



Update on UAS Integration Research (Current & Planned)

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## UAS Integration Strategy – 2020



### FAA's Research Approach

OMB Circular A-11, Section 84.2



EXECUTIVE OFFICE OF THE PRESIDENT OFFICE OF MANAGEMENT AND BUDGET JULY 2016

#### 1. Basic research

Experimental or theoretical work for acquiring new knowledge of the underlying causes and based on observable facts.

#### 2. Applied research

Original investigation directed primarily towards a specific practical aim or objective.

#### 3. Experimental development

Creative and systematic work directed at producing new products or improving existing products or processes. Experimental development will result in gaining additional knowledge.





## FAA's Applied Research Methods



Applied research is directed towards a specific practical aim or objective.



# FAA's UAS Integration Research Functional Framework







# Categorizing UAS Research Activities: Research Informs Operational Capabilities



**Federal Aviation** 

Administration

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## **Research Alignment**







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## **UAS** Research Collaboration & Partnerships







### UAS Safety Case & Test Data Research Accomplishments



#### Task 1: Safety Case Framework



#### **Courtesy Mark Blanks**



### UAS Safety Case & Test Data Research Accomplishments

### Task 2: Data Schema

- CONOPS (1a)
  - Metadata
  - Aircraft Info.
  - Aircraft Procedures
  - Crew
  - Operational Scenario Description
  - Operational Considerations—Ground Based
  - Operational Considerations—Airspace
  - Meteorological Conditions
  - Communications
  - Security
- ORA (1b)
  - Metadata
  - Hazards (Severity, Likelihood, Mitigations, Residual Severity, Residual Likelihood)
  - Multiple ways to organize (Mid-Air Collision, Ground Collision, People, Property)



DATA SCHEMA Phase 1a: Concept of Operations (CONOPS)																
		F	PHASE OF	PROCES	SS					D	ESCRIF	PTION (	OF DA	TA SC	HEMA	
Operation Defin	al Context	2	Data Colle	ection	3 s	afety Case	<b>4</b> F	FAA Approval								
Concept of Operations	Risk Assessment		Test Planning	Testing & Demos		Safety Case Compilation		Approval Granted If:								
<ul> <li>Mission objectives</li> </ul>	<ul> <li>Hazard identification</li> </ul>	$  \rangle$	<ul> <li>Test/data requirements</li> </ul>	<ul> <li>Quantitative data collected</li> </ul>		<ul> <li>Final analysis of safety</li> </ul>		<ul> <li>All hazards are addressed</li> </ul>								
<ul> <li>Operational description</li> </ul>	<ul> <li>Risk mitigation development</li> </ul>	/	<ul> <li>Scope and method of test</li> </ul>	<ul> <li>Verify sufficient data to support</li> </ul>		<ul> <li>Compilation of all data</li> </ul>	/	<ul> <li>Acceptable level of safety</li> </ul>								
Requirements definition	<ul> <li>Identify supporting data needed</li> </ul>		<ul> <li>Schedule and resources</li> </ul>	<ul> <li>Data validates mitigations</li> </ul>		<ul> <li>Completed application package</li> </ul>		<ul> <li>Data verifies mitigations are effective</li> </ul>								
Repeat until risk: to accepta	s are mitigated uble level	< -0 mi	Ipdate ConOps and ligations cannot be v	ORA if , alidated	Safety when are val											
Icreasing FAA Involvement																
_	METADATA															

ME TADA TA											
Field	Data Type	Input Method	Input Options	Relationships	Description/Notes						
Project Identifier	Text	Manual entry	Custom	Carried across all	Allow for custom identification of projects, however it may be possible to create a standardized project identifier structure that helps identify projects that may be similar in nature across various users.						
Title of Project	Text	Manual entry	Custom	Carried across all	Allow users to custom name their projects for easy reference.						
User	Text	Manual entry Drop down list?	Custom	Carried across all	Need to define what a user is. It could be an individual, company, program, or other.						
Keywords	Text	Manual entry Radial buttons	Custom Predefined	Some may be carried from other phases	Keywords may include any number of relevant words. This can be used to identify unique aspects of the CONOPS. The keywords input is a critical to making the narrative format documents searchable in a meaningful way. The keywords section may contain a list of common						



