

# Unmanned Aircraft Systems

## Center of Excellence - General Aviation

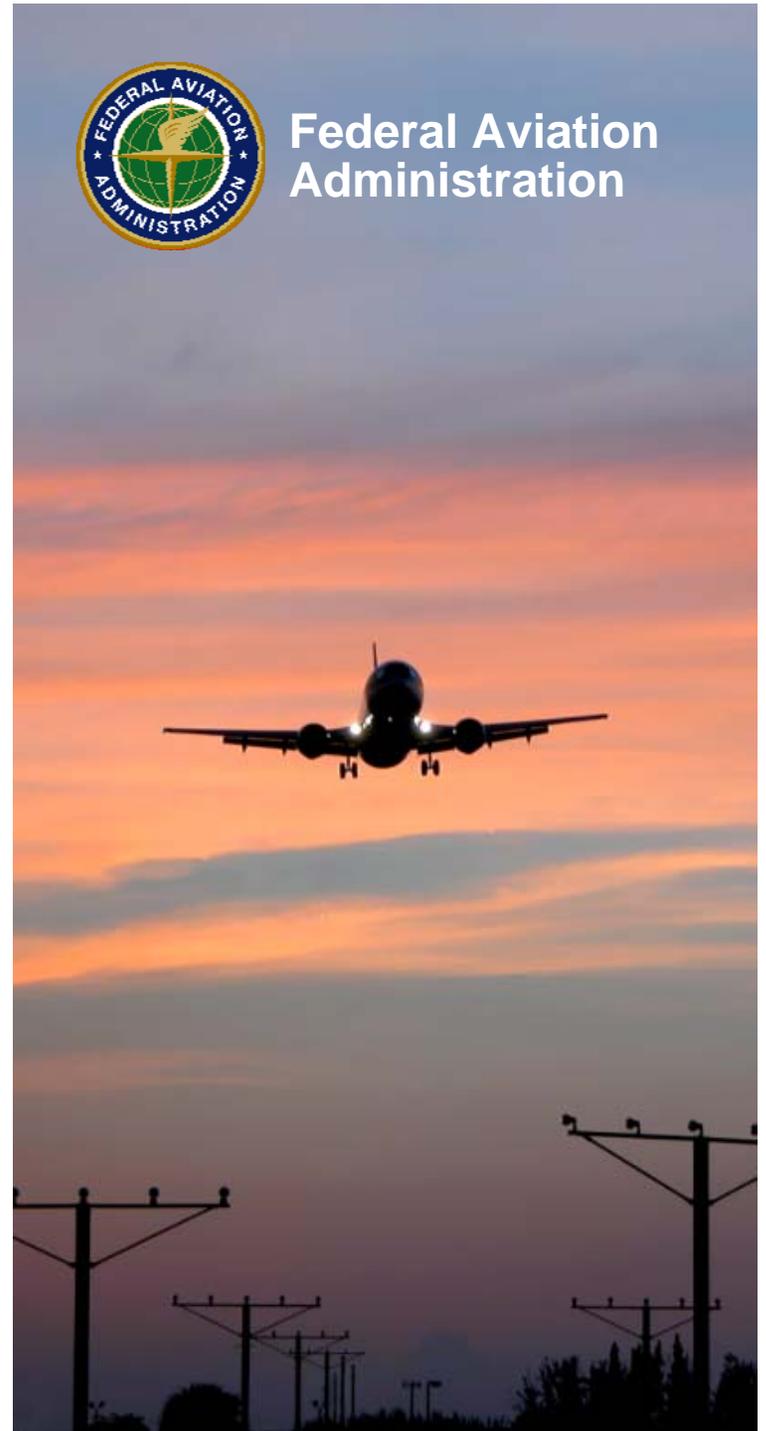
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Federal Aviation  
Administration

