient certification project that will help establish the process for similar UAS certification projects. One manufacturer has made application and the project will proceed per FAA sequencing processes.

Goal 2: FAA's initial issue papers for one or more standard airworthiness certification projects are available by 2014.

A. One or more Pathfinder certification projects underway by the 4th Quarter of 2013.

- Explanation. One manufacturer has made application for a standard airworthiness certificate and the project will proceed per FAA sequencing processes.

B. FAA's initial certification issues defined for the certification basis or new and novel systems (e.g., UAS control station, airframe, control system, propulsion system, ground support equipment (GSE), etc.) by the 4th Quarter of 2013.

- Explanation. The certification basis and any unique requirements for new and novel systems must be established. Requirements can be identified and refined as a result of Pathfinder efforts or publication by standards organizations (e.g., RTCA, Inc., ASTM International).

Goal 3: FAA's unique certification requirements identified through issue papers that have matured for one or more standard airworthiness certification projects by 2015.

A. FAA's unique certification requirements for new and novel systems (e.g., UAS control station, airframe, control system, propulsion system, GSE, etc.) published by 2015.

- Explanation. Lessons learned from certification of Pathfinder systems, publication of consensus standards, and additional operational experience gained as a result of small UAS (sUAS) rule publication will provide additional requirement information for future applicants.

B. One or more Pathfinder standard airworthiness certification projects completed by 2017 if all associated activities are completed per the nominal certification process.

- Explanation. It is expected that type certifications will be granted only when all requirements have been met under existing rules and requirements and this target date is a best-case scenario.

C. Other certification programs completed by 2017–2020, based on timely applications and system commonality/complexity.

- Explanation. Lessons learned from certification activities of Pathfinder systems, publication of consensus standards, and operations under the sUAS rule will provide data and experience to support other certification efforts.

Goal 4: FAA certification requirements updated and systems certified as necessary.

A. Certification requirements updated as necessary.

B. UAS certified as necessary.

C.2 Certification Requirements (Pilot/Crew)

Goal 1: FAA certification requirements for pilots and crew members for sUAS classes (including medical requirements, training standards, etc.) published as part of a sUAS rule by 2014 in accordance with the FMRA. Note: These requirements include coordination with other government agencies on security/vetting requirements.

Goal 2: Necessary changes to record keeping systems established as part of a sUAS rule and in accordance with the FMRA.

- Explanation. Once the final requirements are established, some changes to existing record keeping systems will be necessary.

Goal 3: FAA certification requirements for pilots and crew members for UAS classes other than those addressed under the sUAS rule (including medical requirements, training standards, etc.) published by 2014–2017.

C.3 Ground Based Sense and Avoid (GBSAA)

Goal 1: FAA draft Advisory Circular on GBSAA systems and requirements released by 2015.

A. FAA approvals for use of GBSAA at one or more DoD GBSAA test sites granted by the 3rd Quarter of 2015, subject to timely application and completion of Certificate of Waiver or Authorization (COA) or other approval processes.

- Explanation. Use U.S. Army and U.S. Air Force developed solutions at DoD UAS test sites. (Note: These are existing DoD GBSAA test sites, not the new test ranges discussed in Section 4.8 and Appendix C.7.)

B. FAA approvals for use of GBSAA for educational and other public applications granted by 2016–2018, subject to timely application and completion of COA or other approval processes.

- Explanation. As above, but expanded beyond the DoD to include public use at other locations equipped with suitable GBSAA systems.

Goal 2: GBSAA operations fully approved by the FAA for routine use by all aviation, including both public and civil entities (if needed).

A. FAA approvals for use of GBSAA for limited civil applications granted.

- Explanation. As with FAA operational approvals for use of GBSAA at all DoD GBSAA test sites and operational approvals for use of GBSAA for educational and other public applications, expanded approvals are expected to be granted for limited civil use at select locations. These approvals will incorporate relevant data from UAS test site operations with GBSAA.

B. FAA's initial GBSAA certification standards for civil operations established.

- Explanation. Assimilate prior deployment experience for DoD, public, and limited civil use, and develop Minimum Aviation System Performance Standards (MASPS) for GBSAA. These approvals will incorporate relevant data from UAS test site operations with GBSAA.

C. FAA approvals for use of GBSAA for civil applications granted.

D. FAA's final GBSAA certification standards for civil operations established.

E. GBSAA certification standards updated as necessary.

C.4 Airborne Sense and Avoid (ABSAA)

Goal 1: Initial FAA certification of ABSAA that facilitates UAS operations without the requirement for a visual observer by 2016–2020.

A. Initial industry proposal for Sense and Avoid (SAA) implementation, integration, and operation in a Pathfinder program provided by the 2nd Quarter of 2014. (See Appendix C.1 for the Pathfinder program goals and metrics.)

- Explanation. This industry proposal will address: a) general UAS operations requirements, b) UAS sense-and-avoid requirements for all proposed operations, including proposed launch and recovery sites, c) proposed UAS ABSAA equipage, and d) planned installation and integration of the proposed ABSAA system(s). ("System" includes both hardware and software.)

B. FAA Stage 2 issue paper on UAS SAA implementation in one or more Pathfinder programs completed by the 2nd Quarter of 2015, subject to applicant provision of sufficient information in certification application and ongoing processes.

- Explanation. An FAA Stage 2 issue paper will provide the "FAA Position" indicating the FAA's concerns, opinions, and actions the applicant is required to accomplish to resolve the issue. This position gives the applicant direction that will enable compliance to the requirements without dictating design

Goal 2: Installation and certification of ABSAA developed to meet industry standards for use by the DoD and other public and civil entities that provide the SAA functions required in the NAS for Classes A, E, and G airspace, and operations approved without the requirement for a visual observer or a COA. Note: the RTCA Program Management Committee established a new Special Committee 228 and working group for Detect and Avoid (DAA). SAA and DAA may be used interchangeably until SC-228 provides a unique definition for DAA. Special Committee 228's Terms of Reference acknowledge that the requirements for UAS DAA in some airspace will require rulemaking.

A. RTCA Operational and Functional Requirements and Safety Objectives (OFRSO) for UAS, Volume 1 was released in the 2nd Quarter of 2013.

- Explanation. The OFRSO "provides recommendations for UAS system level operational and functional requirements and safety objectives for UAS flown in the United States National Airspace System (NAS) under the rules and guidelines for civil aviation." This document provides a framework to support the development of future UAS performance standards and "will prove useful to designers, manufacturers, installers, service providers and users in the development of future standards."

B. RTCA preliminary Phase 1 Detect and Avoid (DAA) Minimum Operational Performance Standards (MOPS) developed to establish performance standards that can be verified and validated for UAS DAA equipment in specified airspace by the 3rd Quarter of 2015.

- Explanation. Emphasis for this initial phase will be standards development on civil UAS equipped to operate into Class A airspace under IFR. A second phase of MOPS development may include DAA equipment to support extended UAS operations in Class D, E and perhaps G airspace. This work effort includes recommendations for a verification and validation test program to be completed before the release of the DAA MOPS. Note: RTCA has sunset Special Committee 203 and Special Committee 228; has a new Detect and Avoid working group developing these DAA MOPS.

C. RTCA Phase 1 DAA MOPS released by the 3rd Quarter of 2016.

- Explanation. This document includes the avionics onboard the UAS and required elements of ground control systems and is based on the results of verification and validation activities on the preliminary Phase 1 DAA MOPS.

D. FAA DAA Technical Standard Order (TSO) issued by the 1st Quarter of 2017.

- Explanation. This document includes the avionics onboard the UAS and required elements of ground control systems.

E. FAA DAA TSO-required equipment used operationally.

Goal 3: DoD or other public entity certification of initial ABSAA systems that enable the DoD and other public entities to safely operate ABSAA-equipped UAS in all NAS airspace classes without the need for a COA. Note: RTCA Special Committee 228's Terms of Reference acknowledge that the requirements for UAS DAA in some airspace will require rulemaking.

A. Initial proposal for ABSAA implementation, integration, and operation in one or more programs released by 2016.

- Explanation. This proposal will address the requirements for ABSAA system(s), including the SAA avionics onboard the unmanned aircraft and required elements of ground control systems. "System" includes both hardware and software.

B. FAA issue paper(s) on UAS SAA implementation in one or more programs for UAS operations in one or more airspace classes released.

- Explanation. The FAA issue paper(s) will document the special considerations for certification of UAS airborne systems that include SAA functions. They also will document special considerations for operating UAS that employ these ABSAA systems and special considerations (including avionics equipage requirements) for manned aircraft operating in the same airspace.

Goal 4: Installation and certification of ABSAA systems for use by the DoD and other public and civil entities that provide the SAA functions that facilitate integrated operation of manned and unmanned aircraft in all NAS airspace classes.

A. RTCA OFRSO for UAS, Volume 1 was released in the 2nd Quarter of 2013.

- Explanation. The OFRSO "provides recommendations for UAS system level operational and functional requirements and safety objectives for UAS flown in the NAS under the rules and guidelines for civil aviation." This document provides a framework to support the development of future UAS performance standards.

B. RTCA Phase 1 DAA MOPS released by the 3rd Quarter of 2016.

- Explanation. This document includes the SAA avionics onboard the aircraft and required elements of ground control systems for IFR flight in Class D, E, and G airspace as noted in the Terms of Reference.

C. RTCA DAA MOPS released for other classes of airspace.

- Explanation. The second phase of DAA MOPS may specify DAA equipment to support extended UAS operations in Class D, E, G, and other airspace as noted in the Terms of Reference.

D. FAA initial DAA TSO released by the 1st Quarter of 2017.

- Explanation. This document will include the avionics onboard the aircraft and required elements of ground control systems as invoked from requirements specified in the Phase 1 DAA MOPS.

E. FAA DAA TSO-required equipment used operationally.

- Explanation. UAS will receive operational approval to use DAA equipment through standard operational approval processes that may include exemptions to Part 91 and/or rulemaking activities as defined by FMRA.

F. RTCA UAS OFRSO and DAA MOPS updated as necessary.

G. FFAA DAA TSO(s) updated as necessary.

C.5 Control and Communications (C2)

Note: For purposes of this section, line-of-sight (LOS) means radio LOS, not visual LOS.

Goal 1: International agreements, industry standards, and FAA regulations and guidance material established by 2015 for civil UAS Control and Communications (C2) capabilities such that C2 subsystems can be certified by the FAA for use in FAA-approved UAS operations.

Note: C2 includes communications internal to the UAS for pilots to operate unmanned aircraft from ground control stations.

A. International agreement was reached in February 2012 at the International Telecommunication Union's (ITU) World Radiocommunication Conference (WRC) on spectrum identified for radio LOS UAS C2 links (or in ITU terminology, Control and Non-Payload Communications links).

- Explanation. Internationally harmonized radio spectrum is needed to help ensure protection from unintentional radio frequency interference, to help ensure adequate spectral bandwidth is available, and to facilitate operation of UAS across international borders. While spectrum is also needed for beyond-line-of-sight (BLOS) C2 links, the initial focus was on radio line-of-sight for civil UAS because demand for LOS links is expected to be greater.

B. RTCA OFRSO for UAS, Volume 1 was released in the 2nd Quarter of 2013.

- Explanation. The OFRSO "provides recommendations for UAS system level operational and functional requirements and safety objectives for UAS flown in the NAS under the rules and guidelines for civil aviation." This document provides a framework to support the development of future UAS performance standards.

C. RTCA's initial MOPS for all the UAS subsystems involved in providing or enabling C2 Data Link using L-Band and C-Band Terrestrial data links are available to be verified and validated by the 3rd Quarter of 2015.

- Explanation. These preliminary MOPS and associated recommendations for a verification and validation test program are needed for the FAA and industry to mature the final Terrestrial data link standards before the release of the final MOPS. RTCA is expected to define MOPS that include L-Band and C-Band frequencies identified at WRC 2012. The resulting MOPS form the basis upon which the FAA can certify systems and services used in providing C2 capabilities for civil UAS.

D. RTCA final Phase 1 C2 Terrestrial Data Link MOPS released by the 3rd Quarter of 2016.

- Explanation. These performance standards in both L-Band and C-Band spectrum are based on the results of the verification and validation test program activities. RTCA is expected to define MOPS that include L-Band and C-Band frequencies identified at WRC 2012.

E. FAA's initial regulations and guidance material (such as TSOs and Advisory Circulars) to enable the production, sale, installation, and maintenance of FAA-certified systems and services used in providing radio LOS C2 capabilities for civil UAS published by 2016–2017.

- Explanation. For the commercial marketplace to offer FAA-certified systems and services for use in providing C2 capabilities for civil UAS, the FAA must establish the necessary regulations and guidance material. These are expected to be based on and largely incorporate the consensus industry standards defined in the RTCA MOPS.

F. Initial FAA-certified Terrestrial C2 Data Link subsystems intended for civil UAS operations are available commercially.

- Explanation. FAA-certified Terrestrial C2 Data Link subsystems for civil UAS are needed for operators and manufacturers to incorporate in their UAS, and for operators to obtain FAA approval for their UAS operations.

Goal 2: Beyond-Line-of-Sight C2 links and capabilities are addressed in international agreements, industry standards, and FAA regulations and guidance material.

A. International agreement reached at the ITU's WRC 15 on radio spectrum identified for BLOS UAS C2 links by 2015.

- Explanation. Internationally harmonized radio spectrum is needed for UAS C2 links to help ensure their protection from unintentional radio frequency interference, to help ensure adequate spectral bandwidth is available for meeting the projected C2 link capacity demands, and to facilitate operation of UAS across international borders. In the far-term, an increasing number of civil UAS operations are expected to require BLOS C2 links.

B. RTCA's second phase MOPS for all the UAS subsystems involved in providing or enabling radio BLOS C2 capabilities for civil UAS published. These elements will include the necessary portion of avionics onboard the unmanned aircraft, the voice and data links, and the necessary portion of ground control systems.

- Explanation. This second phase of MOPS will be needed to provide standards for the use of SATCOM in multiple bands as a C2 Data Link to support UAS. This development will be based on the results of the ITU's WRC 15 as well as lessons learned from industry application of the initial MOPS during product development and FAA certification activities.

C. FAA's final regulations and guidance material to enable the production, installation, and maintenance of FAA-certified systems and services used in providing radio BLOS C2 capabilities for civil UAS published.

- Explanation. A revised set of FAA regulations and guidance material will be needed to address BLOS C2 Data Link systems. These regulations and guidance material will apply lessons learned from application of the initial set.

D. Initial FAA-certified BLOS C2 subsystems intended for civil UAS operations are available commercially.

- Explanation. FAA-certified BLOS C2 subsystems for civil UAS are needed for operators and manufacturers to incorporate in their UAS, and for operators to obtain FAA approval for their UAS operations.

Goal 3: Adequate spectrum is available for both radio LOS and BLOS C2 links to meet the current and projected demand generated by civil UAS operations in the NAS.

A. International spectrum identified for LOS and BLOS UAS C2 links reviewed for possible modification at a future WRC by 2020.

C.6 Small UAS (sUAS) and Other Rules

Goal 1: sUAS rule adopted to allow for both civil and public operations.

A. Agreements (Memorandums of Understanding (MOU), Memorandums of Agreement (MOA), COA, etc.) among the FAA and the DoD, the Department of Homeland Security (DHS), the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the Department of Justice (DOJ) and other public entities finalized and signed in conjunction with the release of the sUAS Notice of Proposed Rulemaking (NPRM). (The sUAS NPRM is expected to be released in early 2014).

- Explanation. The sUAS proposed rule has undergone a risk assessment by the FAA through its Safety Management System (SMS) process. Adopting or applying the provisions of the proposed rule for public operations is necessary and will accelerate NAS integration of sUAS. It will also reduce the number of COAs the FAA will need to process and free up FAA resources to address other time-critical UAS in the NAS integration issues.

B. sUAS follow-on night operations experiments and study accepted by the FAA for review by the 3rd Quarter of 2014.

- Explanation. NASA completed an initial study at New Mexico State University in 2012. The FAA reviewed the report on this initial study and provided questions and other inputs for inclusion in NASA's planned follow-on study. The FAA will review the report of these focused experiments and may consider DoD and other night operational data.

C. If night operations are deemed as safe as or safer by the FAA, increased night operations for public entities are allowed by the 3rd Quarter of 2015.

- Explanation. Public entities are requesting night operations as a means to fully exploit the capability of sUAS.

D. D. Drafts of all required consensus standards necessary for the implementation of 14 CFR Part 107 available to the public in conjunction with the release of the sUAS NPRM (currently expected to be released in 2013).

- Explanation. More than three years of consensus standard development have occurred. When completed, these standards will provide meaningful guidance to manufacturers and end users for the design, construction, and operation of sUAS. The timely release of the standards will permit industry an opportunity to fully prepare for publication of a final rule, and provide useful guidance to public entities desiring UAS deployment prior to final rule release.

Goal 2: sUAS rule adoption for public and civil operations.

A. 14 CFR Part 107 published, consensus-based standards accepted by the FAA, and the FAA able to issue permits to operate in accordance with requirements of the FMRA.

- Explanation. In order for operations to be conducted under 14 CFR Part 107, the FAA will issue a Notice of Applicability of referenced consensus-based standards and will be able to issue permits to operate.

B. Update sUAS rules, guidance, and/or consensus-based standards after sufficient data have been gathered and analyzed.

- Explanation. Assuming a final rule implementation, the FAA will gain experience with sUAS operating under 14 CFR Part 107. Advancements in technology and analysis of operational and safety data will provide the catalyst for refinement and improvement of Part 107 guidance and/or standards.

C. Update sUAS rules, guidance, and/or consensus-based standards as necessary.

- Explanation. As more operational and safety data is accumulated it will provide a catalyst for refinement and improvement of 14 CFR Part 107 guidance and/or standards as necessary.

Goal 3: sUAS rule supports ATC interoperability to ensure safe and efficient NAS operations.

A. Train air traffic control workforce within six months after sUAS rule enactment.

B. Ensure consistency between sUAS rule proposed operational expectations and proposed changes to ATC Handbook and the Aeronautical Information Manual (AIM).

C. sUAS operations are aligned with ATC Handbook and AIM when the sUAS rule is published and effective.

D. Employ existing strategies to conduct UAS integration safety analysis within SMS Manual guidance to ongoing safety analyses supporting ATC interoperability.

- Explanation. The FAA will enhance ATC interoperability under sUAS rule operations with safety analyses, as required.

Goal 4: Other Rulemaking per the FMRA.

A. Notice of Proposed Rulemaking published to implement the recommendations of the plan required by FMRA by the 3rd Quarter of 2014.

- Explanation. Section 332, subsection (a)(1) of the FMRA specifies plan requirements and subsection (b) requires publication of an NPRM.

B. Final rule published to implement the recommendations of the plan required by the FMRA by the 4th Quarter of 2015.

- Explanation. Section 332, subsection (a)(1) of the FMRA specifies plan requirements and subsection (b) requires publication of a final rule not later than 16 months after publication of the associated NPRM.

C. C. Update to the Administration's most recent policy statement on unmanned aircraft systems contained in Docket No. FAA–2006–25714 required by the FMRA by the 3rd Quarter of 2014.

- Explanation. Section 332, subsection (b) requires publication of this update.

C.7 Test Ranges

Goal 1: FAA program to integrate UAS into the NAS at six test ranges established in accordance with the FMRA.

- Explanation. To establish this program, selection criteria and procedures were developed and communicated to prospective site operators. Test areas criteria consider geographic and climate diversity, the location of ground infrastructure, and research needs. FAA dialogue with prospective site operators clarified criteria and procedures by gathering prospective site operator questions and documenting answers for use by all.

Goal 2: Test ranges selected by FAA in accordance with the FMRA.

- Explanation. The FAA received applications from prospective site operators in the 1st Quarter of 2013 and is evaluating the applications per the established selection criteria and procedures. Any test range selected should provide the FAA, NASA, DoD, industry and academia with the opportunity for UAS prototype development and deployment.

Goal 3: Selected test ranges operational in accordance with the FMRA

- Explanation. The FMRA states that "the test range shall be operational no later than 180 days after the date on which a project is established."

Goal 4: Test range program operational until February 2017.

- Explanation. The FMRA requires the test range program to be terminated by February 2017.

Goal 5: Report findings and conclusions concerning projects in accordance with the FMRA.

- Explanation. The FMRA states that "Not later than 90 days after the date of the termination of the program...the Administrator shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure and the Committee on Science, Space, and Technology of the House of Representatives a report setting forth the Administrator's findings and conclusions concerning the projects."

C.8 Air Traffic Interoperability

Goal 1: Safety and Interoperability—The overall level of safety in the NAS is preserved through NAS integration, which requires adherence to rigorous airworthiness standards and airspace regulations. While they apply equally to manned aircraft, they also recognize the distinguishing characteristics of UAS.

A. Conduct research that validates the required functional and performance capabilities for safe operation of UAS within the various airspaces of the NAS from 2012 to 2017.

B. Air Traffic interoperability requirements will be allocated to appropriate Air Traffic program and UAS integration efforts from 2012 to 2017.

C. Employ existing strategies to conduct UAS integration safety analysis within SMS Manual guidance to ongoing safety analyses supporting ATC interoperability.

D. Conduct research on Sense and Avoid algorithms for collision avoidance and self-separation that are interoperable with evolving Next Generation Air Transportation System (NextGen) ATC systems and manned collision avoidance systems.

E. Analyze human factors data to determine the safest technologies and best procedures for air traffic controllers to provide services to UAS pilots.

F. Track safety and operational data to use as a basis for policy decisions from 2012 to 2017.

Goal 2: Procedures and Training

A. Develop ATC training requirements specific to different types of UAS characteristics, including UAS performance, behavior, communications, unique flight profiles, ATC standardized procedures, lost link/ fly away profiles, operating limitations, and emergency procedures. Initial training produced in 2009, first revision to be available in 3rd Quarter of 2013. Subsequent training development will occur through 2020.

B. B. Administer UAS training to ATC facilities throughout the NAS from 2013 to 2020.

C.9. Miscellaneous

Goal 1: Develop more detailed plans for safely integrating UAS operations in the NAS by 2015.

A. UAS ARC reviewed FAA and industry plans, including the 2006 Airspace Integration Plan, in 2012.

- Explanation. The 2006 Airspace Integration Plan modified the airspace integration plan developed under the government-industry Access 5 program to more directly address the eight major challenges with UAS integration in the NAS. The UAS ARC will review the 2006 plan and update recommendations consistent with current thinking, including goals and metrics documented in this roadmap.

B. UAS ARC made recommendations for changes to FAA and industry programs and provided them to the FAA in the 2nd Quarter of 2013.

- Explanation. The UAS ARC completed its review of FAA and related industry plans and sent the FAA recommendations for additional planning elements and details. These recommendations include proposed changes to existing and planned programs.

C. Updated FAA UAS Integration Roadmap published annually in accordance with the FMRA.

Goal 2: Identify air traffic management system changes required to be implemented in NextGen.

A. UAS are addressed in the FAA's 2012 *NextGen Implementation Plan* by the 4th Quarter of 2013.

- Explanation. This requires explicitly addressing the operation of UAS in the NAS and the evolution of enabling system capabilities in the various NextGen Segment Implementation Plans (NSIP). Although no significant changes to the current NAS and future NextGen are expected for the integration of UAS operations in unrestricted airspace, some system and procedure changes may be necessary. Any changes need to be incorporated in the *NextGen Implementation Plan,* so that appropriate adjustments to program baselines can be made.

B. UAS are addressed in FAA's NextGen Enterprise Architecture by the 4th Quarter of 2013.

- Explanation. This requires explicitly addressing the integration of UAS operations in the NAS, including the necessary operational concepts and system capabilities. The NextGen Enterprise Architecture identifies whatever is needed to integrate UAS operations in unrestricted airspace. The CY 2012 update to the NextGen Enterprise Architecture depicted FMRA milestones in the aircraft roadmap component.

Goal 3: Review and revise and/or develop new UAS operational scenarios to mature UAS operational concept elements, update operational requirements, and validate key concept elements for UAS integration into the NAS.

A. FAA initiates an effort to review existing UAS operational scenarios/concept elements and revise them and/or develop new scenarios, if needed, for use in UAS operational concept development per established air traffic system engineering practices by the 1st Quarter of 2014.

- Explanation. A rich set of operational scenarios and mature concept elements is needed to develop a complete set of operational requirements, from which system functional and performance requirements can be derived. Off-nominal operations may also be defined for conceivable contingency situations.

B. FAA uses vetted operational scenarios and other concept maturation products to update UAS operator and NAS operational requirements by the 3rd Quarter of 2014.

- Explanation. This process uses vetted scenarios and other mature concept elements to update and document the set of UAS operator and NAS operational requirements associated with integrating UAS operations into the NAS per established air traffic system engineering analyses and related processes.

C. FAA uses vetted operational scenarios, updated UAS operator and NAS requirements and other mature concept elements to validate key concept elements and requirements associated with integrating UAS operations into the NAS.

- Explanation. Air traffic system engineering processes continue to validate concept elements and requirements based on priority need for their validation. Concept element validation priorities will determine resource allocations and schedule for validation of respective concept elements.

Goal 4: Develop UAS integration in the Arctic Region in accordance with the FMRA

A. A. FAA evaluates key operational concepts for potential inclusion into appropriate operational policy and procedures documents (e.g., FAA Order 8900.1 (Flight Standards Information Management System), state Aeronautical Information Publication (AIP) supplements, Notices to Airmen (NOTAM), etc.) by the 2nd Quarter of 2015.

B. FAA and Arctic UAS operators examine the costs (e.g., aircraft certification, mandatory equipage requirements, etc.) and benefits (i.e., value of main business cases for use) by the 3rd Quarter of 2015.

C. FAA begins Air Traffic Organization (ATO) process to establish UAS Arctic Areas, including airspace designation and DoD notice, by the 3rd Quarter of 2015.

D. FAA completes safety studies in accordance with Section 335 of the FMRA by the 3rd Quarter of 2015. (Note: The first safety risk management (SRM) panel for initial projects convened in 2013 and has drafted the associated SRM document.)

E. FAA develops UAS restricted category special airworthiness certificate standards by the 3rd Quarter of 2015.

F. FAA reviews planning and approval documents (e.g., COA template, FAA Destination 2025, FAA Flight Plan 2012, other FAA/International Civil Aviation Organization (ICAO) documents) and evaluates or adapts their use for Arctic Area operations by 2015.

G. Begin international UAS scientific experiments (Marginal Ice Zone Observations and Processes Experiment (MIZOPEX)) with NASA, NOAA, and the University of Alaska), commercial UAS photography missions, or other expanded use/demonstration of UAS in accordance with the Arctic Plan by the 3rd Quarter of 2013.

Goal 5: Develop implementation of Common Strategy for DOJ and associated law enforcement, fire, and first responder agency use of sUAS in the NAS in accordance with the FMRA.

Note: Progress on original metrics is documented below along with metrics to be completed.

A. FAA began collaboration with the DHS Science and Technology (S&T) Directorate during the 4th Quarter of 2012 to support FAA testing and evaluation program of sUAS for law enforcement and first responders, with high-level suitability criteria.

B. FAA formally accepted and signed the MOU with the DOJ National Institute of Justice (NIJ) in the 1st Quarter of 2013.

C. FAA established a working group to examine validity of legacy pilot-in-command (PIC) and observer medical qualifications currently stipulated in COA guidelines in the 2nd Quarter of 2013.

D. FAA established a liaison with DOJ NIJ and U.S. Fire Administration on the development of common strategies for the deployment of sUAS technologies in support of fire enforcement agencies in the 2nd Quarter of 2013.

E. FAA established a working group to examine validity and alternatives to PIC certification requirements established in the 2nd Quarter of 2013.

F. FAA established a collaborative working group with DOJ NIJ and federal law enforcement agencies to examine, plan, and develop a nationwide COA process/approval for the Federal Bureau of Investigation, Bureau of Alcohol, Tobacco, Firearms and Explosives, the National Park Service, and other federal law enforcement and emergency management agencies with country-wide jurisdictions in the 2nd Quarter of 2013.

G. FAA incorporates key operational concepts of strategy into a revised law enforcement/first responder-specific COA template by the 4th Quarter of 2013.

H. FAA establishes a collaborative working group with DOJ NIJ and appropriate law enforcement agencies and trade associations to examine, plan, and develop a COA approval process for law enforcement and first responder mutual aid operations by the 4th Quarter of 2013.

I. FAA to establish working group with DOJ NIJ and the DHS S&T on the development of a technical bulletin on the Common Strategy for distribution to law enforcement/first responders across the nation by the 4th Quarter of 2013.

J. FAA commences collaboration and coordination with DOJ NIJ and DHS S&T to support the co-hosting of a DOJ/FAA/DHS-focused sUAS conference to be convened in the 4th Quarter of 2013.

K. FAA establishes a collaborative working group with DOJ NIJ, DHS and appropriate law enforcement associations to examine, plan, and develop guidelines for any law enforcement agency contemplating the use of unmanned aircraft by the 4th Quarter of 2013.

L. FAA establishes working group with DOJ NIJ on the development of a process for the collection of Unmanned Aircraft Aviation Operations Report data from law enforcement agencies by the 4th Quarter of 2013.

M. FAA completes the development of law enforcement and first responder sUAS competency evaluation procedures, safety risk analysis plan (SRAP), and evaluation checklist completed by the 4th Quarter of 2013.

N. FAA assists three different-sized law enforcement agencies in first implementation of the Common Strategy – target date coordinated with the agencies and confident timeline for the agencies – 4th Quarter of 2013.

- Explanation: FAA assistance is planned for one small agency (i.e., less than 100 sworn officers), one medium agency (i.e., 100 to 300 sworn officers), and one large law enforcement agency (i.e., greater than 300 sworn officers).

O. FAA establishes working group to examine sUAS aircraft recommended guidelines for law enforcement agencies contemplating the use of unmanned aircraft by the 4th Quarter of 2013.

P. FAA will complete COA online modifications to enable Common Strategy implementation by law enforcement agencies by the 4th Quarter of 2014.

Q. FAA reviews planning and approval documents (e.g., unique law enforcement agency COA template, FAA Flight Plan 2012, other FAA/ICAO documents) and modifies or adapts their use for law enforcement agency and first responder sUAS operations by 2015.

