RTCA

THE GOLD STANDARD FOR AVIATION SINCE 1935

Drone Advisory Committee

Meeting #5

November 8, 2017 - Seattle, WA

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1 DAC Membership

Name	Organization	Role
Greg Agvent	CNN	Member
John Allen	JetBlue Airways	Member
Juan Alonso	Stanford University	Member
Mark Baker	Aircraft Owners and Pilots Association	Member
Jaz Banga	Airspace Systems Inc.	Member
Linden Blue	General Atomics Aeronautical Systems, Inc.	Member
Robert Boyd	Riley County, Kansas	Member
James Burgess	Google	Member
Tim Canoll	Air Line Pilots Association (ALPA)	Member
Michael Chasen	Precision Hawk USA Inc.	Member
Nancy Egan	3D Robotics	Member
Dan Elwell	Federal Aviation Administration (FAA)	Designated Federal Officer
Deborah Flint	Los Angeles World Airports	Member
Trish Gilbert	National Air Traffic Controllers Association (NATCA)	Member
Martin Gomez	Facebook	Member
Todd Graetz	BNSF Railway	Member
David Greene	Wisconsin Department of Transportation, Bureau of Aeronautics	Member
Rich Hanson	Academy of Model Aeronautics	Member
Ryan Hartman	Insitu Inc.	Member
Robert Isom	American Airlines, Inc.	Member
Gur Kimchi	Amazon Prime Air	Member
George Kirov	Harris Corporation	Member
Brian Krzanich	Intel	Committee Chairman
Ed Lee	San Francisco, California	Member
Nancy Leveson	MIT Lincoln Laboratory	Member
Nan Mattai	Rockwell Collins, Inc.	Member
Houston Mills	United Parcel Service (UPS)	Member
Marily Mora	Reno-Tahoe Airport Authority	Member
Christopher Penrose	AT&T	Member
Steven Rush	Professional Helicopter Pilots Association	Member
Lillian Ryals	The MITRE Corporation	Member
Robie Samanta Roy	Lockheed Martin Corporation	Member

Name	Organization	Role
Brendan Schulman	DJI Technology	Member
Al Secen	RTCA, Inc.	Committee Secretary
Phil Straub	Garmin Ltd.	Member
Brian Wynne	Association for Unmanned Vehicle Systems International (AUVSI)	Member
Matthew Zuccaro	Helicopter Association International (HAI)	Member

DACSC Organizational Membership

3D Robotics
A3 by Airbus Group
Academy of Model Aeronautics
Aerospace Industries Association (AIA)
AeroVironment (EUROCAE member)
Air Line Pilots Association (ALPA)
Air Traffic Control Association (ATCA)
Aircraft Owners and Pilots Association
Airlines for America
AirMap
Airports Council International (ACI North America)
Airspace Systems Inc.
Airware
Alabama Department of Transportation/NASAO
Amazon Prime Air
American Airlines, Inc.
American Association of Airport Executives
American Insurance Association
Apex Unmanned LLC
Association for Unmanned Vehicle Systems International (AUVSI)
AT&T
ATAC
Aviation Management Associates, Inc.
BNSF Railway
City of Los Angeles
Consultant
Consumer Technology Association
Covell
Dart Aerospace
DJI Technology
DLA Piper LLP
Echodyne Corp
Facebook
Federal Aviation Administration (FAA)
Garmin Ltd.
GE Aviation
General Atomics Aeronautical Systems, Inc.
Google
GoPro, Inc.
Gryphon Sensors
Harris Corporation
Helicopter Association International (HAI)
HobbyTown
Honeywell International, Inc.
IBM
Insitu Inc.
Intel
JetBlue Airways
JHW Unmanned Solutions LLC
Kansas Department of Transportation
Leidos
Ligado Networks
Lockheed Martin Corporation
Los Angeles World Airports
Matternet
MCR
NASA
National Agriculture Aviation Association
National Air Traffic Controllers Association (NATCA)
National Association of Counties
National Association of State Aviation Officials (Exempt)
National Business Aviation Association
National Conference of State Legislators (NCSL)
National League of Cities
Noblis Inc.
Northrop Grumman Corporation
OPEIU
Port Authority of New York & New Jersey
Precision Hawk USA Inc.
Property Drone Consortium
Qualcomm Technologies, Inc.
Regional Airline Association
Reno-Tahoe Airport Authority
Rockwell Collins, Inc.
RTCA, Inc.
SAIC
San Francisco International Airport
San Francisco, California
Security101
Skyward IO, Inc.
Small UAV Coalition
Stanford University
State of California
Thales Group
The MITRE Corporation
United Airlines, Inc.
United Parcel Service (UPS)
University of Massachusetts, Amherst
University of Oklahoma
US Department of Transportation

3 Meeting Agenda

Fifth Meeting of the Drone Advisory Committee (DAC)
Agenda

DATE: November 8, 2017

TIME: 9:00 AM – 4:30 PM PST

PLACE: Amazon Meeting Center
2031 7th Avenue
Seattle, WA 98121

Wednesday, November 8, 2017

Start	Stop	
9:00 AM	9:02 AM	Official Statement of the Designated Federal Officer (DFO)
9:02 AM	9:12 AM	Welcome and Introductions, Review of Previous DAC Meeting
9:12 AM	9:15 AM	Approval of Minutes from Previous DAC
9:15 AM	9:25 AM	DAC Chairman's Report
9:25 AM	9:50 AM	FAA Remarks
9:50 AM	10:05 AM	Presidential Memo on UAS Integration Pilot Program
10:05 AM	10:25 AM	MITRE Report
10:25 AM	10:35 AM	Break
10:35 AM	10:40 AM	DAC Sub-Committee (DACSC) Co-Chair Report
10:40 AM	11:10 AM	Report of DACSC Task Group (TG) 1 (Roles and Responsibilities)
11:10 AM	12:00 PM	Discussion of Task Group 1 Material
12:00 PM	1:15 PM	Lunch
1:15 PM	1:55 PM	Report of DACSC TG2 (Access to Airspace)
1:55 PM	2:40 PM	Discussion of TG2 Material
2:40 PM	2:55 PM	Break
2:55 PM	3:35 PM	Report of DACSC TG3 (Funding UAS)
3:35 PM	4:10 PM	Discussion of TG3 Material
4:10 PM	4:20 PM	New Assignments/Agenda Topics/Next Meeting Details/Meeting Summary
4:20 PM	4:25 PM	FAA DFO Closing Remarks
4:25 PM	4:25 PM	Adjourn

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Welcome to the Meeting of the Drone Advisory Committee

November 8, 2017

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Official Statement of the Designated Federal Officer

PUBLIC MEETING ANNOUNCEMENT
Read by: Designated Federal Officer Dan Elwell
Drone Advisory Committee
November 8, 2017

In accordance with the Federal Advisory Committee Act, this Advisory Committee meeting is OPEN TO THE PUBLIC.

Notice of the meeting was published in the Federal Register on:

October 10, 2017

Members of the public may address the committee with PRIOR APPROVAL of the Chairman. This should be arranged in advance.

Only appointed members of the Advisory Committee may vote on any matter brought to a vote by the Chairman.

The public may present written material to the Advisory Committee at any time.

DAC Agenda Topics

- Welcome and Introductions, Review of the Fourth DAC Meeting
- Approval of Minutes from the Fourth DAC Meeting
- Report from the DAC Chairman/Update from the FAA
- Report from the DAC Subcommittee (SC) Co-Chairs
- Reports from the Co-Chairs of the DACSC Task Groups (TGs)
- Discussion of Reports from the Co-Chairs of the DACSC TGs
- Report from MITRE
- New Assignments/Agenda Topics/Other
- Closing Remarks
- Adjourn

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Welcome and Introductions
Opening Remarks

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Review and Approval of:

Minutes – July 21, 2017

DAC Chairman Report

FAA Update

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Report of Local Outreach
MITRE Corporation

Co-Chairs:
Michael Guterrez, *MITRE*

U.S. Mayors and County Officials: Drone Discussion Groups

Michael Guterres

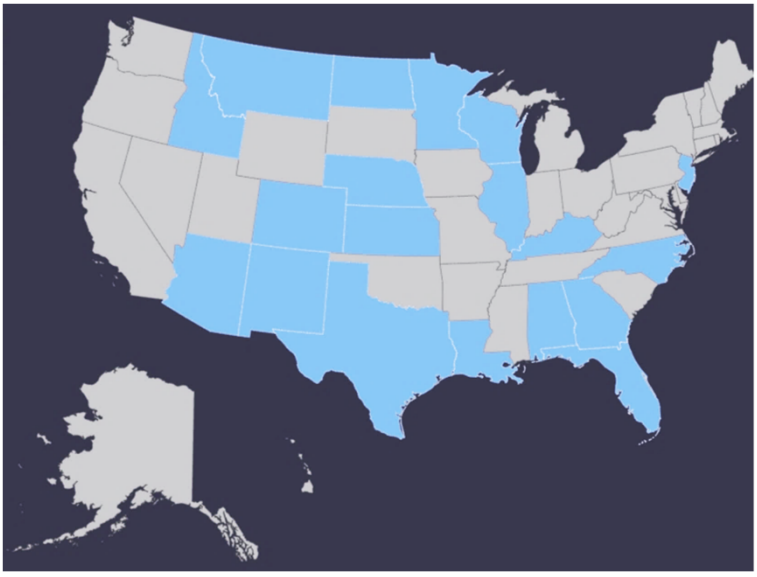
November 8, 2017

MITRE

Background

- FAA, at the request of members of Drone Advisory Committee, asked Stanford and MITRE to solicit broader feedback from local government officials about their views on what role, if any, local governments should have in regulating low-altitude drone operations
- Two near-term opportunities were identified:
  - U.S. Conference of Mayors in Miami, Florida, June 23-26, 2017
  - National Association of Counties Conference in Columbus, Ohio, July 21-24, 2017
- MITRE carried out focus-group sessions at both events, using a variety of scenarios and questions to elicit opinions and views
- Earl Lawrence and Jonathan Cross (AGC) participated in both events as technical advisors

County and City Representatives: State Map



Outline

- Major Findings
- Jurisdiction and Enforcement
- Outreach, Education & Training
- Major Concerns
- Benefits

Major Findings

- Jurisdiction: Local governments want jurisdiction over low-altitude drones in their geographic areas
- Enforcement: Local officials expect to be responsible for enforcement of drone laws
- Outreach: Local officials want to be included in national decision making about drone laws, or at least have input
- Education & Training: Local officials and law enforcement feel they need drone-related education, training, and outreach
- Concerns: Most significant concerns about drones in their communities are safety, security, privacy, difficulty of enforcement, liability, operations by children, preemption, and lack of laws for recreational drones
- Benefits and Positive Feedback: Most local officials are enthusiastic about potential benefits of drones in their communities for both public use and private use

Jurisdiction and Enforcement

- Jurisdiction: Mayors and County Officials want jurisdiction over drone operations at low altitudes in their geographic areas
  - No specific altitude proposed; 50 feet, 100 feet, 200 feet all mentioned
  - Local officials would like to be able to set local restrictions as needed
    - Some expressed a wish for a baseline set of Federal and/or state regulations, along with the ability to customize specific aspects of the rules to each community's needs
- Enforcement: Local officials and local law enforcement expect to be responsible to enforce drone rules and handle drone-related problems in their cities and counties
  - They do not believe that FAA is able to provide enforcement resources

Outreach, Education and Training

- Outreach: Local officials and communities want to be included in the Federal and state discussions and decision making about drone laws
  - Mayors and County Officials want to participate in the process as rules for drones are developed and evolve, not just at the end
- Education & Training: Mayors and County Officials believe they and local law enforcement need FAA education and training about drone laws, operations, and issues
  - To help local officials create more effective local drone laws, some would like FAA to provide guidance or help with development of local rules (Note – FAA has been doing so since 2015)
  - To help local law enforcement enforce drone laws more effectively, need to know:
    - What is lawful under Federal laws
    - What is in their jurisdiction
    - When to call FAA
  - To help local governmental agencies use drones more effectively, need to know how to obtain approvals for public operations

Major Concerns

- **Safety, security, and privacy**
  - Significant safety concerns about drones interfering with first responders such as firefighting
  - Privacy identified as both a “real” issue and a “perception” issue; i.e., public perception that all drones are spying on them
- Enforcement
  - Concerns about difficulty of catching errant drone operators
  - Concerns about how to tell good guy from bad guy operator
- **Liability**
  - Liability concerns if local drone laws are passed and bad things happen
  - Liability concerns if local government operates drones for public use and bad things happen
- **Children**
  - Concerns about how to manage drones being operated and registered by children
- Preemption
  - Concerns that state and Federal governments will disregard local needs and issues and override local rules
- Recreational Drones
  - Concerns about lack of legal jurisdiction over recreational operators, and recent court decision about registration

Benefits and Positive Feedback

- Enthusiastic about expected benefits of commercial drones:
  - Financial growth potential for local jobs, businesses, taxes
  - Enhanced convenience and safety for public works, inspections, firefighting, search and rescue, etc.
  - Interested in educating the public about drones in a positive way, to improve public expectations and assumptions
- Eager for drone identification capability:
  - Want inexpensive solutions for local law enforcement to identify and track drones (e.g., smartphone app)
  - Want easy way to tell the difference between types of drone operations (e.g., recreational vs. real estate vs. news gathering vs. firefighting)
- No significant concerns raised about resources and costs needed for drone enforcement:
  - Generally seen as “normal cost of doing business”
  - Some minor concerns raised about cost of training local law enforcement

Differences Between Mayors' and County Officials' Feedback

- County Officials more focused on:
  - Positive aspects of drone current and future potential uses and benefits
  - Concerns about overregulation (national, state, and local)
  - Logistics of clarifying and managing jurisdictional boundaries and differences between laws; examples discussed:
    - Texas state law prohibiting drones from photographing a property without explicit approval by property owner
    - Logistical orchestration of 911 handoffs between jurisdictions
- Mayors more focused on:
  - Concerns about safety, security, and privacy; examples discussed:
    - Firefighting operations suspended because of unknown drones
    - High school football championship game suspended because of an unknown drone
    - Local parades and gatherings affected by unknown drones
  - Concerns about state governments overriding local jurisdictions

Recommendations and Next Steps

- Continued engagement by the FAA and UAS community with local government entities is essential
  - Local officials are eager to be part of making commercial UAS a reality
  - Continuous educational outreach and a sincere attempt to address their on-going issues will improve partnership
- Detailed report is being provided to the FAA

Backup Information

National Association of Counties: Drone Policy Resolution 2016-17

- *Resolution Stressing the Important Role of Counties in Establishing and Implementing Laws and Regulations for Unmanned Aircraft Systems (UAS)*
- *Issue: Counties must have a seat at the table as Congress and the Administration develop and implement laws and regulations relating to unmanned aircraft systems (UAS), i.e. drones.*
- *Adopted Policy: The National Association of Counties (NACo) calls on Congress and the president to consult and work closely with County Officials and other local stakeholders as they consider new legislation and regulations addressing the emerging UAS/drone industry and to permit appropriate local regulations in any new legislation or regulation. We further urge the FAA to allocate additional seats on the Drone Advisory Council to counties.*
- *Approved | July 25, 2016*

U.S. Conference of Mayors Conference: Resolution in Support of Drone Federalism (1 of 2)

WHEREAS, cities recognize that domestic unmanned aircraft systems (UAS), or drones, have many potential benefits and may help improve city services from infrastructure inspection to search and rescue and firefighting, and security at large gatherings to accident investigations; and
WHEREAS, cities would like to harness the innovation of drones and safely integrate this technology into their airspace now and in the future; and
WHEREAS, UAS are significantly different from manned aviation and require different rules since drones take-off, land, and primarily operate in low-altitude airspace extremely close to people, structures and events; and
WHEREAS, UAS operate over very short distances and require information of a local character that cities are best equipped to share with operators and with future autonomous systems; and
WHEREAS, NASA and the FAA are working to develop an unmanned traffic management (UTM) system to manage drones flying in low-altitude airspace, which will require active participation from states and cities to be effective; and
WHEREAS, cities use traditional police, land use, and zoning powers to protect the safety of their citizens, guarantee the enjoyment of their communities, maintain order, and provide for the general welfare; and
WHEREAS, cities have the authority to regulate conduct in public places to ensure safety, such as skateboarding on city sidewalks, using heavy equipment on city streets or permitting large gatherings in public spaces; and
WHEREAS, cities can use their authority to make reasonable time, manner, and place restrictions around First Amendment rights; and
WHEREAS, the local needs of cities vary within and across states and Federal regulators will never have sufficient information or enforcement resources to know when conditions on the ground may make the low altitude operation of a drone unsafe due to local public gatherings, local sporting events or emergency response; and
WHEREAS, drones have interfered with first responders operations, including firefighting aircraft, air ambulance helicopters, and law enforcement helicopters; and
WHEREAS, drones have crashed into power substations leaving entire neighborhoods without power, been used to drop contraband into prison yards, and have flown over large public gatherings, falling from the sky, injuring children and damaging property; and
WHEREAS, it is local first responders, not the FAA, that residents call when drone incidents occur; and
WHEREAS, an integrated regulatory framework is needed so that local regulations complement Federal and state regulations to ensure that the benefits and opportunities presented by drones can be realized,

U.S. Conference of Mayors Conference: Resolution in Support of Drone Federalism (2 of 2)

NOW, THEREFORE BE IT RESOLVED, that the United States Conference of Mayors supports Federal legislation and regulation to allow local governments to participate in the regulation of drones by issuing reasonable restrictions on the time, manner, and place of operation of a civil unmanned aircraft system that is operating below 200 feet above ground level; and

BE IT FURTHER RESOLVED, that the United States Conference of Mayors urges Federal action that provides that the operation of civil unmanned aircraft in the immediate reaches of the airspace above property is not authorized without the permission of the property owner; and

BE IT FURTHER RESOLVED, that the Unites States Conference of Mayors urges the FAA to establish pilot programs with state, local and tribal governments to participate in the development of unmanned traffic management (UTM) so that all drone operators know what the conditions are when a drone can be operated in low altitudes; and

BE IT FURTHER RESOLVED, that the United States Conference of Mayors opposes any efforts to pre-empt local participation in the regulation of low-altitude drone operations.