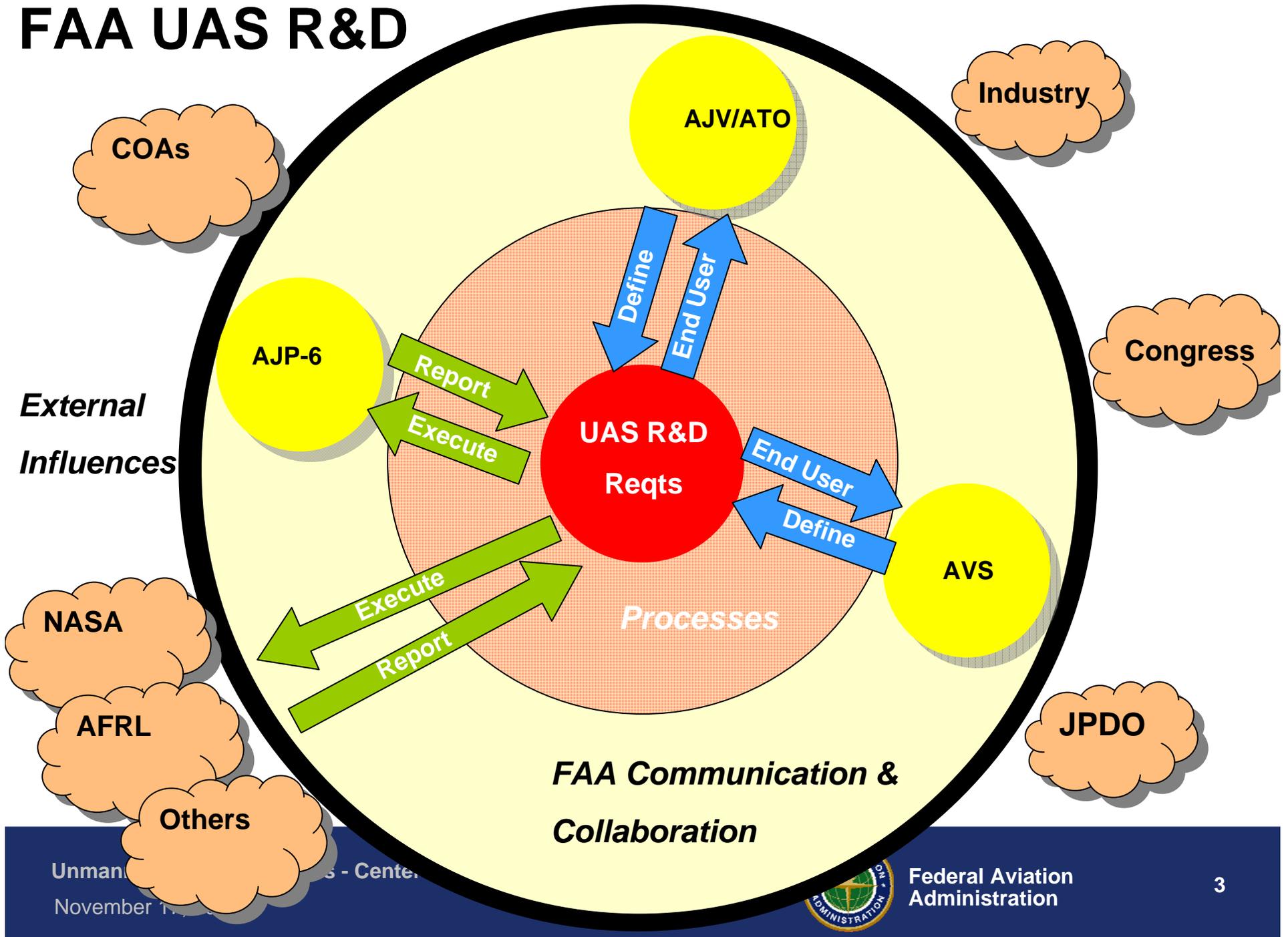


# FAA UAS R&D Overview

- **FAA organizations with unique UAS R&D needs**
  - Unmanned Aircraft Program Office, AFS-407
  - Unmanned Aircraft Systems Group, AJV-13/ATO
- **FAA R&D execution**
  - Research and Technology Development, AJP-6



# FAA UAS R&D



# AFS-407 UAS R&D Roles

- **Objectives**

- Establish and oversee UAS requirements on UAS research
- End-user of research products for regulatory development
- Ensure alignment of research efforts and products with ongoing UAS regulatory and policy development

- **Activities**

- Rulemaking, policy, and standards development
- Participate in development of FAA's UAS ConOps
- Define and manage critical areas of Aviation Safety (AVS) research
- FAA Civil UAS Roadmap



# AJV-13/ATO UAS R&D Roles

- **Objectives**

- Responsible as the Air Traffic Organization (ATO) focal point, advocate, and facilitator to develop ATO policy, guidance, and procedures for the safe integration of UAS into the National Air Space (NAS) today and the NextGen transformation.