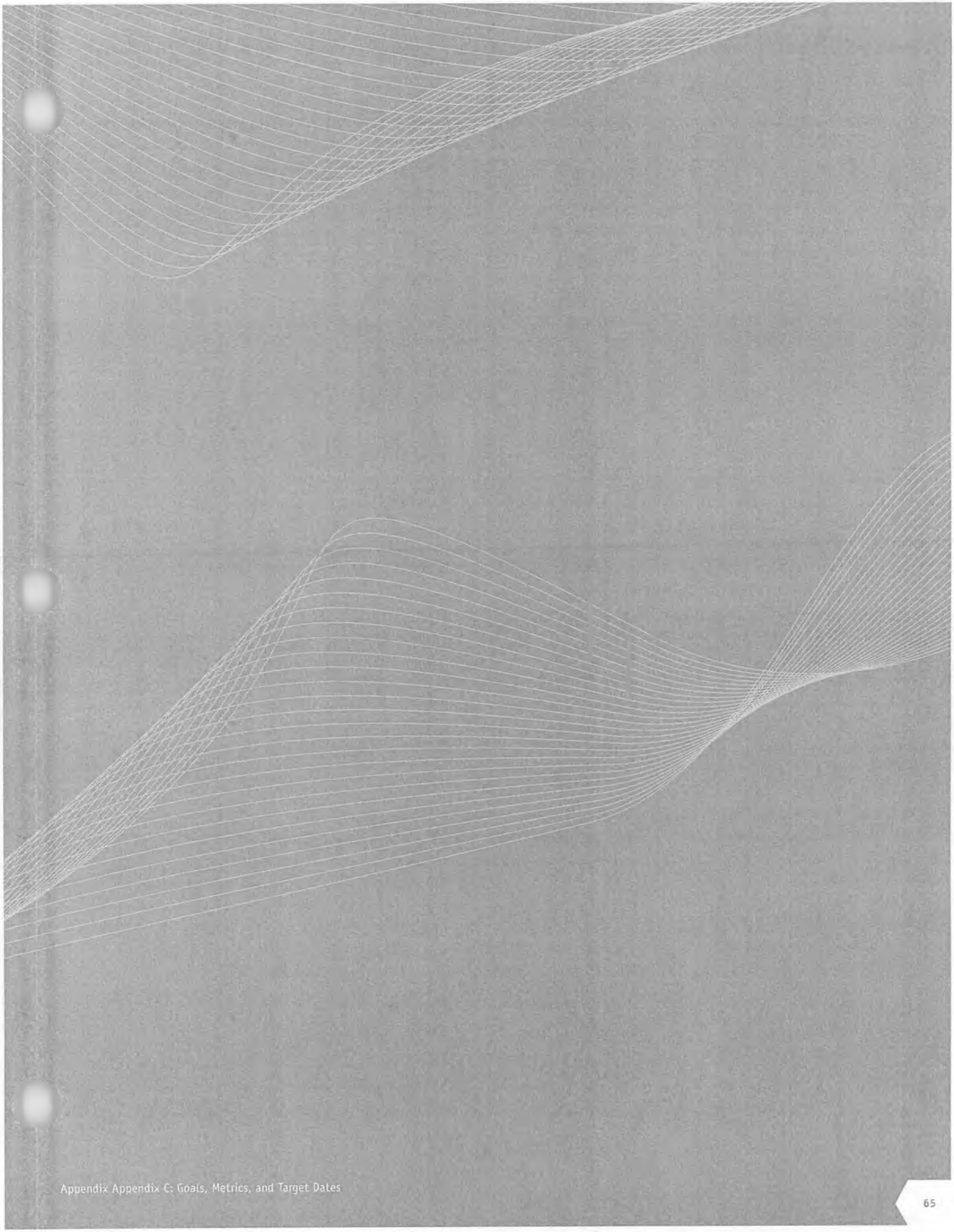
Goal 6: In accordance with the FMRA, develop policies to ensure "the Administrator of the FAA may not promulgate any rule or regulation regarding a model aircraft, or an aircraft being developed as a model aircraft."

A. Publish FAA order to establish criteria the agency will use to determine which model aircraft organizations can be considered community-based organizations.

B. Publish update to Federal Register that compares content of AC 91-57 and the FMRA, provides examples of careless and reckless operations, and makes distinction between modeling and commercial operations.

Goal 7: Requirements for the operation of "public unmanned aircraft systems" in the NAS in accordance with the FMRA.

A. Develop and implement operational and certification requirements for the operation of "public unmanned aircraft systems" in the NAS by the 4th Quarter of 2015.



Appendix D: FAA Modernization and Reform Act of 2012 Reference Text

Appendix D: FAA Modernization and Reform Act of 2012 Reference Text

Subtitle B—Unmanned Aircraft Systems

SEC. 331. DEFINITIONS.

In this subtitle, the following definitions apply:

(1) ARCTIC.—The term "Arctic" means the United States zone of the Chukchi Sea, Beaufort Sea, and Bering Sea north of the Aleutian chain.

(2) CERTIFICATE OF WAIVER; CERTIFICATE OF AUTHORIZATION.—The terms "certificate of waiver" and "certificate of authorization" mean a Federal Aviation Administration grant of approval for a specific flight operation.

(3) PERMANENT AREAS.—The term "permanent areas" means areas on land or water that provide for launch, recovery, and operation of small unmanned aircraft.

(4) PUBLIC UNMANNED AIRCRAFT SYSTEM.—The term "public unmanned aircraft system" means an unmanned aircraft system that meets the qualifications and conditions required for operation of a public aircraft (as defined in section 40102 of title 49, United States Code).

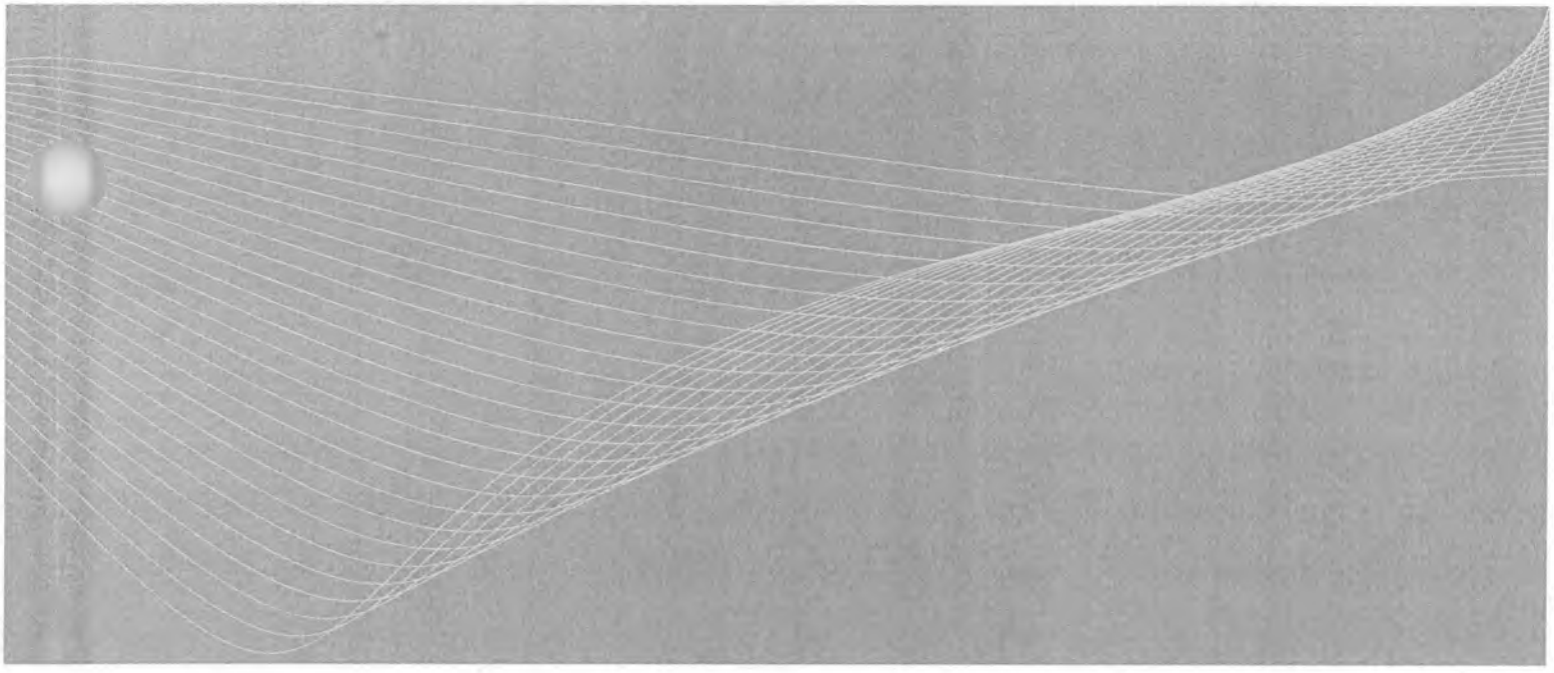
(5) SENSE AND AVOID CAPABILITY.—The term "sense and avoid capability" means the capability of an unmanned aircraft to remain a safe distance from and to avoid collisions with other airborne aircraft.

(6) SMALL UNMANNED AIRCRAFT.—The term "small unmanned aircraft" means an unmanned aircraft weighing less than 55 pounds.

(7) TEST RANGE.—The term "test range" means a defined geographic area where research and development are conducted.

(8) UNMANNED AIRCRAFT.—The term "unmanned aircraft" means an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft.

(9) UNMANNED AIRCRAFT SYSTEM.—The term "unmanned aircraft system" means an unmanned aircraft and associated elements (including communication links and the components that control the unmanned aircraft) that are required for the pilot in command to operate safely and efficiently in the national airspace system.



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

(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;

(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; and

(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 5-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.

(b) RULEMAKING.—Not later than 18 months after the date on which the plan required under subsection (a)(1) is submitted to Congress under subsection (a)(4), the Secretary shall publish in the Federal Register—

(1) a final rule on small unmanned aircraft systems that will allow for civil operation of such systems in the national airspace system, to the extent the systems do not meet the requirements for expedited operational authorization under section 333 of this Act;

(2) a notice of proposed rulemaking to implement the recommendations of the plan required under subsection (a)(1), with the final rule to be published not later than 16 months after the date of publication of the notice; and

(3) an update to the Administration's most recent policy statement on unmanned aircraft systems, contained in Docket No. FAA-2006-25714.

(c) PILOT PROJECTS.—
(1) ESTABLISHMENT.—Not later than 180 days after the date of enactment of this Act, the Administrator shall establish a program to integrate unmanned aircraft systems into the national airspace system at 6 test ranges. The program shall terminate 5 years after the date of enactment of this Act.

(2) PROGRAM REQUIREMENTS.—In establishing the program under paragraph (1), the Administrator shall—
(A) safely designate airspace for integrated manned and unmanned flight operations in the national airspace system;
(B) develop certification standards and air traffic requirements for unmanned flight operations at test ranges;
(C) coordinate with and leverage the resources of the National Aeronautics and Space Administration and the Department of Defense;
(D) address both civil and public unmanned aircraft systems;
(E) ensure that the program is coordinated with the Next Generation Air Transportation System; and (F) provide for verification of the safety of unmanned aircraft systems and related navigation procedures before integration into the national airspace system.

(3) TEST RANGE LOCATIONS.—In determining the location of the 6 test ranges of the program under paragraph (1), the Administrator shall—
(A) take into consideration geographic and climatic diversity;
(B) take into consideration the location of ground infrastructure and research needs; and
(C) consult with the National Aeronautics and Space Administration and the Department of Defense.

(4) TEST RANGE OPERATION.—A project at a test range shall be operational not later than 180 days after the date on which the project is established.

(5) REPORT TO CONGRESS.—

(A) IN GENERAL.—Not later than 90 days after the date of the termination of the program under paragraph (1), the Administrator shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure and the Committee on Science, Space, and Technology of the House of Representatives a report setting forth the Administrator's findings and conclusions concerning the projects.

(B) ADDITIONAL CONTENTS.—The report under sub-paragraph (A) shall include a description and assessment of the progress being made in establishing special use air-space to fill the immediate need of the Department of Defense—

(i) to develop detection techniques for small unmanned aircraft systems; and

(ii) to validate the sense and avoid capability and operation of unmanned aircraft systems.

(d) EXPANDING USE OF UNMANNED AIRCRAFT SYSTEMS IN ARCTIC.—

(1) IN GENERAL.—Not later than 180 days after the date of enactment of this Act, the Secretary shall develop a plan and initiate a process to work with relevant Federal agencies and national and international communities to designate permanent areas in the Arctic where small unmanned aircraft may operate 24 hours per day for research and commercial purposes. The plan for operations in these permanent areas shall include the development of processes to facilitate the safe operation of unmanned aircraft beyond line of sight. Such areas shall enable over-water flights from the surface to at least 2,000 feet in altitude, with ingress and egress routes from selected coastal launch sites.

(2) AGREEMENTS.—To implement the plan under paragraph (1), the Secretary may enter into an agreement with relevant national and international communities.

(3) AIRCRAFT APPROVAL.—Not later than 1 year after the entry into force of an agreement necessary to effectuate the purposes of this subsection, the Secretary shall work with relevant national and international communities to establish and implement a process, or may apply an applicable process already established, for approving the use of unmanned aircraft in the designated permanent areas in the Arctic without regard to whether an unmanned aircraft is used as a public aircraft, a civil aircraft, or a model aircraft.

SEC. 333. SPECIAL RULES FOR CERTAIN UNMANNED AIRCRAFT SYSTEMS.

(a) IN GENERAL.—Notwithstanding any other requirement of this subtitle, and not later than 180 days after the date of enactment of this Act, the Secretary of Transportation shall determine if certain unmanned aircraft systems may operate safely in the national airspace system before completion of the plan and rulemaking required by section 332 of this Act or the guidance required by section 334 of this Act.

(b) ASSESSMENT OF UNMANNED AIRCRAFT SYSTEMS.—In making the determination under subsection (a), the Secretary shall determine, at a minimum—

(1) which types of unmanned aircraft systems, if any, as a result of their size, weight, speed, operational capability, proximity to airports and populated areas, and operation within visual line of sight do not create a hazard to users of the national airspace system or the public or pose a threat to national security; and

(2) whether a certificate of waiver, certificate of authorization, or airworthiness certification under section 44704 of title 49, United States Code, is required for the operation of unmanned aircraft systems identified under paragraph (1).

(c) REQUIREMENTS FOR SAFE OPERATION.—If the Secretary determines under this section that certain unmanned aircraft systems may operate safely in the national airspace system, the Secretary shall establish requirements for the safe operation of such aircraft systems in the national airspace system.

SEC. 334. PUBLIC UNMANNED AIRCRAFT SYSTEMS.

(a) GUIDANCE.—Not later than 270 days after the date of enactment of this Act, the Secretary of Transportation shall issue guidance regarding the operation of public unmanned aircraft systems to—

(1) expedite the issuance of a certificate of authorization process;

(2) provide for a collaborative process with public agencies to allow for an incremental expansion of access to the national airspace system as technology matures and the necessary safety analysis and data become available, and until standards are completed and technology issues are resolved;

(3) facilitate the capability of public agencies to develop and use test ranges, subject to operating restrictions required by the Federal Aviation Administration, to test and operate unmanned aircraft systems; and

(4) provide guidance on a public entity's responsibility when operating an unmanned aircraft without a civil air-worthiness certificate issued by the Administration.

(b) STANDARDS FOR OPERATION AND CERTIFICATION.—Not later than December 31, 2015, the Administrator shall develop and implement operational and certification requirements for the operation of public unmanned aircraft systems in the national airspace system.

(c) AGREEMENTS WITH GOVERNMENT AGENCIES.—

(1) IN GENERAL.—Not later than 90 days after the date of enactment of this Act, the Secretary shall enter into agreements with appropriate government agencies to simplify the process for issuing certificates of waiver or authorization with respect to applications seeking authorization to operate public unmanned aircraft systems in the national airspace system.

(2) CONTENTS.—The agreements shall—

(A) with respect to an application described in paragraph (1)—

(i) provide for an expedited review of the application;

(ii) require a decision by the Administrator on approval or disapproval within 60 business days of the date of submission of the application; and

(iii) allow for an expedited appeal if the application is disapproved;

(B) allow for a one-time approval of similar operations carried out during a fixed period of time; and

(C) allow a government public safety agency to operate unmanned aircraft weighing 4.4 pounds or less, if operated—

(i) within the line of sight of the operator;

(ii) less than 400 feet above the ground;

(iii) during daylight conditions;

(iv) within Class G airspace; and

(v) outside of 5 statute miles from any airport, heliport, seaplane base, spaceport, or other location with aviation activities.

SEC. 335. SAFETY STUDIES.

The Administrator of the Federal Aviation Administration shall carry out all safety studies necessary to support the integration of unmanned aircraft systems into the national airspace system.

SEC. 336. SPECIAL RULE FOR MODEL AIRCRAFT.

(a) IN GENERAL.—Notwithstanding any other provision of law relating to the incorporation of unmanned aircraft systems into Federal Aviation Administration plans and policies, including this subtitle, the Administrator of the Federal Aviation Administration may not promulgate any rule or regulation regarding a model aircraft, or an aircraft being developed as a model aircraft, if—

(1) the aircraft is flown strictly for hobby or recreational use;

(2) the aircraft is operated in accordance with a community-based set of safety guidelines and within the programming of a nationwide community-based organization;

(3) the aircraft is limited to not more than 55 pounds unless otherwise certified through a design, construction, inspection, flight test, and operational safety program administered by a community-based organization;

(4) the aircraft is operated in a manner that does not interfere with and gives way to any manned aircraft; and

(5) when flown within 5 miles of an airport, the operator of the aircraft provides the airport operator and the airport air traffic control tower (when an air traffic facility is located at the airport) with prior notice of the operation (model aircraft operators flying from a permanent location within 5 miles of an airport should establish a mutually-agreed upon operating procedure with the airport operator and the airport air traffic control tower (when an air traffic facility is located at the airport)).

(b) STATUTORY CONSTRUCTION.—Nothing in this section shall be construed to limit the authority of the Administrator to pursue enforcement action against persons operating model aircraft who endanger the safety of the national airspace system.

(c) MODEL AIRCRAFT DEFINED.—In this section, the term "model aircraft" means an unmanned aircraft that is—

(1) capable of sustained flight in the atmosphere;

(2) flown within visual line of sight of the person operating the aircraft; and

(3) flown for hobby or recreational purposes.

U.S. Department of Transportation
Federal Aviation Administration

800 Independence Avenue, SW
Washington, DC 20591

2012-AJG-502 Produced by FAA Communications

3

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:

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 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 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).

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

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 Senate Committee on Commerce, Science and Transportation 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 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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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 Senate Committee on Commerce, Science and Transportation.

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.

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[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]

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[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.

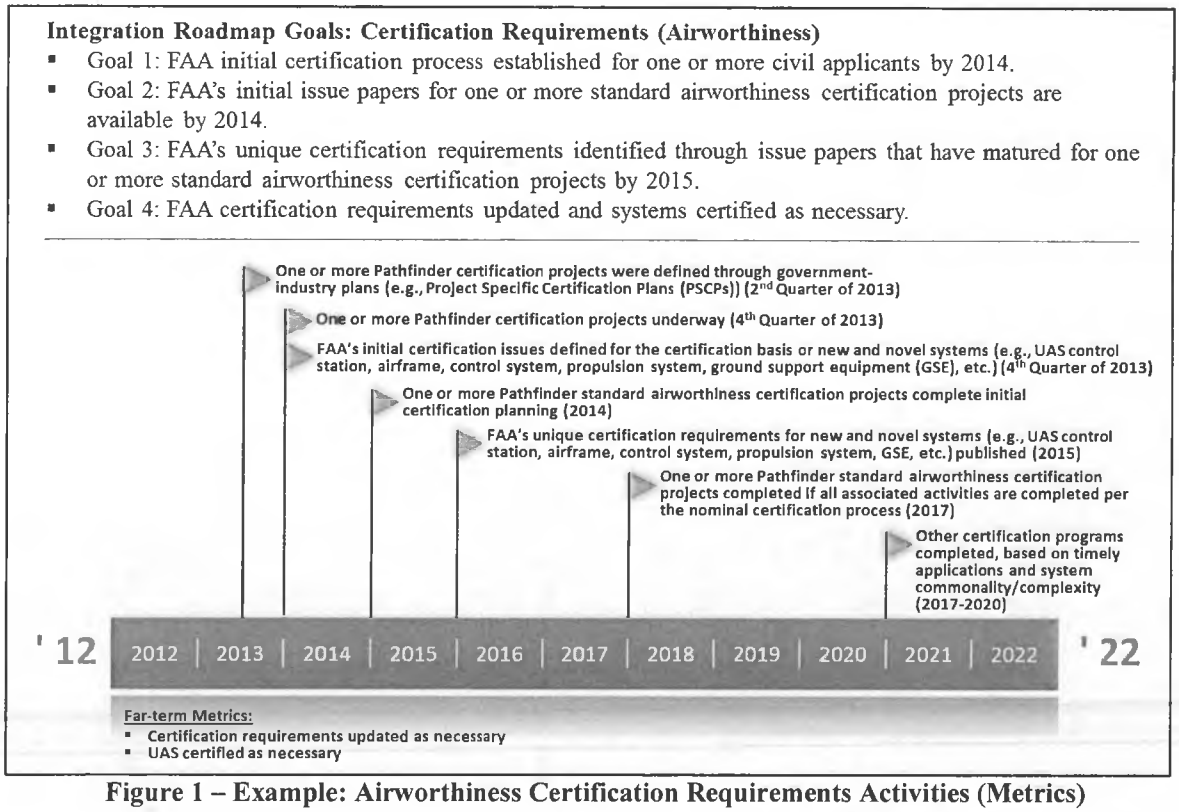


Figure 1 – Example: Airworthiness Certification Requirements Activities (Metrics)

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;

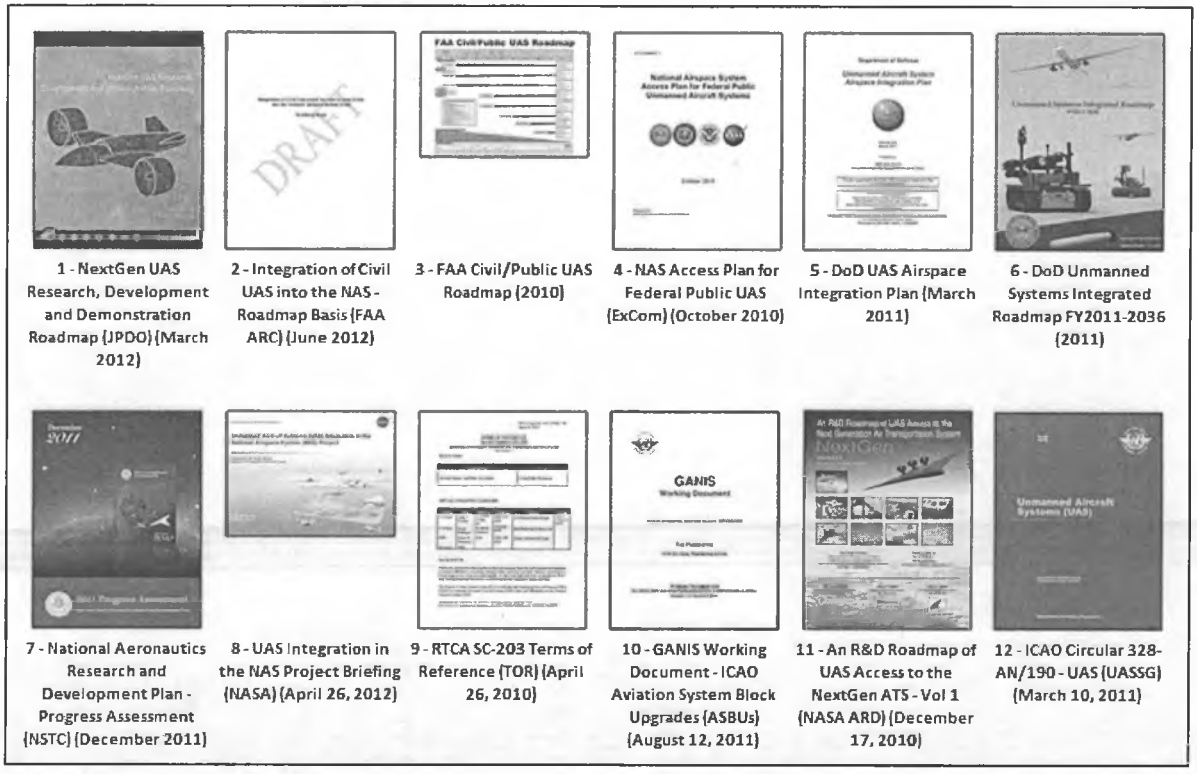
[14] Additional wording for this requirement may have been inadvertently omitted from this Bill (H.R.658).

(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 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 in 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)

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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

4

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 91

[Docket No.: FAA-2013-0061]

Unmanned Aircraft System Test Site Program

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of availability of final privacy requirements for the unmanned aircraft system ("UAS") test site program; response to comments

SUMMARY: On February 22, 2013 the FAA published and requested public comment on the proposed privacy requirements (the "Draft Privacy Requirements") for UAS test sites (the "Test Sites") that the FAA will establish pursuant to the FAA Modernization and Reform Act of 2012 ("FMRA"). This notice responds to the public comments received and publishes the FAA's final privacy requirements for the Test Sites (the "Final Privacy Requirements").

ADDRESSES: You may review the public docket for this rulemaking (Docket No. FAA-2013-0061) on the Internet at http://www.regulations.gov. You may also review the public docket at the Docket Management Facility in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, 20590-0001 between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: For technical questions concerning the test site program, contact Elizabeth Soltys, Unmanned Aircraft Systems Integration Office, Federal Aviation Administration, 800 Independence Avenue SW., Washington, DC 20591; email: 9-ACT-UASTSS@faa.gov.

For legal questions concerning the FAA's privacy requirements for the Test Sites contact Carlos Siso, Office of the Chief Counsel, Federal Aviation Administration, 800 Independence Ave. SW., Washington, DC 20591; email: 9-AGC-UASPrivacy@faa.gov.

SUPPLEMENTARY INFORMATION

This notice summarizes and responds to the public comments received in response to the following Federal Register notices seeking public comment on the Draft Privacy Requirements for the Test Sites:

(i) Notice of availability and request for comments published in the Federal Register on February 22, 2013 (78 FR 12259), Docket No. FAA-2013-0061-0001; and

(ii) Notice of public engagement session published in the Federal Register on March 28, 2013 (78 FR 18932), Docket No. FAA-2013-0061-0050.

In addition, this notice publishes the FAA's Final Privacy Requirements for the Test Sites which are set forth under the "Conclusion" section below.

Discussion of Comments

The FAA received 99 comments through Regulations.gov and 53 comments through the public engagement session. A transcript of the public engagement session is available at: http://www.faa.gov/about/initiatives/uas/media/UAStranscription.pdf. Public comments ranged from recommending that the FAA not impose any privacy requirements on the Test Sites to recommending that the FAA impose extensive privacy requirements on the Test Sites. The FAA also received comments that were not responsive to the notice or that were unclear.

The FAA analyzed the responsive comments and grouped them into ten categories. The following sections address the comments by category.

1) The FAA should focus on its safety mission; it should not engage in regulating privacy.

The FAA received a number of comments advocating that the FAA should focus on its safety mission and should not engage in regulating privacy. The following comments were received:

- The FAA should focus on safety;
- Regulating privacy is outside the FAA's mission;
- The FAA does not have statutory authority to regulate privacy;
- The FAA does not have the authority to impose privacy requirements on the Test Sites;
- The FAA should allow privacy to be addressed by other more appropriate government bodies including: Federal agencies that have expertise and authority to deal with privacy concerns; Congress; state or local legislative bodies; and the judicial system;
- The Federal Government should not regulate privacy impacts of UAS; these issues should be left to states, cities, and counties to address;
- The FAA should only require compliance with privacy laws that are already in place and focus on developing safe operation of UAS;
- The FAA should not deny access to the national airspace for reasons other than safety;
- Existing privacy laws are sufficient to cover the responsible use of UAS. There already exist Federal, state and other laws that protect privacy. In addition, tort law may also provide avenues of recourse for plaintiffs to protect their privacy rights;
- The FAA should not implement privacy regulations that make entry into the market prohibitive for small businesses;
- The FAA should not allow privacy issues to hinder commercialization of UAS;
- There is no evidence that the operations at the Test Sites will harm privacy interests. Restricting activities at the test sites at this early stage will likely overprotect privacy at the expense of innovation;

- The FAA should afford adequate time for non-governmental solutions such as industry norms and practices to develop before intervening administratively to protect privacy. These less restrictive solutions will reduce the need for administrative intervention and will allow for increased innovation in the national airspace;
- Requiring Test Site operators to develop privacy policies that are informed by Fair Information Practice Principles is onerous for commercial operators of UAS and its cost will likely outweigh any hypothetical benefits;
- Requiring Test Site operators to issue privacy policies informed by Fair Information Practice Principles will limit the diversity of data that will inform integration of UAS into the national airspace. The FAA's approach would exclude an important possible alternative from the discussion: some operators might choose not to issue a privacy policy or adopt a non-FIPPs-compliant policy; and
- The FAA should treat data gathered by UAS no differently than data gathered by a manned aircraft or by other electronic means. There is no significant difference in terms of surveillance between a UAS and a manned aircraft, and manned aircraft are permitted to operate in the national airspace with cameras.

Response: The FAA's mission is to provide the safest, most efficient aerospace system in the world and does not include regulating privacy. At the same time, the FAA recognizes that there is substantial debate and difference of opinion among policy makers, industry, advocacy groups, and members of the public as to whether UAS operations at the Test Sites will raise novel privacy issues that are not adequately addressed by existing legal frameworks.

The FAA will require the Test Site operators to comply with the Final Privacy Requirements. Congress mandated that the FAA establish the Test Sites to further UAS integration into the national airspace system. The Final Privacy Requirements advance this purpose by helping inform the dialogue

among policymakers, privacy advocates, and industry regarding the impact of UAS technologies on privacy.

The FAA's authority for including the Final Privacy Requirements in the Test Site OTAs is set forth in 49 U.S.C. 106(l)(6). That statute authorizes the FAA Administrator to enter into an OTA "on such terms and conditions as the Administrator may consider appropriate." The FAA believes that it is appropriate to require Test Site operators to comply with the Final Privacy Requirements.

2) The FAA should require warrants before law enforcement can use UAS in the Test Sites to conduct surveillance or gather evidence.

The FAA received a variety of comments advocating that:

- The FAA should include provisions in the OTA that require warrants to be obtained when UAS are used to conduct surveillance or gather evidence within the Test Site; and
- The OTA include appropriate safeguards to protect Fourth Amendment rights at and around our national borders.

Response: The FAA's mission is to provide the safest, most efficient aerospace system in the world. The FAA is establishing the UAS Test Sites consistent with its mission and the direction in the FMRA. The FAA appreciates the commenters' concerns. Accordingly, the final privacy requirements provide that the Site Operator and its team members must comply with all applicable privacy laws.

3) The FAA should mandate specific privacy requirements for the Test Sites.