Approved | June 24, 2016

Disclaimer

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DAC Subcommittee Co-Chair Report

Co-Chairs:
Nancy Egan, *3DRobotics*
John Allen, *jetBlue Airlines*

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Status Report of DACSC TG1 (Roles and Responsibilities)

Co-Chairs:
Dr. John Eagerton, *Alabama DoT*
Brendan Schulman, *DJI*

Task Group 1
Tasking Statement (Reminder)

The (big, audacious, transformative) TASK:

- Develop a set of consensus based recommendations :
  - the roles and responsibilities of federal, state, and local governments in regulating and enforcing drone laws
- Consider and include recommendations regarding:
  - Defining low-altitude UAS navigable airspace susceptible to State/local governmental interests;
  - Relative roles and responsibilities of the Federal, State and local governments;
  - Enforcement;
  - Education;
  - Technological tools and solutions;
  - Local government operational issues

Common Principles

(1) Public Process to support reasonable outcomes for Local UAS Ordinances/Laws

- In order to implement state, local, or tribal time/place/manner ordinances/laws, there must be a public process to support reasonable outcomes. This could include common practices such as advanced hearings and public notices that enable stakeholder input. This process could also benefit from voluntary reporting of these notices to a centralized repository.

Common Principles

(2) UAS Operations Impact on Private Property and Interests

- **Option 1**: If there is a "line," the property/trespass/exclusionary rights aspect should be at a relatively low (or close-in) limit which could be a lower altitude (or closer distance) than a line used for community time/place/manner restrictions. If this "line" is relatively high, the property/trespass/exclusionary framework should be less absolute and more liberal, and include features like exceptions for transient operations, a requirement to show substantial interference (such as in the existing aerial trespass doctrine), rebuttable presumptions, and other protections for beneficial applications that do not generally cause actual harm or nuisance.
- **Option 2**: The 5th Amendment to the Constitution furthered the right to private property by guaranteeing that "No person shall…be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use, without just compensation." The Supreme Court interpreted the 5th amendment in the aviation context to convey to a property owner the right to enjoy his or her property within the "immediate reaches above the land" (United States v. Causby, 328 U.S. 256 (1946)). Further, the FAA has concluded in the context of UAS that "Laws traditionally related to state and local police power – including land use, zoning, privacy, trespass, and law enforcement operations – generally are not subject to federal regulation. Skysign International, Inc. v. City and County of Honolulu, 276 F.3d 1109, 1115 (9th Cir. 2002)." (FAA Fact Sheet, December 2015). Developing a "line in the sky" to define the "immediate reaches above the land" where private property owners hold a property right may assist to provide clarity to property owners and allow UAS operators to efficiently operate in national airspace.

Common Principles

(3) Common Ground Not Applicable to Manned Aviation

- None of this applies to manned aircraft operations.

Common Principles

(4) Take off and Landing

- **Option 1**: Takeoff and landing should be subject to the same framework of reasonable time/place/manner restrictions and the process-based protections above. This requires state and local government to make adjustments to existing zoning authority. Reasonableness would take into account UAS that take off and land at fixed sites such as airports or heliports. There should be greater latitude to operations that take off or land from the UAS operator's private property.

- **Option 2**: State and local governments are the exclusive regulators of land use and zoning. These state and local police powers allow state and local governments to reasonably regulate UAS takeoff and landing within their jurisdiction without limitation.

Common Principles

(5) Initial UAS State and Local Model Policy or Guidance

- Model drone policy or guidance for reasonable time/place/manner (RTPM) restrictions should be created by informed, diverse stakeholders to inform policymaking in a process that is collaborative, appropriate, reasonable, and based on knowledge of the benefits and challenges presented by this technology. However, as every jurisdiction faces different constraints and opportunities, no one model policy will likely serve every community. Development of model drone policy or guidance should come in advance of a new RTPM framework, but it should not unreasonably delay implementation of a new RTPM framework, and therefore must be subject to a reasonable near-term schedule.

Common Principles

(6) Altitude Estimation Challenges

- **Option 1**: The difficulty in judging altitude from the ground raises concerns about enforcement, if there is a "line." There is a compelling interest in development of precise altitude measurement technologies. Also important if there is no "line."

- **Option 2:** In order to facilitate federal, state, tribal, and local regulation and law enforcement of UAS, the FAA should encourage the development of technologies that allow for precise altitude measurement.

Common Principles

(7) FAA's Role in Aircraft Certification

- **Option 1:** In an aviation operational context, FAA is the exclusive regulator of [matters such as]: aircraft design, testing, airman certification, aircraft cert, operator cert, equipage, technology standards, economic regulation, security regulation (other than operational restrictions that are contemplated in a new framework).

- **Option 2:** The FAA is the exclusive regulator of aircraft certification, aircraft licensing, and maintenance of unmanned aircraft systems. State and local governments, through their police powers, are the exclusive regulators of land use, zoning, privacy and trespass. Federal, state, tribal and local governments all have a role in oversight of UAS safety and operations.

Common Principles

(8) Unjust or Unreasonable Discrimination

- The grant/acknowledgement of authority that enables state and local regulation should not unjustly or unreasonably discriminate as to the UAS type, model, owner operator, manufacturer, or purpose of the operation. Likewise, the state and local restrictions should not unjustly or unreasonably discriminate as to the UAS type, model, owner, operator, manufacturer, or purpose of the operation. Justifiable differentiation may be necessary to achieve public interest goals.

Common Principles

(9) Generally applicable state criminal law and state tort law

- In most respects, generally applicable state criminal law and state tort law should not be disturbed. However, to the extent that such generally applicable laws create a carve-out for otherwise unlawful behavior when such behavior is conducted using UAS, such laws will need to be updated.

Comments/Discussion

- TG1 continues to work towards developing consensus recommendations

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Discussion of TG1 Report

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Status Report of DACSC TG2 (Access to Airspace)

Co-Chairs:
Sean Cassidy, *Amazon Prime Air*
Rob Hughes, *Northrop Grumman Corporation*

Agenda

- Background
- Follow-up from 15 Jun DAC SC
- Approved Recommendation 1
- Approved Recommendation 2
- Approved Recommendation 3
- Approved Recommendation 4
- Approved Recommendation 5
- Summary of Report Changes
- Questions

Background

- FAA Tasking
  - Provide recommendations for roles and responsibilities for the UAS, the remote pilot, the operator, and air navigation service provider.
  - Provide recommendations for safe, expedited UAS airworthiness and operational approvals where required, for the various near-term (within 24 month) UAS missions.
  - Provide recommendations on minimum essential aircraft equipage, public/private infrastructure needs, and operational requirements beyond those currently permitted (such as under 14 Code of Federal Regulations Parts 101 and 107) to include information flow and interoperability considerations.
  - Provide recommendations on methods of communications for command and non-payload communications – specifically, how these requirements may vary among the likely near-term UAS missions.
- 70 members (23 voting)
- Process

Assumptions & Guiding Principles → Use Cases → Issues Papers → Review & Balloting → DACSC → DAC

Follow-up Items for DAC & DACSC

- 3 May DAC indicated general approval for DACSC TG2 five draft recommendations with the following exceptions:
  - Urged to change recommendations stylistically to make them more advisory and less directive in nature (FAA Input)
  - Modify C2 technology-specific recommendation (recommendation 3) to be more technology neutral (Industry member input)
- TG2 follow-up edits and balloting re interim recommendations based on 3 May DAC input
  - Webex 5 June to review recommended edits
  - Balloting June 6-8 on revised recommendations
  - 100 percent consented (17 of 23 voting members participating)
- Presentation to DACSC June 15 -- Approved
- Final recommendations prepared for 21 July DAC – Deferred to 8 Nov DAC

Recommendations

(Approved 15 Jun)

Interim Recommendation 1:

- *Addition of clarifying language along with footnote regarding Class B airspace and Mode C veil*
- *Removal of verbiage regarding manned aircraft operation densities*

1. Prioritize sUAS BVLOS operations within the Mode C Veil below 400 ft AGL.

Recommend FAA prioritize BVLOS UAS operations in airspace within the Mode C Veil which includes Class B airspace, below 400 feet AGL, and below the obstacle clearance surfaces (OCS) for either the airport itself or any instrument approach to the airport. Within this volume of airspace, equipage requirements exist for nearly all aircraft, thus enabling cooperative aircraft separation and Part 107 BVLOS and commercial UAS BVLOS operations.

"Mode C Veil" refers to Section 1, Appendix D of 14 CFR 91, Airports/Locations: Special Operating Restrictions. These operating restrictions apply below 10,000 feet MSL within a 30-nautical-mile radius of each location of airports listed in Section 1: https://www.gpo.gov/fdsys/pkg/CFR-2001-title14-vol2/xml/CFR-2001-title14-vol2-part91-appD.xml

Recommendations

(Approved 15 Jun)

Interim Recommendation 2:

- *Stylistic change (from "FAA should" to "Recommend FAA")*

2. Develop technology-neutral navigation performance requirements.

Recommend the FAA establish, evaluate and implement performance-based navigation requirements for low altitude BVLOS operations within the Mode C Veil, the result of which will promote integrated BVLOS airspace operations with shared intent, position data, and other information to help UAS operators/pilots maintain awareness of other aircraft as well as remaining in their approved operating volume.

Recommendations

(Approved 15 Jun)

Interim Recommendation 3:

- *Retitle recommendation heading to remove cellular specific language*
- *Replace recommendation language to incorporate performance based guidance vs more prescriptive cellular/3GPP verbiage*

3. Evaluate the minimum requirements needed to meet low altitude UAS C2 operations.

- Recommend the FAA sponsor a program to evaluate the viability of existing commercial technologies and networks in the context of performance-based C2 (command and control) standards and concepts of operation. The FAA should consider leveraging the work of industry groups.
- As part of this program recommend FAA sponsor an operational prototype that includes different connectivity options including cellular. Within this prototype, the FAA should pursue the opportunity to pull data directly from other industry trials.

Recommendations

(Approved 15 Jun)

Interim Recommendation 4:

- *Stylistic change (from "FAA should" to "Recommend FAA")*

4. Establish a FAR Part 135 regulatory "pathfinder" program for commercial UAS low-altitude (<400') BVLOS operations

- Recommend the FAA create a well-defined pathway, derivative of Part 135 and other related requirements for air carrier operations and operations for compensation and hire, that are specific to UAS and that enable low-altitude BVLOS commercial operations.
- Upon the conclusion of this regulatory pathfinder program, recommend FAA promulgate further guidance in the form of an Advisory Circular and include a Part 135-derivative process path for operational approval.

Recommendations
(Approved 15 Jun)

Interim Recommendation 5:

- *Stylistic change (from "FAA should" to "Recommend FAA")*

5. Beyond 24 Month Timeframe Recommendations

- Recommend FAA conduct an analysis of, at a minimum, FAR Part 91 and Part 77 as a basis for the creation of a new set of operational rules which provide the operational flexibility of Visual Flight Rules, while operating with reference to displays and instruments without natural visual reference to a horizon. This analysis must consider visibility, distance-from-clouds criteria, equipage, and communication requirements related to dynamic operations in Class G and Class E (including "Upper E") airspace, specifically above 400 ft AGL.
- This analysis should also consider the impact of a UTM capable of providing separation between (i) UAS with other UAS and (ii) UAS with other manned aircraft independent of Air Traffic Control.

Summary of DACSC Final Report Changes

- Title Page retitled: "Drone Access to Airspace,"
- Subtitle from "interim" to "final"
- Added paragraph to executive summary statement reflecting the culmination of this process that lead to our recommendations.

"The summary and recommendations reflect an iterative process involving first task group consensus, then DAC SC approval, and finally affirmation by the DAC to ensure the final product is aligned with the input of all those groups. The first set of interim recommendations were presented to the DAC on 3 May 2017 where there was general consensus on most of the items presented with two minor recommendations: First it was recommended we change the tone of the recommendations to FAA and make them more advisory rather than directive in nature. Next it was recommended we modify our command/control (C2) technology-specific recommendation (recommendation 3) to be more technology neutral. Modifications to the draft recommendations were made, consensus was attained within TG2 on the modified recommendations, and final recommendations reported to the DAC SC, which gave its approval on 15 June 2017 and recommended these comprise our final recommendations to the DAC."

- Appended with FAA tasking letter to TG2
- Cleaned up the formatting in the appendix
- Corrected minor grammatical errors

Questions?

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Discussion and Approval of TG2 Report

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THE GOLD STANDARD FOR AVIATION SINCE 1935

Status Report of DACSC TG3 (UAS Funding)

Co-Chairs:
Mark Aitken, *AUVSI*
Howard Kass, *American Airlines*

Refresher and Background

- Future success of the drone industry depends on government and private sector funding to support and facilitate the integration and operations of drones in the NAS.
- The FAA requires new resources to be devoted to this task.
- Task Group 3 (TG3) submitted short term recommendations to the DAC in July 2017.
- Longer term recommendations are due in March 2018.
- We held a listening session for the entire DACSC in July.

Listening Session Notes

- Key issues to address are how to fund and how to organize.
- Should it be a separate agency? FAA people that work on drones consolidated into one agency? Within FAA? Outside?
- Examples of funding constructs
  - National Park Service funded by user fees and annual passes
  - FCC- spectrum are auctioned off to users
  - FDA gets funding from drug companies that want to do trials
- Principles: Make a plan that is equitable; generate revenues to fund FAA to pay for these things; and scalability.
- The purpose of the DAC to foster this industry.
- Right now it's a zero-sum game, every dollar spent on drones is a dollar not spent on manned.
- Use tax for using airspace or on services rendered, could be passed on to end user, proportional and fair.
- Tax could be a based on cost, size, height, weight.

Listening Session Continued…

- Shouldn't be segmented by class of airspace, that's why we have the National Airspace *System*; it is not segmented.
- Registering under 107 is primarily commercial, we could link the two.
- Counterpoints:
  - Taxing a process that already costs a lot will discourage advancement. Part 107 doesn't use the word commercial. Part 107 operators are integrating into NAS. There will be significant resistance, because it's unfair.
  - We're taxing the good guys if we track by the rule. We aren't addressing the bad actors or passive users.
  - We are putting a tax on small business to pay for a dream system for the larger companies that won't start operating until the thing is built, paid for by the little guy.
- User fees also an option.
- Current registration fee pays for the cost of the actual registration system only.
- People receiving services should be paying for those services. It is hard to argue that a real estate photographer under part 107, flying below the trees, receives benefit of the FAA.

Process and Next Steps

- Look at all intended beneficiaries of the system--delivery companies, logistics, utilities, google, telecom, we need to look at all of those when we come up with an equitable plan for funding.
- Look at all funding options:
  - Taxes
  - Fees
  - Auction for classes of airspace within UTM (think FCC spectrum auction)
  - PPPs.
- Consider the organizational structure options:
  - A new mode within DOT
  - A new operational division within DOT with all resources centralize
  - Status quo in FAA current organizational structure, with increased staffing throughout.
- Additional FAA/Industry Briefings:
  - Update on UAS Office Integration Office and FAA-wide UAS activity
  - LAANC/UTM—what it is, timelines, FAA and industry responsibilities, allocation of resources, technology needs, and how it is envisioned to be a piece of a broader UTM framework
  - How the spectrum system is allocated and sold and monetized
- Then we will divide into groups and work through recommendations.

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Discussion of TG3 Report

New Assignments/Agenda Topics

Closing Remarks

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Summary of Meeting and Next Steps

Concluding Items

- Action Items
- Other Business
- Tentative 2018 Meeting Schedule
  - April 11, 2018, Location-TBD
  - July 11, 2018, Location-TBD
  - October 24, 2018, Location-TBD

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Adjourn

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Task Group 1 Common Ground Principles

Development of the Common Ground Principles

TG1 is pleased to present this interim work product to the Drone Advisory Committee Subcommittee. The work product is centered on "common ground" principles developed by the TG after robust discussion among the members as to the roles and responsibilities of federal, state, local, and tribal governments., assuming that authority to impose reasonable time, place and manner restrictions upon UAS operations is provided to an authority other than the Federal Aviation Administration.

These discussions revealed that there were a significant number of points upon which to base consensus. Perhaps most informative was the general conclusion recognized by all participants that there ought to be reasonable time, place and manner regulations implemented at the state or local level, provided that protections were put in place to maximize the likelihood that such a significant change in the regulatory framework for unmanned aircraft would not undermine the safety of the national airspace system, unduly impede innovation, or result in confusing, unreasonable, or unjust restrictions.