- **Activities**

- Define ATO aspects for incorporation in FAA Civil UAS Roadmap
- Define and manage ATO critical areas for research
- Develop appropriate Air Traffic operational guidance, procedures, and training for UAS integration in the NAS



# AJP-6 UAS R&D Roles

- **Objectives**

- Execute UAS research based on established requirements
- Coordinate requirements levied from external sources with UAS offices
- Ensure alignment of research efforts and products with ongoing UAS work
- Actively engage AVS and ATO during all phases of UAS research execution

- **Activities**

- Executing UAS research programs and tech transfers
- Managing UAS research partnerships, including grants
- Leading development of FAA's UAS ConOps



# UAS Path Forward

1. **Accommodation** – Ability to take current UA and apply special mitigations and procedures to safely facilitate limited access to the NAS.
2. **Integration** – Establishing threshold performance requirements for UAS that would increase access to the NAS.
3. **Evolution** – All required policy, regulations, procedures, technology and training are in place and routinely updated to support UAS operations in the NAS.



# UAS Integration into the NAS

- **Maintain/Improve NAS safety levels while accommodating UAS user needs**
- **Define requirements that will drive research**
- **Define research that will refine requirements**
- **Focus is on Safety, Air Traffic, and regulatory research**



# AJP6 UAS Research Areas

- **Baseline UAS Acceptable performance in the NAS**
- **Sense and Avoid (SAA)**
- **Control and Communication (C2)**
- **Human Factors (HF)**
- **Maintenance and Repair Issues**
- **NAS Integration and NextGen concept exploration**
- **System Safety Criteria for Airborne and Ground Lethality**



# AJP6 UAS Research Methods

- **Modeling and Simulation**
- **Demonstration**
- **Engineering Analysis**



# AJP6 Research

- **Modeling and Simulations**
  - Shadow Assessment at Cherry Point, NC
  - Objective: Model a proposed operational procedure for the transit of a UAS between Class D airspace and a restricted airspace with a GBSAA
  - Outcome: Human-in-the-Loop (HITL) simulation completed. Concept is feasible and warrants further investigation. No loss of separation, workload not an issue, and UAS crossed with no issues (as simulated).



# AJP6 Research

- **Modeling and Simulations**
  - Multi-UAS in Class D Airspace Assessment
  - Objective: Evaluate ATC procedures and NAS operations with multiple UAS in Class D airspace. Explore airspace integration.
  - Outcome: HITL simulation completed. Analysis in progress.



# AJP6 Research

- **Demonstrations**

- Demo 1-P/S/SE
- Objective: Verify and calibrate actual flight performance of PredatorB/Shadow/Scan Eagle UAS with the intent of comparing these measures to the six degree-of-freedom models that were integrated into the NAS model.
- Outcome: Successful/Successful/Pending
  
- Demo 2: Shadow with Flight Management System (FMS)
- Objective: Couple an FMS with four dimensional trajectory functionality to a UAS platform to evaluate the FMS as a control mechanism for precise and manageable flight trajectories, a key capability necessary for NextGen Trajectory Based Operations.
- Outcome: Performed the first “proof of concept” flight demonstration of a UAS with a FMS. Demonstrated initial feasibility for trajectory-based UAS operations and provided data to increase the FAA’s understanding of UAS flight performance.



# AJP6 Future Research

- **Engineering Analysis**
  - SAA Engineering Analysis and Tech Evaluation
  - Objective: Develop the capability to evaluate potential SAA logic and algorithms, and assess feasibility and interoperability of logic implementations.
  - Product: Determine performance metrics and processing architecture required for analysis. Determine laboratory upgrades needed and identify test data for studies.



# AJP6 Future Research

- **Modeling and Simulation**

- NAS feasibility studies of SAA logic implementations
- Objective: Utilize CRDA and industry/academia partners to conduct feasibility studies of multiple dissimilar SAA logic implementations. Investigate the implications of separation minimums when deploying multiple UAS SAA algorithms as well as manned aircraft collision technologies in a NAS simulated environment.
- Product: Technical reports documenting results.