The FAA received a variety of comments advocating that the FAA mandate specific privacy requirements for the Test Sites. The recommendations included the following:

- The FAA should specify minimum privacy requirements and require each Test Site to comply with them;
- The FAA should mandate compliance with Fair Information Practice Principles for all Test Site operators;

- The FAA should establish prohibitions on where UAS can operate within a Test Site and the kinds of surveillance activities that UAS conduct at the Test Sites;
- The FAA should require all UAS flown at the Test Sites to have unencrypted down links so that all their data collection can be viewed by the public, including records contained onboard and recovered after landing;
- The FAA should require each Test Site operator to conduct a full Privacy Impact Assessment;
- The FAA should require each Test Site operator to establish a Chief Privacy Officer and centralize privacy responsibilities in that person;
- The FAA should require each Test Site operator to establish a privacy advisory committee to review proposed UAS research at the Test Sites for privacy concerns;
- The FAA should require each Test Site operator to provide a detailed response to public input it receives regarding the Test Site's privacy policy;
- The FAA should prohibit the sharing of recorded surveillance footage beyond the scope of its original purpose;
- The FAA should prohibit UAS in the Test Sites from flying below a minimum altitude;
- The FAA should prohibit UAS in the Test Sites from carrying any equipment that could be used to conduct surveillance;
- The FAA should limit the use of the data collected at the Test Sites;
- The FAA should prohibit (i) the use of Test Sites for government surveillance, and (ii) sharing data collected with law enforcement for the purpose of investigating or prosecuting a crime;

- The FAA should limit the type of data that can be collected by UAS at the Test Sites including limiting the resolution of visual imagery that UAS can collect, prohibiting recording of audio data, and restricting the ability to collect WiFi and cellular signals;
- The FAA should require Test Site operators to provide data on the payload of each UAS flown at the Test Site including specific information on the data the payload is capable of collecting;
- The FAA should mandate privacy policies that require deletion of collected data within a certain time period;
- The FAA should prohibit the Test Site operator and UAS operators at the Test Sites from retaining any data collected longer than is necessary to fulfill the purpose of the Test Site;
- The FAA should require UAS operators to file data collection statements with the FAA for UAS operations that involve remote sensing and signals surveillance from the UAS platform; and
- The FAA should require UAS operating at altitudes over 400 feet to carry an automatic dependent surveillance-broadcast transponder (ADS-B Out) so that UAS operations can be tracked.

Response: The FAA's mission is to provide the safest, most efficient aerospace system in the world. Although there is a long history of placing cameras and other sensors on aircraft for a variety of purposes—news helicopters, aerial surveys, film/television production, law enforcement, etc.—the FAA is not, through awarding and supervising these Test Sites, taking specific views on whether or how the Federal Government should regulate privacy or the scope of data that can be collected by manned or unmanned aircraft.

There was substantial difference of opinion among commenters as to whether UAS operations and manned aircraft operations present different privacy issues that justify imposing special privacy

restrictions on UAS operations at the Test Sites. In addition, there was substantial difference of opinion among commenters regarding what elements would be appropriate for a Test Site privacy policy. Based on the comments received, the FAA will require Test Sites to comply with the following requirements in addition to those described in the Draft Privacy Requirements:

(1) Test site operators must maintain a record of all UAS operating in the test sites;

(2) Test site operators must require every UAS operator in the Test Site to have a written plan for the operator's use and retention of data collected by the UAS; and

(3) Test site operators must conduct an annual review of test site operations to verify compliance with stated privacy policy and practices and share those outcomes annually in a public forum with an opportunity for public feedback.

The above are reflected in the Final Privacy Requirements.

The FAA has determined that it should not impose privacy requirements beyond those in the Final Privacy Requirements for the following reasons. *First*, there are many privacy laws and applications of tort law that may address some of the privacy issues that arise from UAS operations at the Test Sites.

Second, the FAA believes that Test Sites operators will be responsive to local stakeholders' privacy concerns and will develop privacy policies appropriately tailored to each Test Site. The selection criteria for the Test Sites specify that only a "public entity" can serve as a Test Site operator. The term "public entity" is defined in the selection criteria to mean "(A) any State or local government; (B) any department, agency, special purpose district, or other instrumentality of a State or States or local government; and (C) the National Railroad Passenger Corporation, and any commuter authority." The FAA expects that public entities will be responsive to stakeholder concerns.

Third, if UAS operations at a Test Site raise privacy concerns that are not adequately addressed by the Test Site's privacy policies, elected officials can weigh the benefits and costs of additional

privacy laws or regulations. Forty-three states have already enacted or are considering legislation regulating use of UAS. *See* Drone Legislation All the Rage: Varies Widely Across 43 States, According to WestlawNext, June 17, 2013, *available at*: http://thomsonreuters.com/ press-releases/062013/drone_legislation_varies_across_ states_according_to_Westlaw.

4) The FAA should conduct audits of the Test Sites to ensure compliance with privacy policies.

Various commenters recommended that the FAA should audit each Test Site to ensure compliance with the privacy policies in the OTA.

Response: Each Test Site will be operated by a public entity (see response to Category 3 above). The FAA expects that the public entity operating each test site will already be subject to oversight and audit requirements. The FAA does not believe that it is appropriate for the FAA to impose additional audit requirements on the Test Site operators.

5) The FAA should require Test Site operators to keep records that will allow for effective citizen participation and reporting of privacy violations.

One commenter recommended that the FAA require Test Site operators to keep accurate, detailed, frequent, and accessible records to allow for effective citizen participation and reporting of privacy violations.

Response: Each Test Site operator will be a public entity (see response to Category 3 above). Public entities are generally subject to laws that establish record keeping requirements and provide the public access to records. The FAA does not believe that it is appropriate for the FAA to impose additional record keeping requirements on the Test Site operators other than those specified in the Final Privacy Requirements.

6) The FAA should establish a searchable database or registry of UAS operators and operations at the Test Sites.

The FAA received a variety of comments advocating that:

- The FAA should create a public, searchable database or registry of all UAS operators. Some commenters recommended that the database include information about surveillance equipment used and the operator's data collection practices;
- The FAA should require UAS operators at the Test Sites to provide public statements describing the surveillance equipment that will be carried by a UAS, the geographical area where the UAS will be operated, and the purposes for which the UAS will be deployed; and
- The FAA should establish a means for the public to access the data on UAS flights collected by the FAA.

Response: The FAA believes that it is not appropriate for the FAA to create a public registry or database of UAS operations at the Test Sites. However, the FAA has included a contractual provision in the Final Privacy Requirements that will require each Test Site operator to maintain a record of all UAS operating at the Test Site.

7) **The FAA should modify its Test Site selection criteria to take into account privacy concerns.**

Various commenters recommended that the FAA revise its selection criteria. Suggestions included the following:

- The FAA should choose an applicant that has an established UAS research program with active engagement with UAS privacy issues;
- The FAA should choose at least one Test Site in a state with strong privacy protective UAS laws and regulations;
- The FAA should select one or more Test Sites in or near a densely populated urban area in order to avoid a bias towards privacy issues relevant for rural UAS operations; and

- The FAA should consider the privacy track record of applicants as part of the selection process.

Response: The FAA believes that it is not appropriate to modify the Test Site selection criteria to include the recommended privacy considerations. Applicants have already submitted complete applications based on the announced selection criteria and the application period has closed.

The FAA published the Test Site selection criteria and application instructions on February 14, 2013 on https://faaco.faa.gov under Solicitation number DTFACT-13-R-00002. The selection criteria incorporate the factors that Congress directed the FAA to consider in the FMRA, including, geographic and climatic diversity; location of ground infrastructure; and research needs. The FAA required applicants to submit seven volumes of extensive and detailed information that address a broad set of considerations including safety, airspace use, experience, research objectives, and risk considerations. This information will allow the FAA to make a selection based on the direction provided by Congress in the FMRA and on the FAA's mission.

The FAA developed the Test Site selection criteria after seeking public input and consulting with other agencies regarding what selection criteria would be appropriate. In March 2012, the FAA published a request for comment in the Federal Register and in April 2012, the FAA hosted two public webinars to obtain public input on the FAA's proposed selection criteria. Although there was significant public participation, the FAA did not receive comments advocating that privacy issues be used as a factor in choosing the Test Sites.

8) The FAA should require Test Site operators to conduct specific tests related to privacy and surveillance.

Commenters recommended that the FAA should:

- Require UAS operators at Test Sites to conduct specific tests related to surveillance and privacy;

- Require Test Site operators to design the sites— including the creation of "fake" houses or businesses—to allow UAS operators to test how accurate their surveillance systems are and test how much data those systems collect; and
- Develop and require Test Sites to implement a standard battery of privacy tests that each UAS operating within a Test Site should have to perform in order to collect data that the FAA can use to make decisions about privacy issues.

Response: The FAA is not planning to have the Test Site operators conduct specific research.

9) The FAA should not take punitive actions against a Test Site operator for privacy violations without due process.

One commenter noted that if charges are filed by law enforcement against a Test Site operator due to potential violations of privacy laws, the OTA allows the FAA to suspend or modify the relevant operational authority for a Test Site (e.g. Certificate of Operation, or OTA). That commenter recommended that a Test Site operator be entitled to due process before the operational authority be suspended or modified.

Response: A Test Site operator's rights to operate a Test Site are set forth in the OTA and are subject to the terms and conditions in the OTA. The FAA believes that it is appropriate to include contractual provisions in the Final Privacy Requirements that allow the FAA to protect the public interest by suspending or modifying the relevant operational authority for a Test Site if charges are filed by law enforcement against a Test Site operator due to potential violations of privacy laws.

10) The FAA should establish sanctions for violations of privacy policies or rights.

One commenter recommended that the FAA rescind the OTA for a Test Site where serious privacy violations have occurred and levy fines against operators that fail to comply with privacy policies.

Response: The Final Privacy Requirements provide that violations of privacy laws can result in suspension or termination of the OTA.

The FAA will not monitor a Test Site's compliance with its own privacy policies. The FAA expects the public entities operating the Tests Sites and their respective state/local oversight bodies to monitor and enforce a Test Site's compliance with its own policies.

Conclusion

Based on the comments submitted, the FAA intends to require each test site operator to comply with all of the privacy requirements included in the Draft Privacy Requirements as well as the following additional privacy requirements:

(1) Test site operators must maintain a record of all UAS operating in the test sites;

(2) Test site operators must require every UAS operator in the Test Site to have a written plan for the operator's use and retention of data collected by the UAS; and

(3) Test site operators must conduct an annual review of test site operations to verify compliance with stated privacy policy and practices and share those outcomes annually in a public forum with an opportunity for public feedback.

Accordingly, the FAA intends to include the following terms and conditions into Article 3 of the OTA:

"ARTICLE 3 PRIVACY; APPLICABLE LAW

a. Privacy Policies

The Site Operator must:

(i) Have privacy policies governing all activities conducted under the OTA, including the operation and relevant activities of the UAS authorized by the Site Operator.

(ii) Make its privacy policies publicly available;

(iii) Have a mechanism to receive and consider comments from the public on its privacy policies;

(iv) Conduct an annual review of test site operations to verify compliance with stated privacy policy and practices and share those outcomes annually in a public forum with an opportunity for public feedback;

(v) Update its privacy policies as necessary to remain operationally current and effective; and

(vi) Ensure the requirements of its privacy policies are applied to all operations conducted under the OTA.

The Site Operator's privacy policies should be informed by Fair Information Practice Principles.

b. Compliance With Applicable Privacy Laws

For purposes of this agreement, the term "Applicable Law" shall mean (i) a law, order, regulation, or rule of an administrative or legislative government body with jurisdiction over the matter in question, or (ii) a ruling, order, decision or judgment of a court with jurisdiction over the matter in question.

The Site Operator and its team members must operate in accordance with all Applicable Law regarding the protection of an individual's right to privacy (hereinafter referred to as "Privacy Laws").

If the U.S. Department of Justice or a state's law enforcement authority files criminal or civil charges over a potential violation of a Privacy Law, the FAA may take appropriate action including suspending or modifying the relevant operational authority (e.g., Certificate of Operation, or OTA) until the proceedings are completed. If the proceedings demonstrate the operation was in violation of the Privacy Law, the FAA may terminate the relevant operational authority.

c. Change in Law

If during the term of this Agreement an Applicable Law comes into effect which may have an impact on UAS, including impacts on the privacy interests of individuals or entities affected by any operation of any UAS operating at the Test Site, such Applicable Law will be applicable to the OTA and the FAA may update or amend the OTA to reflect these changes.

d. Transmission of Data to the FAA

The Site Operator should not provide or transmit to the FAA or its designees any data other than the data the data requested by the FAA pursuant to Article 5 of this OTA.

e. <u>Other Requirements</u>

The Site Operator must:

(i) Maintain a record of all UAS operating at the test sites; and

(ii) Require each UAS operator in the Test Site to have a written plan for the operator's use and retention of data collected by the UAS."

Issued in Washington, DC on November 7, 2013.

Marc L. Warren

Acting Chief Counsel, Federal Aviation Administration.

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REPORT OF THE
DEPARTMENT OF CRIMINAL JUSTICE SERVICES

Protocols for the Use of Unmanned Aircraft Systems (UAS) by Law-Enforcement Agencies

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

HOUSE DOCUMENT NO. 12

COMMONWEALTH OF VIRGINIA
RICHMOND
2013

COMMONWEALTH of VIRGINIA

Department of Criminal Justice Services

Garth L. Wheeler
Director

1100 Bank Street
Richmond, Virginia 23219
(804) 786-4000
TDD (804) 786-8732

November 1, 2013

To: The Honorable Robert F. McDonnell
Members of the General Assembly

From: Garth Wheeler, Director

Subject: Protocols for the Use of Unmanned Aircraft Systems by Law-Enforcement Agencies

It is my pleasure to provide you with the Protocols for the Use of Unmanned Aircraft Systems by Law-Enforcement Agencies developed pursuant to House Bill 2012 (2013). During the 2013 General Assembly Session, House Bill 2012 created a moratorium on the use of unmanned aircraft systems by law-enforcement agencies until July 1, 2015, with certain exceptions. The legislation also required the Department of Criminal Justice Services, in consultation with the Office of the Attorney General and other agencies, to develop model protocols for the use of unmanned aircraft systems by law-enforcement agencies. The results of the Department's work are included in the attached report.

If you have any questions about the protocols, please contact Teresa Gooch, Division Director, Division of Law Enforcement and Security Services (804-786-8730).

Unmanned Aircraft Systems (UAS) Protocols for use by Law Enforcement Agencies

October 7, 2013

Virginia Department of Criminal Justice Services
www.dcjs.virginia.gov

In the 2013 session of the General Assembly, House Bill 2012 placed a moratorium on the use of unmanned aircraft systems by state and local law enforcement and regulatory entities until July 1, 2015, except in defined emergency situations or in training exercises related to such situations.

The moratorium does not apply to certain Virginia National Guard functions or to research and development conducted by institutions of higher education or other research organizations.

The bill requires the Department of Criminal Justice Services, in consultation with the Office of the Attorney General and other agencies, to develop protocols for the use of drones by law enforcement agencies and report its findings to the Governor and the General Assembly by November 1, 2013.

In April 2013, a workgroup of public safety and legal professionals was assembled to accomplish the Department of Criminal Justice Services requirement of this bill.

The Department of Criminal Justice Services would like to thank the following individuals for their professional contributions to this policy:

Colonel Steven Sellers, Albemarle County Police Department
Sheriff Brian Roberts, Brunswick County Sheriff's Office
Chief Doug Middleton, Henrico County Department of Police
Ms. Shannon Dion, Office of the Attorney General
Sheriff Steve Dye, Russell County Sheriff's Office
SSA Marc Haalman, Virginia Department of Alcoholic Beverage Control
Officer Greg Hall, Virginia Department of Game and Inland Fisheries
Mr. David Summers, Virginia Department of Conservation and Recreation
Lt. Colonel James Caruso, Virginia Department of Military Affairs
Capt. Kirk Marlowe, Virginia Department of State Police
1st Sgt. Angelo Woodhouse, Virginia State Police

Virginia Department of Criminal Justice Services staff:

Teresa Gooch, Director, Division of Law Enforcement
Sam Hoffman, Standards, Policy and Homeland Security Manager
Gary M. Dillon, Manager, Virginia Accreditation Center

Definitions

Model Aircraft – Remote controlled aircrafts used by hobbyists, which are built, produced, manufactured and operated for the purposes of sport, recreation and/or competition. Model aircraft use is not regulated at the federal level and many UAS hobbyist belong to the Academy of Model Aeronautics, a professional association representing the interests of the hobby.

Unmanned Aircraft System (UAS) – The preferred industry definition of aircraft designed to navigate in the air without an on-board pilot. The authorization to use UAS is regulated by the Federal Aviation Administration (FAA). For the purposes of this policy guideline, UASs are non-weaponized.

UAS Flight Crew Member – A pilot, observer, payload operator or other person(s) assigned duties for a UAS flight mission or training exercise.

UAS Pilot – A person exercising control over a UAS during flight.

VTOL – Vertical take-off and landing

Potential Law Enforcement Applications

Accident Investigation
Missing Persons
Search and Rescue
Drug Investigations
Disaster Management
Crowd Control
Explosive Ordnance Disposal
Hostage and Barricade Situations
CBRNE Incident *(chemical, biological, radiological, nuclear, and explosives)*
Forensic Scenes
Support for Arrest Warrants
VIP Security Support
Perimeter Security
Low Cost Aerial Imagery
Enhance Situational Awareness

Protocols Based upon Legislation

Under current Virginia legislation, UASs cannot be used by law enforcement agencies for anything other than specified types of search and rescue or training. This legislation places a moratorium on their use, with exceptions, until July 1, 2015.

Protocols for the use of UASs currently must mirror those situations specified in that legislation, as listed below:

Amber Alert

Senior Alert

Blue Alert

Search or Rescue (To alleviate an immediate danger to a person)

Training exercises related to these uses

Benefits to Officer and Community Safety

Unmanned Aerial Systems (UAS) do not require a qualified pilot on board to operate the UAS or the attached equipment such as cameras, FLIR (forward looking infrared), etc. UAS operators and system operators remain safely on the ground reducing their exposure to threats.

UASs are able to enter environments, which may be hazardous to pilots of manned aircraft. These threats may be natural or manmade. They include hazardous waste, fire, smoke, threatening weather, and ground fire from perpetrators.

UASs provide superior situational awareness while minimizing the danger to which operators are exposed.

UASs and trained operators minimize response time to most emergency situations. UASs can be launched from a safe location within close proximity to the scene.

UASs designed for law enforcement come in two categories, vertical takeoff and landing (VTOL), and fixed wing. This allows for their use in different environments that may restrict the size of the launch area. VTOL may be launched and landed in a very limited space.

UAS operators should be in direct contact with incident command, enhancing communication between command and air assets.

Community safety is enhanced by the rapid response of air assets to an emergency. Many UASs designed for law enforcement use can be launched within five minutes. In most cases manned aircrafts must take off and land at an airports under the direction of air traffic controllers, which can adversely delay response time.

UASs designed for law enforcement use are small enough to be stored in containers, which are the approximate size of a small backpack, or in small cases that can be carried in patrol vehicles, thereby minimizing response time.

Agencies wishing to utilize UASs must obtain a Certificate of Authorization (COA) from the Federal Aviation Administration (FAA) to ensure compliance with federal requirements thus ensuring UASs are operated in accordance strict federal guidelines.

Cost Benefit

The cost benefit of utilizing a UAS designed for public safety as compared to manned aircraft is substantial. It should be noted that UASs are not designed to take the place of manned aircraft. The use of UASs would supplement the aerial capabilities of a law enforcement agency to provide enhanced service to the public.

The Metro Aviation Unit, a joint effort by the City of Richmond, Chesterfield County, and Henrico County, operates four fixed wing aircraft (two Cessna 172s and two Cessna 182s). The average hourly cost to operate each of these aircraft is $150. The cost of purchasing a manned aircraft similar to those being utilized by the Metro Aviation Unit is in excess of $800,000. These figures do not include personnel costs.

According to the Association for Unmanned Vehicle Systems International (AUVSI), the average hourly cost of operating a UAS designed for public safety use ranges from $30 to $50. The costs of UASs designed for law enforcement ranges from a few hundred dollars to over $40,000. These figures do not include personnel costs.

Training

The FAA has developed the rules for the public's operation of UASs. They can be found in FAA Memorandum "Interim Operational Approval Guidance 08-01 Unmanned Aircraft Systems Operations in the U. S. National Airspace".

Agency model policy and operational procedures

Community Engagement

Law enforcement agencies interested in integrating UAS technology in their operations should actively engage their communities in an effort to educate the public. Due to extensive media coverage of military drone use, there is widespread fear of similar deployment tactics on Virginia soil. Additionally, civil liberties organizations have concerns about violations of 4th Amendment rights.

1. Law enforcement agencies desiring to use UAS technology should first determine how they will utilize this technology, including the costs, benefits and risks.
2. Law enforcement agencies should then engage the community early in the planning process, including their governing body and civil liberties advocates.
3. It's imperative that the use of UAS technology be as transparent as possible to ensure the community that the law enforcement agency is in full compliance with the US Constitution, federal, state and local law governing search and seizure.
4. Law enforcement agencies should provide an opportunity for the community to review and comment on agency procedures for the use of UAS.
5. Transparency is the key to successful community support. For that reason, it is recommended that agencies work with the local media to help facilitate community education and dialogue.

System Requirements

1. Agencies deploying UAS technology shall maintain a flight log, which captures flight time, duration, date, supervisory authorization and reason for flight. UAS vehicles equipped with digital logs/counters are an acceptable alternative.
2. It is strongly encouraged that UAS vehicles should be painted in a high visibility paint or display high visibility markings, if the construction of the UAS permits. This will facilitate line-of-sight control by the pilot and allow for easier ground monitoring. In situations where covert operations are authorized (high risk search/arrest warrant), high visibility markings may not be optimal.
3. Equipping law enforcement UAS with weapons of any kind is strictly prohibited.
4. Law enforcement UAS technology shall be equipped with "auto return" technology, which automatically returns the vehicle to the launch location if radio connectivity is lost. For this reason, the use of "home built" aircraft or RC model aircraft is strongly discouraged.

Operational Procedures

1. All law enforcement UAS vehicles require a Certificate of Authorization (COA) from the Federal Aviation Administration (FAA). 0A law enforcement agency interested in deploying UAS technology should contact the FAA early in the planning process to determine the requirements of a COA.
2. UAS vehicles will only be operated by personnel, both pilots and crewmembers, who have been trained and certified in the operation of the system. All law enforcement agency personnel with UAS responsibilities, including supervisors and commanders, must complete training in the policies and procedures governing their use.

3. All flights will be approved by a supervisor and must be for a legitimate public safety mission, training or for demonstration purposes. Supervisory authorization shall be documented in the flight log.
4. A Virginia standardized flight log shall be used.
5. An authorized supervisor/commander will conduct a quarterly audit of flight logs. Unless as restricted by the Virginia FOIA, all flight logs and quarterly audits will be made available to the public upon request. Public agencies are encouraged to publish flight log information on their webpages.
6. Agencies must develop a disciplinary policy, which addresses unauthorized use of UAS technology.
7. Unless community or officer safety is compromised, agencies are encouraged to publically notify neighborhoods prior to using an UAS vehicle. The use of Reverse 911 telephone calls is a good example of a notification procedure.
8. When the primary mission is to collect evidence of a criminal incident AND the UAS vehicle will intrude upon the reasonable expectation of privacy, the law enforcement agency should consult with their Commonwealth's Attorney about obtaining a search warrant in advance of deployment.

Legal Considerations

Federal Legislation Governing the Use of UASs

The FAA Modernization and Reform Act of 2012 (49 U.S.C. § 40101, et seq.) is the only legislation passed by the United States Congress on the topic of unmanned aircraft systems. The act sets out requirements for new laws and regulations concerning unmanned aircrafts. The requirements are to ensure public safety and uniformity throughout national airspace and that civil unmanned aircraft systems include a sense and avoid capability. The act defines different types of unmanned aircraft and aircraft systems including:

1. **Unmanned aircraft** – an aircraft operated without the possibility of direct human intervention from within or on the aircraft.

2. **Small unmanned aircraft** – an unmanned aircraft weighing less than 55 pounds.

3. **Unmanned aircraft system** – an unmanned aircraft and associated elements (including communication links and the components that control the unmanned aircraft) required for the pilot in command to operate safely and efficiently in the national airspace system.

4. **Public unmanned aircraft system** – an unmanned aircraft system meeting the qualifications and conditions required for operation of a public aircraft.

Law enforcement agencies should be aware that laws and regulations related to the use of UAS are evolving and what may be true today is not necessarily true tomorrow. For example, the FAA is expected to release proposed rules later this year establishing policies, procedures and standards for small UAS which law enforcement may use. Additionally, there are several bills under consideration by the U.S. Congress, including: Preserving American Privacy Act of 2013, Preserving Freedom from Unwarranted Surveillance Act of 2013, Drone Aircraft Privacy and Transparency Act of 2013, and Safeguarding Privacy and the Fostering Aerospace Innovation Act of 2013. Enactment of these bills will impact law enforcement agencies' use of UASs and agencies should diligently monitor the law for future changes.

Federal Communications Commission Considerations

The Federal Communications Commission (FCC) regulates the use of radio frequencies, which UASs depend upon for operation. Frequencies allow the ground operator to control the device and collect surveillance data but are subject to interference. Some UAS systems available at retail stores include FCC approved frequencies that are shared by many users, which means reliability and security of the system may be at risk. For example, a UAS operating on a shared frequency may not maintain adequate connectivity between the device and the ground operator, thereby increasing the risk of losing control of the device. If control is lost, the device may crash into the ground or other property. Shared frequencies are also not secure, meaning a sophisticated user could intercept the frequency and access data sent from the UAS to the ground operator. Both scenarios involve liability issues for agencies which should be thoroughly considered before utilization of a UAS.

On the other hand, some UAS manufacturers have safeguards in place to decrease the risk of frequency interference. Some systems use encrypted communications and technology to prevent detection and unauthorized access. "Pairing" a UAS and ground control station creates a unique line of communication, which prevents outside linkage to the system. Other safeguards include key recognition, monitoring for interference and lost link modes.

If an agency wants a more secure frequency with which to control their UAS, it should petition the FCC for a designated spectrum for law enforcement. Doing so does not guarantee protection from interference, as the device itself must have built in safeguards to protect against interference and consequence mitigation in the event there is a communication breech. In summary, law enforcement agencies should thoroughly research various types of UAS systems to determine which model offers the best security measures for its intended use. Agencies are encouraged to contact the Virginia State Police Communications Division for additional guidance.

Freedom of Information Act

The Virginia Freedom of Information Act (FOIA) "ensures the people of the Commonwealth ready access to public records in the custody of a public body or its officers and employees, and free entry to meetings of public bodies wherein the business of the people is being conducted." All public records are presumed open unless a public body properly invokes an exemption and does not disclose the records. Va. Code §§ 2.2-3700-3714. Law enforcement agencies should consider the applicability of statutory exemptions for their public records regarding UASs. For example, an agency may elect to withhold records contained in criminal investigative files which include photographs taken by an UAS or specific tactical plans utilizing UAS technology. See Va. Code 2.2-3705.2 and 2.2-3706. Other exemptions may apply depending on the situation and agencies are advised to consult with their legal counsel in drafting responses to FOIA requests.

Agencies with specific FOIA questions are encouraged to contact the Virginia Freedom of Information Advisory Council at http://foiacouncil.dls.virginia.gov/ or (804) 225-3056.

Image Retention

The Government Data Collection and Dissemination Practices Act (Va. Code §§ 2.2-3800 – 3809), or the "Data Act," addresses how agencies handle personal information obtained through various methods. The Data Act defines personal information as information providing a basis for inferring personal characteristics, such as "photographs or things done by or to such individual." The Data Act specifies that personal information shall not be collected unless need for the information has been clearly established, shall be relevant for the purpose it is collected, shall not be misused, and must be collected within the confines of the law. However, the Data Act does not apply to personal information systems maintained by the Department of the State Police or other police departments that deal with investigations and intelligence gathering relating to criminal activity. (Va. Code § 2.2-3802(7)).

A recent Attorney General opinion addresses the use of license plate readers and whether information obtained by these devices can be kept by law enforcement. (2013 Op. Va. Att'y Gen. No. 12-073, *available at* www.ag.virginia.gov.) The answer depends on whether the information collected is for a specific criminal matter, which is exempt from the Data Act, or whether the information is collected for potential future use, which is subject to the Data Act. As applied to law enforcement's use of UAS to collect images, if the images are obtained for no particular reason, the Data Act prohibits law enforcement from storing the information for future use. However, if the UAS is deployed for a particular purpose directly related to "investigations and intelligence gathering related to criminal activity" the Data Act does not apply.

Federal Aviation Administration

Law enforcement agencies utilizing UAS technology must comply with federal laws and regulations which currently require public entities, such local police departments, to obtain a Certificate of

Authorization or Waiver (COA) before using an UAS in civil airspace. The primary purpose of the COA is to avoid in-air collisions with other objects in the air. Applicants apply online and the FAA evaluates the proposed operation for safety feasibility. For a complete listing of regulations, visit: www.faa.gov/regulations_policies/faa_regulations

The COA allows an operator to use a defined area of airspace and includes special provisions unique to the proposed operation. COAs usually are issued for a specific period and most require the applicant to coordinate with an air traffic control facility. Because UAS technology cannot currently comply with "see and avoid" rules that apply to all aircraft, a visual observer must maintain visual contact with the UAS and serve as its "eyes" when operating outside airspace restricted from other users.

Applying for a COA: https://ioeaaa.faa.gov/oeaaa/

Who may apply for a COA? Only public agencies operating an unmanned aircraft. A public agency is any agency that operates a public aircraft (14 CFR Part 1.1). If you receive funding from the federal government at some level, you are probably a public agency. A public agency can never operate under the guidelines of Advisory Circular 91-57 (Model Aircraft Operating Standards).

Additional Resources: "*Unmanned Aircraft Systems Operations in the U.S. National Airspace System – Interim Operational Approval Guidance"* provides FAA guidance for public use of unmanned aircraft by defining the COA evaluation process.
www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/aaim/organizations/uas/coa/faq/media/uas_guidance08-01.pdf

4th Amendment Considerations

The 4th Amendment protects individuals and their homes from unreasonable, warrantless searches and seizures by government actors. People have certain expectations of privacy in their property, particularly in their homes. Several doctrines have emerged by courts in balancing individual privacy and the need for government to keep people safe. The plain view doctrine authorizes warrantless searches when an officer, in a lawful place, can plainly see an item of incriminating character. The open fields doctrine recognizes that a person has less expectation of privacy outside of his home.

Applying the 4th Amendment to UAS surveillance is new territory for both law enforcement and the courts. The constitutionality of this technology as used by law enforcement will depend on many factors, including how and where the surveillance takes place. Whether a target is at home or in a public place will affect a court's analysis of how strong his expectation of privacy is. Other factors include the type and length of surveillance. The following cases primarily focus on manned airplane and helicopter flights but may be helpful to law enforcement agencies navigating the unchartered waters, or airspace in this instance, of using UAS technology in a manner that respects the 4th Amendment.[1]

Privacy in the Home

Kyllo v. U.S., 533 U.S. 27 (2001). Receiving tips from an informant, a federal agent acting without a warrant used a thermal imaging device to view Kyllo's home to help determine whether he was growing marijuana inside. Based on information yielded by the device, a warrant was obtained to search the home.