1 Public Process To Support Reasonable Outcomes For Local UAS Ordinances/Laws

In order to implement state, local, or tribal time/place/manner ordinances/laws, there must be a public process to support reasonable outcomes. This could include common practices such as advanced hearings and public notices that enable stakeholder input. This process could also benefit from voluntary reporting of these notices to a centralized repository.

2 UAS Operations Impact on Private Property and Interests

If there is a "line," the property/trespass/exclusionary rights aspect should be at a relatively low (or close-in) limit which could be a lower altitude (or closer distance) than a line used for community time/place/manner restrictions. If this "line" is relatively high, the property/trespass/exclusionary framework should be less absolute and more liberal, and include features like exceptions for transient operations, a requirement to show substantial interference (such as in the existing aerial trespass doctrine), rebuttable presumptions, and other protections for beneficial applications that do not generally cause actual harm or nuisance.

3 Common Ground Not Applicable to Manned Aviation

None of this applies to manned aircraft operations.

4 Take Off and Landing

Takeoff and landing should be subject to the same framework of reasonable time/place/manner restrictions and the process-based protections above. This requires state and local government to make adjustments to existing zoning authority. Reasonableness would take into account UAS that take off and land at fixed sites such as airports or heliports. There should be greater latitude to operations that take off or land from the UAS operator's private property.

5 Initial UAS State and Local Model Policy Or Guidance

Model drone policy or guidance for reasonable time/place/manner (RTPM) restrictions should be created by informed, diverse stakeholders to inform policymaking in a process that is collaborative, appropriate, reasonable, and based on knowledge of the benefits and challenges presented by this technology. However, as every jurisdiction faces different constraints and opportunities, no one model policy will likely serve every community. Development of model drone policy or guidance should come in advance of a new RTPM framework, but it should not unreasonably delay implementation of a new RTPM framework, and therefore must be subject to a reasonable near-term schedule.

6 Altitude Estimation Challenges

The difficulty in judging altitude from the ground raises concerns about enforcement, if there is a "line." There is a compelling interest in development of precise altitude measurement technologies. Also important if there is no "line."

7 FAA's Role in Aircraft Certification

In an aviation operational context, FAA is the exclusive regulator of [matters such as]: aircraft design, testing, airman certification, aircraft cert, operator cert, equipage, technology standards, economic regulation, security regulation (other than operational restrictions that are contemplated in a new framework).

8 Unjust or Unreasonable Discrimination

The grant/acknowledgement of authority that enables state and local regulation should not unjustly or unreasonably discriminate as to the UAS type, model, owner operator, manufacturer, or purpose of the operation. Likewise, the state and local restrictions should not unjustly or unreasonably discriminate as to the UAS type, model, owner, operator, manufacturer, or purpose of the operation. Justifiable differentiation may be necessary to achieve public interest goals.

9 Generally Applicable State Criminal Law and State Tort Law

In most respects, generally applicable state criminal law and state tort law should not be disturbed. However, to the extent that such generally applicable laws create a carve-out for otherwise unlawful behavior when such behavior is conducted using UAS, such laws will need to be updated.

Comments on the 4 remaining draft principles by the City of San Francisco, City of Los Angeles, National League of Cities, National Conference of State Legislatures, National Association of Counties, and James Grimsley, Associate Vice President for Research, University of Oklahoma.

Subsequent to the TG1 vote on October 24, the release of a Presidential Memorandum on establishing an Unmanned Aircraft Systems Integration Pilot Program received wide support from the aviation and drone community. This action demonstrates the growing recognition at the federal level of the critical role that state and local governments play in helping to integrate drones into the national airspace

Further, we remind the subcommittee that no consensus position was reached on four of the common ground principles. Although a majority opinion was reached, it was the result of the highly unbalanced TG1 membership as we have previously noted since the beginning of the Task Group.

Below are the joint positions of the state and local members of TG1 for the four common ground principles that TG1 was not able to reach consensus on.

2 UAS Operations Impact on Private Property Interests

The 5th Amendment to the Constitution furthered the right to private property by guaranteeing that "No person shall…be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use, without just compensation." The Supreme Court interpreted the 5th amendment in the aviation context to convey to a property owner the right to enjoy his or her property within the "immediate reaches above the land" (United States v. Causby, 328 U.S. 256 (1946)). Further, the FAA has concluded in the context of UAS that "Laws traditionally related to state and local police power – including land use, zoning, privacy, trespass, and law enforcement operations – generally are not subject to federal regulation. Skysign International, Inc. v. City and County of Honolulu, 276 F.3d 1109, 1115 (9th Cir. 2002)." (FAA Fact Sheet, December 2015). Developing a "line in the sky" to define the "immediate reaches above the land" where private property owners hold a property right may assist to provide clarity to property owners and allow UAS operators to efficiently operate in national airspace.

4 Take off and Landing

State and local governments are the exclusive regulators of land use and zoning. These state and local police powers allow state and local governments to reasonably regulate UAS takeoff and landing within their jurisdiction without limitation.

6 Altitude Estimation Challenges

In order to facilitate federal, state, tribal, and local regulation and law enforcement of UAS, the FAA should encourage the development of technologies that allow for precise altitude measurement.

7 FAA's Role in Aircraft Certification

The FAA is the exclusive regulator of aircraft certification, aircraft licensing, and maintenance of unmanned aircraft systems. State and local governments, through their police powers, are the exclusive regulators of land use, zoning, privacy and trespass. Federal, state, tribal and local governments all have a role in oversight of UAS safety and operations.

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DRONE ACCESS TO AIRSPACE

Report of the Drone Advisory Committee

Final Report – November 2017

Drone Access to Airspace

1. Executive Summary

Task Group 2 (TG2) of the Drone Advisory Subcommittee (DAC SC) was assigned the task of providing recommendations to FAA for near term steps (within 24 months) that will enable new UAS use cases via greater airspace access within the National Airspace System. This report provides five final recommendations as well as insights into the thinking and methodology of TG2 members.

The summary and recommendations reflect an iterative process involving first task group consensus, then DAC SC approval, and finally affirmation by the DAC to ensure the final product is aligned with the input of all those groups. The first set of interim recommendations were presented to the DAC on 3 May 2017 where there was general consensus on most of the items presented with two minor recommendations: First it was recommended we change the tone of the recommendations to FAA and make them more advisory rather than directive in nature. Next it was recommended we modify our command/control (C2) technology-specific recommendation (recommendation 3) to be more technology neutral. Modifications to the draft recommendations were made, consensus was attained within TG1 on the modified recommendations, and final recommendations reported to the DAC SC, which gave its approval on 8 June 2017 and recommended these comprise our final recommendations to the DAC.

2. Background

During its inaugural meeting on September 18, 2016, the DAC members discussed the need to work collaboratively with the FAA to provide consensus-based recommendations on issues related to the integration of UAS into the nation's airspace. Based on those conversations, the FAA requested the DAC's assistance in developing consensus recommendations regarding the operational priorities to achieve full integration of UAS into the NAS. A DAC Task Group was established in November, 2016, under the DAC Subcommittee, and its members worked with the FAA to develop a task statement for this work, which was approved by the DAC during its January 2017 meeting. The FAA requested that the DAC respond with recommendations on some or all the questions posed in its task statement by the May 2017 meeting of the DAC

3. Scope

Federal Aviation Administration (FAA) developed a roadmap to ensure the safe and efficient integration of Unmanned Aircraft Systems (UAS) into the National Airspace System (NAS). During the past several years, the Agency has been fully engaged working across a variety of platforms, multiple types of operations, and different classes of airspace to provide a structured approach to UAS integration. FAA requested the DAC's assistance in developing consensus recommendations regarding the operational priorities to achieve full integration of UAS. The DAC is asked to provide recommendations on UAS operations/missions beyond those currently permitted, and define procedures for industry to gain access to the airspace. These additional operations should be achieved within the next 24 months through a risk-based approach to gaining operational approval and certification based on FAA regulations and guidance. The near-term recommendations should be easily achievable and use existing public/private infrastructure to the greatest extent possible. The Task Group should provide additional recommendations on expanded access for UAS operations/missions that may require public/private infrastructure, rulemaking, and or other changes that would extend implementation beyond the 24-month time frame (e.g. missions/operations in Class-B Airspace requiring interactions with ATM systems).

Important for the Task Group's frame of reference is an awareness that the FAA aircraft certification philosophy is evolving to make it more responsive to rapidly changing technology, using a risk-based approach to accommodate new mission types.

Specifically, the FAA asked the DAC (via TG2) to advise on the following issues regarding airspace access for UAS:

- Provide recommendations for roles and responsibilities for the UAS, the remote pilot, the operator, and air navigation service provider.
- Provide recommendations for safe, expedited UAS airworthiness and operational approvals where required, for the various near-term (within 24 month) UAS missions.
- Provide recommendations on minimum essential aircraft equipage, public/private infrastructure needs, and operational requirements beyond those currently permitted (such as under 14 Code of Federal Regulations Parts 101 and 107) to include information flow and interoperability considerations.
- Provide recommendations on methods of communications for command and non-payload communications – specifically, how these requirements may vary among the likely near-term UAS missions.

The FAA requested final recommendations to be presented at the October 2017 DAC meeting. The complete task statement is included in Appendix a) of this document

4. Assumptions and Guiding Principles

- TG2 will NOT deal with anything addressed by Parts 101 and 107 that does not require a waiver
- TG2 will NOT necessarily result in FAA certification requirements
- TG2 will address how this work relates to work of UTM RTT groups
- TG2 will NOT be vehicle- or design-specific
- TG2 will develop a tiered approach to access based on risk, industry need, and ease of implementation, to determine which categories should be addressed within the next 24 months
- TG2 will develop use cases for these near-term categories and define minimum requirement for airspace access for these cases

5. Methodology

Task Group 2 is composed of approximately 70 members (23 of which are voting representatives) from a cross-section of stakeholder groups with relevant industry experience to include many who have been engaged in planning and implementing various aspects of unmanned aircraft manufacture, application, and operations. They include operators, pilots, controllers, automation providers, technical advisors, and a diverse set of FAA Subject Matter Experts who provided leadership in UAS Integration, Air Traffic Services, NextGen planning, pilot and demonstration programs, and UAS regulatory implementation.

The following is a short summary of the approach and methodology used by Task Group 2 to develop this final report:

Collaborate/Educate

- *Coordinated trajectory, aim points with TG2 members & FAA. Meetings with FAA ATO*

- *Multiple education sessions held with FAA on airspace classifications and access requirements, status of waivers, and certification requirements for commercial UAS operations*
- *Presentations of UAS use cases and assumptions provided for initial consideration*

Build and Leverage Consensus

- Initial consensus reached to focus on two use cases based on market needs, ease of implementation, and safety risk to the NAS
- *Five focus groups created to address issues of:*
    - *Low altitude operations within the Mode C Veil*
    - *Equipage requirements*
    - *Leveraging existing cellular networks for C2*
    - *Operational and airworthiness certification requirements for commercial UAS BVLOS operations*
    - *Future needs for airspace access beyond the 24 month timeframe*
- *Five issue papers generated by focus groups addressing issues above*
- *Balloting held on five issues papers to confirm consensus & highlight outstanding issues*
- *Follow-up and re-balloting conducted, and 100% consensus achieved on all issues papers*

Make Rapid Progress

- *Avoid temptation to "get technical"*
- *Maintain focus on assumptions and guiding principles, timeline & deliverables*

6. Final Recommendations to the FAA

1. Prioritize sUAS BVLOS operations within the Mode C Veil below 400 ft AGL.

Recommend FAA prioritize BVLOS UAS operations in airspace within the Mode C Veil which includes Class B airspace, below 400 feet AGL, and below the obstacle clearance surfaces (OCS) for either the airport itself or any instrument approach to the airport. Within this volume of airspace, equipage requirements exist for nearly all aircraft, thus enabling cooperative aircraft separation and Part 107 BVLOS and commercial UAS BVLOS operations.
"Mode C Veil" refers to Section 1, Appendix D of 14 CFR 91, Airports/Locations: Special Operating Restrictions. These operating restrictions apply below 10,000 feet MSL within a 30-nautical-mile radius of each location of airports listed in Section 1.

2. Develop technology neutral navigation performance requirements.

Recommend the FAA establish, evaluate and implement performance-based navigation requirements for low altitude BVLOS operations within the Mode C Veil, the result of which will promote integrated BVLOS airspace

operations with shared intent, position data, and other information to help UAS operators/pilots maintain awareness of other aircraft as well as remaining in their approved operating volume.

3. Evaluate the minimum requirements needed to meet low altitude UAS C2 operations.

Recommend the FAA sponsor a program to evaluate the viability of existing commercial technologies and networks in the context of performance-based C2 (command and control) standards and concepts of operation. The FAA should consider leveraging the work of industry groups.

As part of this program recommend FAA sponsor an operational prototype that includes different connectivity options including cellular. Within this prototype, the FAA should pursue the opportunity to pull data directly from other industry trials

4. Establish a FAR Part 135 regulatory "pathfinder" program (and draw upon findings from other pathfinder programs) for commercial UAS low-altitude (<400') BVLOS operations

Recommend the FAA create a well-defined pathway, derivative of Part 135 and other related requirements for air carrier operations and operations for compensation and hire, that are specific to UAS and that enable low-altitude BVLOS commercial operations.

Upon the conclusion of this regulatory pathfinder program, recommend FAA promulgate further guidance in the form of an Advisory Circular and include a Part 135-derivative process path for operational approval.

5. Beyond 24 Month Timeframe Recommendations

Recommend FAA conduct an analysis of, at a minimum, FAR Part 91 and Part 77 as a basis for the creation of a new set of operational rules which provide the operational flexibility of Visual Flight Rules, while operating with reference to displays and instruments without natural visual reference to a horizon. This analysis must consider visibility, distance-from-clouds criteria, equipage, and communication requirements related to dynamic operations in Class G and Class E (including "Upper E") airspace, specifically above 400 ft AGL.

This analysis should also consider the impact of a UTM capable of providing separation between (i) UAS with other UAS and (ii) UAS with other manned aircraft independent of Air Traffic Control.

7. Appendices

a) FAA Tasking Statement

b) List of TG2 participants (voting members)

c) Matrix charts of UAS use cases and assumptions

d) Approved Issues Papers

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

Office of the Deputy Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

Drone Advisory Committee (DAC) – Task Group (TG) 2
Recommended Tasking on Access to Airspace
January 31, 2017

ACTION: Topics for discussion and analysis for DAC Subcommittee (DACSC) TG on access to airspace.

SUMMARY: As you know, the Federal Aviation Administration (FAA) has developed a roadmap to ensure the safe and efficient integration of Unmanned Aircraft Systems (UAS) into the National Airspace System. During the past several years, the agency has been fully engaged working toward the integration across a variety of platforms, multiple types of operations, and different classes of airspace to provide a structured approach to UAS integration. Since the agency established the DAC last fall, the aviation community has expressed interest in working with the DAC to develop and provide the FAA consensus-based recommendations on issues related to UAS based on discussion at the DAC's September 2016 "kickoff" meeting, the FAA requests the DAC's assistance in developing consensus recommendations regarding the operational priorities to achieve full integration of UAS.

Specifically, we seek greater input on a range of guidance material, and we believe that the DACSC is an appropriate forum to obtain industry input and perspective. We understand the DACSC, in response to direction from the DAC, has established an Access to Airspace TG. The tasking outlined in this letter is intended to facilitate the DACSC's focused and sequential review of UAS integration/access issues. It is intended that follow-on taskings will be provided as needed for additional focus and direction in order to achieve measurable progress on airspace access issues by the end of 2017.

TASK: Create an Access to Airspace TG to provide recommendations on UAS operations/missions beyond those currently permitted, and define procedures for industry to gain access to the airspace. These additional operations should be achieved within the next 24 months through a risk-based approach to gaining operational approval and certification based on FAA regulations and guidance. The near-term recommendations should be easily achievable and use existing public/private infrastructure to the greatest extent possible. The TG should provide additional recommendations on expanded access for UAS operations/missions that may require public/private infrastructure, rulemaking, and or other changes that would extend implementation beyond the 24-month time frame (*e.g.*, missions/operations in Class-B Airspace requiring interactions with Air Traffic Management (ATM) systems).

Important for the TG's frame of reference is an awareness that the FAA aircraft certification philosophy is evolving to make it more responsive to rapidly changing technology and using a risk-based approach to accommodate new mission types. To facilitate completion of the work, the TG will reference material produced by RTCA, NASA and the FAA; including UAS

operational scenarios, the UAS Traffic Management (UTM) pilot project, Pathfinder progress to date; appropriate RTCA special committee Minimum Aviation System Performance Standards (MASPS)/Minimum Operations Performance Standards for Global Positioning System (MOPS), and recommendations; and the like.

Develop Recommendations

The TG will:

1. Provide recommendations for roles and responsibilities for the UAS, the remote pilot, the operator, and air navigation service provider;
2. Provide recommendations for safe, expedited UAS airworthiness and operational approvals where required, for the various near-term (within 24 months) UAS missions;
3. Provide recommendations on minimum essential aircraft equipage, public/private infrastructure needs, and operational requirements beyond those currently permitted (such as under 14 Code of Federal Regulations Parts 101 and 107) to include information flow and interoperability considerations; and
4. Provide recommendations on methods of communications for command and non-payload communications – specifically, how these requirements may vary among the likely near-term UAS missions.

