Unmanned Aircraft System (UAS) Integration

Overview and Perspectives

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The Challenge

UAS integration is not just about creating new rules, policies, and processes...

Volume
- New UAS entering the NAS
- New users joining the aviation community

Pace
- Technological innovation
- Regulatory, policy, and procedural changes

High demand on FAA time and resources
Growing Commercial Interest

The New Aviation Community

Data
at&t
verizon

Infrastructure
CISCO
Intel
QUALCOMM

Operators
OPEN for BUSINESS
BNSF RAILWAY

Tools
DJI
3DR
AIRROBOT

Operators
Google
Amazon

Federal Aviation Administration
Traditional Aviation Industry

- **211,804** Aircraft
- **593,499** Pilots

- **Certificated Airmen**
- **Registered Private Aircraft**
- **Registered Commercial Aircraft**
Small UAS Registration (Dec-Apr)

- 3,800 registrations PER DAY
- 425,653+ UAS users in 4 months

Week 1: 108,342
Week 2: 163,359
Week 3: 203,355
Week 4: 245,830
Week 5: 299,796
Week 6: 328,265
Week 7: 340,471
Week 8: 371,975
Week 9: 391,705
Week 10: 405,244
Week 11: 411,672
Week 12: 425,653

Federal Aviation Administration

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UAS Model Aircraft

Source: FAA Aerospace Forecast (2016-2036)
Small UAS (non-model) Fleet

Thousands of Units

2016 2017 2018 2019 2020

33 101 196 352 542

2492 2555 2620 2686

Low Forecast
High Forecast

Reality is somewhere in here...

Source: FAA Aerospace Forecast (2016-2036)
UAS Integration Strategy

Path to Full UAS Integration

1. Managing NAS Access
   - Concept Validation (Pathfinders, CACI)
   - Policies & Procedures (Pathfinders, COE, ExCom)
   - Small UAS Registration
   - Industry Standards (Micro UAS ARC)

2. Performance-Based Regulatory Standards
   - Minimum Operational Performance Standards (MOPS)
   - Research Results (Test Sites, COE)

Operator Certification Only

Aircraft + Operator Certification

Least Complex Operations

Most Complex Operations

Least Complex UAS

Most Complex UAS
# FAA UAS Activities

<table>
<thead>
<tr>
<th>1. Manage NAS Access</th>
<th>2. Provide Minimum Standards</th>
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<td><strong>UAS Advisory Committee (DAC)</strong></td>
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| **UAS Center of Excellence**  
*Research informs development of procedures for airspace access and performance standards* | |
| **UAS Registration**  
*Informs airspace management by creating traceability* | **UAS Test Site Program**  
*Operational data, research, concept validation to inform regulatory framework* |
| **Focus Area Pathfinder Program**  
*Informs policies and procedures for managing airspace access* | **FAA Research Portfolio**  
*Operational data, research, concept validation to inform regulatory framework* |
| **UAS Detection at Airports**  
*Informs policies and procedures for managing airspace access* | **RTCA Special Committee 228**  
*Developing Minimum Operational Performance Standards (MOPS) for Detect and Avoid (DAA) and Command and Control (C2)* |
| **Low Altitude Airspace Access (e.g. UAS Traffic Management System – UTM)**  
*Informs policies and procedures for managing airspace access* | **Part 107 Rule**  
*Sets minimum operational standards for routine non-hobby UAS operations* |
| **UAS Executive Committee (ExCom)**  
*Streamlines airspace access for federal UAS operations* | **Micro UAS Aviation Rulemaking Committee**  
*Will inform development of a performance standard for operations over people* |
Managing NAS Access

**Risk/Complexity**

- Integrated Operations
  By Full Performance-Based Rules (Class A/B/C/D Ops)

- Segregated Operations VLOS
  – Over People / High Density

- Segregated Operations – VLOS Over People / Low Density

- Segregated Operations By Rule 107 – VLOS Class G

- 333/336 Ops – Segregated Operations By Waiver/Exemption

**Functionality Over Time**

- Identification, Location, and Intent
- Communication
- Transit Controlled Airspace (UTM)
- Schedule (UTM)
- Notification
- User Provided
- Static Identification
- VLOS

- Fly like an aircraft
- ADS-B
- Command and Control
- Detect, Sense and Avoid

- Integrated Class A,B,C,D Airspace
- UAS ATM Integration
- UAS Traffic Management
- Fly autonomous
- Security
- UAS Info Management
- Registration
System Safety – The Safety Continuum

- Too little rigor:
  - Safety escapes
  - Fatal accidents increase

- SEEK:
  - Establish appropriate balance in our regulatory approach
  - Achieve safety objectives while imposing the least burden on society.