[1] See "*Drones in Domestic Surveillance Operations: Fourth Amendment Implications and Legislative Responses,*" by Congressional Research Service, April 3, 2013, at www.fas.org/sgp/crs/natsec/R42701.pdf for additional information.

The Supreme Court ruled that use of the thermal imaging device to gather information about the inside of the home constituted a search under the 4th Amendment.

Property Rights

Florida v. Jardines, 569 U.S. __ (2013). Officers brought a narcotics dog to defendant's front porch, which alerted for the presence of drugs. A search warrant was obtained for the home and marijuana plants were subsequently found. Using a property-rights analysis, the court concluded that using a trained dog on the front porch of a home was a physical intrusion on defendant's 4th Amendment rights. Unlike simply knocking on the door, which is a customary and routine act, bringing a police trained dog is neither customary nor routine. Because the officers only learned about the drugs by physically intruding on the defendant's property in order to gather evidence, an unlawful search occurred. (This case may be applicable if UASs are used in close proximity to homes in order to peer into windows.)

Open Fields and Manned Aerial Surveillance

Wellford v. Virginia, 227 Va. 297 (1984). After receiving a tip that Wellford was growing marijuana plants, law enforcement used a helicopter to fly 1000 feet above his fields and observed marijuana plants. Defendant was arrested after being observed caring for the plants. The court ruled that the open field was not part of the home's curtilage and therefore defendant had no expectation of privacy.

California v. Ciraolo, 476 U.S. 207 (1987). After receiving a tip that Ciraolo was growing marijuana plants in his backyard, which was shielded from view at ground level with a fence, law enforcement conducted warrantless aerial surveillance at 1000 feet. Officers, using nothing more than their "naked eyes," observed marijuana plants in the yard, which led to a search warrant of the property. The naked-eye aerial surveillance did not violate a reasonable expectation of privacy because it "took place within public navigable airspace in a physically nonintrusive manner."

Giancola v. West Va. Dep't of Pub. Safety, 830 F.2d 547 (4th Cir. 1987). Aerial surveillance from a helicopter flying at 100 feet did not violate the 4th Amendment. The aerial surveillance tactics were not unreasonably intrusive after considering the total number of surveillances conducted (two), the frequency of the surveillance, the length of each surveillance, altitude, number of aircraft (one), the degree of disruption of legitimate activities on the ground, and compliance with flight regulations.

Florida v. Riley, 488 U.S. 445 (1989). After receiving an anonymous tip that marijuana was growing in a greenhouse located ten to twenty feet behind a mobile home, law enforcement flew a helicopter over the property at an altitude of 400 feet. Marijuana was observed growing inside the greenhouse, which led to the issuance of a search warrant. In denying the motion to suppress the Court reasoned the helicopter was flying at a legal altitude, met all flight regulations, and that any member of the public could have legally taken the same flight and made the same observations. Therefore, Riley had no reasonable expectation of privacy in the greenhouse.

U.S. v. Breza, 308 F. 3d. 430 (5th Cir. 2002). During a drug interdiction helicopter flight, law enforcement officers observed what they thought were marijuana plants in an area surrounding Breza's dwelling. After descending to approximately 200 feet, this suspicion was confirmed and officers on the ground, without a warrant, searched the garden and seized hundreds of marijuana plants. The 4th Circuit held that the surveillance did not violate the 4th Amendment because the flight fully complied with all laws and regulations and were a regular occurrence. The court also upheld the warrantless entry because the defendant was observed burning the marijuana plants.

Agency/Operator Certifications

Pilot & Observer Certifications/Qualifications

It should be noted that all certifications/qualifications herein are applicable to operations of UAS at and below 400 feet. All pilot and observer training records will be maintained by the agency employing those persons and are subject to state and federal inspection.

Pilots:

Each UAS pilot must be an FAA-certificated airman or successfully pass either the FAA's pilot knowledge exam or complete an FJ\1\-approved UAS pilot training curriculum. However, if operating in controlled airspace, additional certifications are required. *Note*: Certification does not require the practical fight requirements of a manned aircraft.

Pilots will receive training specific to the UAS to be operated. This training must be conducted and documented by a qualified instructor designated by the proponent as being the individual(s) trained and certified by the manufacturer to provide training on the specified UAS.

Pilots must not perform duties for more than one UAS at a time and are not allowed to perform concurrent duties both as pilot and observer.

Pilots are prohibited from flying any law enforcement mission without having completed three UAS flight events within the preceding 90 days.

Law enforcement standard operating procedures (SOP) must include Crew Resource Management (CRM) techniques to ensure the highest possible situational awareness and effective communication by pilots during each flight operation. Pilots must be trained in these procedures and techniques. ***Note*:** CRM training involves a wide range of knowledge, skills and attitudes to include communications, situational awareness, problem solving, decision making, and teamwork. CRM is defined as a management system which makes optimum use of all available resources – equipment, procedures and people – to promote safety and enhance the efficiency of operations.

All pilot training must be conducted and documented by a qualified instructor designated by the proponent as being an individual trained and certified.

Pilots must be medically qualified and have in their possession a second class (or higher) airman medical certificate that has been issued under 14 CFR Part 67, Medical Standards and Certification.

Pilots are subject to the provisions of 14 CFR § 91.17, Alcohol and Drugs.

Observers:

Observers must successfully complete a UAS observer training curriculum that includes, at a minimum, instruction on rules and responsibilities described in 14 CFR § 91.111, Operating Near Other Aircraft, 14 CFR § 91.113, Right of Way Rules, Cloud Clearances, and that emphasizes "See and Avoid" concepts and fundamental radio communications, including standard ATC phraseology. Observer training must include thorough instruction regarding manned aircraft traffic conflicts and pilot communications for any maneuvers/actions required to avoid traffic conflicts.

Observers must not perform duties for more than one UAS at a time and are not allowed to perform concurrent duties both as pilot and observer.

Law enforcement standard operating procedures (SOP) must include Crew Resource Management (CRM) techniques to ensure the highest possible situational awareness and effective communication by observers during each flight operation. Observers must be trained in these procedures and techniques.

All observers training must be conducted and documented by a qualified instructor designated by the proponent as being an individual trained and certified by the manufacturer to provide training on the specified UAS.

Observers must be medically qualified and have in their possession a second class (or higher) airman medical certificate that has been issued under 14 CFR Part 67, Medical Standards and Certification.

Observers are subject to the provisions of 14 CFR § 91.17, Alcohol and Drugs.

It should be noted that the FAA is working to change the requirement for a second-class airman medical certification to self-certification as to being healthy to fly and a letter from a competent medical authority certifying the operator's eyesight to the second-class medical certification requirements of correctable to 20/20.

Memorandum of Understanding Between Federal Aviation Administration and the U.S. Department of Justice, Office of Justice Programs, National Institute of Justice Concerning Operation of Unmanned Aircraft Systems by Law Enforcement (www.alea.org/assets/pressReleases/assets/1805/DOJ%20FAA%20MOU.pdf)

Regulatory Considerations

24VAC5-20-100. Operation of aircraft.

All aircraft operations shall be conducted in conformity with Federal Aviation Regulations as amended from time to time and violation of such federal regulations shall also constitute a violation of this chapter.

Statutory Authority

§§ 5.1-2.2 and 5.1-2.15 of the *Code of Virginia.*

Historical Notes

Derived from VR165-01-02:1 § 2.9, eff. September 9, 1992.

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Unmanned aerial vehicle industry taking off in Alaska

ELWOOD BREHMER, ALASKA JOURNAL OF COMMERCE

PHOTOS/MICHAEL DINNEEN/AJOC

The venerable Piper Super Cub isn't being squeezed out, but the face of aviation in Alaska is changing.

Once strictly a military tool, unmanned aerial vehicles, or UAVs, are now being used in civilian government work and the private sector.

Fairweather LLC announced the formation of research subsidiary Tulugaq LLC Sept. 30. A joint venture between the resource industry support company and regional Native corporations Olgoonik Corp. and Kaktovik Inupiat Corp., Tulugaq's work centers on its 21st Century aircraft, the Diamond Aircraft DA42. The word Tulugaq is Inupiaq for raven. Fairweather was founded in 1976 by Sherron Perry with an initial focus on providing aviation weather observation services to remote regions, and has since expanded into a wide array of industry support activities.

"We make science happen," Tulugaq Operations Manager Steve Wackowski said. "My boss, Sherron Perry, saw a niche for airborne remote sensing so we're approaching it in two ways: manned and unmanned remote sensing. Part of our DA42 is the manned portion of that, but the kicker on the DA42 is it's optionally unmanned."

By replacing the pilot seat in the DA42 with a remote control conversion kit, the $1.2 million aircraft becomes a UAV with a 44-foot wingspan.

The dual-flight option is the reason Tulugaq bought the DA42, Wackowski said. And when the time comes, it will be taken advantage of, he said.

Manned or not, the Tulugaq has about $400,000 worth of sensing equipment and cameras that can be swapped in and out of receivers on the nose and belly of the DA42.

All of the equipment is operated with a Microsoft Xbox video game controller. Wackowski said it was developed with the Xbox controller so the controls would be as recognizable to operators as possible.

Because the sensors are designed to fit into receivers built into the plane, Tulugaq does not need to get a certificate of airworthiness every time it changes them, he added.

"The analogy I use, is, the plane's kind of like an iPhone; you can build an app for that," Wackowski said.

Until recently the Federal Aviation Administration had banned commercial operation of UAVs in the United States. On Sept. 24, ConocoPhillips announced it had completed the country's first commercial UAV (also known as an unmanned aircraft system, or UAS) flight off of Northwest Alaska in the Chuckchi Sea. The roughly 40-pound ScanEagle UAV was launched from Fairweather's Westward Wind research vessel during a week of flights, according to a ConocoPhillips release.

"Airborne surveillance is often a component of offshore projects. The UAS could be useful in monitoring and data collection efforts, with the benefit of improved safety and lower noise levels as compared to using manned aircraft," ConocoPhillips President Trond-Erik Johansen said in a formal statement.

To operate a UAV, a certificate of authorization, known in the industry as a COA, must be approved by the Federal Aviation Administration. It is essentially a flight plan for unmanned aircraft. It designates where, when and at what altitude a UAV can be flown.

ConocoPhillips can claim the first commercial UAV flight, but Alaska has also already seen unmanned craft used for noncommercial purposes.

The National Oceanic and Atmospheric Administration Alaska Fisheries Science Center staff flew UAVs on Steller sea lion surveys in the Aleutian Islands in the spring of 2012 in conjunction with University of Alaska Fairbanks researchers at the UAF's Geophysical Institute, which has become a leading research center for unmanned aircraft development.

By hovering a small, quad-copter UAV above the sea lions' brooding grounds the researchers took infrared photos of the animals — listed as an endangered population — and were able to count them from an offshore vessel without disturbing the sea lions or putting pilots and biologists in risky low-level flying situations.

Unmanned craft will allow for monitoring shifting sea ice, marine mammals and birds as more companies from transportation to resource development enter the Arctic.

While it will likely be another couple years before widespread commercial use of UAVs is approved, particularly for large aircraft like the DA42, it's "dull, dirty and dangerous" missions similar to the sea lion counts that they are made for, Wackowski said.

"Most clients won't let you put a manned crew (in the Arctic) when you're talking about going more than 20 to 30 miles offshore," he said.

Prior to his work with Fairweather and its subsidiary, Wackowski had experience as an unmanned aircraft pilot in the Alaska Air Force Reserve. He holds the record for the northernmost UAV flight at 88.5 degrees North for flying a hand-launched AeroVironment Raven RQ-11 off of a Canadian icebreaker in the summer of 2011.

He was flying so close to the North Pole that the Raven's compass was disrupted, Wackowski said.

"Things operate differently up in the high Arctic," he said.

While setting the record, Wackowski was able to find leads, or cracks, in the sea ice ahead of the ship with an infrared camera on the Raven, which ship pilots prefer to follow when traveling through an icepack, he said. He also searched for polar bears while a team off the ship installed a buoy under the ice.

While he didn't find any bears, he said the mission is an example of a simple task a UAV can perform to make Arctic work easier.

The FAA is in the midst of developing operational guidelines for UAVs and was directed by Congress to have them complete by 2015. As part of the 2012 FAA Modernization and Reform Act, the agency was tasked with choosing six UAV test sites across the country.

UAF Geophysical Institute Director Greg Walker is pushing for Alaska to be one of the test sites and has said that given the state's areas of open airspace and potential for future UAV use, it is more a matter of whether Alaska is chosen first, rather than at all. The FAA is expected to choose the test sites by the end of the year.

A test site would consist of airspace and a landing strip designated for UAV research.

"We fully support the University of Alaska's efforts to get the UAV test bed up here," Wackowski said. "It would be huge — a boom for industry and Alaska."

Aviation industry experts have forecast UAVs will quickly become a $30 billion-plus business in the U.S. once the FAA clarifies its airspace and communication regulations for the aircraft subset.

Anchorage-based Peak 3 Inc. is in the business of prepping other companies for the FAA standards rollout. Peak 3 President and CEO Jen Haney said her company has worked in Alaska and the Lower 48 consulting with businesses and government agencies on how UAVs can benefit their operations and how to be ready to fly when the FAA says, "cleared for takeoff."

Part of the UAF team pushing for an Alaska test site, Haney said the culture of UAV operators needs to be similar to that of traditional aviation for safety reasons.

"I don't think it's unreasonable for (UAV) pilots to be required to have their pilot's license," she said.

The FAA is the "biggest roadblock" to expanding the unmanned industry, Haney said, but the slow careful nature of the agency is necessary to safely integrate a whole new realm of aircraft into the skies.

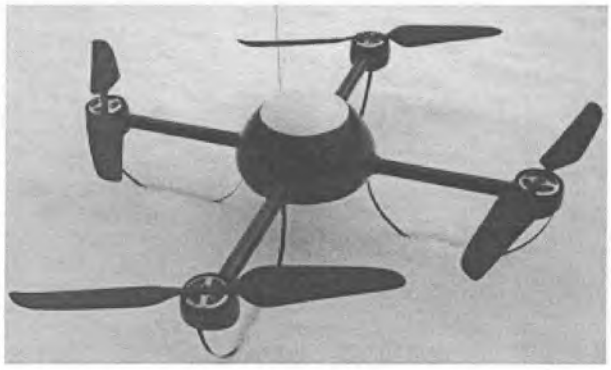
Elwood Brehmer can be reached at elwood.brehmer@alaskajournal.com.

FAA prepares for invasion of 7,500 drones

By Washington Times (DC) November 9, 2013 6:50 am

Print Email Letter to Editor

Text Size: A A A



(File Photo)

The chief of the Federal Aviation Administration predicted Thursday that U.S. airspace could be crowded with as many as 7,500 commercial drones within the next five years, as he unveiled a long- awaited regulatory blueprint that seeks to protect Americans' privacy while requiring testing for law enforcement and private companies seeking to operate unmanned aerial vehicles.

FAA Administrator Michael Huerta said his agency would set up six sites across the country to test drone operators, but cautioned that there could be delays for those looking to obtain certificates to operate unmanned aircraft once the regulatory guidelines are in place. He said ensuring safety in increasingly congested skies was his agency's top priority.

"We must fulfill those obligations in a thoughtful, careful manner that ensures safety and promotes economic growth," Mr. Huerta said in a speech to aerospace industry executives.

The FAA's announcement is the latest step in the march toward transitioning drones from the military use in the war on terrorism that made them famous to civilian applications that can range from collecting survey and weather data to assisting rescues and law enforcement operations.

The Association for Unmanned Vehicle Systems, the leading trade group for the nation's private-sector drone operators, estimated this year that the commercial drone industry will create more than 100,000 jobs and generate more than $82 billion in economic impact over the next 10 years - if the government moves quickly to establish workable operating regulations and safeguards.

The impending boom has raised concerns among privacy advocates about how and where drones might be used to collect data. The FAA is requiring future test sites to develop privacy plans and

make them available to the public. The policy also requires test site operators to disclose how data will be obtained and used.

"Make no mistake about it, privacy is an extremely important issue and it is something that the public has a significant interest and concern over and we need to recognize as an industry that if we are going to take full advantage of the benefits that we are talking about for these technologies we need to be responsive to the public's concerns about privacy," Mr. Huerta said.

Christopher Calabrese, American Civil Liberties Union legislative counsel, told The Washington Times that while the FAA's requirement for public disclosure of data and retention policies are needed and welcome, the safeguards do not go far enough.

"It's crucial that as we move forward with drone use, those procedural protections are followed by concrete restrictions on how data from drones can be used and how long it can be stored. Congress must also weigh in on areas outside of the FAA's authority, such as use by law enforcement and the Department of Homeland Security, which have the ability to use drones for invasive surveillance that must be kept in check," Mr. Calabrese said.

Legislation has been introduced by Sen. Edward J. Markey, Massachusetts Democrat, and Rep. Ted Poe, Texas Republican, and Rep. Zoe Lofgren, California Democrat. If passed, this legislation would require law enforcement agencies to obtain warrants before using drones to collect surveillance data on U.S. soil. "People are really worried about drone use. You see it in a huge number of state bills and laws, and I think the FAA needs to understand that if they don't address privacy issues then drones are not going to be a useful technology," he said. "Privacy can't be swept under the rug."

Mr. Huerta told reporters after his address that there was not a fast-track application process for particular agencies - such as law enforcement - looking to apply for certification to operate unmanned aircraft.

"Our current policy provides for any public user that would like to apply for a certificate of operation to operate unmanned aircraft within national airspace, they are free to apply...," he said. "But I wouldn't say we have a particular priority one way or the other."

Mr. Huerta did allude to possible exceptions for law enforcement agencies to use small unmanned aircraft systems but stressed that the FAA was looking into how to streamline the application process in a way that ensures safe integration into the system and said approximately 80 law enforcement agencies already operate unmanned aircraft under special certificates of authorization.

The FAA released an integration road map and comprehensive plan on its website Thursday.

Both documents lay out steps for unmanned aircraft integration by 2015. Setting up test sites for unmanned aircraft is the next step on the path to integration, and bidding from states to host the sites has been spirited.

"By the end of the year, we plan to choose six test sites for civil unmanned aircraft. Congress required us to do so, and we need to make sure we use these sites to obtain the best data that we can," Mr. Huerta said.

The FAA has received 25 applications for test sights representing 26 states.

The drone industry, which has pushed the Obama administration to speed regulations to clear the way for more commercial uses, called the FAA's moves "an important step."

"From advancing scientific research and responding to natural disasters to locating missing persons and helping to fight wildfires, [drones] can save time, save money, and, most importantly, save lives," said a statement by Mr. Michael Toscano, president and CEO of the Association for Unmanned Vehicle Systems.

Mr. Toscano noted that the FAA's announcements were better late than never as the FAA has missed every deadline laid out for drone integration in the reauthorization act. However, they have had to cope with significant funding cuts from sequestration and government shutdowns. "Every day that we don't fly in national airspace, we lose between $27 to $30 million of economic revenue," he said.

KRAMER LEVIN
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Commercial Litigation
ALERT

November 11, 2013

THE FAA'S ROADMAP FOR UNMANNED AIRCRAFT SYSTEMS (UAS) INTEGRATION: FORESHADOWING FUTURE REGULATIONS FOR SMALL COMMERCIAL DRONES

On November 7, the Federal Aviation Administration released its first annual Integration of *Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap* (the "Roadmap") and accompanying *Notice of Final Privacy Requirements for UAS Test Sites* (Docket No. FAA-2013-0061) ("the "Privacy Requirements"). At the same time, the FAA's Joint Planning and Development Office delivered to Congress the *UAS Comprehensive Plan* (the "Plan") mandated by the 2012 FAA Modernization and Reform Act. These three documents represent the first comprehensive look at how and when the FAA plans to integrate commercial drones into the national airspace system.[1]

A Faster Track for Small Commercial Drones

The FAA's new documents make clear that larger commercial drones will be integrated into the national airspace system very slowly, over an extended period involving technical testing and rulemaking that may span a decade.[2] However, the timeframe for the express approval of so-called "small" commercial drones ("sUAS"), weighing less than 55 pounds, is of arguably greater interest to the nation's nascent commercial drone industry. Many of the most beneficial uses of civilian drone technology can easily be implemented using technology available today, at low altitudes, by platforms weighing far less than 55 pounds. These include aerial photography and cinematography, agricultural crop analysis, wildlife and environmental monitoring, search-and-rescue, geographical mapping, power line and infrastructure inspection, and countless others.

A notice of proposed rulemaking ("NPRM") specifically addressing sUAS has been promised by the FAA since 2010, but its release has been repeatedly delayed. This most recent update moves the goal again, but sounds promising. The Comprehensive Plan indicates that "The NPRM for small UAS is being drafted and is targeted for release in 2014." Plan at 15. The Roadmap is a little more specific: "The sUAS NPRM is expected to be released in *early* 2014." Roadmap at 58 (emphasis added).

[1] These documents are available at http://www.faa.gov/news/press_releases/news_story.cfm?newsId=15334 .

[2] Currently there is no federal aviation regulation specifically addressing the commercial operation of unmanned aircraft systems. The FAA has asserted as its "policy" that commercial uses are prohibited.

A Foreshadowing of Burdensome Regulations

Although the contents of the anticipated sUAS NPRM have remained a closely-guarded secret for years, a significant portion of the future proposed regulatory framework may now be gleaned by a close reading of the FAA's new Roadmap, Comprehensive Plan and Privacy Requirements documents. These suggest that the proposed regulatory framework may be much more burdensome than anticipated by developers of the smallest UAS platforms intended to be flown at low altitudes.

Operator Qualifications

Pilot Certification, including Medical Requirements: The FAA's introductory section of the Roadmap indicates that "At the core of these policies is the concept that each aircraft is flown by a pilot in accordance with required procedures and practices. This same policy applies to UAS." Roadmap at 9. The Roadmap further indicates that the FAA plans to amend its regulations so as to address "certification of sUAS pilots." Roadmap at 34. Additionally, the Roadmap's "Goals, Metrics and Target Dates" section includes the following as "Goal 1": "FAA certification requirements for pilots and crew members for sUAS classes (including medical requirements, training standards, etc.) published as part of a sUAS rule by 2014." Roadmap at 52. These statements strongly suggest that future operation of sUAS may be limited to persons who have undertaken a training course, who pass an examination of some kind, and who are medically qualified. This framework, reminiscent of the current pilot certification regime for manned aircraft, threatens the practicality of commercial uses of very small drones where pilot certification is arguably unnecessary (for example, a photographer using a hobby-grade radio-controlled multirotor to take photographs of real estate at very low altitudes).

Operational Restrictions

Constrained Airspace and Performance: The Roadmap indicates that "[o]perations of sUAS under new regulations may have operational, airspace, and performance constraints." Roadmap at 34. "As integration begins, there will be approved airspace and procedures for sUAS." *Id.* at 35. The Comprehensive Plan gives a more specific sense of the anticipated initial airspace restrictions for sUAS: The "Initial Capability" will involve "Operations outside of Class B/C airspace and not over populated areas." Plan at 9. The indication of an airspace restriction (in particular, an altitude ceiling) for early commercial drone use is not a surprise. However, the reference to "not over populated areas" may pose a serious impediment to numerous commercial applications, such as cinematography on controlled film sets, crop inspection in semi-rural areas, or the survey of disaster-stricken urban areas. Moreover, the reference to "performance constraints" and "approved procedures" suggests potential restrictions on the capabilities and applications of sUAS platforms even within the designated airspace.

Line-of-Sight Requirement: The Roadmap hints that sUAS may need to be operated within the "visual line-of-sight (LOS) of the flight crew" in order to avoid regulations similar to those applicable to manned aircraft. Roadmap at 33. Otherwise, a lengthy list of "general requirements and assumptions" for UAS operations may be applied to non-LOS sUAS, including compliance with existing operating rules, the need for an airworthiness certificate, the requirement to "file and fly an IFR flight plan," the use of an on-board ADS-B (Out) transponder, air traffic separation capabilities, and pilot communication with ATC using standard phraseology, among others. *Id.* at 33-34. The Plan similarly suggests that the early FAA goals "apply to small UAS (under 55 pounds) within visual line-of-sight (VLOS)." Plan at 3. Many small sUAS will operate at the limit of visual perception, or be momentarily out of sight such as when flying low between buildings on a disaster relief mission or under tree-top level during infrastructure inspection. Therefore, the definition of "visual line of sight" will seemingly play an important role in the exemption from the long list of technical and procedural requirements. In the Glossary at the back of the Roadmap, the term "Visual Line-of-Sight" is defined as "Unaided (corrective lenses and/or sunglasses exempted) visual contact between a pilot-in-command or a visual observer and a UAS

sufficient to maintain safe operational control of the aircraft, know its location, and be able to scan the airspace in which it is operating to see and avoid other air traffic or objects aloft or on the ground." The term is not defined in the Comprehensive Plan. Arguably, direct visual observation of an sUAS is far less useful as an indication of its precise location than video and digital telemetry sent back to the ground, and there is some sentiment among industry participants that the more important point is visual confirmation that the surrounding airspace is free of other air traffic even if the sUAS is not directly visible for its entire operation.

Autonomous Flight Prohibited: The FAA appears to have drawn a line in the sand with respect to autonomous flight for any UAS. "Autonomous operations are not permitted. The [pilot] has full control, or override authority to assume control at all times during normal UAS operations." Roadmap at 33. Some of the more innovative small multirotor designs contemplate the use of autonomous technologies to navigate the environment, for example in a search and rescue operation surrounding a collapsed building. One key technology already implemented in many existing sUAS platforms is the ability to "return to home" via GPS guidance in the event of a control signal loss or other malfunction. Although that situation may not qualify as "normal UAS operations," the FAA's Roadmap suggests that developers generally must include the ability of a ground-based pilot to monitor and override all of a drone's autonomous flight functions.

Daytime Flight Only: The FAA's timeline indicates that "sUAS follow-on night operations experiments and study accepted by the FAA for review by the 3rd Quarter of 2014" with a goal of "increased night operations for public entities . . . by the 3rd Quarter of 2015." Roadmap at 58. This suggests a delay for certain commercial applications, such as search-and-rescue, agriculture, or wildlife monitoring, where night operations are advantageous or critical.

Privacy Considerations

Privacy Framework: The FAA's Roadmap declares that "the FAA's mission does not include developing or enforcing policies pertaining to privacy or civil liberties." Roadmap at 11. Its response to privacy concerns that have been raised with respect to the six planned UAS test sites is to permit the test site operators (who are "public entities" -- generally state or local government agencies) to develop their own privacy policies, with the FTC's Fair Information Practice Principles as an informative guideline. *Id.* at 11-12. The FAA expects those policies to be in writing, to provide for public comment, and to involve an annual compliance review. *See* Privacy Requirements at 8, 13. "[T]he 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." Roadmap at 12. Noticeably absent from any of the FAA's documents is an indication of how the FAA plans to address privacy issues with respect to *sUAS platforms*, as to which it has promised an NPRM by "early 2014," and which are anticipated to be in "routine" operation by 2015. Obviously, the experiences to be gained from the six test sites cannot guide the sUAS NPRM because the test sites have not even been chosen and will not be operational for some time. In light of the statement concerning its "mission, "perhaps the FAA plans to defer to state and local standards. Indeed, many of the privacy concerns that are often expressed about commercial drone technology are already addressed by technology-neutral state common law principles, or anti-stalking and invasion-of-privacy statutes.

Mandatory Procedures

Registration and Approval: The FAA has also indicated that future regulations will address "registration of sUAS [and] approval of sUAS operations." It is not clear from these documents whether the registration and approval mechanism will be minimally burdensome (such as simple identification and operational notice provided on an FAA website) or something more complex resembling the registration

of manned aircraft and the visible display of an N-Number on the drone. The latter approach could be difficult for smaller platforms.

Safety Data Reporting and Recordkeeping: The Roadmap indicates that "[d]ata collection will expand when . . . new rules and associated safety data reporting requirements are implemented for sUAS." Roadmap at 28. This safety data will be used by FAA to "support the basis for and define appropriate UAS operating requirements." One of the FAA's early goals is to accomplish "Necessary changes to record keeping systems established as part of a sUAS rule." *Id.* at 53. These statements all suggest that commercial sUAS operators will be expected to collect safety-related data, potentially using required sensors on board the drone, and to maintain formal operating records.

Interface with Air Traffic Control: The Roadmap contemplates that the FAA will "[t]rain air traffic control workforce within six months after sUAS rule enactment" and "sUAS operations are aligned with ATC Handbook ... when the sUAS rule is published and effective." This suggests that sUAS operation may, in some way, be subject to interaction with air traffic control.

The Path Forward

Government Users First: The Comprehensive Plan states that with respect to routine sUAS operations, the FAA is "assuming the public realm would be accomplished first and civil would follow." Plan at 16. In other words, public operators (typically government agencies or organizations funded by government, such as law enforcement or state universities) can be expected to be permitted use of sUAS platforms before civil (private, commercial) operators. 2015 is indicated as the goal for both of those "national goals," however, so the purpose of the two-step approach is unclear. *Id.* at 9.

Risk Assessment Hurdle: The Roadmap indicates that "The sUAS proposed rule has undergone a risk assessment by the FAA through its Safety Management System (SMS) process." Roadmap at 58. This may account for the FAA's already lengthy delay. However, it also suggests that public input during the notice-and-comment period might require the SMS risk assessment to be redone, triggering a new delay before the final sUAS rules are actually implemented.

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If you have any questions or need additional information about this Alert, or any unmanned aircraft systems topic, please contact:

Brendan M. Schulman
Special Counsel
bschulman@kramerlevin.com

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LISA MURKOWSKI
ALASKA

COMMITTEES:
ENERGY AND NATURAL RESOURCES
RANKING MEMBER
APPROPRIATIONS
HEALTH, EDUCATION, LABOR, AND PENSIONS
INDIAN AFFAIRS

United States Senate
WASHINGTON, DC 20510-0203
(202) 224-6665
(202) 224-5301 FAX

510 L STREET, SUITE 600
ANCHORAGE, AK 99501-1956
(907) 271-3735

101 12TH AVENUE, ROOM 329
FAIRBANKS, AK 99701-6278
(907) 456-0233

800 GLACIER AVENUE, SUITE 101
JUNEAU, AK 99801
(907) 586-7277

805 FRONTAGE ROAD, SUITE 105
KENAI, AK 99611-9104
(907) 283-5808

1900 FIRST AVENUE, SUITE 225
KETCHIKAN, AK 99901-6059
(907) 225-6880

851 EAST WESTPOINT DRIVE, SUITE 307
WASILLA, AK 99654-7142
(907) 376-7665

November 12, 2013

Representative Shelley Hughes
Alaska State Legislature
600 E. Railroad Ave
Wasilla AK, 99654

Senator Donny Olson
Alaska State Legislature
716 W. 4th Ave. Suite 560
Anchorage AK, 99501-2133

Dear Representative Hughes and Senator Olson:

I am pleased to provide supporting comments to the Unmanned Aerial Systems (UASs) Legislative Task Force for consideration as you move forward with recommendations on the use of UASs in the public, private and commercial arena. I commend the Task Force for taking a robust look at the public interest issues associated with UASs.