SCHEDULE: The FAA requests an interim set of recommendations at the May 2017 DAC Meeting, followed by a final report no later than the October 2017 DAC Meeting. The FAA will make subject matter expertise available to the DAC upon request.

FOR FURTHER INFORMATION CONTACT: Victoria Wassmer, Deputy Administrator (A), Chief NextGen Officer and DAC Designated Federal Official, at 202-267-8111.

Issued in Washington, DC, on February 10, 2017.

Victoria B. Wassmer
Deputy Administrator (A), Chief NextGen Officer
and DAC Designated Federal Officer

Task Group 2 Voting Members

Co-Chair Cassidy, Sean	*Amazon Prime Air*
Co-Chair Hughes, Robert	*Northrop Grumman*
Pgm Dir: Chaudhari, Claudia	*RTCA*

Bahrami, Ali	*AIA*
Cleveland, Peter	*Intel*
Collura, John	*UMass*
Cooper, Diana	*Precision Hawk USA*
Egan, Nancy	*3DR*
Guckian, Paul	*Qualcomm*
Hammer, Jonathan	*Noblis Inc*
Heinrich, Rick	*Rockwell Collins*
Lamond, Bob	*NBAA*
Marcus, Ben	*AirMap*
Martino, Chris	*Helo Assoc Intl (HAI)*
McDuffee, Paul	*Insitu*
McNall, Peter	*General Atomics*
Moore, Andrew	*Natl Ag Av Assoc*
Nagle, Margaret	*Google X*
Reed, Mark	*A L P A*
Richards, Jeffrey	*NATCA*
Stone, Bill	*Garmin*
Stull, Tim	*American Airlines*
Thurling, Andy	*AeroVironment*
Walden, Greg	*Akin Gump*
Wright, Steve	*ATAC*

UAS Use Cases and Assumptions

UAS Mission Type	Operations Over People (Public Events)	Rural, Contained Area Operations	Rural, Linear Operations	Suburban/Urban (Dynamic Operations)	Small Cargo (Networked Operations)	Medium Cargo	Large Cargo	HALE
Traffic Management Responsibility	ATC Authorization as Required	- ATC Authorization as Required	- ATC Authorization as Required	- ATC Authorization as Required	- ATC Authorization as Required - FAA procedures and rules for these operations	- IFR operation, under ATC control - FAA procedures and rules for UAS unique issues (e.g., lost link contingency)	- IFR operation, under ATC control - FAA procedures and rules for UAS unique issues (e.g., lost link contingency)	- IFR operation, under ATC control - FAA procedures and rules for UAS unique issues (e.g., lost link contingency)
UAV Automation Responsibility	- None	Ability to detect manned aircraft and notify UAS remote pilot (in non-cooperative airspace)	Ability to detect manned aircraft and notify UAS remote pilot (in non-cooperative airspace)	Ability to detect manned aircraft and notify UAS remote pilot (in cooperative airspace)	- Ability to detect and avoid aircraft, people, and structures (yield right-of-way to manned aircraft) - Ensure safety of cargo carriage and delivery	- Ability to detect manned aircraft and notify UAS remote pilot - Ability to conform to FAA UAS procedures (e.g., lost link contingency procedures)	- Ability to detect manned aircraft and notify UAS remote pilot - Ability to conform to FAA UAS procedures (e.g., lost link contingency procedures)	- Ability to detect manned aircraft and notify UAS remote pilot - Ability to conform to FAA UAS procedures (e.g., lost link contingency procedures)
Operator Responsibility	- Request Authorization - UAS maintenance - Insurance - Remote pilot training	- Request Authorization - UAS maintenance - Insurance - Remote pilot training	- Request Authorization - UAS maintenance - Insurance - Remote pilot training	- Request Authorization - UAS maintenance - Insurance - Remote pilot training	- Develop procedures & infrastructure for UAS networked operations, to be approved by FAA - UAS maintenance - Insurance - Remote pilot training	- File IFR Flight Plan - UAS maintenance - Insurance - Remote pilot training	- File IFR Flight Plan - UAS maintenance - Insurance - Remote pilot training	- File IFR Flight Plan - UAS maintenance - Insurance - Remote pilot training
Remote Pilot Responsibility	- Must avoid aircraft, people, and structures	- Must avoid aircraft, people, and structures (yield right-of-way to manned aircraft)	- Must avoid aircraft, people, and structures (yield right-of-way to manned aircraft)	- Must avoid aircraft, people, and structures (yield right-of-way to manned aircraft)	- Must avoid aircraft, people, and structures (yield right-of-way to manned aircraft)	Follow normal IFR procedures	Follow normal IFR procedures	Follow normal IFR procedures
Other Aircraft Responsibility	- Comply with NOTAMs	- Comply with NOTAMs	- Comply with NOTAMs	- Comply with NOTAMs - Must broadcast own position	- Comply with NOTAMs - Must broadcast own position	- Comply with NOTAMs - Must broadcast own position	- Comply with NOTAMs - Must broadcast own position	- Comply with NOTAMs - Must broadcast own position
UAS Equipage (other than DAA & C2)	Injury Mitigation (e.g. parachute)	Ability to remain within contained area (e.g., geofencing)	Ability to remain within linear area (e.g., geofencing)	Ability to avoid restricted/prohibited areas and airspace (e.g., geofencing)	Ability to avoid restricted/prohibited areas and airspace (e.g., geofencing)	Must meet IFR aircraft equipage requirements	Must meet IFR aircraft equipage requirements	Must meet IFR aircraft equipage requirements
FAA Infrastructure Needs	ATC authorization/ notification capability	ATC authorization/ notification capability	ATC authorization/ notification capability	ATC authorization/ notification capability	ATC authorization/ notification capability	ATC - UAS Pilot Communications	ATC - UAS Pilot Communications	- Flight Plan filing for unique UAS flights - ATC - UAS Pilot Communications
UAS Operator Infrastructure Needs	As needed for operation	As needed for operation	As needed for operation	As needed for operation	- Cleared landing areas at delivery sites - FAA-approved UAS cargo "hubs" - UAS fleet management system	Operator ability to file IFR flight plans	Operator ability to file IFR flight plans	Operator ability to file IFR flight plans
Information Flow	- UAS Operator - FAA (for authorization) - Remote Pilot - UAV	- UAS Operator - FAA (for authorization) - Remote Pilot - UAV	- UAS Operator - FAA (for authorization) - Remote Pilot - UAV	- UAS Operator - FAA (for authorization) - Remote Pilot - UAV	UAS Operator - FAA	- UAS Operator - FAA - Remote Pilot - ATC - Remote Pilot - UAV	- UAS Operator - FAA - Remote Pilot - ATC - Remote Pilot - UAV	- UAS Operator - FAA - Remote Pilot - ATC - Remote Pilot - UAV
Interoperability	Limited	None	Limited	Medium	Significant	Same as manned aircraft	Same as manned aircraft	Same as manned aircraft
CNPC Equipage and Spectrum Needs	Unlicensed spectrum or LTE	LTE	LTE	LTE	LTE?	- Networked radio that meets approved standard - Protected Aeronautical Spectrum?	- Networked radio that meets approved standard - Protected Aeronautical Spectrum?	- Networked radio that meets approved standard - Protected Aeronautical Spectrum?

UAS Use Cases and Assumptions- Consensus Priorities

UAS Mission Type-->	Operations Over People (Public Events)	Rural, Contained Area Operations	Rural, Linear Operations	Suburban/Urban (Dynamic Operations)	Small Cargo (Networked Operations)	Medium Cargo	Large Cargo	HALE
BVLOS	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rule Implementation	Part 107 Waiver	Part 107 Waiver	Part 107 Waiver	Part 107 Waiver	Part 135	Part 135	Part 135	Part 91
All manned aircraft required to broadcast position	N/A	No	No	Yes	Yes	Yes	Yes	Yes at altitude, No during climb
Manned Traffic Density	None	Low	Low	Medium	Medium	Medium	High	Low altitude at altitude
Altitude	< 400 ft	< 400 ft	< 400 ft	< 400 ft	< 400 ft	< 10,000 ft	Class A	> FL600
Weight	< 55 lb	< 55 lb	< 55 lb	< 55 lb	< 55 lb	> 500 lb	> 12,500 lb	> 55 lb
Multiple UAS per pilot	Depends on operation	Depends on operation	Depends on operation	Depends on operation	Yes	No	No	No
Typical Applications	- News gathering parades; stadium events; media coverage; music festivals	- Agricultural Sensing - Bridge inspection, Agricultural mapping; Wildlife observation; Surveying/ inspection	Pipe inspection; advertising over water front; Railway inspection; hiking trail	S&R, News gathering (long distance)	- Package delivery	- Humanitarian Delivery of critical supplies	- Traditional cargo	Comm relay
Industry Need within 24 months	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low
Ease of Implementation within 24 months	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low
Safety Risk	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low	High/Medium/Low

Drone Advisory Committee – Special Committee
Task Group 2: Access to Airspace
Focus Group 1: sUAS BVLOS in the Mode C Veil (DAC SC TG2 FG1)

Introduction

Providing safe Integration to the United States (US) National Airspace System (NAS) for Unmanned Aircraft System (UAS) is an extremely complex endeavor. The Drone Advisory Committee (DAC) was established to develop recommendations to the FAA to enable the integration of UAS into the NAS. TG2 was tasked to identify recommendations for near-term (24 months) increased airspace access for small UAS (sUAS). TG2 considered a number of sUAS use cases based on the three criteria of sUAS industry demand, safety risk, and difficulty of implementation. A key consideration to enabling UAS access is the small UAS rule that became effective on August 29th, 2016. The small UAS (sUAS) rule, Part 107 of Title 14 of the Code of Federal Regulations (CFR) (14 CFR 107), currently regulates UAS weighing less than 55 pounds (sUAS), e.g. to operate during daylight hours within visual line of sight of the remote pilot and not over people. It also provides for unmanned aircraft to operate beyond these restrictions via waiver[1]. 14 CFR 107 does not permit, even by waiver, "the carriage of property of another by aircraft for compensation or hire"; TG2 was informed that the FAA believes the current approval path for these types of "small cargo" operations is under 14 CFR 135 because they are considered air carrier operations. TG2 does not believe new UAS regulations are likely to be published in the near future and thus will focus on solutions that allow operations within the current regulatory framework of Part 107 and Part 135.

TG2 understands the UAS community is primarily focused on using sUAS for operations at low altitudes. After discussion of various UAS use cases, the need to enable operations beyond visual line of sight (BVLOS) was deemed high priority for the UAS industry. Three key challenges face sUAS operating BVLOS: (1) communications between the UA and the remote control station/pilot, (2) separation assurance from other aircraft and hazards and (3) navigation performance. These are often described in the UAS research community as (1) control and non-payload communications (CNPC), (2) detect and avoid (DAA), and (3) containment or geofencing.

FG 2 will be discussing CNPC and communications overall as well as other equipage requirements including navigation/geofencing and DAA requirements. FG 1 is describing a recommendation on which airspace the FAA should focus it's near term efforts and thus is an input to these other focus groups.

Scope

1. Mode C veil[2]
2. Below 400 feet
3. sUAS

[1] 14 CFR 107 Subpart D—Waivers
[2] AIM 3−2−3 (6) Mode C Veil

Assumptions

1. Allow for routine normalized operations
2. A methodology accepted by the FAA administrator as a means to fly BVLOS safely
    a. Flight over people
    b. Detect and avoid other aircraft (including UAS)
    c. Avoiding other hazards

Recommendation

FG1 recommends that in the near-term, FAA focus on sUAS BVLOS operations within the Mode C veil below 400 ft AGL.

The Mode C Veil consists of airspace within 30 nautical miles of the 37 principal class B airports.

TG2 understands that the FAA has a program called Low Altitude Authorization Notification capability (LAANC) to expedite the approval of sUAS under Part 107[3] to operate in Class B, C, D or within the lateral boundaries of the surface area of Class E airspace. This program is based on facility maps around these airports, designating areas that are controlled airspace but have been designated as being acceptable for limited sUAS activity. In particular, areas that are currently controlled airspace below 400 feet AGL but are also below the obstacle clearance surfaces (OCS) for either the airport itself or any instrument approach at the airport could be considered for sUAS operations.

Rationale (Pros)

One significant safety concern for UAS operations BVLOS is collision with a manned aircraft. Therefore, either: (a) the UAS must have an approved DAA system, or (b) the airspace must be segregated between manned and unmanned operations. Therefore, the only practical solution for the Mode C veil, high demand, airspace is the sUAS have a DAA system. Detection of non-cooperative aircraft is a challenging problem that various research and standards groups have worked for more than a decade. While there DAA solutions under development, as of this writing there are currently no methods to detect manned non-cooperative aircraft that are ready for deployment on a sUAS. Within the Mode C Veil, IAW 14 CFR 91.215, all aircraft will be equipped with, at least, a Mode C transponder, thus making it an easier first step. By January 1st, 2020 the vast majority of manned aircraft operating within 30 NM of one of the primary class B airports will be required to broadcast their position and velocity via automatic dependent surveillance broadcast (ADS-B)[4]. These areas are also generally the areas with the most comprehensive air traffic services and ground-based surveillance coverage. This coverage will improve with the full implementation of ADS-B and the FAA's SBS could be leveraged for providing this information to sUAS

[3] 107.41 Operation in certain airspace.
[4] 91.225 Automatic Dependent Surveillance-Broadcast (ADS-B) Out equipment

operations. sUAS operators can use the position information of the manned traffic to remain well clear of those aircraft.

Due to their size and weight limitations, most sUAS have quite limited range/endurance. They must be operated close to their mission area. Based on 2010 Census data, approximately 176 million people or 56% of the U.S. population live and work in metro areas inside the Mode C Veils. These metro areas represent a large customer base living in high density areas for the UAS industry. These areas afford numerous opportunities to serve the public beyond package delivery. Before any BVLOS operations can be authorized for routine use, the FAA must publish criteria for flight over people; without that criteria, in the opinion of TG2, normalized operations of BVLOS is not practical in Mode C Veil airspace.

This recommendation allows for the use of existing 14 CFR 107 and 14 CFR 135 regulations to get near term access to airspace for the UAS industry.

Challenges (Cons)

UAS Operating in urban and suburban areas involves flying over human beings. Identifying a combination of acceptable safety mitigations for operating over people has been a difficult challenge. Clearly, for UAS to operate effectively in these urban and suburban areas, an acceptable combination of aircraft reliability, performance and other safety mitigations must be found to allow for operations over human beings.

While the Mode C Veil requires most manned aircraft to equip with a transponder (and by 2020 with ADS-B, there are exceptions. The requirements for transponder and ADS-B equipage “do not apply to any aircraft that was not originally certificated with an electrical system, or that has not subsequently been certified with such a system installed, including balloons and gliders.” Although few gliders and balloons operate in these urban and suburban areas, this does present a challenge to the assumption that the UAS operator can detect 100% of the air traffic via transponder and ADS-B. It is worth the effort to investigate other means to mitigate the risk of collision with the limited number of these unusual manned aircraft.

Navigation performance of all aircraft (including sUAS) is critical to the safe operations in the NAS. If the FAA follows these recommendations allowing sUAS to operate in the general vicinity of these large airports, the navigation system onboard the sUAS must have integrity. The sUAS must be able to establish acceptable performance of the navigation sensors, the flight technical error, and navigation database assurance. sUAS are subject to the same performance based operations (PBO) standards as manned aircraft for the appropriate class of airspace.

Drone Advisory Committee – Special Committee – DACSC
Task Group 2: Focus Group 2: Equipage Focus Group

Issue Description

As part of the guidance provided by FAA through the Drone Advisory Committee (DAC), Task Group 2 (TG2) of the Drone Advisory Committee Subcommittee (DACSC) was tasked to develop recommendations to the FAA that will facilitate increased near-term (within 24 months) airspace access for UAS into the NAS. TG2 considered several UAS use cases based on industry need, ease of implementation, and safety risk. Consensus was reached by TG2 to focus on low altitude (less than 400 feet) BVLOS operations for two use cases: dynamic suburban/urban operations that require waivers to or permissions beyond those currently provided for under part 107 of the FAR's, and BVLOS networked operations such as small cargo operations.

The equipage focus group was tasked to provide recommendations on the necessary UAS equipage for those operations. We believe that UAS systems used for BVLOS require navigation, information sharing, collaborative detect and avoid, and communications features.

Navigation: Precise navigational performance is required to safely integrate into the NAS. This includes compliance with geo-restrictions, and minimum UTM performance requirements relative to the type of airspace being accessed,

Information Sharing and Collaborative detect and avoid: The scenarios described above are expected to be in higher density areas and in airspace where operational requirements will generally dictate that most aircraft be suitably equipped. Systems must be able to provide a level of separation assurance suitable to the airspace in which they operate. Examples of such technology which could be considered are ADS-B, and V2V collision avoidance systems similar to those being incorporated in the automotive industry.

Communication. There is a separate focus group regarding CNPC (Command and Non-Payload Communication), so the equipage group did not address any required communication equipage.

Influencing Factors

UAS equipage is not a one technology solution. For example, Unmanned Aircraft (UA) utilize a broad range of aids and sensors in navigation such as GPS, visual navigation, ground based navigational aids, ultrasonic sensors, LTE positioning based on ranging signals with "observed time difference of arrival", and many others.