- Too much rigor:
  - Innovative safety enhancements don’t reach the fleet
  - Finite dollars that could be spent on safety enhancements go elsewhere
  - Fatal accidents increase

Risk of accidents due to inadequate safety program
Risk of accidents due to lack of safety innovation

Risk

Extent of Safety Effort

+ Total Risk

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Rulemaking Approach
Increasing Operator Certification

Societally Acceptable Risk & Desire for Low Cost

Less Demand

Public Demand for Safety Assurance

Absolute Safety

Society’s Demand for Safe Outcomes

Rulemaking Approach
Increasing Operator Certification

< 0.5 lbs. (Hubsan X4) < 1 lbs. (DJI Phantom) < 2.5 lbs. (DJI Phantom) < 4.4 lbs. (3DR Solo) < 55 lbs. (Scan Eagle) < 1,000 lbs. (Hunter) > 2,000 lbs. (Predator) > 12,500 lbs. (Global Hawk)

< 0.5 lbs. (DJI Phantom) < 1 lbs. (Parrot Bebop) < 2.5 lbs. (DJI Phantom) < 4.4 lbs. (3DR Solo) < 55 lbs. (Scan Eagle) < 1,000 lbs. (Hunter) > 2,000 lbs. (Predator) > 12,500 lbs. (Global Hawk)
Focus Area Pathfinder Operations

Pathfinder 1: CNN

Pathfinder 2: PrecisionHawk

Pathfinder 3: BNSF

Ops over People

EVLOS Ops

BVLOS Ops
Developing Operating Standards

- **Mature Standards**: Includes specific FAA airworthiness and operations limitations (e.g., package delivery).
- **Generic Standards**: Industry-based (e.g., real estate photography).
- **Least Potential Risk**: Low-risk, segregated.
- **Most Potential Risk**: NAS and public safety.
- **Level of FAA effort to approve UAS operations**
- **Degree of integration**
- **Full UAS integration**
- **Part 107 Expansion**
- **Sec. 333**
- **Micro**
- **Part 107**

- **Large UAS / high energy output**
- **Small UAS / low energy output**

- **Within VLOS or segregated operating area**
- **Beyond VLOS or populated operating area**
Key 2016 Milestones

- ASSURE Program Management Review
- UAS COE Research Expo
- UTM Research Transition Team Kick-off
- Proposed COE Research Reviewed by AVS TCRG*
- UAS Symposium
- ASSURE Program Management Review
- AUVSI Xponential
- FAA/NASA UTM Quarterly Review
- Advisory Committee Meeting
- Results of Initial COE Research Projects Due
- Final Command and Control (C2) MOPS**
- Final Detect and Avoid (DAA) MOPS**
- 2017 Business Plans Start
- FAA/NASA UTM Quarterly Review
- Draft EVLOS** Policy
- UAS TAAC 2016

- Micro UAS ARC*
- Expanded Part 107 Rulemaking Plan Approved
- Micro UAS ARC* Final Report
- Part 48 Commercial Registration
- Part 107 Final (expected)
- Begin Drafting Part 48 Final Rule
- Begin Part 107 Waiver Processing
- Micro UAS NPRM^
UAS Strategic Planning

- FAA Strategic Initiatives
  - UAS Mission Statement
    - UAS Strategic Plan
      - Strategic Priorities
        - Implementation Plan
          - UAS Budget Effort
            - LOB, S/O Business Plans and Budget Planning
            - UAS Civil Integration Roadmap

Filled boxes = public documents
UAS Strategic Priorities

- **Safety**: Enable safe UAS operations within the NAS
- **Adaptability**: Create an environment where emergent technology can be safely and rapidly introduced into the NAS
- **Global Leadership**: Shape the global standards and practices for UAS through international collaboration
Meeting the Challenge

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**Pace**
- Technological innovation
- Regulatory, policy, and procedural changes

Internal and external coordination, communication, and collaboration