I recognize the valuable role these systems can play in public safety, law enforcement, land management, and agriculture, among other sectors. The potential economic benefits of a carefully managed effort to integrate UASs in the airspace are demonstrably large. Already, ConocoPhillips contractors have sent a ScanEagle aircraft offshore from Wainwright for exploratory purposes. One of the University of Fairbanks' (UAF) unmanned aircraft helped a Russian tanker in 2011-2012 to find a path to deliver fuel. The FAA is approving unmanned flights nationwide and I support the state's interest in safely and responsibly considering the use of UASs across industries.

As we look at evaluating UAS implementation, the following issues must be addressed: safety, privacy, controlling information, certification and balancing data collection with privacy. If we can use unmanned aircraft efficaciously to conduct mapping, for search and rescue operations, crash investigations, pipeline inspections or monitoring oil spills and wildfires then we must look at the potential for implementation in Alaska.

In 2012, FAA was tasked with determining how to integrate UAS into the National Airspace System. In this effort, an economic analysis was completed by the Association for Unmanned Vehicle Systems International providing useful data. This study indicates that the industry impact totals more than $13.6 billion and more than 70,000 new jobs from 2015 to 2017. In Alaska, this amounts to a $19 million economic effect with 95 additional jobs. What is needed is a regulatory structure for commercial and civil development to take advantage of this opportunity in a responsible manner.

The FAA is working to integrate UASs into the national airspace by 2015. As the FAA works to establish six test sites for evaluating how to accomplish the integration, the Legislative Task Force is well poised to address concerns of privacy, overreach, uses and regulations. I support FAA's consideration of UAF as an arctic test site to further vet the use of UASs in diverse terrain and airspace.

Thank you for the opportunity to comment on the Unmanned Aerial Systems Legislative Task Force process. I support your efforts to evaluate all issues associated with the use of unmanned aircraft in Alaska and to consider the application of these systems for public, private and commercial purposes.

Sincerely,

Lisa Murkowski

United States Senator

Written Testimony

Of

Stephen J. Ingley
Executive Director
Airborne Law Enforcement Association

Before the
Legislative Task Force on Unmanned Aircraft Systems Public Meeting
State of Alaska

Good morning Representative Hughes and members of the Legislative Task Force on Unmanned Aircraft Systems. My name is Stephen Ingley and I am the executive director of the Airborne Law Enforcement Association (ALEA). ALEA is a 501(c)(3) non-profit educational membership organization, founded in 1968 to support, promote and advance the safe and effective utilization of aircraft by governmental agencies in support of public safety missions through training, networking, advocacy and educational programs. Our vision is the safe and successful completion of each airborne public safety operation. And our values are Safety, Education & Training, Networking, Public Service, Professionalism, and Ethics and Integrity. Our members operate traditional aircraft (airplanes and helicopters), alternative aircraft (light sport aircraft, gyro-copters and powered parachutes) and unmanned aircraft systems (UAS).

UAS technology has been successfully fielded by the US military in combating terrorism. As the war has drawn down, UAS manufacturers have developed more devices that are small, portable and reliable. More importantly, the manufacturers started to develop devices that were relatively inexpensive, making it conceivable that those agencies that could not afford traditional aviation assets, could afford small UAS (sUAS) technology.

Realizing the potential of this technology, in 2005, the ALEA became active in researching the feasibility of incorporating sUAS into the "toolbox" of public safety agencies. This included participating in the Federal Aviation Administration's (FAA) Proposed Rulemaking Committee for UAS, participating in the Department of Justice's, National Institute of Justice research projects for UAS, conducting UAS training for ALEA members, and working with various organizations and federal and state legislatures on UAS issues. In addition to this, the ALEA has taken the lead in public safety aviation by embracing this new technology, as we see the capabilities of UAS in enhancing the safety of our citizens and public safety employees.

It is a very common occurrence to see military operated UAS on national and local news programs. These devices are large, armed with weapons and operated in theater. Many times, articles have been written regarding the use of UAS technology by American public safety agencies, along with a photos of military grade Predators and Global Hawks. The depiction of military UAS devices within an article concerning public safety's use only heightens the fear of the public and fosters distrust. More importantly, it paints a picture that your local police or sheriff's department is going to operate Predator type UAS devices, capable of long-term, sustainable surveillance and rocket-launched weapons. This stylized hype couldn't be further from the truth.

While the military has been successful in its use of UAS technology to combat terrorism, American public safety is in its infancy in using these devices to combat crime, save lives and enhance the efficiency of agencies. Today, there are four local agencies that have FAA approval to operate UAS devices in their respective

jurisdictions. They are the Grand Forks County (North Dakota) Sheriff's Office, Mesa County (Colorado) Sheriff's Office, Arlington (Texas) Police Department and the Miami-Dade Police Department. Mesa County was the first agency to initiate utilizing UAS technology within their day-to-day operations. Being a very rural county in Colorado, this was a relatively easy process for them, as they had little impact on the national airspace and interfering with the safe operation of other aircraft. Although rural, Mesa County has pioneered the use of these devices for all agencies. What Mesa County has discovered is that these devices are not just a law enforcement tool, but also a tool for public safety generally, as well as government operations. For example, the Mesa County UAS program routinely assists its various fire agencies in responding to building fires. Their UAS devices are launched to provide fire incident commanders timely information regarding the fire that they are combating. In addition, the devices are routinely used for Search and Rescue (SAR) missions. sUAS are able to clear large areas of land (wooded and cleared) much faster than utilizing ground personnel. This permits the Mesa County rescuers to manage a SAR operation much more efficiently and enhances the chance of finding any victims much sooner by deploying search personnel smarter. Mesa County also utilized its sUAS to survey its county owned landfill for an annual land use survey. In the past, the county hired a company to conduct this survey using traditional aircraft and it cost taxpayers thousands of dollars. By using the county owned sUAS, the work was conducted for only hundreds of dollars, saving the county precious funds to allocate elsewhere.

In the province of Saskatchewan, the Royal Canadian Mounted Police, utilizing a sUAS, was recently credited with the first public safety SAR mission that directly resulted in saving someone's life.

I would like to highlight an event that occurred in Baltimore County (Maryland) recently. On May 28, 2013, a large container vehicle and a CSX freight train collided at a vehicle crossing. This incident occurred in an area that is near the city of Baltimore and in an area of mixed commercial and residential use. In addition, the incident occurred less than one half mile from Interstate 95, a major north and south thoroughfare. The incident included the explosion of a railroad car carrying hazardous materials and serious damage to commercial, government and personal property miles away. Immediately after the incident occurred, the Baltimore County Police Department launched one of their turbine engine helicopters to provide command and control support for the Baltimore County Fire Department incident commander (clearly not a law enforcement mission). The aircraft provided an "eye-in-the-sky" for the incident commander and continuously downlinked the images to the incident command post, Emergency Operations Center and within the county's intranet for police and fire commanders. Although the county used its traditional aviation resources to complete this mission, the mission could have been conducted by a sUAS at a fraction of the cost. The turbine engine aircraft costs approximately $400.00 per hour to operate, and they were on-scene for several hours with multiple aircraft. A sUAS would have only cost the agency approximately $25.00 per

hour to operate and would have provided the same aerial images to the fire and police commanders.

Of course, Mesa County and the other agencies use their sUAS for law enforcement missions as well. These missions include, but are not limited to:

- Traffic crash scene photography
- Crime scene photography (with and without the need for a search warrant)
- Command and control of major incidents
- Tactical Operations (Barricaded subjects, armed subjects, school incidents)

As much as the ALEA embraces the inclusion of new technology into the airborne public safety industry, we also embrace the rights of our citizens. The ALEA supports the professional operation of aircraft in public safety missions and expects its members to do so within the framework of the laws of this country. In fact, we routinely say that we are a "Profession within a Profession." We are both professional public safety officers and professional aviators. As such, we work tirelessly to educate our members on search and seizure laws pertaining to privacy and the use of aircraft, UAS included.

To reiterate our opening remarks submitted to the Privacy Project 2013, we "support and promote the IACP Aviation Committee's Recommended Guidelines for the use of Unmanned Aircraft and the Association for Unmanned Vehicle Systems International's (AUVSI) Unmanned Aircraft System Operations Industry 'Code of Conduct.' We do not concur with privacy advocates who claim that public safety agencies' utilization of unmanned aerial systems (UAS) poses a greater threat to 'privacy rights' than manned aviation. Similarly, we do not concur that said uses pose a greater threat to privacy 'rights' than other technologies currently utilized by public safety agencies, both in manned aircraft and on the ground. Furthermore, we do not accept that any legislation is necessary as there are long-standing court rulings upholding our Fourth Amendment protections; but we are particularly opposed to legislation that focus their attention on one technology based on fears of what could occur tomorrow, however unlikely. Aside from recent laws enacted that place outright bans on UAS use, such as that in Charlottesville, VA, many current 'anti-drone' bills appear to be more of an attempt to increase protections under the Fourth Amendment without actually altering the U.S. Constitution. The presumption in most of these pieces of legislation is that a reasonable expectation of privacy now exists in places where there has been no such expectation. As such, a warrant must be obtained before UAS can be utilized by public safety."

The ALEA believes that the Fourth Amendment of the Constitution of the United States of America is alive and well; and the protections contained therein against unreasonable searches and seizures have been supported through years of judicial opinions. We also believe in the Constitutional process of lawfully obtaining a search warrant when there are specific, articulable grounds to believe that the use

of an aircraft, UAS included, will intrude upon a reasonable expectation of privacy. However, in situations where time is of the essence and **NO** reasonable expectation of privacy exists, we would be opposed to restrictions that would limit the effectiveness of UAS.

We would encourage you to focus attention on the more basic issue at hand -- the storage, use, retention, and destruction of sensitive data; not the technology that gathers the data. Similar to law enforcement's use of Automated License Plate Readers (LPRs) and government and non-government surveillance camera's, the data captured and the use of this data is of concern to civil liberty advocates and others. As such, ALEA believes that law enforcement agencies must have solid policies that address, at a minimum, the following:

- How captured data is stored.
- Who has access to the data.
- How long the data is stored.
- How the data is purged.
- Audit controls to hold law enforcement employees accountable for the proper use of captured and stored data.
- Transparency in the inspection of stored data that is not evidence of a crime.

As stated above, these are the same privacy issues that we face concerning LPRs and surveillance cameras. However, unlike these two public safety tools, UAS is being treated differently, resulting in the creation of a separate and higher set of operating standards. If there is to be legislation, it needs to focus on public safety agencies utilization of sound policies that address the bullet points above, as opposed to developing different sets of legislated standards for each device that may be used to gather data.

In closing, ALEA, along with other organizations, have worked diligently with the FAA to develop procedures to operate UAS technology within the National Airspace. This includes the newly released FAA and Department of Justice Memorandum of Understanding that clearly explains the procedures to obtain a Certificate of Authorization to operate a UAS by a public safety agency. The ALEA continues to be committed to embracing this technology, working with others to see its safe integration into the National Airspace, and to developing training for public safety professionals who operate UAS. Our subsidiary, the Public Safety Aviation Accreditation Commission, is also committed to developing standards for the operation of UAS by public safety agencies.

On behalf of the Airborne Law Enforcement Association and its membership, thank you for the opportunity to participate in these deliberations.

United States Department of the Interior
BUREAU OF OCEAN ENERGY MANAGEMENT
Alaska OCS Region
3801 Centerpoint Drive, Suite 500
Anchorage, Alaska 99503-5823

OCT 2 3 2013

The Honorable Shelley Hughes
Representative
Alaska State Legislature
House District 8 Greater Palmer
600 East Railroad Avenue
Wasilla, Alaska 99654

Dear Representative Hughes:

The Bureau of Ocean Energy Management (BOEM) is responsible for managing exploration and development of mineral and energy resources in the Outer Continental Shelf, seaward of State boundaries. BOEM's Environmental Studies Program (ESP) supports research to collect information needed for assessment and management of potential impacts from oil and gas development and to enable BOEM to develop mitigation protocols to protect the Arctic environment and the Alaska Native subsistence way of life. The ESP has supported aerial surveys generally flying at altitudes between 1000-2000 feet to monitor distribution and movement of multiple species of marine mammals. Manned aircraft flights can be dangerous and expensive because of long transit times, hazardous weather conditions, fuel-capacity limitations and operation costs. The ESP remains interested in working with our partners to evaluate the use of UAS to help fill information gaps often unattainable from manned aircraft in remote, hazardous or sensitive areas where use of conventional aircraft may present logistical difficulties.

Since 1974, the ESP has supported large scale aerial surveys during the summer and fall to document distribution, relative abundance, and migration of marine mammals in the Beaufort Sea. This decades-long coverage provides one of the longest monitoring efforts of biological phenomenon, which is increasingly valuable during this time of changing Arctic environmental conditions. The geographic area of these aerial surveys was extended to also cover the Chukchi Sea in 2008. **As the use of Unmanned Aircraft Systems increases, it is important to ensure that protocols are developed to avoid conflicts between aerial and UAS surveys which may be proposed for the same geographic area during the same time period. We encourage this Legislative Task Force on Unmanned Aircraft Systems to address coordination with ongoing efforts as legislation is developed.**

When we submit our statement, as per the flyer for this, we have been asked to include the following, with proposed answers given in **bold**:

Your name – **Dee Williams, PhD**
Business name – **BOEM Environmental Studies Program**
Contact information – **907-334-5283; dee.williams@boem.gov**
Business category: **Government**
Business client: **Public**

Sincerely,

Sharon E. Warren
Acting Regional Director

Scenarios Network
FOR ALASKA & ARCTIC PLANNING

October 22, 2013

Representative Shelley Hughes
Alaska State Legislature
600 East Railroad Avenue
Wasilla, Alaska 99654

Dear Representative Hughes

Please consider my concerns regarding the potential for "over" legistlation of unmanned aircraft systems (UAS) technology because of unwarranted fears.

UAS will provide many new capabilities for commercial, research, government, and even recreational users. In order to realize this potential, especially for commercial uses, it is important to acknowledge the tension that will occur among all parties, especially in the area of privacy. We need a better understanding of the technology's benefits before laws are created restricting their use.

A good example is the issue of public versus private airspace. For example, a manned aircraft flying at 500 feet altitude, in the National Airspace, over a person's private property is legally permitted to collect air photographs of the property. Is the same true for UAS? What if the altitude is less than 500 feet, i.e. 450 or even 50 feet? Does a property owner have rights to the airspace above their property and to what height? Can they shoot at the manned aircraft at 500 feet or the UAS at 100 feet?

On the otherhand, a significant cause of concern with UAS technology is privacy. Do voyeurism and peeping tom laws apply to UAS? What if the UAS is on your property but you are using the camera on the UAS to peer through a neighbor's window, perhaps above a privacy fence?

We can all acknowledge this tension created by privacy does exist. And will likely a source of future litigation. But the early uses of the technology, especially for search & rescue, research, and commercial innovation likely deserves some protection.

I can be reached at 907-474-6958 or kwcunningham@alaska.edu should you have any questions.

Cheers

Keith W. Cunningham

Keith W. Cunningham, PhD
Research Assistant Professor – Remote Sensing

David R. Neel **6 March 2013**

(U) SUBJECT: Potential for Nefarious Use of Unmanned Aerial Vehicles (UAVs)

(U) UAVs can provide first responders, private industry, or government agencies with multiple advantages; from providing aerial imagery, use as a communications relay platform in remote areas, infrared (IR) detection during search and rescue operations, or monitoring the movement of a wildfire; UAV applications have only the limitations of the imagination. Within the year, the FAA must allow any "government public safety agency" to operate a UAV weighing 25 pounds or less, as long as certain conditions are met. The FAA predicts that after they allow commercial use of drones in U.S. airspace, 15,000 of the flying robots will be in the skies by 2015, and double that by 2030.

(U) Often, what benefits legal use of a tool has an equalizing balance of adding a burden to society when that same technology is used with nefarious intent. Unlawful use of UAV technology will be as diverse as the proposed legitimate applications. Criminal individuals and organizations will quickly identify the legal and operational gaps in law enforcement response to such an asymmetric vector. Additionally, criminals will recognize the initial legal and privacy constraints for law enforcement use of UAVs, and seek to exploit those boundaries. Terrorists will also understand the implications of a potentially low-cost, low-risk delivery of a kinetic attack on buildings, persons, or other manned aircraft. Individuals will also have the readily available, non-attributable means to stalk, spy, eavesdrop, or facilitate retribution violence or destruction of public or private property.

(U) Criminal use of UAVs will include, but not limited to:

- Circumventing checkpoints to move contraband
- Surveillance of law enforcement operations
- Jamming of law enforcement communications
- Act as an airborne communications repeater for "secure" communications
- Electronic eavesdropping platform for government/military/economic espionage
- Fish and Game guiding violations
- Kinetic attacks

(U) Potential for miss-use of this platform is great. Additionally, wrong-doers or those who believe that UAV use is violating their Privacy or Civil Rights-Civil Liberties, will seek ways to defeat, destroy, disable, or misappropriate (steal) UAV's that are conducting legal or commercial missions. New technologies, tactics, techniques and procedures will emerge to support this, and must be anticipated. There are already documents available on the open internet identifying "How to Kill UAVs." This also plays into current negative media coverage of the use of "drones" in the United States.

(U) Legislative bodies and policy makers, law enforcement leadership, and regulatory authorities need to begin now to anticipate how this UAV/UAS technology will be used for criminal activity and pass the appropriate legislation, develop effective operational countermeasures, and identify investigative strategies.

David Neel is the DHS Intelligence Officer assigned to the State of Alaska. This paper represents his personal viewpoint and should not be construed to reflect an official position by the U.S. Department of Homeland Security or the State of Alaska.

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Economic Impact of a

Pan-Pacific Unmanned Aircraft Systems Test Site

May 2013

PREPARED FOR

Alaska Center for Unmanned
Aircraft Systems Integration
University of Alaska Fairbanks

PREPARED BY

McDowell
GROUP

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Executive Summary

Purpose and Scope

In March 2013, the University of Alaska Fairbanks Center for Unmanned Aircraft Systems contracted with McDowell Group to analyze the economic conditions for unmanned aircraft systems (UASs) in Alaska and measure the projected economic impact of developing a Federal Aviation Administration (FAA) test site for UAS in Alaska. The economic impact assessment (EIA) in this report provides annual projections of the direct, indirect, and induced impacts to employment and wages as well as projections of output and value added related to the test site, called the Pan-Pacific UAS Test Range Complex (PPUTRC) – with test ranges located in Alaska, Hawaii, and Oregon. The EIA focuses on the additional economic activity that is expected in response to the PPUTRC test site selection. Additional information is provided in this report on the economic impact of the commercialization of UAS specifically in Alaska once UAS flights are allowed in the National Airspace System (NAS).

Summary

- UAS represent a new industry that is set to quickly grow once new government regulations increase access to designated test sites and then to the National Airspace System (NAS), the system of air traffic control that enables safe and efficient flight activity in the U.S.
- UAS applications are far reaching for civilian and military purposes; ranging from environmental monitoring to search and rescue to pipeline or powerline inspections.
- The FAA has limited the authorized use of UASs in the U.S. to efforts focused on the public interest. There are currently two ways to operate a UAS with the approval of the FAA (both of these options require that the flight takes place outside of densely-populated areas):
    - Certificate of Waiver or Authorization (COA) for public UAS
    - Special airworthiness certificate for private sector (civil) UAS
- However, the FAA is scheduled to designate six UAS test sites in the U.S., as required under the FAA Modernization and Reform Act of 2012. The sites will operate from January of 2014 to February 13, 2017 to provide opportunities for government agencies, industry, and researchers to access this airspace to aid in the integration of UASs in the NAS.
- According to the Association of Unmanned Vehicle Systems International (AUVSI), integration of UASs into the NAS will generate some $82 billion in activity in the U.S. between 2015 and 2025; employment impacts are estimated at just over 100,000 jobs by 2025.

- In an effort to bring additional UAS activity and related economic benefits to Alaska, UAF is leading the PPUTRC Test Site application process for 13 ranges in Alaska, Hawaii, and Oregon.
- Existing UAS activity in Alaska, Hawaii, and Oregon benefits from unique assets and opportunities, including government facilities (e.g. numerous military bases, universities, and maritime assets), wide-open airspace in largely unpopulated areas, and geographic diversity (e.g. tropical to arctic climates, oceanic or mountainous landscapes, and up/down weather fronts).
- In total, designation of PPUTRC as a UAS test site would be expected to generate 1,065 direct, indirect and induced jobs in 2014, increasing to over 1,400 jobs by 2017. Total labor income would climb from $57 million in 2014 to about $76 million in 2017.
- Output in the PPUTRC states attributable to test site designation would climb from $265 million in 2014 to $333 million in 2017.
- Value added would climb from $109 million to $134 million over the same period.
- Designation of the PPUTRC will provide a four-year total of $20 million of income tax revenue to Hawaii and Oregon.

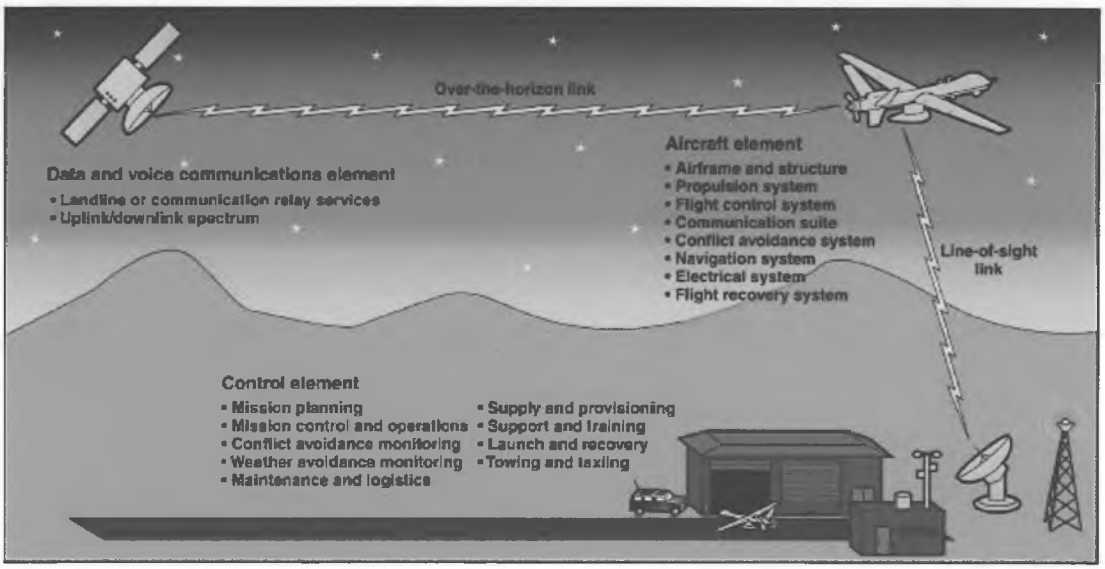
Chapter 1. Unmanned Aircraft Systems in the United States and the NAS

Background

Unmanned aerial vehicles (UAVs) were first described in the late-19th century. Early attempts to develop these UAVs, mostly for combat purposes, soon followed. These remotely piloted vehicles first entered U.S. combat in the mid-20th century to support missions focused on reconnaissance and surveillance, and sometimes they were also used as decoys. Throughout most of the 20th century UAVs lacked real-time data capability and instead focused on collecting images and video for surveillances purposes. Widespread adoption of the technology for U.S. military purposes did not begin until the 1990s and, to a much greater extent, the 2000s during the Afghanistan and Iraq conflicts. It was at this point that technological innovations related to onboard sensors, communication links, and data collection began drastically increasing the potential domestic uses of unmanned aircraft systems.

The increase in complexity for the UAVs required a systems approach to appropriately understand the interactions - and design each component from the start as an integratedsystem - among the on-the-ground control elements, the aircraft, and the communication links. This broader operational perspective is termed "unmanned aircraft system" (UAS). The image below provides a conceptual rendering of the interactions among key elements of a UAS flight.

Figure 1: Conceptual Rendering of an Unmanned Aircraft System



Source: GAO, 2013

UAS Applications

Unmanned aircraft often provide advantages in comparison to manned aircraft. For instance, flights that are dangerous or covert represent potential opportunities where an unmanned vehicle might be preferred over a manned vehicle. Similarly, dull tasks such as extended surveillance missions may be better suited for ground-based operators that can be relieved at the end of their shift. UAVs are often more fuel efficient, quieter, and less disruptive to their surroundings (in comparison to manned aircrafts) and, thus, can allow for fewer environmental disturbances as well as more accurate research results. Finally, initial costs, operating costs (e.g. maintenance costs, fuel costs, storage costs, etc.), and labor costs (e.g. wages, insurances, etc.) are all generally lower for UAVs (Source: Austin, 2010). UASs have already been shown to lead to arrests as well as saving lives during search and rescue missions (Source: The Verge, 2013).

The existing and potential applications for UASs are wide ranging for both civilian uses as well as for military purposes. The lists below provide an abbreviated look at how important this relatively new field may become to sectors throughout Alaska's economy (Source: Austin, 2010):

Civilian

- Aerial Photography - Film, video, stills, etc.
- Agriculture - Crop monitoring and spraying; herd monitoring and driving
- Coastguard – Search and rescue, coastline, and sea-lane monitoring
- Conservation – Pollution and land monitoring
- Customs and Excise – Surveillance for illegal imports
- Electricity Companies – Powerline inspection
- Fire Services and Forestry – Fire detection, incident control
- Fisheries – Fisheries protection
- Gas and Oil Supply Companies – Land survey and pipeline security
- Information Services – News information and pictures, feature pictures (e.g. wildlife)
- Lifeboat Institutions – Incident investigation, guidance, and control
- Local Authorities – Survey, disaster control
- Meteorological Services – Sampling and analysis of atmosphere for forecasting, etc.
- Oil Companies – Pipeline security
- Ordinance Survey – Aerial photography for mapping
- Police Authorities – Search for missing persons, security and incident surveillance
- Rivers Authorities –Water course and level monitoring, flood and pollution control
- Survey Organizations – Geographical, geological, and archaeological survey
- Traffic Agencies – Monitoring and control of road traffic
- Water Boards – Reservoir and pipeline monitoring

Military

- Navy
    - Shadowing enemy fleets

    - Decoying missiles by the emission of artificial signatures
    - Electron intelligence
    - Relaying radio signals
    - Protection of ports from offshore attack
    - Placement and monitoring of sonar buoys and possibly other forms of anti-submarine warfare
- Army
    - Reconnaissance
    - Surveillance of enemy activity
    - Monitoring of nuclear, biological, or chemical (NBC) contamination
    - Electronic intelligence
    - Target designation and monitoring
    - Location and destruction of land mines
- Air Force
    - Long-range, high-altitude surveillance
    - Radar system jamming and destruction
    - Electronic intelligence
    - Airfield base security
    - Airfield damage assessment
    - Elimination of unexploded bombs

UAS Categories

UASs are typically categorized based on the size or capability of the UAV. The five categories below provide a common categorization of UAS that helps simplify requirement assessments and costing estimates (Source: Teal Group, 2008):

- Micro or Mini – A small UAV that ranges in size from something that can be held in the palm of the hand to a UAV that can be carried on your back and launched by hand.
- Naval – A tactical UAV is generally operated with simpler systems over a radius between 100 and 300 km.
- Tactical – A reconnaissance UAV used by the Army for endurance missions ranging several hours over an operating radius up to 200 km.
- MALE – Medium Altitude Long Endurance reconnaissance UAVs fly between 5,000 and 15,000 meters in altitude for approximately 24 hours.
- HALE – High Altitude Long Endurance reconnaissance and surveillance UAVs are usually operated by Air Forces at altitudes over 15,000 meters for periods longer than 24 hours.

National Airspace System

The NAS was developed to allow for safe and efficient commercial aviation. However, commercial UAS flights are currently not allowed in the NAS due to concerns over (1) "the inability to detect, sense, and avoid other aircraft and airborne objects in a manner similar to 'see and avoid' by a pilot in a manned aircraft, (2) vulnerabilities in the command and control of UAS operations, (3) the lack of technological and operational standards needed to guide the safe and consistent performance of UAS, and (4) the lack of final regulations to accelerate the safe integration of UAS into the national airspace" (Source: U.S. GAO, 2012 and Waggoner, 2013).

The first authorized use of UASs in the NAS in the U.S. was permitted by FAA in 1990. Over the past 23 years, the FAA has limited the authorized use of UAS in the U.S. to efforts focused on the public interest. These missions have included border patrol, military training, disaster relief, firefighting, search and rescue, law enforcement, and testing and evaluation. According to the FAA, the Department of Homeland Security currently utilize UASs for border and port surveillance; NASA and NOAA utilize UAS to help with scientific research and environmental monitoring; law enforcement agencies utilize UASs to support public safety; and state universities use UASs to conduct research (Source: FAA Fact Sheet 2013). These efforts are limited to areas outside of major urban areas at elevations less than 50,000 feet. The aircraft range in size from a hummingbird to a wingspan as large as a Boeing 737; although many are the size of a remote-control plane or helicopter. Recreational use of airspace is allowed away from airports and air traffic and below 400 feet above ground level – informal flights for business purposes are specifically excluded (Source: FAA Advisory Circular 91-57).

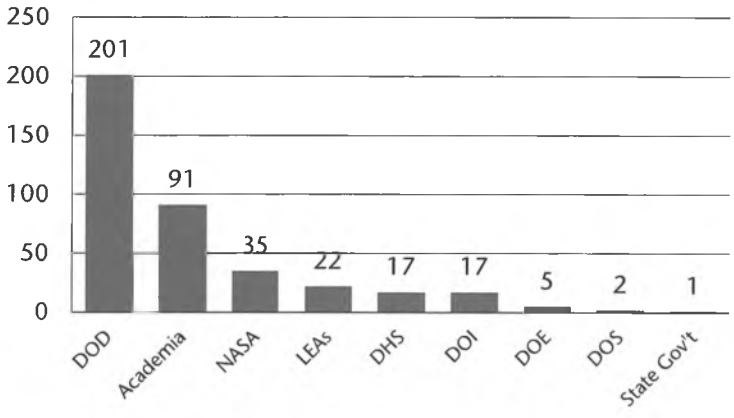
As of 2013, there are currently two ways to operate a UAS with the approval of the FAA: (1) Certificate of Waiver or Authorization (COA) for public UAS's and (2) special airworthiness certificate for private sector (civil) UAS's – both of these options require that the flight takes place outside of densely-populated areas.