Industry innovation in technologies. Technology is rapidly evolving with new technologies becoming the baseline in consumer and commercial drones providing improvements that would not have been considered feasible just a few years ago. Any approach for performance-based requirements needs to enable innovation and incorporation of new technologies. For example, there have been advances in mobile devices including fusing GPS and global navigation satellite services (GNSS) with GPS augmentation, LTE base station ranging data, and on-device inertial sensors that have resulted in improved mobile position accuracy. Such advances can also be used in unmanned aircraft today.

Support existing operations. Existing Part 107 operations consist of a wide range of aircraft from self-built to large scale manufactured aircraft. Providing a framework that enables the range of operations is important. Manually piloted options in VLOS may not require navigation performance beyond the ability of the pilot to ensure the vehicle remains in a specific fixed location, whereas other use cases such as BVLOS would require the use of some form of ID, navigation and tracking technologies.

Approach

The approach focuses on performance-based standards for operations instead of prescribed specific technologies. Performance-based standards are technology agnostic, enabling industry to continue to innovate and iterate current technologies to improve equipment. Prescribing a set of current technologies could limit industry innovation, increase the cost of aircraft without an improvement in safety, and negatively impact current operations.
For a performance-based standard to be effective, it should also consider the type of operation, phase of flight and operating conditions.
Current Part 107 operations vary widely. We recommend that increased equipage and performance should enable additional airspace access, higher density route planning, and more complex operations such as BVLOS.

Initial Recommendations

1. Enable integrated BVLOS airspace by sharing intent, position data information, and other information that helps operators maintain awareness of other aircraft in the Mode C Veil. Sharing of information should consider navigation performance. This collaborative airspace, involving manned and unmanned aircraft, should incorporate information technology neutral, performance-based requirements.
2. Evaluate and establish performance-based navigation requirements for BVLOS operations in Mode C Veil.

Focusing on technology agnostic, performance-based equipage enables industry to continue to innovate and improve safety while identifying key ways to integrate with the NAS, geo restrictions and collaborative airspace.

DAC SC – TASK GROUP 2

Focus Group 3 - CNPC

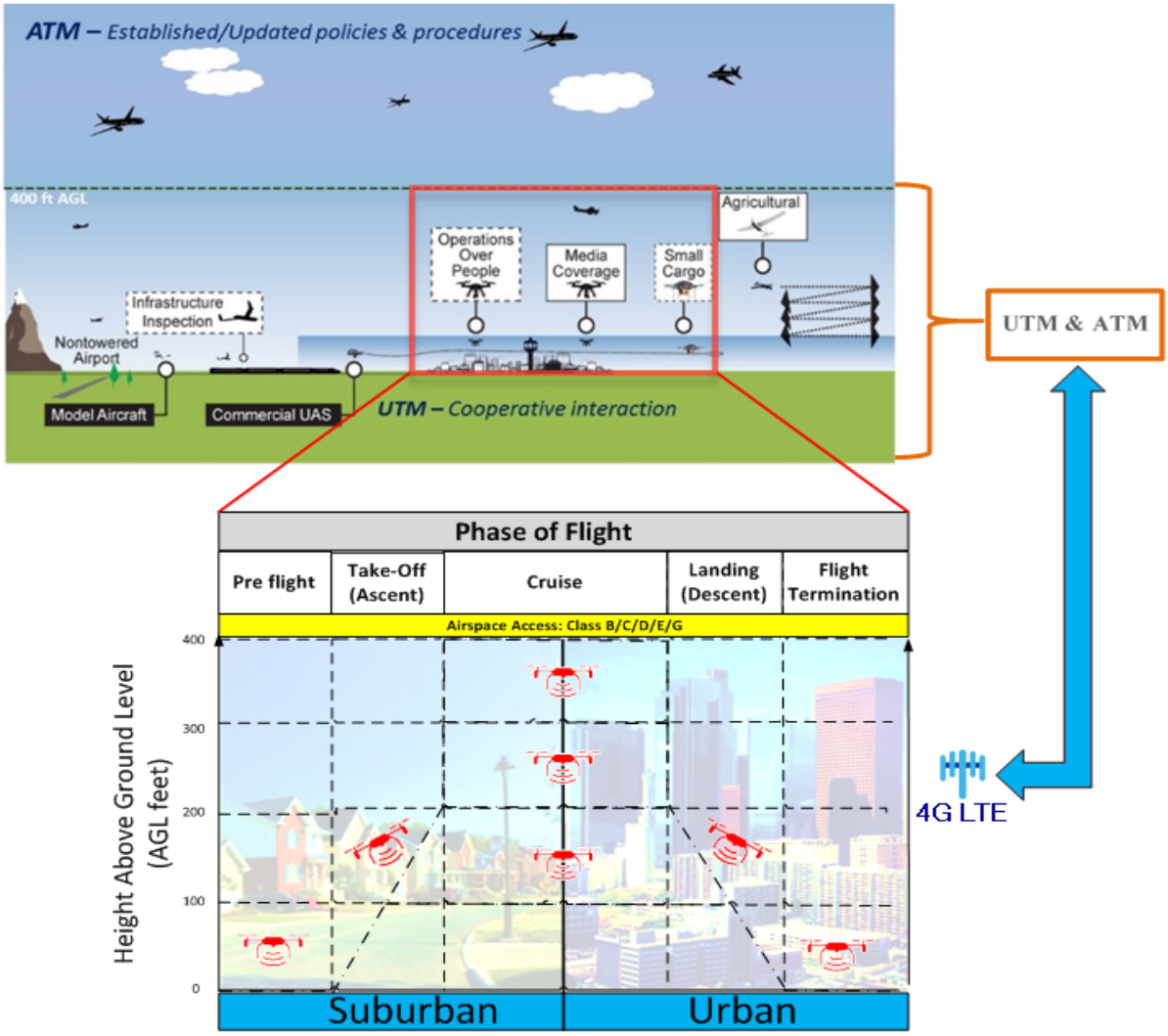
Task: Provide recommendations on methods of communications for command and non-payload communications (CNPC) for UAS operating beyond visual line of sight (BVLOS) in urban and suburban environments at 400 ft. AGL and below

Note: CNPC is used as a general term for describing the connectivity for UAS at 400ft. AGL and below and not intended to align with the definition used in RTCA SC-228

1. Statement of Issue

A UAS operating beyond visual line of sight (BVLOS) in urban and suburban environments at 400 ft. (AGL) and below must have options for connection to a reliable, secure, and cost-effective wireless network that can provide connectivity for data exchange when such connection is required across all phases of flight. This connectivity will provide traffic management systems (UTM and ATM) the ability to provide a centralized management of airspace safety.TG2 identified cellular (LTE) as an option for connectivity that would benefit from a focus group review (FG-3) while recognizing that other UAS connectivity options are being assessed by organizations such are RTCA SC-228 e.g. Satellite. This FG-3 issue paper is intended to examine the viability of the existing commercial cellular network (e.g. 3G, 4G LTE) in providing connectivity for command and non-payload communications (CNPC). The
Use case operation and environment under review is presented in **Figure 1-1.**

Figure 1-1 Overview of Use Case Environment



It should be noted that CNPC is supported through a wide range of connectivity options today (including hybrid models) based on the use case of the operations. This includes:

- Point to Point Command and Control e.g. 2.4 GHz receivers.
  - Commonly used for VLOS, and has range for EVLOS operations and beyond with repeaters
  - Ground control stations may or may not have additional internet connectivity. Commonly available UAS systems utilize an operator phone and/on tablet as the operational display.
  - Point to point cases tend to have the pilot in either direct control (at the sticks) or requires connectivity to make necessary in flight adjustments. Overall a lower level of autonomy.
- IP Based Command and Control e.g. UAS connecting directly to the internet (LTE, WIFI, etc.)
  - Used for VLOS, EVLOS, and BVLOS,

- Assumed internet connectivity and data may be sent to operators over multiple networks, or multiple means of connectivity.
- Utilized by systems that are more latency and loss link tolerant e.g. the vehicle has increase autonomy and may not rely on connectivity to handle many in flight adjustments. For example, loss of LTE connectivity in a backyard during delivery can still result in a safe operation.

This document does not examine other existing or developing connectivity options. The intent of this paper is to assess the viability of the existing commercial cellular networks for the BVLOS operations in suburban and urban environments at or below 400ft AGL.

2. Course of Action

The course of actions described below are already being aggressively pursued across the globe through private, standards, industry, and regulator driven initiatives. The following are examples of industry and standard group interest in UAS (drones):

- 3GPP Study on enhanced Support for Aerial Vehicles
- GSMA Drones Interest Group
- ATIS Unmanned Aerial Vehicles Group
- ASTM F38
- RTCA SC-228
- CTA (R06 WG23 Unmanned Aerial Systems)
- CTIA UAS Spectrum Working Group

Course of Action:

1. Characterize the network performance in rural, urban, and suburban environments providing connectivity to UAS 400 ft. and below and define a minimum performance specification that can support an operator's concept of operations for safe UAS operations in NAS. This requires an understanding of the network performance variance observed across multiple specific instances of each operating environment type.
2. Recommend that communication requirements fully consider the operator's concept of operations.
3. Explore roadmap for Vehicle to Vehicle communications and avoidance including LTE/5G and 802.11p
4. Explore the advantages and disadvantages of deploying additional dedicated UAS/aviation spectrum to augment existing commercial licensed bands for this use.

5. Explore unlicensed/shared band LTE deployments for UAS, use redundant links and bands, local versus wide-area access.
6. Outline UAS roadmap for cellular connectivity: 4G to 5G evolution

3. Influencing Factors

Key factors influencing recommendation for leveraging LTE networks for CNPC:

1. Many BVLOS and Urban/Suburban operations will occur within areas with high LTE coverage
2. Operational requirement for communications vary per use case including which phases of flight require coverage, latency, etc.
3. Timing: Cellular LTE networks are deployed today and operating with high level of reliability and security
4. LTE is based on 3GPP world standard
5. Multimode/multiband chipsets for cellular devices support connectivity options over 2G/3G/4G networks as well as other radio technologies such as Wi-Fi.
6. LTE UAS link performance in terms of latency, reliability, coverage, data rate, UAS density, positioning accuracy, etc. being demonstrated and validated through field trials and simulation
7. UAS device volume and bandwidth need is low compared to capacity of LTE networks
8. LTE services could also be used for UAS payload communications (e.g., sensor control, sensor data downlink). Using the same technology for CNPC and non-CNPC UAS communications could provide cost savings.
9. Cost of entry is low for connectivity and equipment (~$15 LTE Cat 1 Module) given leverage from the massive scale of cellular
10. UAS equipage for LTE + other radio connectivity (2G, 3G, Wi-Fi) is extremely low in weight (4-10g on average, not including battery or antenna(s))
11. Ability to uniquely identify each UAS
12. Ability to handle redundant communication paths e.g. SMS plus data, or two concurrent data sessions with different APNs (Access Point Names). Can also utilize multiple providers to improve coverage.
13. Provides latest evolution for spectrally efficient simultaneous service to multiple devices

Several of these key factors are supported by quality data coming from controlled trials being conducted by many companies. It should be noted that the LTE connectivity performance needs to be considered within the context of system level requirements and is expected to be assessed within an overall risk profile for the given use cases and operational scenarios.

Considerations for Risk Assessment

Security: Security has been a required feature in commercial mobile networks since the digital revolution for ensuring authorized access to service, to protect user communications from eavesdropping, and to prevent unauthorized access to the network infrastructure that could result in service outage. Security protocols involve user/device authentication, key generation, exchange and management, mutual authentication, encryption, and decryption. The security mechanisms developed and adopted in the wireless network standards bodies have benefitted from intense scrutiny by wireless professionals as well as by security experts in industry and academia. UAS systems may add additional layers of security regardless of communication protocols e.g. certifications, encryption, and additional authentication and authorization.

Lost Link: At system level, the link performance needs to be assessed in combination with the UAS autonomous technology (equipage) to determine risk. Cellular performance + autonomous capability = low risk to safety from temporal lost link events. The relevant metric for network performance is "availability" (ability to establish a connection when and where required) not "link loss".

Network Coverage/Reliability: Cellular networks in the US are engineered for massive volumes and cover more than 99% of Americans at approx. 300 million people. 56% of US population resides inside mode C veil. High risk areas are populated and located in proximity to transport infrastructure (e.g. airports). Cellular networks are designed to serve these populated areas with high capacity and high reliability/coverage. There is a strong correlation between high risk airspace environments (controlled from surface) and high risk populated areas with quality of the cellular network.

Rural areas are also well served by cellular coverage, when also considering 2G and 3G services, with UAS benefiting even more from the free space propagation in areas with low blockage such that multiple base stations can be detected by UAS at long distances. UAS, at a distance and at height, can be in the main beam of a cellular base station antenna and can be served by proximity base stations or by base stations > 10 miles away (observed in actual field testing). Rural areas have low blockage in majority of locations (hilly and mountainous regions have challenges) so combined with free space propagation characteristics up to 400 ft. enables high network connection availability. UAS flight paths in rural areas where there are highways and cross country roads are supported by cellular networks deployed to serve the automotive traffic.

Network Capacity: Cellular network capacity has increased to meet the incredible growth in demand. One carrier reported that data traffic grew more than 150,000% between 2007 and 2015 (note: data usage per user very low in 2007)

Protected Spectrum: Cellular networks use licensed spectrum protected under FCC regulations. The operators/carriers purchased this spectrum at a significant cost (billions of $) and implement several metrics (Key Performance Indicators: KPI's) to monitor the use of their spectrum to ensure high-quality service. In the US, there are multiple frequency bands allocated and owned by large operators/carriers such that the networks utilize several bands within any given market. This effectively results in low probability for "jamming" as the user device or UAS has more than one frequency band to use. This is

particularly true for an inflight UAS that is receiving from multiple ground base stations over multiple frequency bands. 5G has been allocated new frequency bands which means that the frequency options for user devices and UAS will continue to increase. Carriers have experience in migrating to newer technology. With the introduction of 5G and additional spectrum resources, the frequency options for user devices and UAS will continue to increase.

QoS – Quality of Service: The term used for the techniques that enable differentiated service level for different users, channels, and/or applications. Not only can messages be prioritized, but channels (called "bearers" in LTE) can be established depending on the latency requirements for the application. QoS mechanisms allow the network to be informed of the application quality requirements, and to adjust data delivery methods to achieve those requirements. For UAS, QoS capabilities can be used to manage different priorities for connections. As an example, a UAS that requires assistance from a ground operator to perform a safety maneuver has a higher priority than a UAS that has already landed. QoS features enable the network to adjust service quality based on dynamic connection priorities to enhance the overall safety of the UAS.

Broadcast and Device-to-Device Features: Advanced features that are being incorporated into standards at present, and could be available in the next few years are LTE Broadcast and LTE-Direct. LTE Broadcast (also called eMBMS for evolved Multimedia Broadcast Multicast Service) can be used for distributing common content to multiple terminals simultaneously. For example, alert/warning/command messages can be sent to a whole fleet or a subset of a fleet quickly and efficiently. LTE-Direct (also called LTE-D) is a technology that supports direct discovery between two devices and ultimately direct communication as well. For UAS, such a direct connection could facilitate high-reliability, low-latency data transfer between nearby UAS enabling collaborative tasks or for collision detection and avoidance.

4. Discussion

Introduction

UAS commercial applications are growing rapidly with some applications now requiring beyond visual line of sight capability (BVLOS), operations over people, and night operations transitioning different environments (rural to urban to suburban) and airspace classes (e.g. Class G to Class B). Like air traffic management and control today, wide-scale deployments of UAS require coordination and traffic management. This will be needed, especially for large fleets of autonomous UAS flying in or near controlled air space (e.g., an airport or military air base).

To perform this management, the UAS must have equipage and a supporting network that allows for connectivity between the UAS and the operator, and the operator to the management system (UTM and ATM when required). LTE commercial networks and LTE-equipped UAS are well positioned to serve this need. Today, there are multiple field trials going on around the globe to evaluate and validate this capability.

Cellular technology (4G LTE and 5G) can bring a new dimension of high reliability, robust security, ubiquitous coverage, and seamless mobility to wide-scale UAS operation. Cellular networks facilitate the operation and control of UAS beyond a pilot's visual line of sight, which will be key to safe, wide-scale UAS operation and the many new services to which UAS open the door. Furthermore, cellular connectivity can enhance autonomous UAS operation safely by enabling and expediting the delivery of optimal flight plans and transmission of flight clearances, tracking UAS location and adjusting flight routes in near real-time.

It is a fact that today's cellular networks are designed to serve smartphones and other ground mobile devices however the actual LTE network deployments result in an RF profile that extends to the low altitudes currently defined for small UAS. Testing by multiple organizations has resulted in consistent finding that UAS are very well-served by the networks even compared to the devices on the ground. In fact, the signals observed by UAS at altitude are significantly more benign than those observed by devices on the ground where clutter, multipath, and blockages are more severe. These line-of-sight conditions for UAS have been shown to produce signals that have smaller variations in power between different locations in the network, and smaller short-term dynamics during UAS flight, simplifying both signal tracking and handover operations while in motion. Various operators utilize cell based communications to manage their operations today.