Certificate of Waiver or Authorization (COA)

COAs allow public entities to fly UASs in a defined block of civil airspace. The FAA issued the first COAs in January 2007. With COAs, the UAV must remain in view, either of the ground crew or via a chase plane, since UAS technology cannot currently comply with 'See and Avoid' rules. COAs usually require between six and 24 months for approval and cost $40,000 to $60,000 (Source: Economic Development of Central Oregon, 2011). Most of the cost is for specialists in the testing protocols, documentation, and in managing the process through the FAA. Common applications by COA holders include firefighting, border patrol, disaster relief, search and rescue, military training, and other government operational missions (Source: FAA 2013b). The number of COAs issued has increased since 2009, with 146 in 2009, 298 in 2010, and 313 in 2011 (Source: FAA 2013b). In 2012, the FAA issued 391 COAs to 121 federal, state, and local government entities in the U.S. A total of 1,428 COAs have been issued since January of 2007 (Source: GAO 2013). As of February 15, 2013, there were 327 active COAs (Source: FAA 2013b).

The graph below aggregates the 391 COAs issued in 2012 to nine types of entities: U.S. Department of Defense, academia, NASA, local law enforcement agencies, U.S. Department of Homeland Security, U.S. Department of the Interior, U.S. Department of Energy, U.S. Department of State, and state government.

Figure 2: Number of Approved COAs, 2012



Source: GAO, 2013

Special Airworthiness Certificate

Special airworthiness certificates are the only way for civil operators to fly UASs in the NAS at present. However, these certificates cannot be utilized to carry people or property for compensation or hire – they can only be issued for research and development, crew training, or market surveys (Source: FAA 2011).

Allowing UAS in the NAS

In recent years the FAA has made a concerted effort to integrate UAS regulations into the NAS. In 2009, the FAA, NASA, DoD, and the Department of Homeland Security began addressing pathways to integrating UAS regulations into the NAS through their UAS Executive Committee. Additionally, the FAA chartered a UAS Aviation Rulemaking Committee in 2011 to create operational procedures, regulatory standards, and policies related to UAS flights in the NAS. In 2012, the FAA Modernization and Reform Act of 2012 (FMRA of 2012) was passed by Congress to approve six test sites where UAS integration could be tested prior to a 2015 integration of UAS regulations in the NAS (Source: FAA 2012). Delays within the FAA due to technical, logistical, and public outreach concerns may contribute to a UAS integration date later than 2015. However, six test sites are still scheduled to run from January 1, 2014 to February 13, 2017.

Six UAS Test Sites

There is considerable competition over where test sites will be designated, since designation will provide immediate employment in the selected region and support a strong foundation for UAS activity prior to integration of UAS regulation in the NAS. As of March 5, 2013, 50 applicants from 37 states were granted access to the FAA test site application web portal (Source: FAA 2013b). The FAA will consider

five key items when deciding the location of the six test sites: (1) geographic and climatic diversity, (2) location of ground infrastructure and research needs, (3) consultation with NASA and DOD, (4) population density and air traffic density of the surrounding area of any proposed location as well as the potential impact areas in the event of incidents, such as "Fly away" given potential safety mitigations; and (5) identification of specific goals and objectives to be accomplished. Additionally, the test sites are expected to provide an environment and opportunity to test conventional takeoff and landing capability, high speed flight (greater than 250 knots indicated air speed), maritime (launch/maneuver/recovery) capability, operations at extremely high altitudes (Class A airspace and above), and evaluation of dissimilar aircraft (including a mix of manned and unmanned aircraft) in multiple altitude structures (Source: FAA 2013a).

The six test sites that are selected will support the following operations and programs:

- Safe designation of airspace for integrated manned and unmanned flight operations in the national airspace system;
- Development of certification standards and air traffic requirements for unmanned flight operations;
- Coordinating with and leveraging the resources of NASA and the Department of Defense;
- Addressing both civil and public unmanned aircraft systems;
- Ensuring that the program is coordinated with the Next Generation Air Transportation System; and
- Ensuring the safety of unmanned aircraft systems and related navigation procedures before they are integrated into the national airspace system (Source: FAA, 2013b).

The test site operators will provide opportunities for government agencies, industry, and researchers to access this airspace to aid in the integration of UAS regulations in the NAS. Additionally, data collection will support development and operations research and professional development opportunities will be available for inspectors, airspace managers, air traffic controllers, and others. The specific goals described by the PPUTRC applicants include (Source: PPUTRC, 2013):

- Develop a set of standards for select unmanned aircraft categories, for aircraft state monitoring, and navigation. PPUTRC goals and objectives work will augment ongoing standards work with research on categories of UAS not yet addressed, and evaluations needed to refine emerging standards under consideration;
- Validate FAA acceptable risk thresholds or safety management system standards for UAS operations;

- Identify safety factors in UAS design; validate certification standards, including protocols for air traffic control interaction. Define and qualify underlying assumptions and a minimum set of air vehicle characteristics critical to safety, reliability, etc.;
- Develop effective, compliant 'sense and avoid' systems to satisfy regulatory guidance;
- Identify gaps in federal and state statutory and case law protections for privacy and recommend policies or legislation to remedy;
- Directly support the federal mandate for "Expanding Use of UAS in the Arctic" (in Sec 332(d) of Public Law 112-95);
- Design experiments and provide data to support American Society for Testing and Materials (ASTM) F38 and Radio Technical Commission for Aeronautics Special Committee (RTCA SC) 203 to evaluate minimum training and operator qualification standards for crew licensing.

Economic Impact of UAS in the U.S.

The economic implications of integrating UAS regulations into the NAS are substantial. According to a study conducted for the Association for Unmanned Vehicle Systems International (AUVSI), integration will generate $82 billion in activity between 2015 and 2025. Employment impacts are estimated at just over 100,000 jobs by 2025.

The direct economic impact of UAS development in the U.S. is expected to climb from $1.1 billion in 2015 to over $5 billion annually by 2025, measured in terms of output. Including indirect and induced effects, the annual economic impact is expected to rise from $2.3 billion in 2015 to $10 billion in 2025 (Source: AUVSI, 2013).

Areas selected as UAS test sites will have an advantage in capturing these economic benefits; thus the fierce competition among the 50 applicants.

Chapter 2. Pan-Pacific Test Range Complex

In 2012, the Alaska Center for UAS Integration (ACUASI) at the University of Alaska Fairbanks Geophysical Institute began collaborating with Oregon State University and the University of Hawaii to propose a Pan-Pacific Test Range Complex (PPUTRC) as one of the six FAA test sites. This proposed PPUTRC contains 13 test ranges located in Alaska, Hawaii, and Oregon. Of the 13 ranges, six ranges are in Alaska (Denali, Kodiak, North Slope, Oliktok, Poker Flat, and Wainwright), three ranges are in Hawaii (Humuula-R-3103, Makua-R-3109, and Maku-R-3110), and four ranges are in Oregon (Juniper MOA, Pendleton, Tillamook Coastal, and Warm Spring).

Existing UAS activity in Alaska, Hawaii, and Oregon benefits from unique assets and opportunities, including government facilities (e.g. numerous military bases, universities, and maritime assets), wide open airspace in largely unpopulated areas, and geographic diversity (e.g. tropical to arctic climates, oceanic or mountainous landscapes, and up/down weather fronts). The diverse testing environments for the PPUTRC are included in the Table 1 below:

Table 1: Diversity of Potential Testing Environments for the PPUTRC

360 degree oceanic airspace access	Arctic landscape	Extreme low temperatures
Oceanic and sea-ice access	High arctic winds	High sea-salt corrosion effect
Able to fully matrix UAS into NextGen and air traffic operating both VFR and IFR; high and low altitude	Operations in all classes and categories of military SUA	Operations in Classes A through F international airspace in the oceanic environment
Class C, D, & E airspace within 5-nautical miles of airports	High and low-land vegetation tundra	Numerous inland waterways and lakes
High density airports integration studies and testing	Class C, D, & E airspace airport approaches/departures	High-humidity high and low-altitude
Hot and cold high-desert testing	Littoral coastal region mountainous area	Class E (high) airspace
Jungle conditions	Class A airspace	Mountainous terrain
Volcanic	Glacier	Ship traffic including open ocean and ports

UAS Activity in Alaska, Hawaii, and Oregon

There are currently 15 active COAs in the PPUTRC area as well as eight in-process COAs and 20 expired COAs.

Alaska

ACUASI at the University of Alaska Fairbanks (UAF) is the lead organization for the proposed PPUTRC. The formal PPUTRC team includes over 80 businesses, universities, tribes, and economic development organizations in Alaska. UAF has actively managed UAS operations since 2004.

ACUASI was formed in 2012 to enhance UAS research in Alaska. ACUASI and the UAF Geophysical Institute have developed and flown a variety of in-situ and remote sensing instruments on various UASs in Alaska and throughout the world. Scientific and research campaigns undertaken in Alaska over the past decade include using UASs to support observation and monitoring of sea lions in the Aleutian Islands, weather forecasting, volcanic plume monitoring, atmospheric sampling during wildfires, monitoring of sea ice build ups, and oil spill mapping. Commercial applications trialed in Alaska include whale monitoring, cadastral mapping, maritime navigation support, industrial plant monitoring, and environmental clean-up. This experience, coupled with the FAA's UAS test site status, would leverage a variety of new economic activities in Alaska.

The following table, which summarizes ACUASI activity in 2012, illustrates the variety of UAS activity supported by the organization. The table also provides revenue and staffing data for each UAS campaign.

Table 2: UAS Campaigns Supported by the University of Alaska Fairbanks in 2012

Client	Flight Locations	Type of UAS	Purpose of Flights	Revenue for Site Operator	Site Operator Staff	Flight Operator Staff
Aleutians	Aleutian Islands, AK	Aeryon Scout and Puma	Seal observation	$314,200	2 pilots	1 observer
Idaho	Lewiston, ID	Aeryon Scout	Salmon nest observation	$115,000	1 pilot	1 observer
Eglin Air Force Base	Fort Walton Beach, FL	ScanEagle and Aeryon Scout	Controlled burn experiment	$413,000	4 pilots	3 observers
Prudhoe Bay	Prudhoe Bay, AK	Aeryon Scout	British Petroleum flare stack monitoring	$190,000	1 pilot	1 observer
Nome	Nome, AK	Aeryon Scout	Harbor Ice monitoring for USCG	$30,000	1 pilot	1 observer
Ugak Island	Ugak Island, AK	Aeryon Scout	Seal population monitor	$6,500	1 Pilot	1 observer
Fort Greely	Fort Greely, AK	ScanEagle and Aeryon Scout	Flight test	$25,000	2 pilots	2 observers
Chile	Santiago, Chile	Aeryon Scout	Glacier Ice monitor	$9,000	1 pilot	1 observer
Belgium	Belgium	Gatewing	Flight training	$16,000	2 pilots	1 observer
Anchorage	Fort Richardson, AK	Aeryon Scout	Flight test and demonstration	$1,000	2 pilots	1 observer
Fairbanks	Poker Flat Research Range	ScanEagle	Payload test	$347,000	2 pilots	1 observer
Fairbanks	Poker Flat Research Range	Aeryon Scout	Payload test and demonstration	$30,000	2 pilots	1 observer
Fairbanks	Poker Flat Research Range	Raven	Flight test for avionics	$5,000	2 pilots	2 observers
Hawaii	Offshore Hawaiian Islands	Puma	Tsunami debris tracking	$95,000	1 pilot	1 observer

Sources: ACUASI, 2013

Figure 3: Types of UAS Flown in Alaska in 2012

Aeryon Scout

Boeing Insitu ScanEagle

AeroVironment Raven

Gatewing

AeroVironment Puma

Hawaii

Hawaii offers many unique qualities that make UAS operations appealing. These include: (1) expansive over-water areas unencumbered by other aviation uses, (2) proximity to U.S. Pacific Command – a significant user of future UAS systems, (3) opportunities for joint operations with the Pacific Missile Range Facility – a major test range on Kauai, and (4) opportunities for long-range point-to-point tests with partner ranges in Alaska and Oregon. The Hawaii ranges have proven an important focus for the development of scientific applications of UAS, with significant milestones including test flights of the Aerovironment Pathfinder; Pathfinder Plus; and Helios solar-hybrid propulsion high altitude, long endurance UAS, between 1997 and 2001. Scientific applications led by U.S. federal agencies have recently seen Hawaii emerge as a focal point for NOAA's exploration of UAS as a tool for marine park surveillance. NOAA has utilized UAS to monitor Papahanaumokuakea Marine National Monument since 2007 and performed initial trials using small hand launched systems in mid-2012.

Oregon

The Oregon-based PPUTRC team members include 16 businesses, universities, tribes, and economic development organizations. Additionally, six committed team partners will convert to formal team members upon FAA test site designation award to PPUTRC. Engagements are also planned with a wide ranging network in Oregon – including the 111 AUVSI members and numerous startup companies, primarily in sensor, robotics, and other supporting technologies. In comparison to Alaska and Hawaii, Oregon has historically been more engaged in design, development, and manufacture of UAV systems and subsystems.

The two largest Oregon UAS firms are Insitu (design, development, and manufacture of UAS systems) and FLIR Systems (remote sensors). The main Oregon firm involved in UAS applications has been Near Space Corporation (NSC). NSC uses very high altitude unmanned balloons and gliders to perform scientific and commercial test activities, ranging from data gathering on behalf of government agencies to near-space testing of hardware and sensors for commercial firms. NSC is opening a new $6 million flight test and operations facility at the Tillamook Airport on the Oregon coast. Existing UAS activity also includes the Oregon Army National Guard operations in Pendleton. Oregon's UAS efforts are synergistic with a separately funded ground vehicle innovation initiative, Drive Oregon, which requires systems that can be spun out of UAS: quiet, efficient motors, lightweight composite designs, and navigation systems. The potential economic benefits of the test sites, as well as NAS integration, are particularly strong for Oregon's already significant aircraft manufacturing sector.

Recent UAS Funding in Alaska, Hawaii, and Oregon

Since 2004, nine Alaska contractors have received direct U.S. federal agency contracts for UAS goods and services. The largest federal contract in Alaska is a 5-year standing services award, worth $47 million, from the U.S. Navy to the University of Alaska in 2010 for UAS payload integration and flight test services. The second major award made since 2004 to an Alaska firm consists of a series of pacts totaling $17 million from the U.S. State Department to Anchorage-headquartered Kuk Construction (subsidiary of Olgoonik Development, an Alaskan Native Corporation) for the provision of UAS-based security surveillance services in Iraq in partnership with KBR, Inc. UAF has collaborated with commercial entities, such as Idaho Power Company, and manufacturers including AeroVironment to conduct surveys and observe environmental impacts. Additionally, UAF has collaborated with BP for oil spill response and flare stack monitoring, as well as projects focused on detecting and locating gas and oil pipeline leaks and developing new sensors and processes to identify leaks.

Hawaii's large military presence has resulted in defense spending as the primary source of federal funding to UAS vendors in the state. Direct defense contracts accounted for 94 percent of all awards in terms of obligated amounts from 2004-2012, rising to 97 percent when including awards placed by the General Services Administration on behalf of the U.S. Air Force. The remaining awards were placed with Honolulu-based Referentia Systems by NOAA as part of the Papahanaumokuakea Marine National Monument monitoring project. Hawaii supports a dedicated UAS development and manufacturing company, Williams Aerospace, a small firm currently developing new platforms in the fixed-wing, hand launched micro and medium altitude endurance classes. The state is also working to create two commercial UAS services arms, addressing the defense, homeland security, and precision agriculture markets.

In Oregon, a consortium of industry, academia, and public entities has created a 7-year strategic plan to double the size of the UAS industry in the state, with the help of a $2.5 million State of Oregon grant scheduled for the 2013-14 biennium and additional investments of at least $1.15 million from other sources for a total of $3.65 million. The plan specifically creates UAS solutions for commercial applications, and safely integrating those UAS solutions into the NAS. Projects include emergency response; weather; firefighting; search and rescue; wildlife and habitat management; law enforcement; physical and resource surveys (land and water); management of agriculture, livestock, and public lands; and management of public and private infrastructure. Oregon State University (OSU) has already begun UAS flights based on these research objectives.

Leveraging Current Research Institutes, Community Colleges, and Training Centers

ACUASI is collaborating with the UAF College of Engineering and Mines (CEM) and the Community and Technical College (CTC) to integrate UAS engineering, science, and technology into UAF's teaching, research, and service activities. Additionally, ACUASI is working with the CEM to fill a full-time tenure track engineering faculty position with a professor focused on UAS engineering, science, and technology. ACUASI and CTC also intend to include UAS technology courses in CTC's aviation curricula to train UAS developers, technicians, and pilots as well as to improve outreach to remote Alaskan villages that could benefit from UAS technologies. Cooperation with the CTC at UAA will add air traffic controller participation, offer training for UAS operators, and ultimately build a maintenance program similar to the Aircraft and Powerplant program currently offered.

The University of Hawaii is testing UASs in several of its research programs, evaluating the utility and impact of UAS through analysis of coastal resource management, terrestrial and aquatic environmental monitoring, natural source management and inventory, and human impact studies. University of Hawaii is also developing programs to train students and research professionals on UASs, and plans to integrate this capacity into accredited degree programs.

The new OSU industry-university UAS consortium will depend on test site facilities for collaborative research and development in all phases of operations and applications. Through the Colleges of Engineering, Science, Agriculture, Forestry and Earth, Ocean and Atmospheric Sciences, OSU has expertise and supports ongoing research on control theory and robotics, flexible airframes and flight, sensors, and signal processing, and numerous applications in natural and environmental sciences and environmental monitoring, measuring, and management. OSU-Cascades, located in Central Oregon near the Warm Springs and Juniper test ranges, offers programs in energy engineering, computer science, natural resources, and business, and plans to add programs designed in conjunction with the UAS industry. OSU-Cascades can also provide on-site facilities for OSU-Corvallis researchers leading projects in the region. Central Oregon Community College (COCC) has one of the largest aviation flight training programs on the West Coast – both fixed wing and rotary. COCC offers certifications for UAS flight training and plans to develop a program for data analysis of sensors, building on the school's strong geographic information systems program. Additionally, Blue Mountain Community College (BMCC) in Pendleton, Oregon is developing a UAS curriculum for instructional delivery and course certification. Oregon Institute of Technology (OIT) offers a variety of degrees in engineering and engineering technology, composite engineering, computer and software systems engineering, and electrical engineering, including a master's degree in manufacturing engineering. It offers degrees in professional land surveying and geographic information systems. OIT is collaborating with Rockwell Collins, the aviation electronics company, on real-world projects at a joint campus outside Portland and offers similar hands-on collaborations with other aerospace firms in the northwestern U.S.

Expansion of Existing Businesses and Attracting New Business Investment

The University of Alaska has spun off at least two companies who intend to test their products on the Pan-Pacific test range. These companies were created by University graduate students who were expanding their research in sensors for testing in UASs. UA recently received $5 million from the State of Alaska to support the development of a sustainable high-tech industry in Alaska. Already two companies have established satellite offices in Alaska to improve collaboration with the ACUASI.

Placement of a UAS test site in Hawaii will promote growth within Hawaii and reduce development cycles for manufacturers and researchers. Additionally, it would reduce or eliminate costs to ship sensors, and send knowledgeable staff, to mainland test sites to operate and demonstrate systems. Close proximity to a test site in Hawaii will greatly benefit firms such as BAE Systems, Williams Aerospace, and others – including many military and government contractors working with the Honolulu Fire Department, Honolulu Police Department, U.S. Civil Air Patrol, U.S. Coast Guard, U.S. Department of Defense, U.S. Department of Homeland Security, U.S. National Guard, and others.

In Oregon, more than a dozen companies have said that they will begin testing their sensor packages, propulsion systems, and airframes in Oregon if the Pan-Pacific UAS Test Area is designated as a national test site. Additionally, two companies have informally pledged to open satellite offices at a state test range. The PPUTRC will benefit UAS businesses in the Columbia River Gorge. Over the past seven years, the Gorge's UAS industry grew from a small core of 30 people to an employment base of more than 1,400 employees. Many of these new jobs were created by the UAS companies' suppliers. The two largest Oregon UAS manufacturers are Insitu, manufacturer of UAS platforms and subsystems, and FLIR Surveillance Systems, a manufacturer of electro-optic and infrared imaging systems. Insitu is a major global supplier of high endurance, runway-independent UAS. FLIR Surveillance provides more ER and IR imaging systems for unmanned aircraft, unmanned ground, and unmanned maritime platforms than any other company. Activity in the Gorge from firms such as Insitu, FLIR Surveillance Systems, Cloud Cap Technology, and UTC Aerospace has spun off more than 20 local companies. Central Oregon's general aviation aircraft manufacturing industry had a similar growth pattern over a 15-year period, expanding from a core company of about 30 employees (Lancair) to a cluster of 25 companies that now employs nearly 1,200 people. It is anticipated the PPUTRC will help expand these existing businesses in the Gorge and Central Oregon.

Infrastructure

Alaska expects to invest $1.5 million to construct a test site center at its Poker Flat Research Range, as well as develop and acquire mobile test infrastructure such as fixtures, data collection devices, and monitoring systems similar to its internet-Portable Aerial Surveillance System (iPASS), a web-based application that merges track information from radar, GPS, and a transponder interrogator/receiver. Additionally, large data collection requirements are expected to drive development of a data center for processing and storage.

Hawaii's test ranges link to military/restricted areas used for current UAS operations. These sites include the Pohakuloa training area on the Island of Hawaii, Bradshaw and Wheeler Army Airfields on Oahu, and the Pacific Missile Range Facility on Kauai. Other areas under consideration include Upolu and Dillingham Airfields (on the Big Island and Oahu, respectively). Test points within the ranges would be utilized to support both shore and ship-based development, testing and certification of new UASs, training and crew certification of operational UASs, and development of expanded and joint capabilities involving existing communications systems and operations tactics using UAS.

The budget for the $2.5 million Oregon innovation grant envisions spending at least $1.2 million at test ranges for new equipment and/or infrastructure, with the grant providing $300,000, private enterprise providing $750,000, and public entities providing $150,000. Possible infrastructure development proposed with this funding includes: portable ground radar units; an automatic dependent surveillance-broadcast ground station or a similar 'sense and avoid' technology system; one or more operations management buildings housing computers, calibration components, baseline sensors with a range of capabilities, data analysis equipment, supporting software, maintenance facilities and machine shops; and ground control stations, an observation tower, and ITAR facilities as needed. Additionally, as noted earlier, Near Space Corporation is preparing to open a new $6 million flight test and operations facility at the Tillamook airport.

Chapter 3. Potential Economic Impacts of the PPUTRC

Designation as one of the nation's six UAS test sites promises to have significant economic impacts in the areas where flight activity occurs and support services are provided. Private and public sector UAS activity that has been constrained by restricted access and a restrictive federal authorizing process will have much greater opportunity to conduct UAV flight operations. In this chapter the potential economic impacts in Alaska, Hawaii, and Oregon related to serving as a test site are quantified.

The following economic impact projections were developed by McDowell Group, Inc. utilizing flight activity, flight cost, and flight-related staffing data provided by PPUTRC team members. Direct economic activity was measured by approximating preflight administrative costs, site fees per day, operating costs per day, and total flight days from historical data provided by the applicant. Sector-level information was obtained from the applicant concerning the number of UAS-related firms and jobs per firm. Direct employment estimates were then coupled with multipliers obtained from the IMPLAN economic impact model to estimate total direct, indirect, and induced economic effects. Annual projections from 2014 to 2017 were calculated for each of the 13 ranges utilizing growth rates based on funding forecasts from the Teal Group UAS market profile and forecast report, historical flight activity, and projected growth in flight activity, research, and UAS-related manufacturing as provided by the applicant.

In total, designation of PPUTRC as a UAS test site would be expected to generate 1,065 direct, indirect, and induced jobs in 2014, increasing to over 1,400 jobs by 2017. Total labor income would climb from$57 million in 2014 to about $76 million in 2017.

Table 3: Summary Impacts of PPUTRC Test Site Designation, 2012-2017
Combined Impacts in Alaska, Hawaii and Oregon

Impact of Test Site Designation				
	2014	2015	2016	2017
Total Employment	**1,065**	**1,260**	**1,335**	**1,429**
Direct Employment	490	571	602	642
Indirect Employment	198	243	259	279
Induced Employment	377	447	474	508
Total Labor Income ($ million)	**$56.9**	**$66.9**	**$70.8**	**$75.6**
Direct Labor Income ($ million)	$26.4	$30.5	$32.2	$34.2
Indirect Labor Income ($ million)	$10.4	$12.5	$13.3	$14.4
Induced Labor Income ($ million)	$20.1	$23.8	$25.3	$27.1
Output ($ million)	**$265.0**	**$301.8**	**$315.9**	**$333.5**
Total Value Added ($ million)	**$109.3**	**$121.9**	**$127.1**	**$133.5**
State Income Taxes ($ million)	$4.3	$5.0	$5.3	$5.6

Employment Resulting from UAS and Test Site Operations

In 2014, with designation of PPURTC as a test site, UAS activity in Alaska, Hawaii, and Oregon is expected to account for 581 direct jobs and a total of 1,254 jobs - including direct, indirect, and induced jobs. Approximately 85 percent of that total employment (1,065 jobs) is attributable to test site designation. The remaining 15 percent (189 jobs) is expected to occur in the absence of PPUTRC test site designation. By 2017, employment will rise to an estimated 904 direct jobs and 1,991 total jobs - with 72 percent of that total employment (1,429) attributable to test site designation. A significant number of these direct jobs are expected in smaller communities that tend to have higher unemployment – thus test site designation for the PPUTRC will help improve opportunities where they will provide the most benefits.

Table 4: Direct Employment, 2012-2017

Direct Employment						
	2012	2013	2014	2015	2016	2017
Total Direct Employment						
PPUTRC	**74**	**82**	**581**	**712**	**801**	**904**
Alaska Ranges	43	47	129	142	157	173
Hawaii Ranges	-	-	-	72	95	126
Oregon Ranges	31	35	452	498	549	605
Impact of Test Site Designation						
PPUTRC	**-**	**-**	**490**	**571**	**602**	**642**
Alaska Ranges	-	-	77	82	86	91
Hawaii Ranges	-	-	-	72	95	126
Oregon Ranges	-	-	414	417	421	424

Oregon's relatively high direct employment numbers are due to the existing, well-developed aircraft manufacturing sector in Oregon. Oregon is well placed to supply the growing demand for UAS aircraft that will be triggered by UAS integration. Most of the new jobs created in Oregon due to PPUTRC designation include manufacturing jobs (many of which may be created due to designation of test sites anywhere in the U.S.). These numbers for Oregon are based on an analysis provided to McDowell Group by Economic Development for Central Oregon (EDCO).

In addition to direct jobs created from UAS firms, significant indirect and induced jobs will also be created. Indirect jobs represent jobs created throughout the supply chain to support the UAS industry and induced jobs represent jobs created due to changes in household consumption as a result of the UAS industry.

Table 5: Indirect Employment, 2012-2017

Indirect Employment	2012	2013	2014	2015	2016	2017
Total Indirect Employment						
PPUTRC	**21**	**24**	**224**	**290**	**328**	**374**
Alaska Ranges	7	8	22	24	27	30
Hawaii Ranges	-	-	-	42	56	74
Oregon Ranges	14	16	202	223	246	271
Impact of Test Site Designation						
PPUTRC	**-**	**-**	**198**	**243**	**259**	**279**
Alaska Ranges	-	-	-	42	56	74
Hawaii Ranges	-	-	185	187	188	190
Oregon Ranges	-	-	13	14	15	16

Table 6: Induced Employment, 2012-2017

Induced Employment	2012	2013	2014	2015	2016	2017
Total Induced Employment						
PPUTRC	**59**	**65**	**448**	**558**	**629**	**712**
Alaska Ranges	35	39	106	117	129	142
Hawaii Ranges	-	-	-	64	84	111
Oregon Ranges	24	26	342	377	416	459
Impact of Test Site Designation						
PPUTRC	**-**	**-**	**377**	**447**	**474**	**508**
Alaska Ranges	-	-	63	67	71	75
Hawaii Ranges	-	-	-	64	84	111
Oregon Ranges	-	-	313	316	319	321

Note: Summation of columns may not match the total due to rounding

Labor Income Resulting from UAS and Test Site Operations

In 2014, UAS activity in Alaska, Hawaii, and Oregon is expected to account for $31 million in direct labor income and $67 million in total labor income - including direct, indirect, and induced - assuming the PPUTRC is awarded test site designation. Approximately 84 percent of that total labor income ($57 million) is attributable to test site designation, while the remaining 16 percent ($10 million) is expected to occur even if the proposed PPUTRC does not become a test site. By 2017, labor income is expected to include $106 million in total direct, indirect, and induced labor income - with 71 percent of that total labor income ($76 million) attributable to test site designation.

Table 7: Direct Income, 2012-2017 ($ million)

	Direct Income					
	2012	2013	2014	2015	2016	2017
Total Direct Income						
PPUTRC	**$4.0**	**$4.4**	**$31.3**	**$38.2**	**$42.9**	**$48.3**
Alaska Ranges	$2.3	$2.6	$7.0	$7.7	$8.5	$9.4
Hawaii Ranges	-	-	-	$3.7	$4.9	$6.4
Oregon Ranges	$1.7	$1.9	$24.2	$26.7	$29.5	$32.5
Impact of Test Site Designation						
PPUTRC	-	-	**$26.4**	**$30.5**	**$32.2**	**$34.2**
Alaska Ranges	-	-	$4.2	$4.4	$4.7	$5.0
Hawaii Ranges	-	-	-	$3.7	$4.9	$6.4
Oregon Ranges	-	-	$22.2	$22.4	$22.6	$22.8

Table 8: Indirect Income, 2012-2017 ($ million)

	Indirect Income					
	2012	2013	2014	2015	2016	2017
Total Direct Income						
PPUTRC	**$1.1**	**$1.3**	**$11.7**	**$15.0**	**$17.0**	**$19.3**
Alaska Ranges	$0.4	$0.4	$1.2	$1.3	$1.5	$1.6
Hawaii Ranges	-	-	-	$2.1	$2.7	$3.6
Oregon Ranges	$0.7	$0.8	$10.5	$11.6	$12.8	$14.1
Impact of Test Site Designation						
PPUTRC			**$10.4**	**$12.5**	**$13.3**	**$14.4**
Alaska Ranges	-	-	$0.7	$0.8	$0.8	$0.9
Hawaii Ranges	-	-	-	$2.1	$2.7	$3.6
Oregon Ranges	-	-	$9.6	$9.7	$9.8	$9.9

Table 9: Induced Income, 2012-2017 ($ million)

	Induced Income					
	2012	2013	2014	2015	2016	2017
Total Induced Income						
PPUTRC	**$3.5**	**$3.8**	**$24.4**	**$30.1**	**$34.0**	**$38.4**
Alaska Ranges	$2.2	$2.5	$6.7	$7.4	$8.2	$9.0
Hawaii Ranges	-	-	-	$3.3	$4.3	$5.7
Oregon Ranges	$1.2	$1.4	$17.6	$19.4	$21.4	$23.6
Impact of Test Site Designation						
PPUTRC	-	-	**$20.1**	**$23.8**	**$25.3**	**$27.1**
Alaska Ranges	-	-	$4.0	$4.3	$4.5	$4.8
Hawaii Ranges	-	-	-	$3.3	$4.3	$5.7
Oregon Ranges	-	-	$16.1	$16.3	$16.4	$16.6

Output, Value Added, & State Income Taxes Resulting from UAS and Test Site Operations

'Output' represents the value of industry production, and 'total value added' is the difference between an industry's total output and the cost of their intermediate inputs. Economic modeling conducted for the purposes of this study indicates output in the PPUTRC states attributable to test site designation would climb from $265 million in 2014 to $333 million in 2017. Value added would climb from $109 million to $134 million over the same period.

Table 10: Output, 2012-2017 ($ million)

	Output					
	2012	2013	2014	2015	2016	2017
Total Output						
PPUTRC	**$18.3**	**$20.2**	**$302.4**	**$366.8**	**$411.7**	**$463.6**
Alaska Ranges	$8.6	$9.5	$34.3	$37.8	$41.7	$46.0
Hawaii Ranges	-	-	-	$33.3	$44.1	$58.3
Oregon Ranges	$9.7	$10.7	$268.1	$295.6	$325.9	$359.3
Impact of Test Site Designation						
PPUTRC	-	-	**$280.1**	**$315.5**	**$328.4**	**$344.7**
Alaska Ranges	-	-	$23.8	$24.8	$25.8	$26.8
Hawaii Ranges	-	-	-	$33.3	$44.1	$58.3
Oregon Ranges	-	-	$256.3	$257.4	$258.5	$259.6

Table 11: Total Value Added, 2012-2017 ($ million)

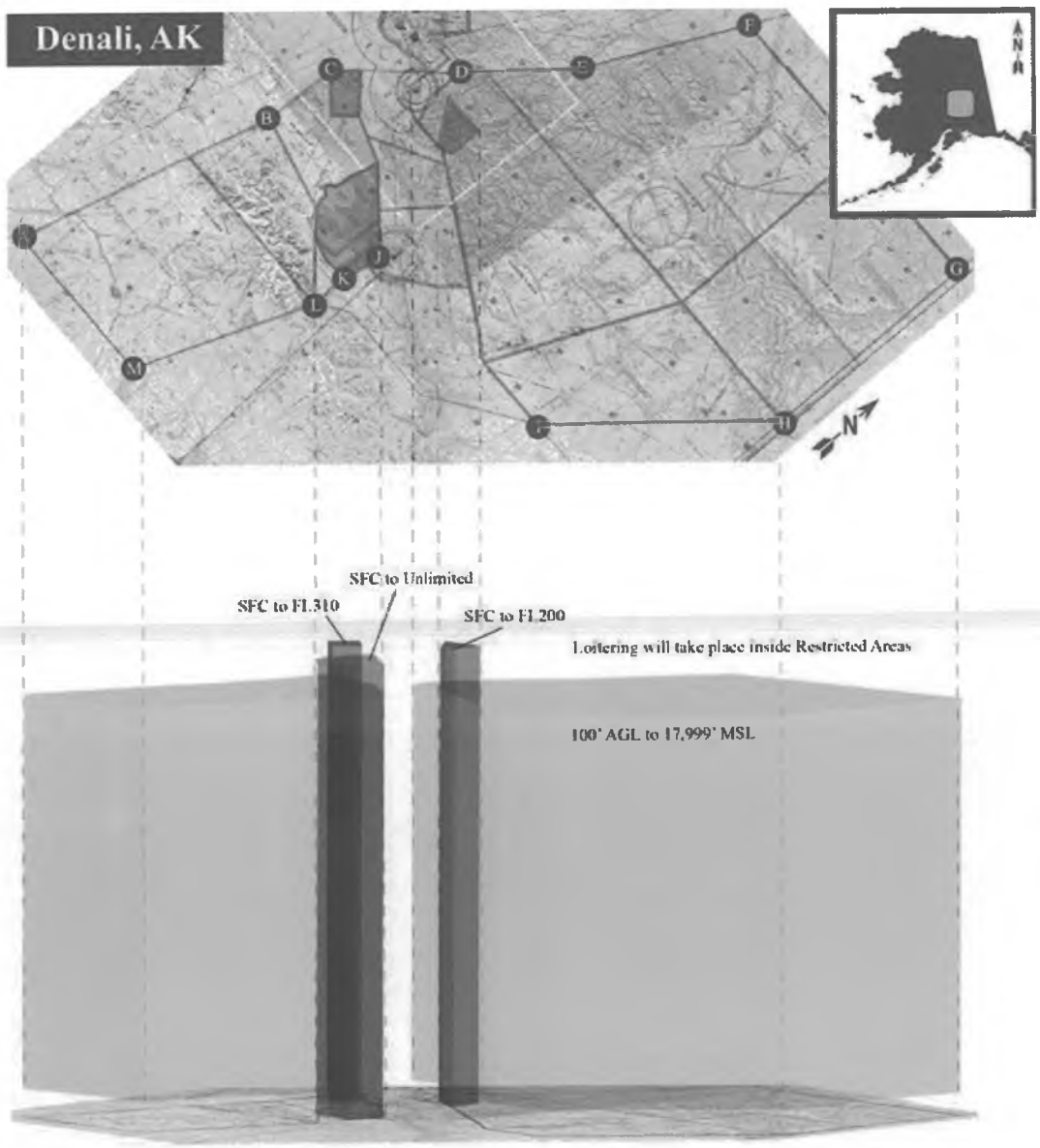
	Value Added					
	2012	2013	2014	2015	2016	2017
Total Value Added						
PPUTRC	**$9.5**	**$10.5**	**$127.7**	**$151.8**	**$169.7**	**$190.3**
Alaska Ranges	$5.7	$6.3	$22.7	$25.0	$27.6	$30.4
Hawaii Ranges	-	-	-	$10.9	$14.5	$19.1
Oregon Ranges	$3.8	$4.2	$105.1	$115.8	$127.7	$140.8
Impact of Test Site Designation						
PPUTRC	-	-	**$116.2**	**$128.2**	**$132.8**	**$138.5**
Alaska Ranges	-	-	$15.8	$16.4	$17.1	$17.7
Hawaii Ranges	-	-	-	$10.9	$14.5	$19.1
Oregon Ranges	-	-	$100.4	$100.9	$101.3	$101.7

Designation of the PPUTRC will provide a combined four-year total of $20 million in income tax revenue to Hawaii and Oregon. The effective income tax rate for these calculations was approximated as 7.5 percent for Hawaii, and 9 percent for Oregon (Alaska has no income tax).

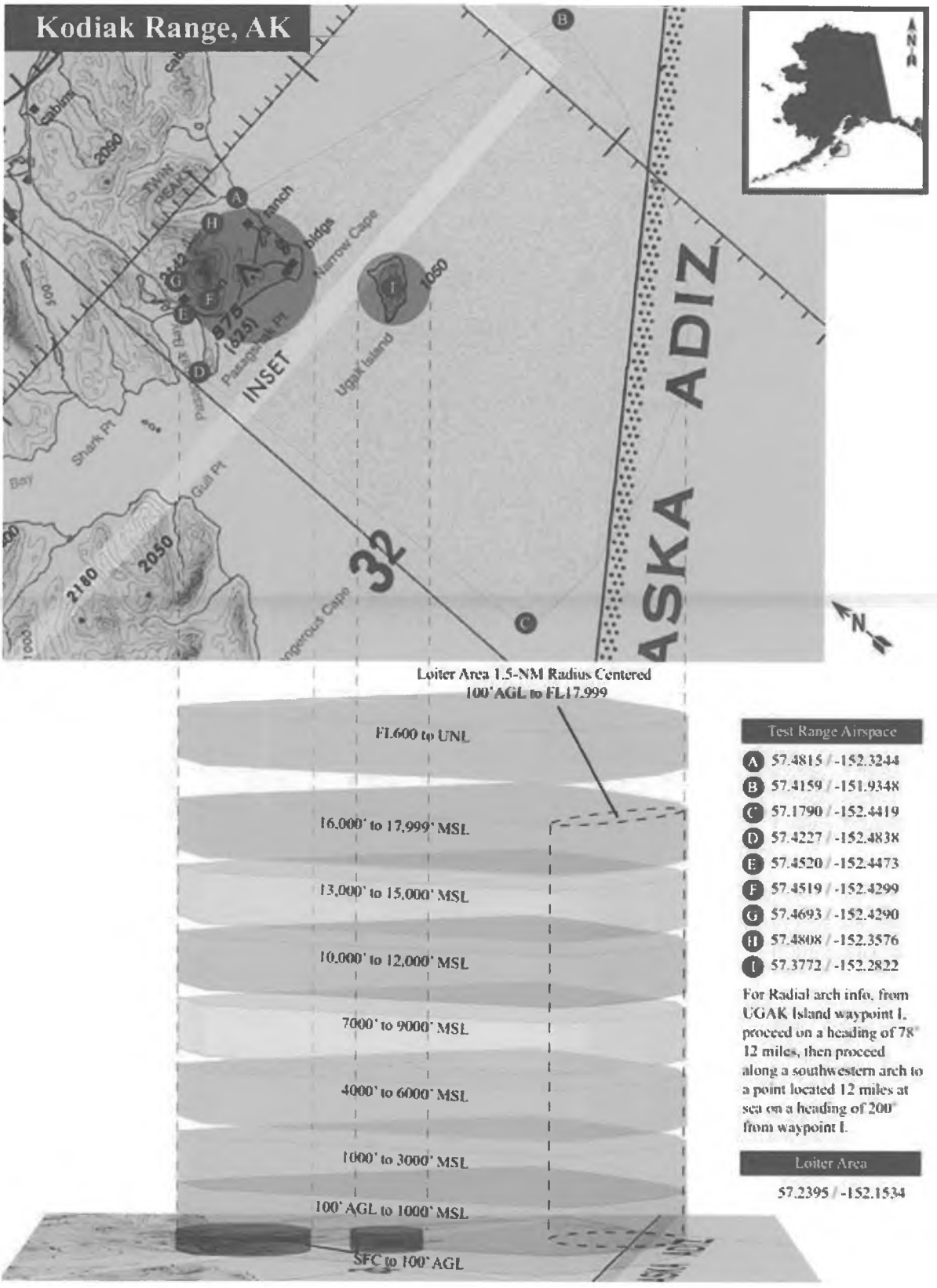
Table 12: State Income Taxes, 2012-2017 ($ million)

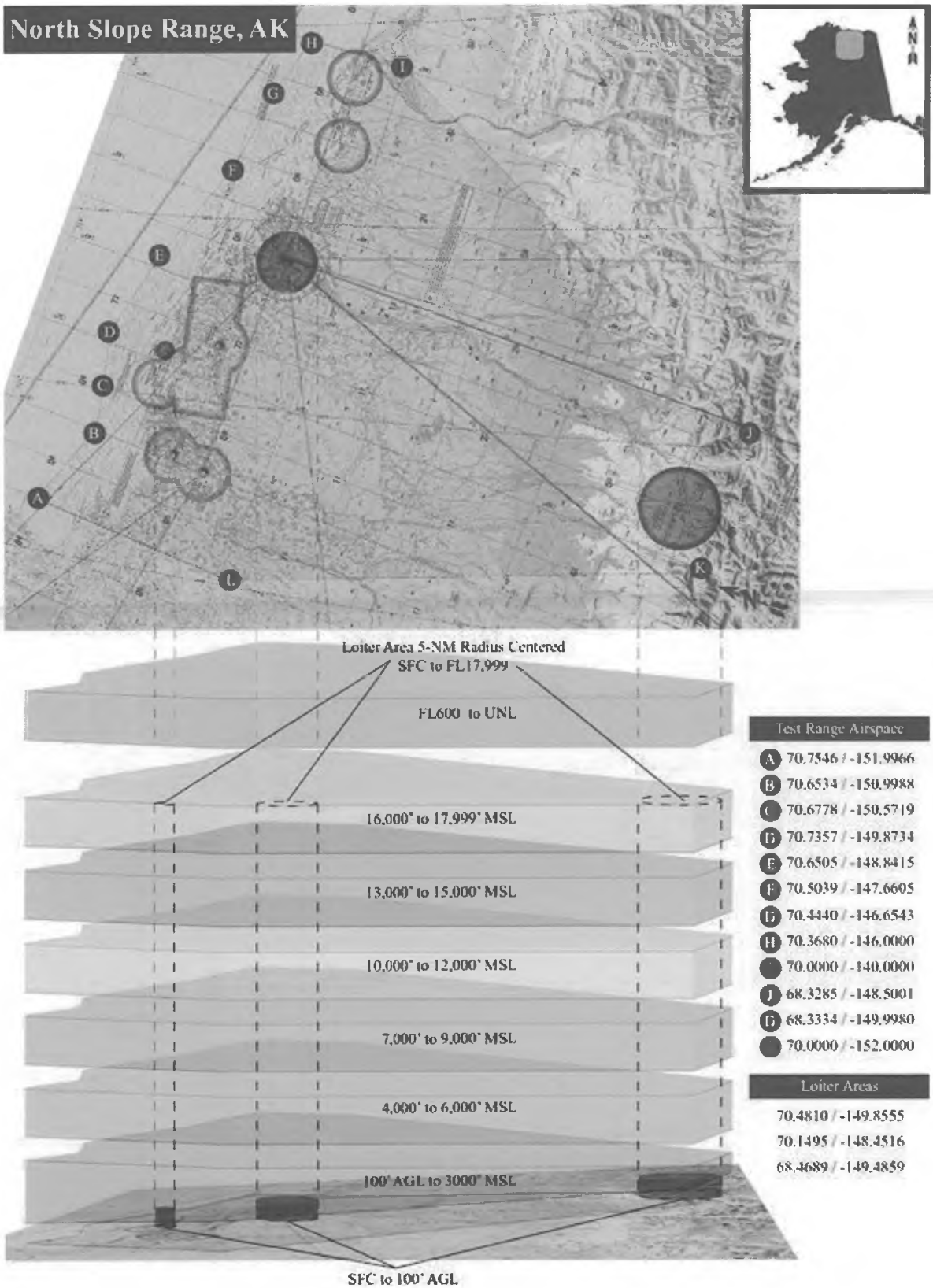
	State Income Taxes					
	2012	2013	2014	2015	2016	2017
Total State Income Taxes						
PPUTRC	**$0.2**	**$0.2**	**$4.7**	**$5.9**	**$6.6**	**$7.5**
Alaska Ranges	-	-	-	-	-	-
Hawaii Ranges	-	-	-	$0.7	$0.9	$1.2
Oregon Ranges	$0.2	$0.2	$4.7	$5.2	$5.7	$6.3
Impact of Test Site Designation						
PPUTRC	**-**	**-**	**$4.5**	**$5.2**	**$5.5**	**$5.8**
Alaska Ranges	-	-	-	-	-	-
Hawaii Ranges	-	-	-	$0.7	$0.9	$1.2
Oregon Ranges	-	-	$4.5	$4.5	$4.6	$4.6

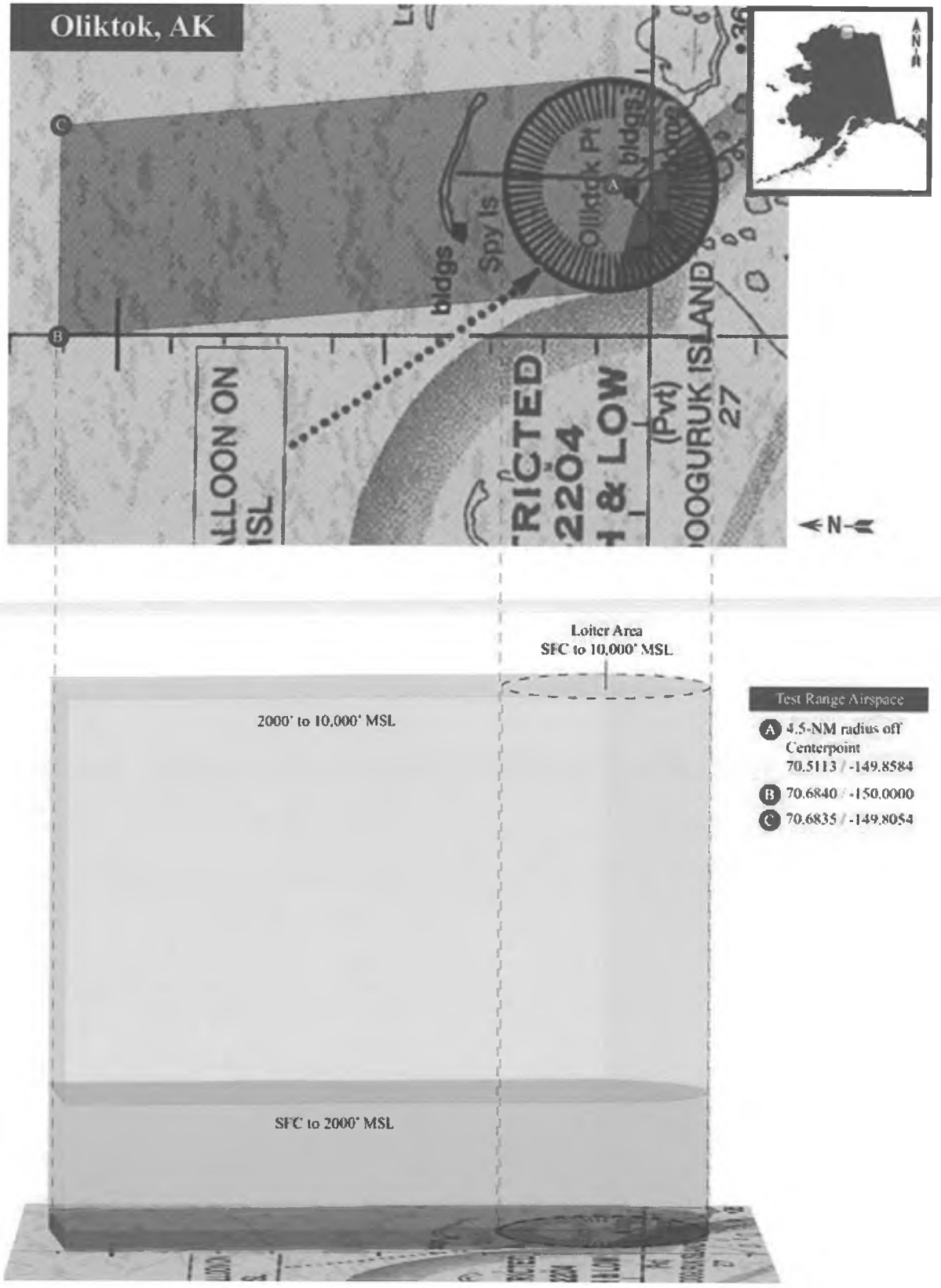
Appendix. Proposed Pan-Pacific Test Ranges

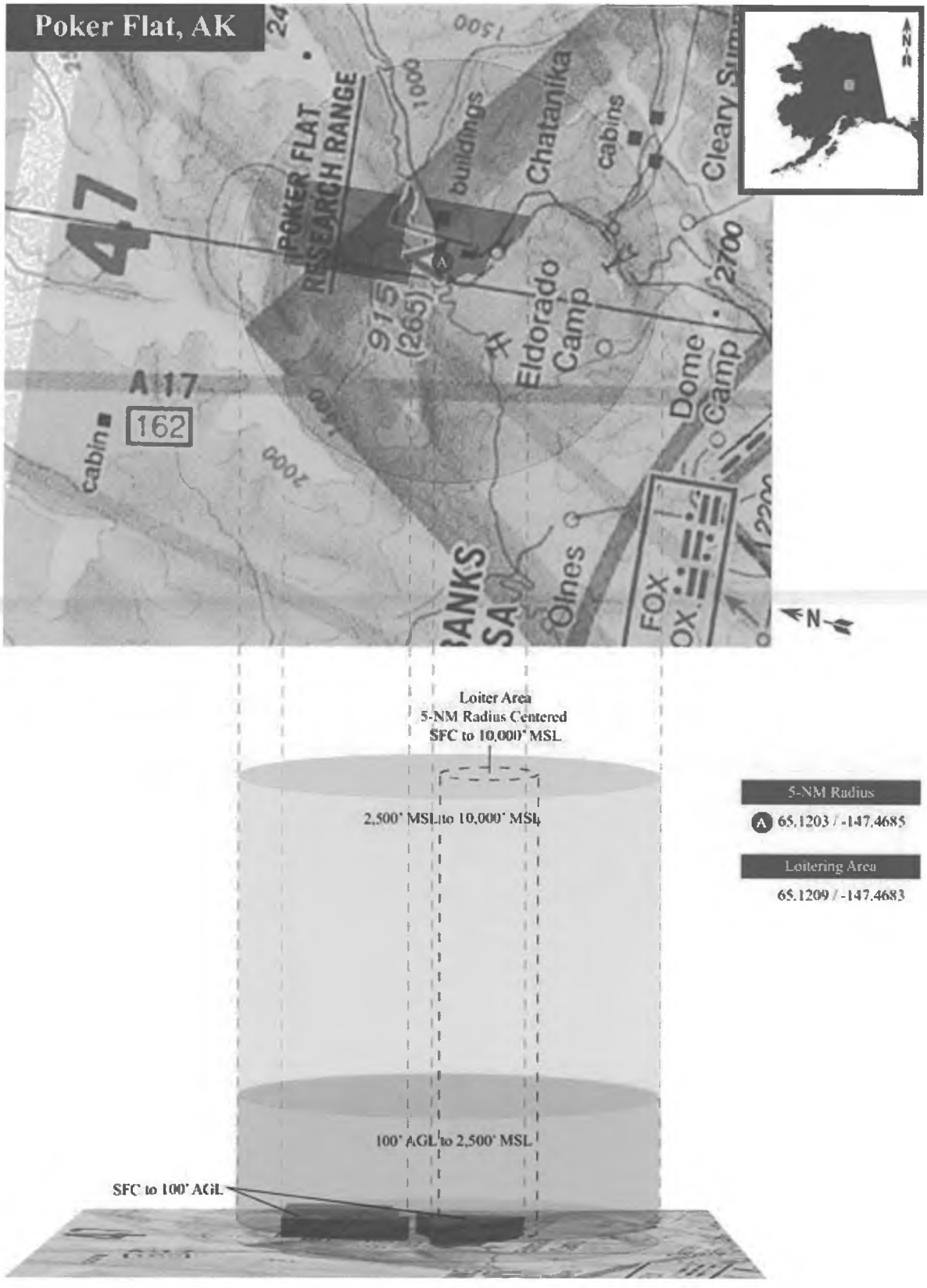


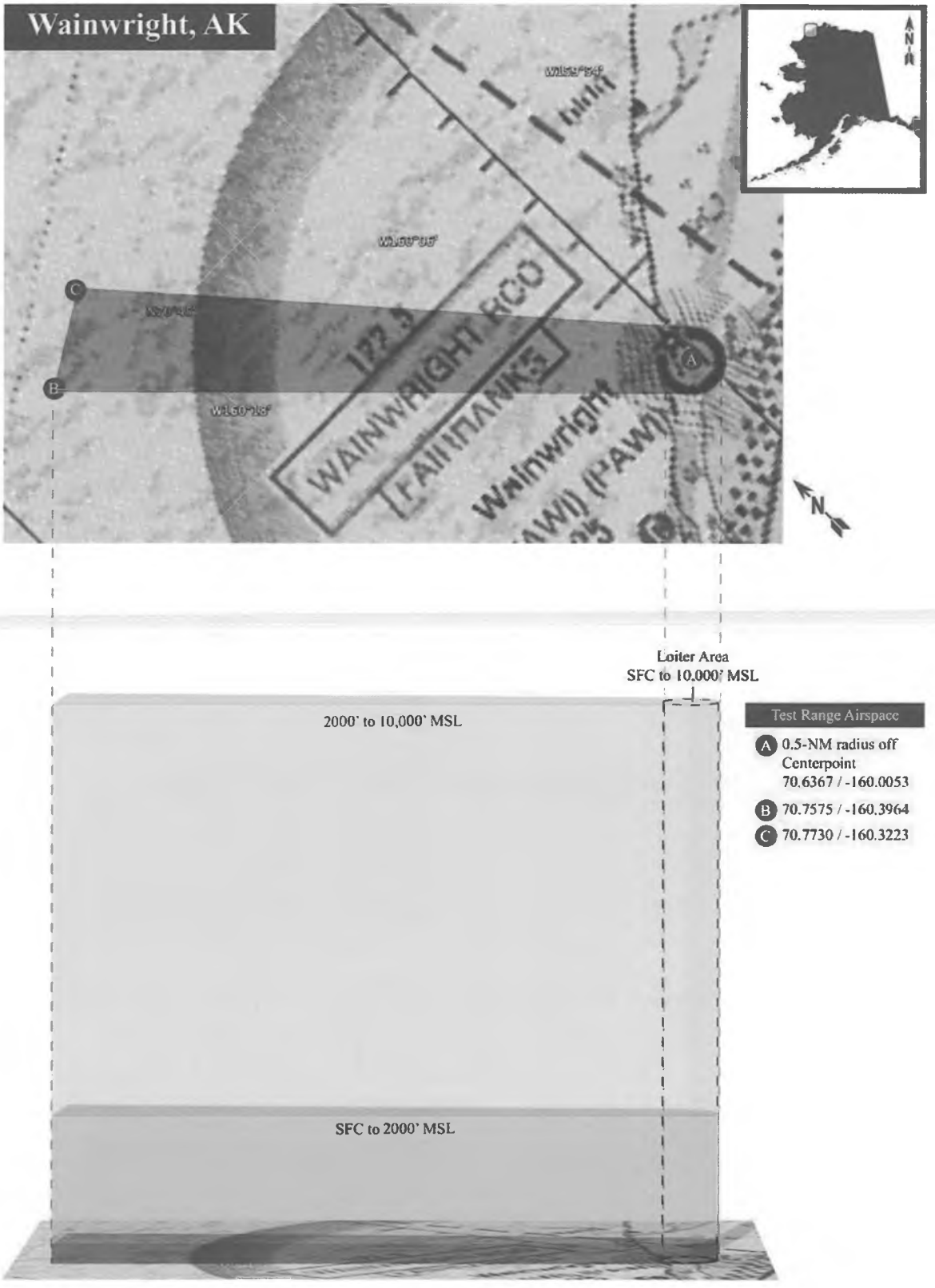
Test Range Airspace		
A 62.5000 / -148.8500	F 66.1668 / -145.0934	J 63.9364 / -145.8266
B 63.9653 / -148.0089	G 66.1692 / -141.0817	K 63.7156 / -145.9051
C 64.3756 / -147.9803	H 65.0000 / -141.0821	L 63.4974 / -145.9046
D 64.9000 / -146.9134	I 64.0000 / -143.0159	M 62.5000 / -146.7279
E 65.3505 / -146.0719		

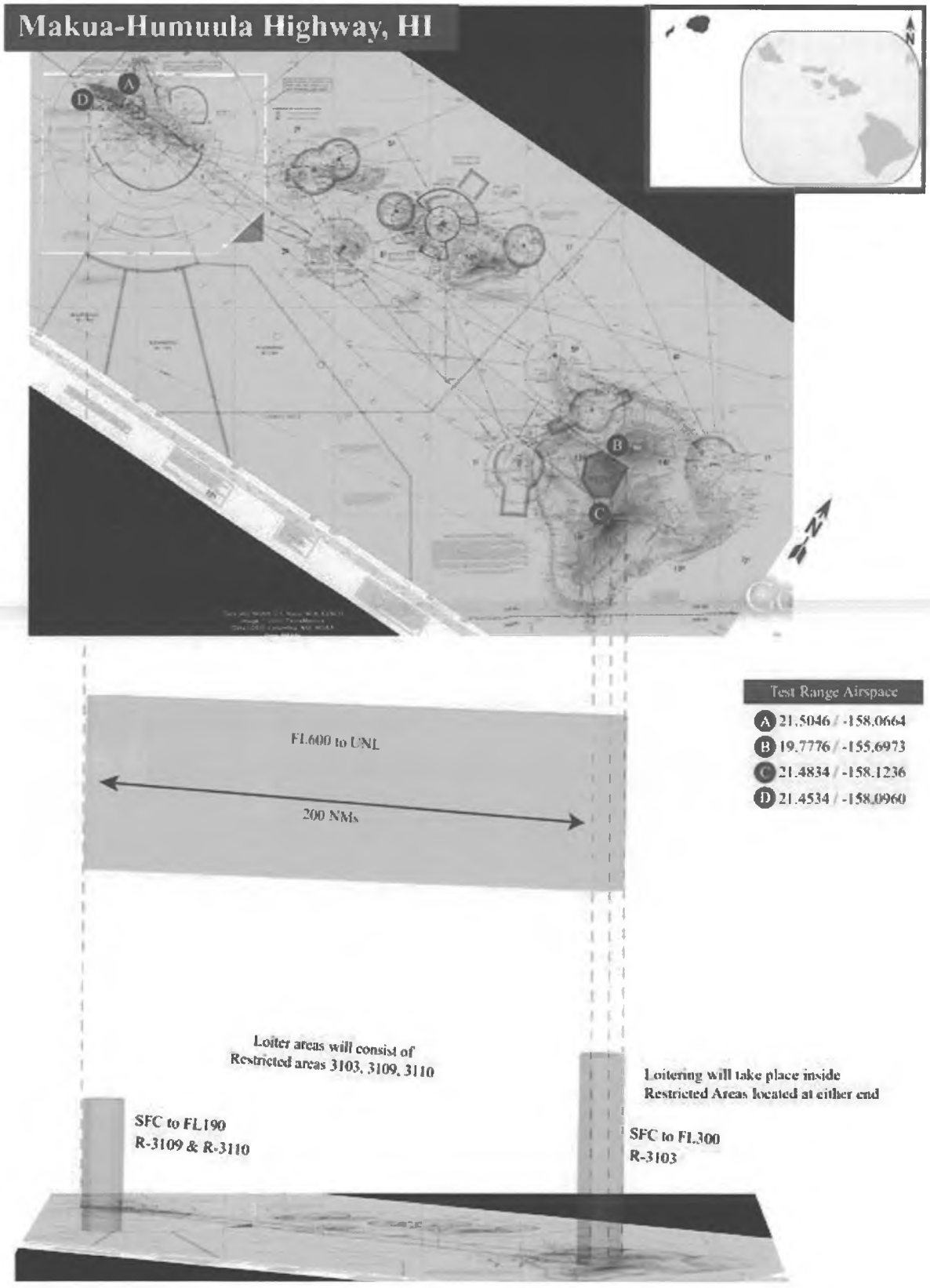

Kodiak Range, AK
INSET
ASKA ADIZ
Narrow Cape
Ugak Island
Shark Pt.
Gull Pt.
Bay
Loiter Area 1.5-NM Radius Centered
100' AGL to FL17,999
FL600 to UNL
16,000' to 17,999' MSL
13,000' to 15,000' MSL
10,000' to 12,000' MSL
7000' to 9000' MSL
4000' to 6000' MSL
1000' to 3000' MSL
100' AGL to 1000' MSL
SFC to 100' AGL
Test Range Airspace
A 57.4815 / -152.3244
B 57.4159 / -151.9348
C 57.1790 / -152.4419
D 57.4227 / -152.4838
E 57.4520 / -152.4473
F 57.4519 / -152.4299
G 57.4693 / -152.4290
H 57.4808 / -152.3576
I 57.3772 / -152.2822
For Radial arch info. from UGAK Island waypoint I, proceed on a heading of 78° 12 miles, then proceed along a southwestern arch to a point located 12 miles at sea on a heading of 200° from waypoint I.
Loiter Area
57.2395 / -152.1534
N