As the commercial UAS traffic increases, there are opportunities to optimize the LTE networks to better balance the service between ground-based and airborne network users. To deliver optimized performance, it is important for the network to be able to distinguish a UAS from a ground mobile device, e.g. during SIM card registration/user agreements.
The effectiveness of the UAS Traffic Management (UTM) system will depend on scalable communications network(s) to enable new capabilities, such as accurate and reliable UAS tracking, two-way data communications between UAS <-> Operator <-> UTM/ATM, and access to near real-time information for flight-planning, flight authorization, flight reroutes and no-fly zones/emergencies.

Evolution of Network Reliability

Cellular networks have evolved through the different generations to now a 4th generation LTE network that is an order of magnitude more reliable than the previous generation. This is particularly true for the outdoor users. This trend will continue with 5G as a next step in that evolution with a resulting improvement in UAS connectivity performance for more mission critical applications.

Evolution of Mobile Network Technology

To keep pace with demand, the process of developing enhancements to mobile technologies and implementing those technologies in mobile networks continues at a rapid pace. Today, many new technologies are in the pipeline, and here we focus on two primary categories: link enhancements, small-cell deployments and discuss their relevance to UAS.

Link Enhancements

Larger amounts of spectrum are being allocated for commercial mobile networks. New technologies and standards are currently under development to further optimize the use of this spectrum.

First, interference cancellation techniques help receivers to not only reduce noise from neighboring users' transmissions but effectively estimate and erase them from the incoming signal before demodulation.

Second, enhanced multi-antenna methods such as MIMO and beamforming are being designed for use in wide-bandwidth channels that can enable effectively "pointing" of the signals to increase the intended user SNR while reducing interference to other spatially separated users. A new aspect of this optimization is being designed that enables dynamic coordination between base stations as the users they serve move in the network.

Finally, because available spectrum is sometimes in non-contiguous blocks, techniques that allow the aggregation of spectrum in different bands into a single effective channel can significantly increase peak data capacity and speeds. This technique is known as "carrier aggregation". It allows wireless operators to bond spectrum in different bands to create channels that are up to 100 MHz-wide, leading to very high average and peak data rates. Currently, devices already support 40 MHz aggregation in the downlink (i.e. base-to-mobile) and further increases are planned over the next two years including uplink carrier aggregation i.e. link bandwidth from the UAS to ground network/services.

Link enhancements create benefits for all uses (throughput per device, number of devices supported, coverage, etc.). But because signals from ground-air and air-ground propagate further than ground-ground signals, interference can be larger for aviation use relative to terrestrial use. Thus, interference management from cancellation and spatial processing is expected to be particularly beneficial for UAS.

Small-Cell Deployments

Traditional high power base stations deployed on towers called "macro cells" have a coverage area of several kilometers. However, macro cells can be augmented with deployment of so-called small cells, which use much less power and do not need to be deployed on a tower. These small cells include so-called femto cells and pico cells. Small cells cost much less than macro cells and because they do not need to be deployed on towers, they are not as limited by zoning laws.

Another goal for small cells is to facilitate local coverage improvement by enabling simple deployment and activation of a small base station or set of small base stations. These would automatically integrate into the larger wireless network or in an isolated area and could simply provide local wireless connectivity to the wired network (on a remote farm, for example). This would enable a UAS to operate in these locations using the same radios and protocols as existing cellular networks use today.

For UAS, the ability to deploy small-cells easily to enhance coverage and capacity will enable safety and performance improvements in selected geographical areas. Examples include takeoff and landing locations such as delivery distribution hubs, corporate shipping and receiving sites, and battery charging/swap stations, areas of high UAS density including urban environments, and specific mission-focus areas. These small-cell deployments could be semi-permanent, or could be temporary depending on mission needs.

UAS CNPC Link Assessment:

1. Types of data from UAS to Operator:
   - □ Telemetry updates (configurable from 1 update/second to 1 update/minute)
   - □ Health of aircraft (asynchronous events, battery life, maintenance alerts)
   - □ Payload status
   - □ Health of Communications Channel(s)
   - □ UAS traffic management system data
   - □ Sense-and-avoid data
2. Types of data from Operator to the UAS:
   - □ Flight path adjustments (weather, TFR's, Operator driven changes, etc.)
     - Remote operation and take over
   - □ Mission instructions
   - □ Approval for flight route prior to initiating flight

5. Recommendations

The following recommendations should be pursued to validate the use of the existing cellular network (2G/3G/4G LTE) as an option in providing CNPC connectivity for safe operation of UAS for low-altitude applications:

a. The FAA sponsor a program to evaluate the viability of leveraging the existing cellular network as a connectivity option in the context of performance based C2 and concepts of operation. The FAA should consider leveraging the 3GPP work study item (Study on Enhanced Support for Aerial) as an input to this program (e.g. a Minimum Aviation System Performance Standards - ***MASPS***)

b. The FAA sponsor an operational prototype that includes cellular connectivity, via the existing commercial cellular networks, as a C2 option. Within this prototype the FAA should pursue the opportunity to pull cellular connectivity data directly from other industry trials.

Drone Advisory Committee – Special Committee – DACSC

Task Group 2: Focus Group 4: BVLOS Commercial Ops Focus Group

Issue Description

Task Group 2 (TG2) of the Drone Advisory Committee Subcommittee (DACSC) was tasked to develop recommendations to the Federal Aviation Administration (FAA) that will facilitate increased near-term (within 24 months) airspace access for UAS into the National Airspace System (NAS). TG2 reviewed and prioritized a number of UAS use cases based on industry need, ease of implementation, and safety risk. Consensus was reached to focus on low altitude (less than 400 feet) BVLOS operations associated with dynamic suburban/urban operations that require waivers to or permissions beyond those currently provided for under Part 107 of the Federal Aviation Regulations (FARs), and BVLOS Part 135 delivery operations. These were chosen because they are beyond operations currently authorized, and they meet a significant portion of emerging market needs. Focus Group 4 was tasked to provide recommendations on what would be needed from an operating certificate, licensing and airworthiness standpoint to enable networked BVLOS commercial delivery operations.

Influencing Factors

The FAA, in their Aerospace Forecast 2017-37, predicts the commercial small UAS fleet in the United States will exceed 420,000 by 2021, compared to 42,000 in 2016. While there clearly is a pressing demand to determine how to safely accommodate this order of magnitude increase in commercial operations, the pathway is anything but clear. Given the two year scope for our activities, and the very challenging legislative and regulatory environment, we must evaluate all recommendations against the practicality and feasibility of seeking legislative outcomes and/or rulemaking to enable expanded UAS operations. The most pragmatic solution is to focus first on ways to work within the framework of existing rules- mindful of the fact that this activity could very well point to the need for a long term UAS specific solution achieved via new rulemaking.

14 CFR Part 107 “Small Unmanned Systems” specifically disallows waivers to visual line of sight aircraft operation if those operations allow the carriage of property of another by aircraft for compensation or hire. In discussions with FAA, when seeking initial guidance regarding under what operating framework UAS operators will be able to perform BVLOS delivery operations for compensation or hire (barring exemptions to the rule), TG2 was instructed that the most practical way to achieve this for vehicles of any mass- to include those less than 55 pounds in the near term would be to review current guidance found under 14 CFR Part 135 - “Operating Requirements: Commuter and on Demand Operations and Rules Governing Persons on Board such Aircraft,” Part 119 - “Certification: Air Carriers and Commercial Operators,” and other portions of the FAR’s to include pertinent areas of Part 91 under general operating rules. Under this framework, applicants would be required to work categorically through the rule, submit an application to be certified to conduct commercial operations under Part 135 in the case of on demand operations for compensation or hire, and establish an underlying airworthiness basis and licensing requirements that support the terms and conditions of the operating certificate.

Based on this initial guidance we next consulted with the FAA UAS Integration Office and received briefings on airspace classifications and operations from ATO and an overview of the requirements to conduct on demand operations and common carriage operations from the FAA Air Transportation Division's Part 135 Air Carrier Operations Branch (AFS-250). The input from both of these entities within FAA backed up their recommendation that the most viable path forward to enable networked cargo operations would be to perform a thorough analysis of those sections of Part 135 (and other sections of the code) pertinent to operations, and simply begin working through them. Regarding vehicle weights, it should be noted that the focus of this activity was not restricted solely to small UAS, because while Part 107 is currently restricted to vehicles under 55 pounds, no such limitation exists under Part 135.

Approach

Our work is anchored in the need to remain allegiant to the scope of our mandate - namely, referencing the certification pathway for low altitude networked BVLOS operations for compensation or hire as the desired output, and defining realistic and achievable inputs to move towards that goal. A comprehensive review of 14 CFR Part 135 is essential to develop a greater understanding of what subparts would be applicable to networked UAS operations (e.g. Subpart B - Flight Operations), and which would not (e.g. Subpart L - Helicopter Air Ambulance Operations). In reality, the analysis may need to be even more granular. It needs to be which provisions apply, and which do not. In some cases, an entire subpart will apply or not. But, in other subparts, some provisions may be applicable, while others are not. It should also be noted that Part 135 contains by reference other portions of the FARs (for instance Part 119 for pilot qualifications and Part 91 for weather limitations).

Just as Part 107 explicitly lists which portion of the rule are subject to waivers, it is important to also understand which portions of the FAR's impacting UAS applicants' ability to gain operating approvals under the applicable FAR's would be subject to waiver, exemption, deviation, and alternate means of compliance. For instance, would it be feasible that portions of Part 107 could be used to satisfy the requirements for portions of Part 91 or Part 135? Will pilot licensing requirements associated with commercial operations in higher altitude blocks in controlled airspace be required for highly automated commercial BVLOS operations below 400 feet, or will an alternate means of compliance proportionate to the risk profile suffice? It should also be explored how upcoming performance based vehicle certification rules such as the Part 23 rulemaking change will impact applicants' ability to meet design and performance requirements. Will this facilitate a new "permit to fly" airworthiness concept for certain BVLOS operations?

Finally, we should be very realistic with regard to the timelines. The work should be incremental and multi-phased, beginning with a review of those regulations most critical to BVLOS commercial operations (e.g. Part 135), then defining the process by which UAS operations could be approved and, finally, developing a detailed roadmap, for the benefit of applicants, of what would need to be accomplished under current FARs.

We focused on BVLOS below 400 feet as operating in that altitude block mitigates for many airborne risks- especially when those operations are conducted in the Mode C veil, and understanding and establishing

associated risk controls affiliated with these operations facilitates many expanded Part 107 and Part 135 use cases. By placing a particular focus on Part 135 operations, TG2 felt this also solves for many requirements associated with airworthiness, licensing and operational approvals associated with a broad variety of use cases.

Initial Draft Recommendations

1. FAA UAS Integration, Flight Standards and other applicable offices shall provide strategic overview and ongoing updates regarding what they believe are the most effective and timely pathways to enable commercial UAS operations, by category of operations, primarily in a low altitude BVLOS environment. This should include a review of studies and work performed to date.

2. FAA shall prioritize a "Pathfinder" style Part 135 certification research and implementation program to thoroughly review all rules, orders, and Operation Specifications related to UAS operators' ability to obtain commercial permissions for low altitude BVLOS operations for compensation or hire. This should result in a performance based commercial operating certification pathway, derivative of current rules, that that is UAS specific and will facilitate operations below 400 feet (although conditions and limitations associated with each operating certificates defines specific operational limits).

3. FAA shall create a template based on current rules that explains this process path. It should address all applicable rules, airworthiness requirements and the means of conformance for UAS applicants seeking to conduct BVLOS commercial (to include on demand/common carriage) operations. This template could take the form of an Advisory Circular or other guidance that benefits new applicants.

The FAA's 2017 Implementation Plan for Integration of Unmanned Aircraft Systems (UAS) into the National Airspace System (NAS) states that over the next year (2017) it will develop a plan for ultimately enabling small cargo UAS door to-door package delivery and UAS passenger operations, and that this plan is expected to consider issues such as design and airworthiness requirements and equipment necessary to safely implement operational concepts.

In light of near term (within five year) ten-fold commercial UAS growth projections, in order to ensure the safe integration of commercial UAS operations into the NAS we need to first understand the relationship between current requirements and the unique attributes of UAS, next define first steps towards enabling commercial BVLOS operations juxtaposed against current certification requirements, and finally, using Part 135 operations as a representative example, clearly define this process path. The draft recommendations are the first steps in providing pragmatic solutions to safely meeting industry needs in the near term, and defining more permanent solutions over the longer timeframe.

Drone Advisory Committee – Special Committee – DACSC
Task Group 2: Focus Group 5: (DACSC TG2 FG5)
Recommendations for Actions Beyond the 24 Month Timeframe

Introduction

Providing safe access to the United States (US) National Airspace System (NAS) for Unmanned Aircraft System (UAS) is an extremely complex endeavor. The Drone Advisory Committee (DAC) was established to develop recommendations to the FAA to enable the integration of UAS into the NAS. TG2 was tasked to identify recommendations for near-term (24 months) increased airspace access for UAS. TG2 considered a number of UAS use cases based on the three criteria of UAS industry demand, operational risk, and difficulty of implementation. The Committee was also tasked to provide additional recommendations on expanded access for UAS operations/missions that may require public/private infrastructure, rulemaking, and/or other changes that would extend implementation beyond the 24 month timeframe.

Scope

Continued growth and full integration of UAS into the NAS will provide significant economic, societal, and environmental benefits. While the workgroup tasking within the 24 month timeframe will provide significant building blocks in achieving integration, we must continue to identify necessary steps to achieve full integration. Many elements of the current aviation system (infrastructure, procedures, policies, etc.) may need to be modified to support the wide range of new capabilities. This full integration must actively be pursued without undue burden on current airspace users and service providers, and without compromising safety.

Assumptions

The ability to operate UAS Beyond Visual Line of Sight (BVLOS) above 400 ft AGL is required to accommodate the future growth of the industry.

The regulatory change process is slow and requires initiating necessary changes now to keep pace with industry demands.

We are encouraged that the Federal Aviation Administration (FAA) and the National Aeronautics and Space Administration (NASA) are fully committed to the development and deployment of UAS Traffic Management (UTM) as currently defined. Introduction of UTM increases likelihood of some level of air traffic control/traffic management of all air assets operating in the UTM airspace strata. For Visual Flight Rules (VFR) operations, UTM can be used to coordinate and control users that are part of the system, but do not necessarily need to interact with all other airspace users if each UTM participant has some onboard capabilities.

The FAA has informed the DAC that it intends to establish the Controlled Airspace ARC, which will work towards the integration of UAS into Controlled Airspace under Instrument Flight Rules (IFR). Therefore,

the DACSC assumes that this set of UAS use cases for BVLOS operations under IFR are already in the process of being enabled.

The Goal

The goal is a set of operational rules that provide the flexibility of operations under VFR but while flying by reference to displays and instruments without natural visual reference. The existing set of IFR rules is most likely not well suited to handle dynamic operations of UAS conducting aerial work on a routine basis. In practice, we appreciate the need for regulations similar to those currently categorized under IFR, especially Communication, Navigation, and Surveillance (CNS) equipage and obstacle/terrain clearance. Recent work on operational environments and use cases conducted by MITRE and shared with the DACSC acknowledge this gap in the regulatory regime, which is exposed by UAS but may not, eventually, be applicable to airspace users beyond UAS. It is widely recognized that the technology that would fully enable this operational goal for UAS has yet to be fully developed.

The UAS Industry requires access to airspace above 400ft AGL for BVLOS operations in both Radio Line of Sight (RLOS) and Beyond Radio Line of Sight (BRLOS) use cases. It is recognized that while Class G extends up to 1200 ft AGL in general and is limited to 700 ft AGL around airports with Instrument Approach Procedures (IAP), it is not obvious that the limitations of Class G would apply to these flexible operational rules while BVLOS. There should not be functional differences between these UAS flexible operations in Class G vs. UAS operations in Class E.

Recommendations

Undertake analysis of, at least, Part 91 and Part 77 to determine which regulations are applicable and appropriate for UAS operating with the flexibility of VFR while navigating solely based on instruments (i.e. current IFR). This analysis should consider the CONOPS for dynamic operations in Class G and Class E (including “Upper E”) airspace. This analysis should also consider the impact of a UTM capable of providing separation between (i) UAS with other UAS and (ii) UAS with other manned aircraft independent of Air Traffic Control.

Conduct a detailed assessment of current Class G and Class E airspace definitions and equipage and operational requirements. Changes in minimum visibility requirements, cloud spacing, equipage, and communication will all need to be considered. Conducting UAS operations BVLOS with the operational flexibility of VFR will naturally require additional Communication, Navigation and Surveillance (CNS) capabilities beyond those required for VFR operations in Class G and E airspace today, so the assessment should also consider this.

Encourage development of a path leading to airspace access above 400’ to the base of Class E and Class E, both above and below Class A. This is the airspace environment in which the value of UAS operations will reach their full potential. The need is nearly immediate and the challenges are significant. If airspace above 400’ become part of the UTM operational environment, changes to the uncontrolled aspects of Class G airspace are needed regardless of the operational capability of the UAS platform. UAS operations will be mixing with other General Aviation (GA) aircraft, and requirements for separation criteria and

conflict resolutions will need to be developed. Industry must be involved in that process, to ensure that aspects unique to higher altitude operations, especially in Class E airspace above Class A airspace, are captured in the evolution of operating rules.