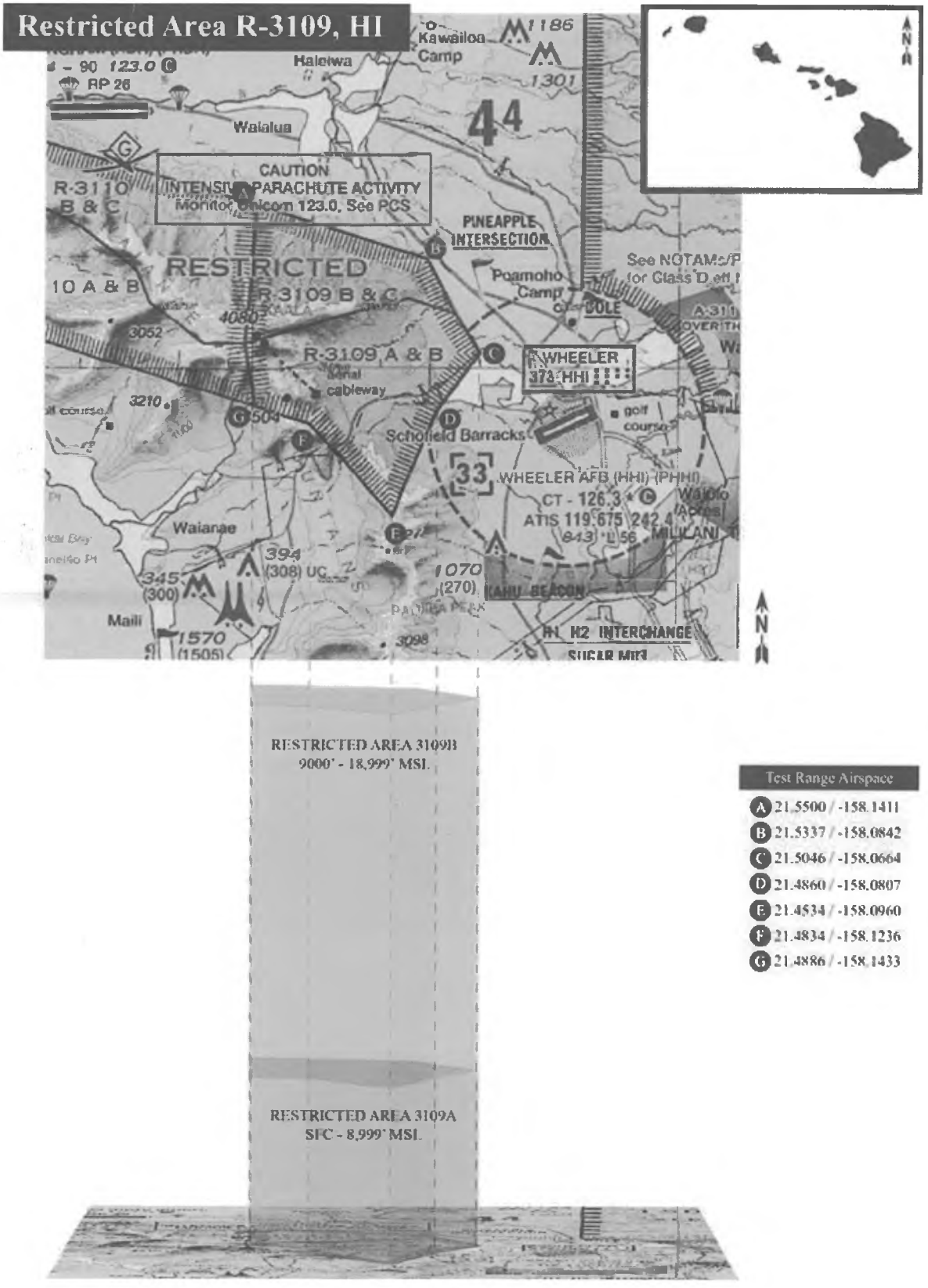

North Slope Range, AK
A
B
C
D
E
F
G
H
I
J
K
L
AK
Loiter Area 5-NM Radius Centered
SFC to FL17,999
FL600 to UNL
16,000' to 17,999' MSL
13,000' to 15,000' MSL
10,000' to 12,000' MSL
7,000' to 9,000' MSL
4,000' to 6,000' MSL
100' AGL to 3000' MSL
SFC to 100' AGL
Test Range Airspace
A 70.7546 / -151.9966
B 70.6534 / -150.9988
C 70.6778 / -150.5719
D 70.7357 / -149.8734
E 70.6505 / -148.8415
F 70.5039 / -147.6605
G 70.4440 / -146.6543
H 70.3680 / -146.0000
70.0000 / -140.0000
J 68.3285 / -148.5001
D 68.3334 / -149.9980
70.0000 / -152.0000
Loiter Areas
70.4810 / -149.8555
70.1495 / -148.4516
68.4689 / -149.4859

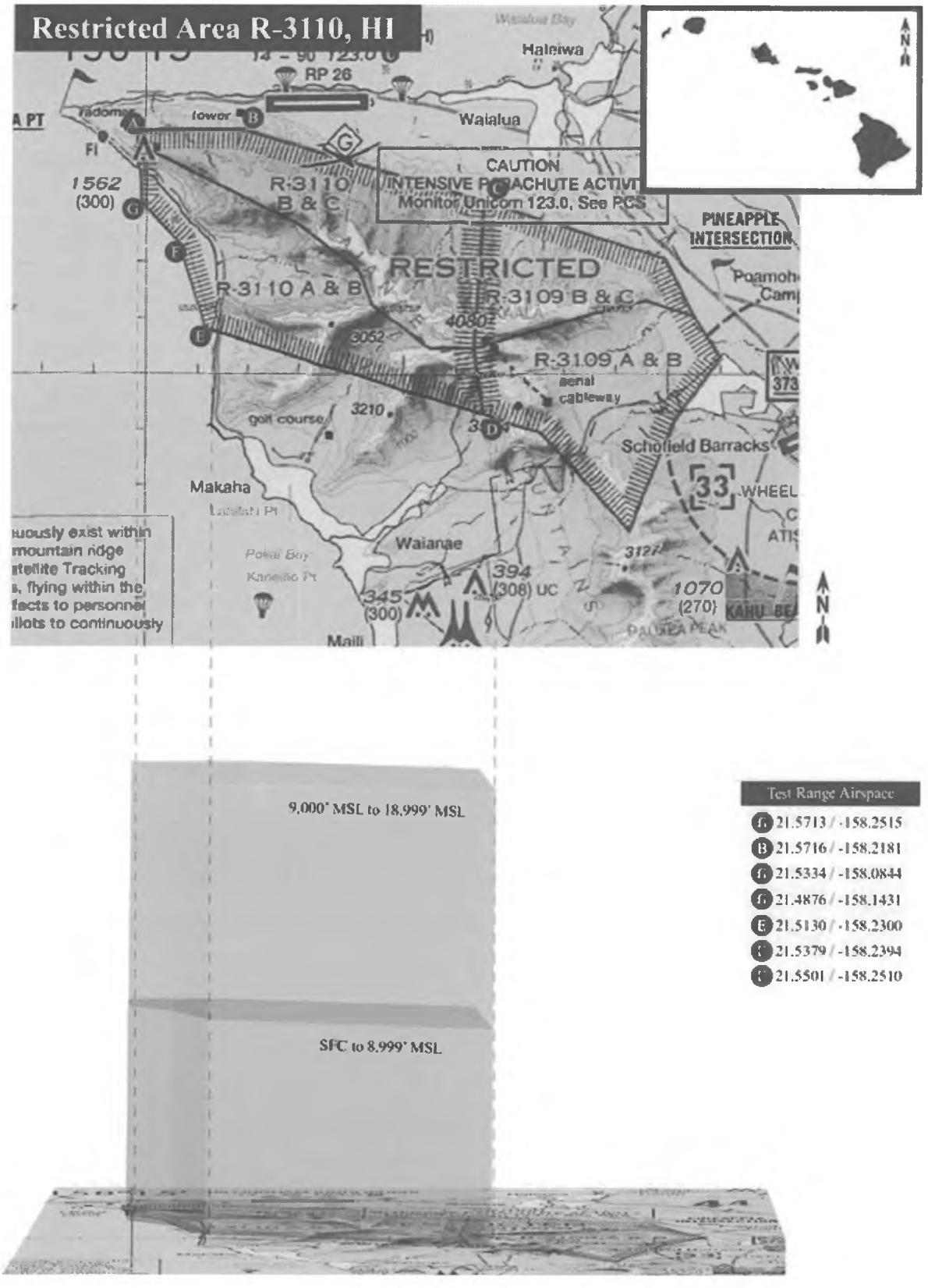

Oliktok, AK
Oliktok Pt
bldgs
Spy Is
bldgs
A
B
C
N
Loiter Area
SFC to 10,000' MSL
2000' to 10,000' MSL
SFC to 2000' MSL
Test Range Airspace
A 4.5-NM radius off Centerpoint 70.5113 / -149.8584
B 70.6840 / -150.0000
C 70.6835 / -149.8054


Poker Flat, AK
POKER FLAT RESEARCH RANGE
47
A17
162
Chatanika
Eldorado Camp
Dome Camp
Cleary Summit
buildings
cabins
cabin
FOX
Olnes
N
Loiter Area
5-NM Radius Centered
SFC to 10,000' MSL
2,500' MSL to 10,000' MSL
100' AGL to 2,500' MSL
SFC to 100' AGL
5-NM Radius
A 65.1203 / -147.4685
Loitering Area
65.1209 / -147.4683

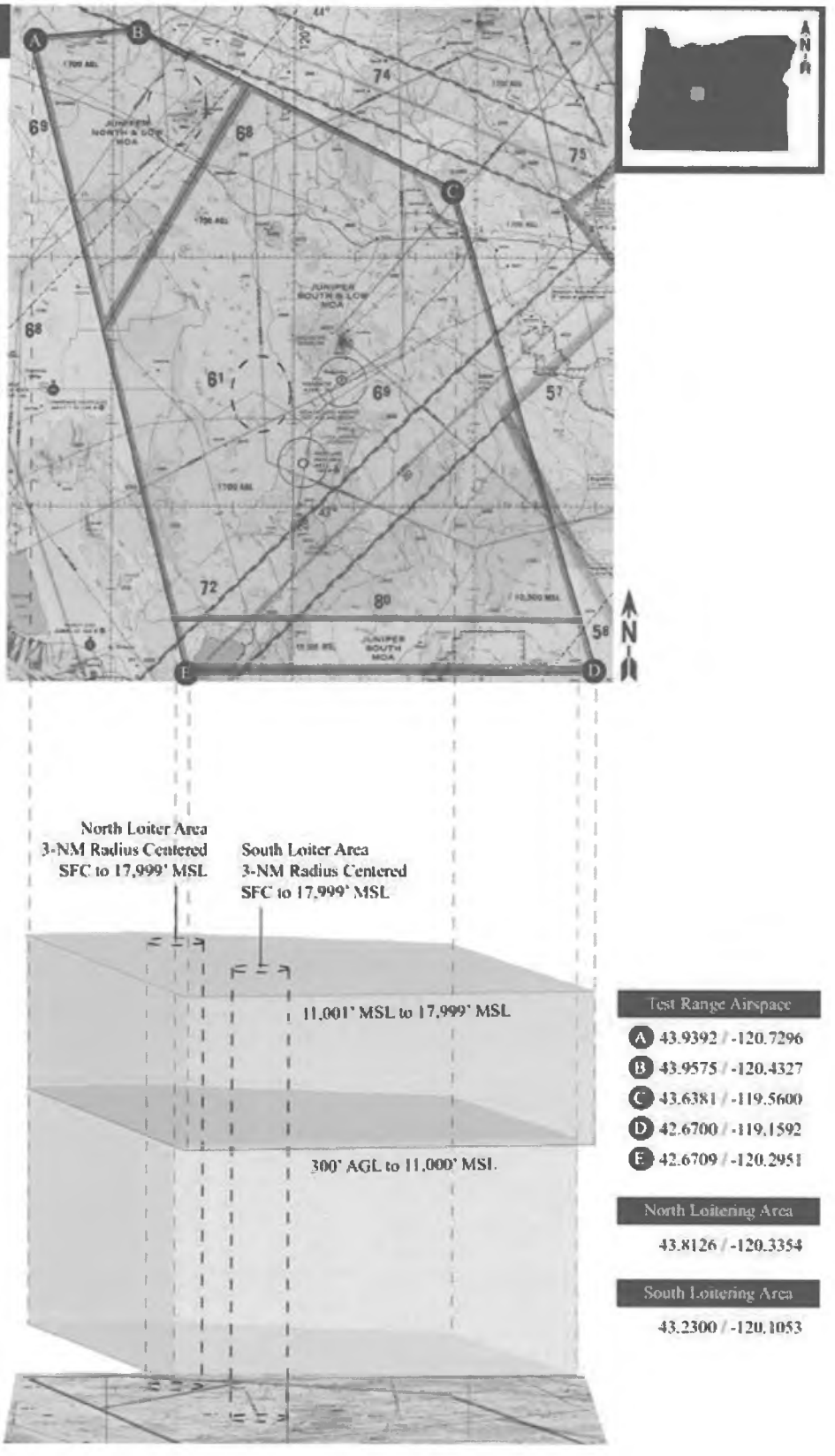

Wainwright, AK
WAINWRIGHT RCO
FAIRBANKS
Wainwright
(PAWI) (PAWI)
A
B
C
N
Loiter Area
SFC to 10,000' MSL
2000' to 10,000' MSL
SFC to 2000' MSL
Test Range Airspace
A 0.5-NM radius off Centerpoint 70.6367 / -160.0053
B 70.7575 / -160.3964
C 70.7730 / -160.3223


Makua-Humuula Highway, HI
A
D
B
C
N
Test Range Airspace
A 21.5046 / -158.0664
B 19.7776 / -155.6973
C 21.4834 / -158.1236
D 21.4534 / -158.0960
FL600 to UNL
200 NMs
Loiter areas will consist of
Restricted areas 3103, 3109, 3110
Loitering will take place inside
Restricted Areas located at either end
SFC to FL190
R-3109 & R-3110
SFC to FL300
R-3103


Restricted Area R-3109, HI
Kawailoa Camp
1186
1301
Haleiwa
RP 26
Waialua
44
CAUTION
INTENSIVE PARACHUTE ACTIVITY
Monitor Unicom 123.0, See PCS
R-3110 B & C
PINEAPPLE INTERSECTION
RESTRICTED
10 A & B
R-3109 B & C
Poamoho Camp
DOLE
See NOTAMs/P
for Class D eff
4080
3052
R-3109 A & B
WHEELER
373 HHI
cableway
3210
golf course
Schofield Barracks
33
WHEELER AFB (HHI) (PHHI)
CT - 126.3
ATIS 119.675 242.4
Waiawa
MILILANI
Waianae
394
(308) UC
345
(300)
1070
(270)
KAHU BEACON
Maili
1570
(1505)
3098
H1 H2 INTERCHANGE
SUGAR MILL
N
RESTRICTED AREA 3109B
9000' - 18,999' MSL
RESTRICTED AREA 3109A
SFC - 8,999' MSL
Test Range Airspace
A 21.5500 / -158.1411
B 21.5337 / -158.0842
C 21.5046 / -158.0664
D 21.4860 / -158.0807
E 21.4534 / -158.0960
F 21.4834 / -158.1236
G 21.4886 / -158.1433


Restricted Area R-3110, HI
Haleiwa
RP 26
Wahiawa
Waialua
tower
CAUTION
INTENSIVE PARACHUTE ACTIVITY
Monitor Unicom 123.0, See PCS
1562
(300)
R-3110
B & C
PINEAPPLE
INTERSECTION
RESTRICTED
R-3110 A & B
R-3109 B & C
4080
3052
R-3109 A & B
aerial
cableway
3210
golf course
Schofield Barracks
33
WHEEL
Makaha
Waianae
394
(308) UC
345
(300)
1070
(270)
KAHU
Maili
9,000' MSL to 18,999' MSL
SFC to 8,999' MSL
Test Range Airspace
G 21.5713 / -158.2515
B 21.5716 / -158.2181
G 21.5334 / -158.0844
G 21.4876 / -158.1431
E 21.5130 / -158.2300
C 21.5379 / -158.2394
C 21.5501 / -158.2510

Juniper, OR



Test Range Airspace

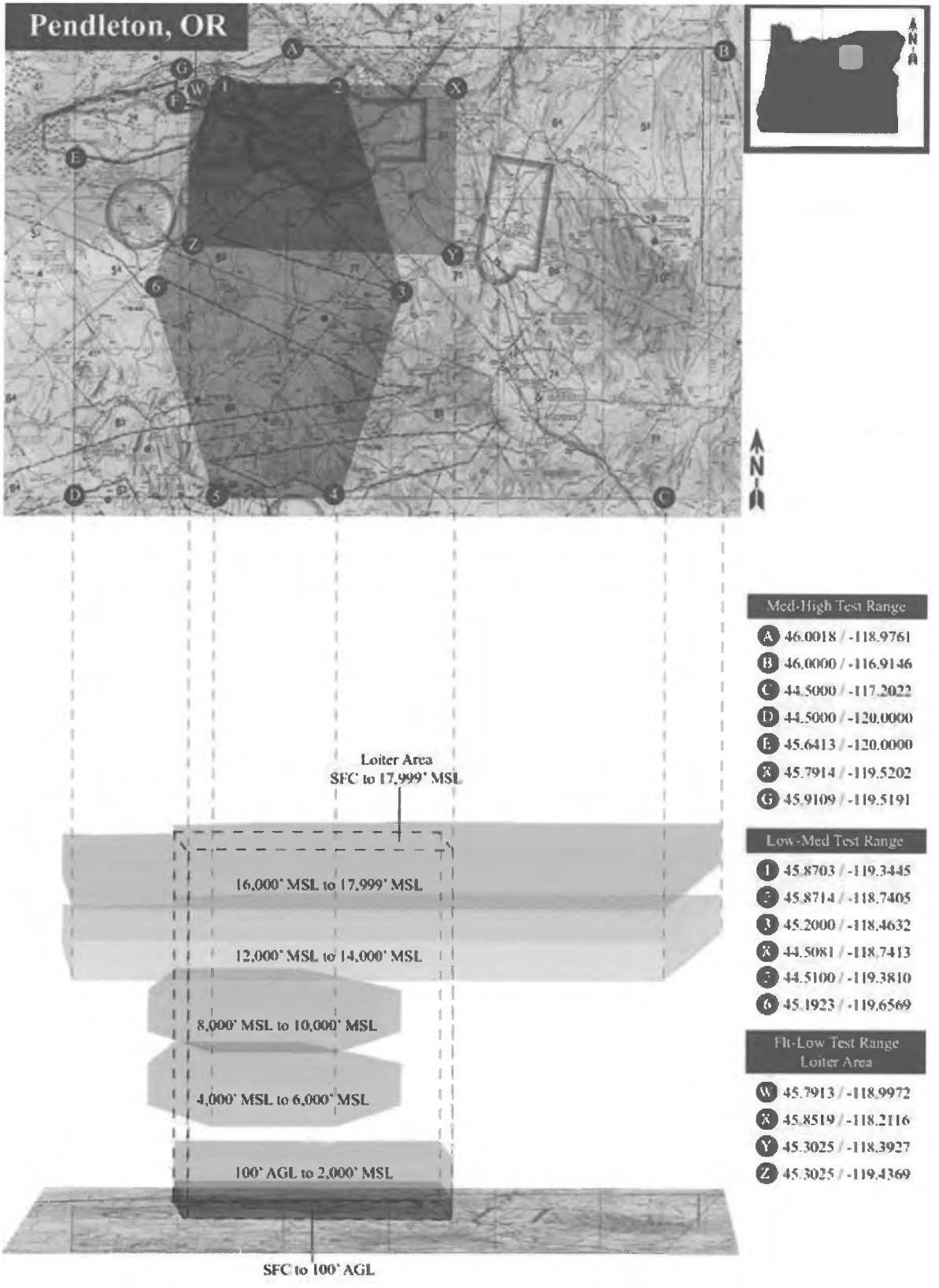
- A 43.9392 / -120.7296
- B 43.9575 / -120.4327
- C 43.6381 / -119.5600
- D 42.6700 / -119.1592
- E 42.6709 / -120.2951

North Loitering Area

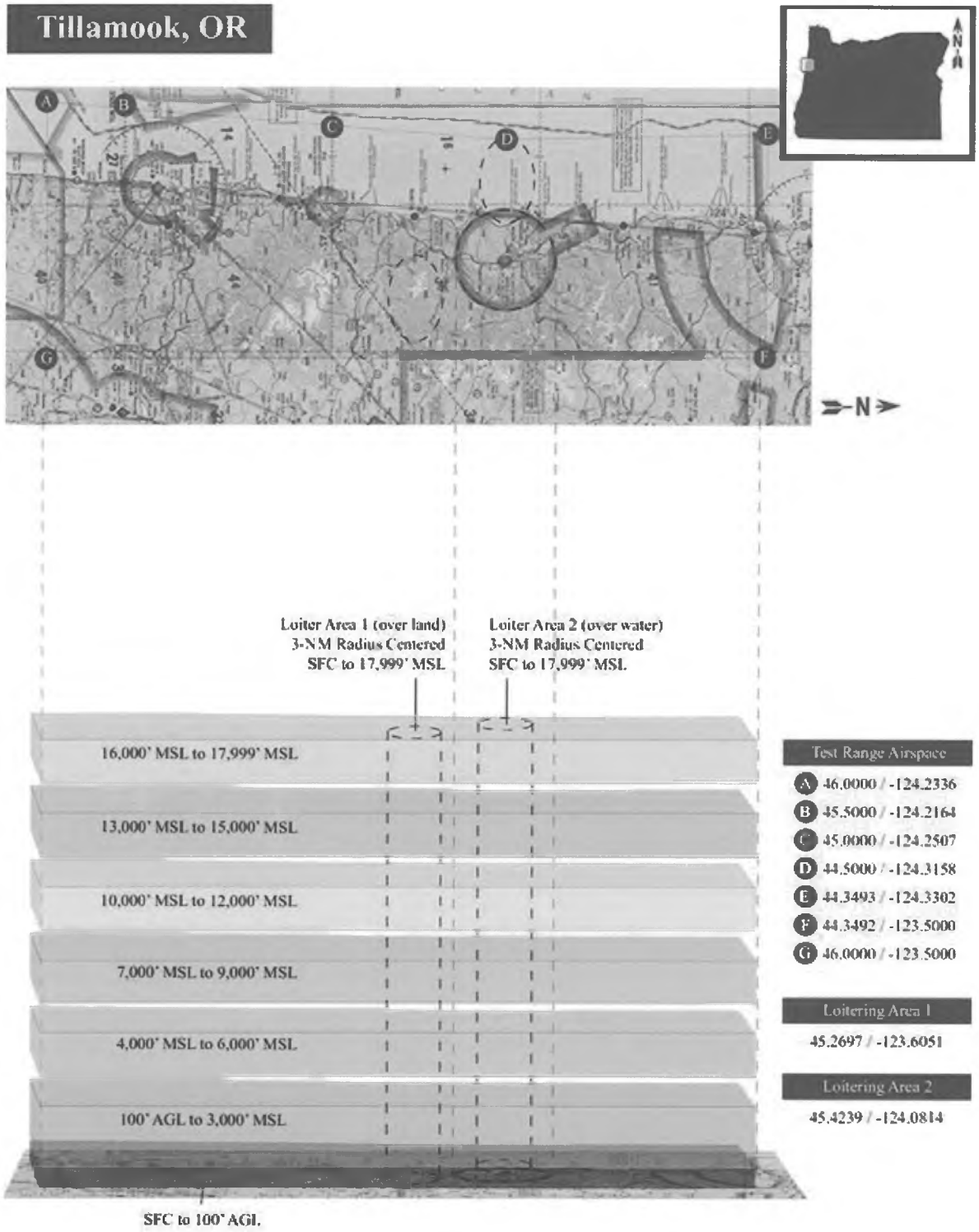
43.8126 / -120.3354

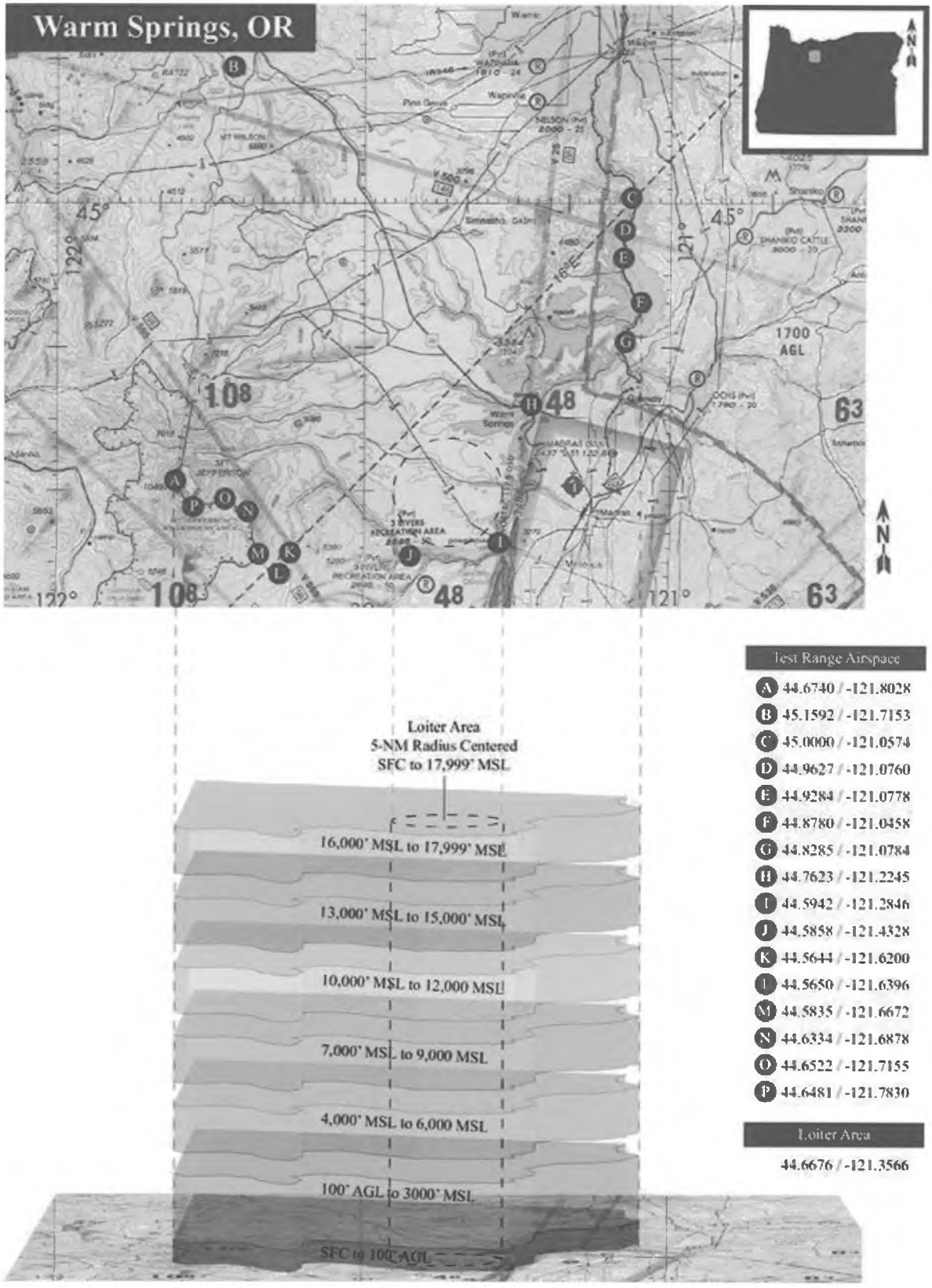
South Loitering Area

43.2300 / -120.1053


Pendleton, OR
A
B
C
D
E
F
G
W
1
2
X
Z
Y
6
3
5
4
N
Loiter Area
SFC to 17,999' MSL
16,000' MSL to 17,999' MSL
12,000' MSL to 14,000' MSL
8,000' MSL to 10,000' MSL
4,000' MSL to 6,000' MSL
100' AGL to 2,000' MSL
SFC to 100' AGL
Med-High Test Range
A 46.0018 / -118.9761
B 46.0000 / -116.9146
C 44.5000 / -117.2022
D 44.5000 / -120.0000
E 45.6413 / -120.0000
X 45.7914 / -119.5202
G 45.9109 / -119.5191
Low-Med Test Range
1 45.8703 / -119.3445
2 45.8714 / -118.7405
3 45.2000 / -118.4632
X 44.5081 / -118.7413
5 44.5100 / -119.3810
6 45.1923 / -119.6569
Flt-Low Test Range
Loiter Area
W 45.7913 / -118.9972
X 45.8519 / -118.2116
Y 45.3025 / -118.3927
Z 45.3025 / -119.4369

Tillamook, OR




Warm Springs, OR
Loiter Area
5-NM Radius Centered
SFC to 17,999' MSL
16,000' MSL to 17,999' MSL
13,000' MSL to 15,000' MSL
10,000' MSL to 12,000 MSL
7,000' MSL to 9,000 MSL
4,000' MSL to 6,000 MSL
100' AGL to 3000' MSL
SFC to 100' AGL
Test Range Airspace
A 44.6740 / -121.8028
B 45.1592 / -121.7153
C 45.0000 / -121.0574
D 44.9627 / -121.0760
E 44.9284 / -121.0778
F 44.8780 / -121.0458
G 44.8285 / -121.0784
H 44.7623 / -121.2245
I 44.5942 / -121.2846
J 44.5858 / -121.4328
K 44.5644 / -121.6200
L 44.5650 / -121.6396
M 44.5835 / -121.6672
N 44.6334 / -121.6878
O 44.6522 / -121.7155
P 44.6481 / -121.7830
Loiter Area
44.6676 / -121.3566

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