As we look forward, in addition to dedicated spectrum for CNPC at higher altitudes, the anticipated development of sophisticated detect and avoid technology and the transmission of payload data represent functionalities that will require significant spectrum resources. The TG/DACSC needs to begin identifying the equipage requirements and making corresponding recommendations related to available spectrum resources – including aviation-protected bands, terrestrial-based networks, and satellite communications links – essential to safe integration, FAA certification, and commercial success in this airspace.

Rationale

Airspace access is key to everything that the UAS industry seeks to achieve, but this does not stop at 400 ft AGL. No matter what happens, the introduction of UAS into the NAS will require changes to how aircraft operate in it, at least in the foreseeable future. It should be the role of the DAC to urge the FAA to begin assessing the larger impact on the current airspace definitions and requirements based on the capability of UAS technology as we can reasonably predict it will be in the next 5-10 years.

The development of UTM by NASA and other stakeholders is intended to provide the FAA with a full infrastructure to deploy for low-level operations, thereby not drawing significantly from current limited FAA resources. This infrastructure is dependent upon autonomous operations, a robust computer-based flight management and separation environment, and integrated vehicle identification technology. The extension of the UTM concept to airspace above 400 ft is natural and NASA has already indicated a willingness and interest to port the UTM model to operations in other airspace.

TERMS OF REFERENCE

Drone Advisory Committee (DAC)

Committee Leadership

Role	Name or Title	Organization
Chairman	Brian Krzanich	Intel
FAA Lead	Administrator	FAA
Designated Federal Officer	Deputy Administrator	FAA
Subcommittee Oversight	Director, UAS Integration Office	FAA
Secretariat Oversight	Director, UAS Integration Office	FAA
Secretariat	VP of Aviation Technology and Standards	RTCA
Support	Program Director	RTCA

Background

Unmanned Aircraft Systems (UAS) offer the United States the opportunity to lead a completely new and expanded vision of aviation. The FAA seeks to establish a venue and process to enable stakeholders to advise the FAA on the needs of these new and expanding users of the National Airspace System (NAS) while identifying the strategic regulatory priorities and structure that simultaneously promote innovation, safety, efficiency and rapid integration of UAS into the NAS.

The best mechanism to leverage all the resources, expertise and energy to achieve the FAA and industry's goals of safe and timely integration of all categories of UAS into the airspace, is through an open, transparent venue of a federal advisory committee (FAC). As with all FACs, the Drone Advisory Committee (DAC) will be designed to: ensure transparency, include broad and balanced representation across the industry, encourage innovation and remain consistent with US anti-trust laws.

Purpose and Scope

The purpose of the DAC is to provide an open venue for FAA and UAS stakeholders to work in partnership to identify and recommend a single, consensus-based set of resolutions for issues regarding the efficiency and safety of integrating UAS into the NAS and to develop recommendations to address those issues and challenges. The DAC will also provide the FAA with recommendations which may be used for tactical and strategic planning purposes. The DAC is comprised of executive leaders from key unmanned aircraft stakeholders as well as key stakeholders in the manned aviation community. The DAC will track and report progress and activities of FAA-approved Task Groups, provide suggested guidance for their work, and will coordinate final products for submittal to the FAA Administrator. Each FAA-approved Task Group will have a specific, limited charter that is developed by the DAC and is approved by the FAA Administrator. Unless otherwise stated, Task Groups will be sunset upon completion of deliverables as documented in their respective charter(s). Task Groups may be cancelled prior to completion of specified deliverables in accordance with the terms in their respective charter(s).

Structure of the Committee:

The DAC will conduct its deliberations on recommendations to be provided to the FAA in meetings that are open to the public. To meet the criteria described above, the Committee structure will be two-tiered with subordinate Task Groups (TG) established to develop recommendations and other documents for the Committee.

Adjunct to the DAC is a Subcommittee (DAC Subcommittee or DACSC) comprised of members with broad knowledge and expertise related to the integration of drones into the airspace system. Some meetings of the DACSC will be open to the public to provide an early opportunity to identify potential concerns associated with draft recommendations.

The DAC may establish TGs to accomplish specific tasks as described above. Depending upon the type of tasking, TG products will either be presented to the DACSC for review and deliberation, then forwarded to the DAC or they might be presented directly to the DAC. Members of TGs will be appointed by the DACSC Co-Chairs in consultation with the RTCA President and DAC Chairman and DFO. TG meetings will not be open to the public. For each TG group that is established, the DAC will approve Terms of Reference defining the objective, scope, membership, specific tasks and deliverables with a schedule. Unlike the DAC and DACSC, members of TG do not represent a particular affected entity and are selected for their expertise in the subject matter rather than their affiliation. TG will disband upon delivery of their recommendations as appropriate.

Responsibilities

a) Drone Advisory Committee (DAC)
    1. Overall direction of Committee
    2. Review and approve recommendations to FAA
    3. Field requests from FAA
    4. Review and approve creation of Work Groups, as appropriate
    5. Meet three times per year in Plenary (open to public)
    6. Direct work of DACSC

b) DAC Subcommittee (DACSC)
    1. Staff to Advisory Committee
    2. Guide and review selected work of TGs, present findings to DAC
    3. Meet bi-monthly or as needed (not all open to public)
    4. Forward recommendations and other deliverables to DAC for consideration

c) Task Groups
    1. Created to address specific tasking
    2. May be short-term or standing activities

Intended Use of DAC Outputs

The end goal of the work done by the FAA and industry, in response to DAC recommendations is to lead to the timely, safe and efficient integration of all categories of UAS into the NAS. The output of the committee will inform the FAA of industry consensus on the areas of FAA tasking. Based on the FAA's response to the committee's recommendations, additional tasks could be assigned to the committee, the committee's working groups and task groups, or outside committees and groups such as ARCs, Standards Committees and research organizations.

Membership and Designation

RTCA provides DAC membership recommendations to the DAC chair and FAA Administrator. Final membership selections, including the DAC chair, are at the discretion of the FAA Administrator. The committee is structured to ensure a balance of various UAS and manned aviation stakeholders. Additional members may be added at the discretion of the FAA Administrator. The DAC functions as a Federal advisory committee with meetings that are open to the public, unless otherwise noted as authorized by section 10(d) of the FACA and applicable regulations, with records subject to Freedom of Information Act, 5 U.S.C §552(b).

The DAC will be comprised of CEO/COO-level executives from key UAS stakeholder organizations. The DAC will leverage the RTCA expertise, and state-of-the-art facilities and tools to enable responsive and inclusive coordination across stakeholders with a wide range of philosophical positions and based in many different geographic locations.

To ensure that the DAC brings together the key stakeholders in the integration of UAS into the national airspace system, DAC Membership recommendations should include the following considerations:

a) Who are the stakeholders of the UAS Community?
b) What are the areas of interest for the UAS Community?
c) Membership must be fairly balanced in terms of the points of view represented and the functions to be performed by the advisory committee
d) Membership must be justifiable to the public and elected officials.
e) In addition to the above requirements DAC membership must have the following characteristics:
f) Executive level membership who can speak for and commit their organizations

g) Flexibility to reach out to necessary segments of the aviation community to answer specific requests from the FAA
h) Membership may not exceed 35 voting members, unless approved by the FAA Administrator
i) Ability to partner with other UAS stakeholders through substantive dialog and the capability to reach timely consensus on recommendations
j) Appropriate expertise as reflected in the following areas of interest:
    1) UAS Manufacturers (all sizes)
    2) UAS Operators (all sizes)
    3) Drone Hardware Component Manufacturers
    4) Drone Software Application Manufacturers
    5) Traditional Manned Aviation Operators
    6) Airports and Airport Communities
    7) Labor (controllers, pilots)
    8) R&D, Academia
    9) Local Government
    10) Navigation, Communication and Surveillance and Air Traffic Management Capabilities Providers
    11) Other specific areas of interest as determined by the Administrator

Other stakeholders might be added later if appropriate. Non-voting members selected by the Administrator who may attend as observers and have access to the committee's online workspace managed by RTCA, will include:

1) Other Federal Agency personnel
2) Other FAA personnel

Ongoing Tasking – Development of Recommendations

DAC recommendations must:

- Inform the FAA of consensus industry positions on specific topics that will advance UAS integration into the NAS.
- Increase safety, security, system capacity, and efficiency
- Be consensus based and articulate required resources
- Define requirements for joint private/public partnership activities

As with any federal advisory committee, the FAA is not obligated to act on any of the DAC's recommendations. However, the FAA will issue written response for DAC recommendations within 60 days of receipt. FAA's response to DAC recommendations may result in the establishment of Aviation Rulemaking Committee(s) to address rulemaking requirements, the assignment of specific activities to Task Groups through the DAC, or other actions as approved by the FAA Administrator.

Considerations and Questions for the development of DAC recommendations

DAC recommendations should include the criteria or address the questions listed below:

a) Must be actionable, with a specific stated recommended outcome or end state
b) Must include an accurate and comprehensive characterization of the suggested capability or policy development; provisions for the "use of service" or "concept of operations"; and the FAA's role (e.g. provide service, qualify service providers, have a "hands off" approach)

c) Are the operational concepts flexible enough to apply to a broad range of business applications?
d) Will the recommendation inform the development of minimum performance standards?
e) Will the recommendation impact safety, efficiency, manufacturing, or innovation?
f) What are the interoperability concerns, among competing technologies and between industry automation and FAA automation?
g) What is the duration or longevity of the proposed recommendation?
Whether additional rulemaking makes sense for the community

Operating Norms

- The charter for the DAC will be for a two-year term and may be extended or revised at the discretion of the FAA Administrator. If the Administrator elects not to renew the DAC charter at the end of the two year period, the DAC will terminate.
- The term of the DAC chair will be for two years; the chair may be invited by the FAA Administrator to serve multiple consecutive terms.
- DAC Committee members are appointed for two-year terms. Members may be invited by the FAA Administrator to serve multiple consecutive one-year terms after the initial two-year term. Members may also be removed from the DAC by agreement between the DAC Chair and FAA Administrator.
- The FAA DFO, DAC Chairman, and RTCA President will review DAC Committee membership yearly to ensure balanced representation that equitably represents, to the extent feasible, the UAS stakeholder community.
- Membership is based on the ability to represent the interests of an organization or constituency authoritatively and effectively.
- The DAC will be expected to meet schedule deadlines and members will be expected to work toward consensus to the greatest extent possible. The DAC will follow RTCA guidance for handling dissenting opinion(s). If consensus is not reached within the timeframe dictated for each product, the DAC shall document majority and dissenting recommendation(s) and deliver to the FAA UAS Board.
- The DAC will hold at least three plenary meetings per year (open to the public), as well non-public preparatory telecons to ensure continuity and good preparation for public meetings
- Task Groups meet as specified in their individual charters.
- As appropriate, Task Groups will reach out to individual experts and other outside groups to assist in developing UAS integration related recommendations

DAC Subcommittee (DACSC) Oversight

The Director of the FAA UAS Integration Office will oversee the DAC Subcommittee and will function as the liaison to the FAA lines of business that have key roles to play in the integration of UAS into the NAS.

Secretariat

- The FAA's UAS Integration Office will oversee the execution of DAC Secretariat functions
- RTCA will function as the Secretariat for the DAC and any Task Groups and will work with the FAA's UAS Integration Office and others within the FAA, including the DFO or the UAS Board, for scheduling meetings, assembling agenda(s), taking meeting minutes, keeping records on

costs, coordinating meeting logistics, and publishing of Federal Register Notices and meeting minutes.

- Proposed agenda items with approximate duration are to be submitted to Secretariat at least 30 days prior to the scheduled date of a meeting. The Secretariat, in consultation with the UAS Integration Office, the DAC Chair, and the DFO, shall refine the scheduled duration of the meeting and promulgate the meeting agenda to the Committee members.
- The Secretariat will also coordinate the writing and approval by both the FAA and the DAC Chair for any media releases or public statements.
- RTCA will maintain an online workspace to facilitate the consensus process of the committee. Content of the DAC workspace will include calendar, roster, documents created by the DAC, documents under review, background materials for meetings, meeting minutes among other things. Workspace will also be used to facilitate document review and commenting in the final stages of the consensus process.

Conduct of Meetings

- Advisory Committee members will receive all information needed to prepare for the meeting (e.g., Task Group progress reports; Task Group products and recommendations for Committee action) at least fifteen (15) calendar days prior to the meeting from the DAC Secretariat
- With the exception of routine administrative items, agenda items will generally be supported by written reports or formal briefing material as appropriate.
- In accordance with the Federal Advisory Committee Act, meeting summaries and related information will be available to the public via RTCA's website. Documents undergoing final review can be obtained by contacting RTCA. Members of the public may also submit comments on documents undergoing final review.

External Coordination: The DAC will consult with and consider the work of the following groups (at a minimum) to avoid overlaps and gaps:

- NASA UTM Program
- NASA "UAS in the NAS" Program (for validation and verification support as appropriate)
- Other FAA ARCs as appropriate or directed by the FAA
- Other RTCA Special Committees, e.g., SC-228
- Other Standards bodies tasked by the FAA
- Inter-agency SARP
- FAA UAS Test Sites
- FAA Pathfinder Program
- FAA Center of Excellence for UAS (COE UAS)
- UAS ExCom
- Other Task Groups or Teams established by the FAA
- Others as appropriate

Drone Advisory Committee (DAC)
July 21, 2017 Meeting Minutes

List of Attachments

- Attachment 1: Attendees
- Attachment 2: Agenda
- Attachment 3: Presentations

Summary

The July 21, 2017 DAC Meeting was a virtual meeting, with several members attending at RTCA headquarters, 1150 18th Street, NW, Suite 910, Washington, DC 20036. The DAC received presentations from two Task Groups (TGs): TG1 – Roles and Responsibilities and TG3 – Unmanned Aircraft Systems (UAS) Funding. TG2 – Access to Airspace – did not present at this meeting. The co-chairs of TG3 presented a summary report of TG3's interim recommendations, including the background of the tasking statement as well as the guiding principles, methodology, and workflow used to develop the interim recommendations. TG3 leadership also outlined the next steps for refining the interim report into the final report to be delivered in November. The DAC also heard from TG1 on the status of evaluating State or local government interests that could form the basis for recommendations to the DAC for future Federal Aviation Administration (FAA) action. These actions are related to the relative role of State and local governments in regulating aspects of low-altitude UAS operations. The meeting discussions are summarized below.

Designated Federal Officer Statement

Dan Elwell, Deputy Administrator and Chief NextGen Officer, FAA

The Designated Federal Officer (DFO) statement was read by FAA Deputy Administrator Dan Elwell at 11:02 AM.

Chairman's Remarks

Brian Krzanich, CEO, Intel

DAC Chairman Brian Krzanich welcomed everyone to the virtual meeting and expressed his hope that the virtual meeting format would not be a hindrance to communications. He thanked the out-going DFO, Victoria Wassmer, for her service and welcomed incoming DFO Dan Elwell to the DAC. He then

thanked the rest of the FAA executive team for their guidance and assistance to the DAC Subcommittee (DACSC) and TGs, and finally he thanked the TGs and DACSC for their progress to-date.

Chairman Krzanich briefly recounted the events that led to the virtual DAC meeting, starting with the January 31, 2017 DAC meeting held in Reno, Nevada, where the TG1 and TG2 tasking statements were approved by the DAC. Since TG3 received their tasking statement after the January 31, 2017 DAC Meeting, this supplementary July Meeting was added (after the already-scheduled May 3, 2017 DAC Meeting) to the schedule to give them more time to prepare their input for the DAC. Chairman Krzanich said the DAC would hear updates from TG1 to make sure they are going in the "right direction," in preparation for the November 8, 2017 DAC Meeting, and would hear from TG3. TG2 would report their recommendations in November. Chairman Krzanich reiterated that the virtual meeting was to ensure the November meeting would be as productive as possible. Note: RTCA provided instructions for participants on the virtual call to be recognized by Chairman Krzanich.

Approval of Minutes from Previous Meeting

The minutes of the previous meeting were unanimously approved as distributed.

RTCA Remarks

Margaret Jenny, President, RTCA, Inc.

Margaret Jenny introduced the incoming DFO, Dan Elwell. Mr. Elwell was with the FAA under the Bush Administration from 2006-2008 as the Assistant Administrator for Policy and Environment. After that, he was in Vice President positions at the Aerospace Industries Association (AIA) and Airlines for America (A4A). He has over 6,000 hours as a military and commercial airline pilot, with over 20 years of flying experience. He also served as a legislative fellow for the late Senator Ted Stevens (R-Alaska). Most recently, he served as Secretary Chao's (DOT) Senior Advisor on Aviation. He was sworn in as the Deputy Administrator on June 26, 2017, and is the new DAC DFO.

FAA Remarks

Dan Elwell, Deputy Administrator and Chief NextGen Officer, FAA

Mr. Elwell thanked Ms. Jenny for the introduction. He stated that he knows many of the committee members. He echoed Chairman Krzanich's thanks to Victoria Wassmer for her service as the FAA's Acting Deputy Administrator and previous DAC DFO. Mr. Elwell thanked Ms. Wassmer, Ms. Jenny, and those who have dedicated their time and energy to the DAC. He stressed that his previous work with the FAA and other organizations has highlighted the importance of listening. He indicated his eagerness to hear about the work of the TGs during the meeting and noted the recommendations being developed by the DAC will be an important factor in the unmanned aircraft policies that the FAA will institute, and

that the importance of the work being done by the DAC cannot be overstated. The FAA will build on the DAC's work presently being done and the work to be done in the future. Mr. Elwell mentioned that the Aviation Rulemaking Committee (ARC) for identification and tracking of drones during flight met for the first time on June 21, 2017. This ARC has formed three working groups: 1) existing and emerging technologies, 2) security and law enforcement, and 3) implementation. The FAA expects to receive recommendations from the ARC by September 30, 2017. The FAA has also signed a charter for an additional ARC that will help prioritize activities to integrate drones successfully into controlled airspace. These actions come as Congress, in both the House and Senate chambers, considers legislation that addresses unmanned aircraft. This underscores the importance and timeliness of the work being done by the DAC and the ARC, which has implications at the very basic levels of government and even at the constitutional level (interpretively).

TG3 – UAS Funding Report Out

Mark Aitken, Director of Government Relations, AUVSI, and Howard Kass, Vice President of Regulatory Affairs, American Airlines

Chairman Krzanich thanked Mr. Elwell for his remarks and invited the leadership of TG3 to make their presentation. Co-Chair Mark Aitken began by thanking the DAC for the opportunity to report their interim (near-term) recommendations for UAS Funding. Because the team briefed at the last DAC meeting, it was expected that today's presentation would go quickly. The second phase of the task will be focused on longer-term funding activities.

Mr. Aitken presented TG3 assumptions and guiding principles:

1) There will be a combination of government, industry, and shared funding across the integration efforts.
2) Options for funding should not be constrained by the current traditional aviation funding structure, although in the near-term, a new model may be difficult to implement.
3) The recommended funding structure should not alter the current structure of funding for traditional, manned aviation.

TG3 used "Decision Lens" to rank all FAA UAS activities against a common set of criteria. The key take-away is the criteria that were decided upon by the team. The top criteria were safety among UAS operators, for people and property on the ground, followed by enabling UAS operations, and finally, economic benefits.

The team examined activities that the FAA conducts to integrate UAS into the airspace safely. TG3 was challenged by having to look across many lines of business within the FAA for their work. The prioritization exercise did not result in a large difference among ranked priorities. This led the group to

believe that all priorities are (relatively) of equal importance in achieving the goal of safe UAS integration.

TG3 reported that they had divided the group into teams that considered their prioritized results to define the short-term government, industry, and collaborative efforts to fund these activities, and then provided written (draft) recommendations. The reports were circulated and discussed, and consensus was reached on the recommendations. The groups also considered the following recommendations from TG2 to ensure there was common guidance across all three TGs:

- Prioritization of UAS beyond visual line of sight (BVLOS) operations within the Mode C Veil below 400 feet above ground level (AGL).
- Development of technology neutral navigation performance requirements.
- Evaluation of the ability of existing networks to meet low altitude UAS Command and Control requirements.
- Establishment of a 14 Code of Federal Regulations (CFR) part 135 regulatory pathfinder program for commercial UAS low-altitude BVLOS operations.
- Recommendations for a timeframe beyond 24-months.

TG3s interim recommendations, as reported, are:

- All regulations, policies, and standards necessary in the next 24 months should be developed primarily by the FAA with significant industry input. Congress should appropriate additional funding and increase FAA staffing to address this ambitious work schedule.
- The research and development, and system development necessary in the next 24 months, should be shared between government and industry.
- Communications, outreach, and training necessary in the next 24 months should be shared between government and industry, depending on the activity.
- Any recommended funding structure should not alter the current structure of funding for traditional, manned aviation.
- In the future, the UAS industry may be expected to pay for the operation, maintenance, and modernization of an automated Unmanned Traffic Management (UTM) system through a yet-to-be-created “pay-for-what-you-use” funding model.

Co-Chair Howard Kass stated that the regulatory framework is already underway to enable the commercialization of drone operations. Several ARCs have been established, and the FAA has held several meetings with other government agencies on the topic of UAS integration. These inter-agency meetings have included counter-drone discussions.

Mr. Kass noted that the FAA would normally carry the burden of cost for development of the policies and standards for drones, but the team believes that industry has a role to play in helping to pay for this activity. He observed that exciting work is underway in systems engineering and research and development (R&D). The industry has considerable experience conducting R&D and many activities can

be leveraged from these efforts (e.g., infrastructure build-out). The government track record in R&D is inadequate and so this may be an area where industry and government can collaborate, with industry leading the activities necessary to implement technology for the integration of UAS.

Outreach and training is an area where the FAA and industry both have extensive experience. As such, both government and industry will both have a role to play in paying for the outreach and education of their traditional constituents.

Mr. Kass acknowledged the efforts of Congress to aid in funding FAA activities in the Fiscal Year (FY) 2017 FAA Reauthorization Bill. There is concern that an FAA reauthorization bill will not be approved and enacted before the end of September 30, 2017.

Mr. Kass then described the future activities for TG3. At the May 3, 2017 DAC Meeting, the DAC instructed TG3 to divide its activities into near-term (24-month horizon) and long-term (5-year horizon). The long-term questions are more complicated, such as cost accounting measures. TG3 will consider options and identify self-sustaining and scalable funding sources. They will consider both government and industry funding sources. Further, they will work to identify a funding option for the UAS industry that is segregated from the mechanisms that funds manned aviation (it could be similar in structure, but they won't cross-pollinate). TG3 is cognizant of the possibility of far-reaching structural and governance changes that could affect the funding for UAS integration. The group will consider new sources of funding for the long term, including user fees, taxes, and/or similar pay-for-what-you-use services. Lastly, Mr. Kass reported that on July 14, 2017, the TG3 had a "listening session" to discuss long-term issues. It was open to the entire DACSC for as many options and voices to be expressed and heard. A priority issue that surfaced in addition to funding, was that the structure of the FAA will have an impact on the integration of UAS into the National Airspace System.

Ms. Jenny offered specific thanks to FAA's Aviation Policy and Plans Executive Director Nan Shellabarger for extraordinary assistance in educating and assisting TG3 on how the FAA budget works, as well as the intricacies of fees and taxes. The co-chairs agreed wholeheartedly with that recognition and offered their thanks as well.

Question: Did the team think about establishing a UAS Trust Fund similar to the Airport and Airways Trust fund?

Response: That will be addressed in the long-term focus work that will be tackled next, but has been mentioned in past discussions.

Question: It appears that the team is looking at the manned aviation funding and recommending changes to that mechanism as opposed to developing a whole new one. With Air Traffic Control

privatization efforts underway in Congress, has the team considered how its recommendations might be altered if privatization becomes reality?

Response: The team was very sensitive to possible structural change within the FAA. They intend to keep that possibility as a "reality" that any ideas must be weighed against. Given the uncertainty of the effort, nothing could be recommended against it.

Question: What are the team's thoughts on the manned aviation funding mechanism of today and trying to have an effective change on those? Is that where we're heading versus just concentrating on how the initiative for integration of UAS are going to be funded and leave the manned funding alone right now?

Response: The team's focus is looking at the unmanned space.

Question: The concept of "pay as you go", assumes there is a service to which an operator must be connected. If you break funding into: what is required to operate automated systems below 400 feet; no interoperability with manned aviation; what policy making, governance, and auditing is required to be in place; when interoperability is required between manned and unmanned aviation, that requires funding on FAA side. Decouple funding from architecture discussion. Industry may be better suited to introduce other architectures that are cheaper, more quickly.

Response: These comments align with why TG2 was consulted – fee for service models will be dictated by available services and those required to operate (i.e., command and control communications services). Additionally, scalability of operations plays an important part. Part 107 is only the tip of the iceberg for what commercial operators would like to see implemented. It will be hard to justify paying for services that aren't available or tie in to ATC services that are not allowed in the operational environment. As we get a better understanding for what's on the immediate regulatory horizon, it will help frame what should be pursued for funding.

Comment: Clarify: funding should be driven by the technology capabilities and the scenarios rather than what funding looks like in today's system. The concept of segregation and integration should be understood that many DAC members believe in deeply integrating one set of standards for everyone in the air. The concept of separation of these activities is not a good idea. We may need tasking statement clarifications or high-level tenets to ensure this is maintained.

Response: As the team looks to all sizes of UAS, leading to full integration will help to inform the work stream (along the 5-year mark). The work done by TG2 will inform the work of TG3.

Comment: There was a reference to operations below 400 feet with no interaction with manned aircraft – helicopters operate below 400 feet routinely and will need the interaction.

Comment: Chairman Krzanich complimented the team on a great job and great progress, and is looking forward to the discussion in November.

TG1 – Roles and Responsibilities Report Out

Brendan Schulman, Vice President of Policy and Legal Affairs, DJI Technology and Dr. John Eagerton, Chief, Aeronautics Bureau, Alabama Department of Transportation/National Association of State Aviation Officials (NASAO)

Chairman Krzanich called upon TG1 to provide a status update on their efforts. Co-Chair Brendan Schulman apologized on behalf of Co-Chair Dr. John Eagerton who was unable to attend the meeting due to a prior commitment. Mr. Schulman led the presentation for TG1 and briefed the DAC members on the history of the tasking statement and progress made since the May 3, 2017 DAC meeting. Since May, the team has incorporated guidance received from the DAC, namely, to set aside work on enforcement for now and focus more on roles and responsibilities task item. He reported that RTCA has added new member and observer participants (local/state government). The TG has conducted three days of in-person TG meetings (May 25 and July 10-11) and a conference call (June 14), and held extensive discussions on governing models (local, State, or Federal) based on altitude. Observing the number of public observers at this meeting, Mr. Schulman invited new members to join to help work on the TG's interesting and complex work.

Specific actions taken to inform the issues being worked included development of a "matrix" of existing roles and responsibilities ("This is a creative exercise – don't look at what exists today but on creative solutions that may not resemble today's reality."), fact gathering from two additional law enforcement subject matter experts, and an altitude drone flight observations "field trip."

TG1 continues to work towards developing consensus recommendations against their tasking. The discussion is spirited and thoughtful. The group's timeline will proceed with urgency, and work to deliver initial recommendations by the November 8, 2017 DAC Meeting, with further guidance from the FAA and DAC as to what is most useful.

Question: There was discussion at the last DAC meeting introduced by the local government representative, Mayor Lee, about a local representative's feelings that they were not being heard in the TG1 discussions. Have you worked with the mayor to develop a process to collect their comments?

Response: Mayor Lee's representative has been added to the TG. There are also efforts to reach out to the National League of Cities (NLC). When we started the DAC, it was very important to not meet just 3 or 4 times a year, but that there should be interaction and discussions outside of the DAC meetings (through subcommittee and TG meetings) and that has been taking place.

Question: American Legislative Executive Council – State Legislators discuss local issues. Which national state organization might exist that might be consulted? State legislators represent a great educational opportunity.

Response: We have engaged the National Conference of State Legislatures (NCSL), the National Association of Counties (NACo), and have a member of the Rhode Island legislature on the TG. Also, NASAO is represented as the co-chair on the TG.

Comment: The DFO requested information on who existed on the TG and who was added.

Response: RTCA took the action to provide the roster and history of the membership of TG1.

Comment: A member observed he is currently at the NACo convention and is participating in a MITRE effort to coordinate and educate NACo members.

Reponses: RTCA clarified that this is not an RCTA initiative and we have received no feedback on this or a similar initiative by MITRE, MIT, and FAA at the Miami Beach, FL U.S. Conference of Mayors (USCM) annual meeting.

Response: Mr. Schulman mentioned he will be on a panel at the NCSL Legislative Summit in Boston, MA.

Comment from a representative of Mayor Lee: Mayor Lee was unable to participate in the virtual DAC meeting and sent a representative. The representative mentioned they were only observers on the TG. Mayor Lee wanted to reiterate his commitment to focus on local authority to make reasonable time/manner/place restrictions in low altitude airspace to ensure public safety. He remains concerned about privacy and ensuring broader input in the discussion from partners such as law enforcement agencies and other local government representatives. The desire is to have an equal, one-to-one representation of local government to industry members. The mayor introduced a resolution at the USCM Transportation and Communications Committee meeting that there are calls for State and local authority to regulate time/manner/place of drone operations within 200 feet of the ground. That resolution was approved by the USCM and was sent to Congress and the Administration as part of the USCM policy agenda. It received bipartisan support. He has encouraged fellow mayors to reach out and express their concerns so they can be passed on to the FAA.

Response: Ms. Jenny made a point of clarification that the mayor's representatives were added as members of the TG originally but were asked to be made observers only. She further went on to say that RTCA was very happy the mayor was undertaking an outreach and look forward to hearing from anyone who wished to become engaged. We have discussion in general about the difficulties securing resources to be involved that makes it difficult for cities to be actively engaged. We will be looking at

other innovative ways to get that input and how often and for how long the group meets. The mayor's office has given us good feedback which we are relaying to the TG leadership to accommodate that more balanced TG membership. This is a challenging work-in-progress.

Comment: The mayor is member of the DAC and is trying to engage other mayors, but the time commitment to take part in the TG is too great for most mayors. RTCA is encouraged to find additional mayors.

Response: RTCA has been in discussion with a few elected officials and also talking to associations that represent cities and mayors. It is good to have large cities represented (like Mayor Lee's), but to get the engagement, we may need to rely on mayors of smaller cities who may have more time available to support the DAC.

Any local or state government has been offered an opportunity to join. Sometimes associations (e.g., NLC or NCSL) can devote someone if the city or state cannot. Most associations have been offered a position but have declined. This TG has a variety of stakeholders that represent many disparate interests – manned, unmanned, airports, etc. Virtual meetings aid in allowing distant persons to attend.

After the conclusion of the TG1 discussion, the DAC revisited the TG3 presentation to accept the group's interim report formally. Chairman Krzanich called for any last comments on TG1's presentation, and there was none. He then called for additional comments and motion for acceptance of TG3 material. A motion to approve TG3's update was made and seconded, and was adopted with no objections.

New Business

A call for new business was made by Chairman Krzanich.

Question: Given the uncertainty with the 2018 FAA reauthorization, is it appropriate, and is there a need, for long-term funding, or to have someone advocate for the DAC to allow continued work in the future?

Response: To reword the question, as the legislation moves forward is there a placeholder in there for UAS? That would be considered as part of the TG3's work, and they will account for the FAA funding overall in the development of their recommendations.

In terms of a placeholder, in the House version of the FAA bill, there is a section asking for a report out on these types of funding issues. TG3 remains mindful of what is happening in the bills as they go forward.

Dates and Agenda (if known) for Next 2 Meetings

November 8, 2017: Seattle, WA.

Action Items

Action	Responsible Party	Schedule	Status
ACTIONS OPEN FROM PREVIOUS MEETING			
RTCA to summarize the comments received for each TG and submit for their review and consideration.	RTCA	ASAP	CLOSED
TG1 re-look at priority 4 (State and Local Interest In and Response to UAS) with more attention.	TG1	July	CLOSED
RTCA to help identify DAC members who wish to assist in addressing county and city conventions, and to assist in defining what output can be produced that will benefit the two conventions; and work with DAC member Mayor Lee's office and Robert Boyd to get on the agendas.	RTCA	On-Going	OPEN
RTCA to coordinate a webinar for SC-228 that can be reviewed by all DAC members.	RTCA & SC-228	ASAP	CLOSED
NEW ACTIONS			
RTCA to send a roster of the government attendees to the DFO including add-date.	RTCA	July	CLOSED

Closing Remarks

Chairman Krzanich expressed his thanks to the members for their preparation and participation. He believes that the committee is well-positioned for the November meeting.

Mr. Elwell also thanked the TGs for their time, hard work, and participation in the meeting. He expressed appreciation for the work being done on the country's behalf in this new technology. There are many activities involving UAS happening in Washington DC, and the FAA is providing assistance to Congress as the reauthorizations bills before them are worked. Between now and November 8, 2017, there may be new things to incorporate into the committee's work and the FAA looks forward to the next meeting and report of progress. On Administrator Huerta's behalf, he thanked all the members.

Ms. Jenny observed the extraordinary work of TG2, who although they did not report during this meeting, has submitted their final report to the DAC for review in November.

The meeting was adjourned at 12:35 PM EDT.

Attachments

Member Attendance

Agvent, Greg	CNN
Boyd, Robert	Riley County, Kansas
Canoll, Tim	Air Line Pilots Association (ALPA)
Chasen, Michael	Precision Hawk USA Inc.
Chaudhari, Claudia	RTCA, Inc.
Egan, Nancy	3D Robotics
Elwell, Dan	Federal Aviation Administration (FAA)
Gilbert, Trish	National Air Traffic Controllers Association (NATCA)
Gomez, Martin	Facebook
Graetz, Todd	BNSF Railway
Greene, David	Wisconsin Department of Transportation, Bureau of Aeronautics
Hanson, Rich	Academy of Model Aeronautics
Hartman, Ryan	Insitu Inc.
Isom, Robert	American Airlines, Inc.
Jenny, Margaret	RTCA, Inc.
Kimchi, Gur	Amazon Prime Air
Kirov, George	Harris Corporation
Krzanich, Brian	Intel
Mattai, Nan	Rockwell Collins, Inc.
Mills, Houston	United Parcel Service (UPS)
Mora, Marily	Reno-Tahoe Airport Authority
Ryals, Lillian	The MITRE Corporation
Schulman, Brendan	DJI Technology
Secen, Al	RTCA, Inc.
Straub, Phil	Garmin Ltd.
Wynne, Brian	Association for Unmanned Vehicle Systems International (AUVSI)
Zuccaro, Matthew	Helicopter Association International (HAI)