### **UAS Test Data** Accomplishments



### Task 2: Data Schema (cont.)

- Test Planning (2a)
  - Metadata
    - Includes relevant hazard(s) and mitigations
  - Test Requirements
  - Data Requirements
  - Required Resources
  - Test Execution
  - Deliverables
  - Schedule
- Test Data/Reports (2b)
  - Developing

The FAA's Center of Excellence for UAS Research

Alliance for System Safety of UAS through Research Excellence

Currently breakout is similar to 2a



DATA SCHEMA

# Utilizing ASSURE Safety Case Research to Inform Operational Approvals



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### FAA SPONSORED UAS RESEARCH WITH ASSURE





Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
<b>Evaluation of UAS Ground Collisions</b> Develop a simplified testing method for testing injury potential of sUAS to provide a clear path for applicants to apply for a flight over people waiver under part 107 or provide a safety case that can be consistent with future flight over people rulemaking.	Operations Over People	Directly Fulfills: H.R. 636 - The FAA Extension, Safety, and Security Act of 2016 Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY17-FY19	ASSURE
Propose sUAS DAA Requirements Necessary for Limited BVLOS Ops This research will develop a test method for evaluating Detect and Avoid (DAA) Systems for sUAS operating BVLOS	Expanded Operations	Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY19-FY20	ASSURE COE
<ul> <li>UAS Flight Data Collection and Analysis</li> <li>This research is working to develop a safety case framework to enhance integration of UAS into the National Airspace System (NAS).</li> <li>At the foundation is development of a test data collection and analysis system that collects test data (test objectives, operational description data, hazard and mitigation data, etc.) and produces desired output that enables evaluation of safety cases, enables operations, and identifies research needs, etc.</li> </ul>	Expanded Operations	N/A	FY18-FY20	ASSURE COE

Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
UAS Safety Case Development, Process Improvement, and Data Collection Develop a framework for an applicant's safety case and an approach for repeatedly accepting safety cases. Identify key components needed to make a robust safety case for UAS operations.	Expanded Operations	N/A	FY20-FY22	ASSURE COE
STEM Outreach to Minority K-12 Students Using UAS as a Learning Platform Enable Science Technology, Engineering, and Math (STEM) outreach to students of all backgrounds and specifically to groups who are under-represented in STEM fields in order to educate and inspire youth to pursue careers in UAS-related avenues.	Expanded Operations	Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 350: The Use of UAS at Institutions of Higher Education	FY17-FY20	ASSURE COE
Evaluation of Transportation Disaster Preparedness and Response Investigate the roles of UAS aiding in disaster response operations, the results of which will help inform developments needed to enable and coordinate emergency response operations for UAS as well as meet Congressional requirements.	Expanded Operations	Directly Fulfills: Direction in 2018 Omnibus Appropriation Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 359: Study on Fire Department and Emergency Service Agency Use of UAS	FY19-FY21	ASSURE COE

Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
Propose Viable Criteria and Thresholds for Assessment of Safety Case Submissions (SMS) This research will develop a framework for reusing existing waiver and exemption approvals that contributes to a repeatable process as well as develop guidance.	Expanded Operations	N/A	FY20-FY21	ASSURE COE
UAS Data Collection, Analysis, and Safety Case Development Phase II Develop an enhanced test data collection framework and safety analysis tools to inform the UAS Integration Research Plan by enabling users to cross-check needs for UAS data/research with test data stored in the system as well as enabling analysis to determine if the data meets the need and whether additional data/testing would be required.	Expanded Operations	N/A	FY19-FY21	ASSURE COE
Propose sUAS Well Clear and Collision Avoidance for V2V This research will propose collision avoidance thresholds for UAS-to-UAS vehicle to vehicle (V2V) coordination. The efforts will look at separation volumes for UAS to UAS interactions as well as the messaging needed on V2V services.	Expanded Operations	Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY19-FY20	ASSURE COE

Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
Implications of UAS Delivery Operations on NAS Integration (E-Com) Gather and survey market and business intelligence, existing data and sources for UAS commercial delivery operations to support risk and hazard analysis for safety goals of the agency.	Small UAS Package Delivery Operations	N/A	FY19-FY20	ASSURE COE
Develop Pilot and Visual Observer Requirements (Multi-UAS) This research will inform development of modified and/or new regulations, standards and guidance regarding UAS crewmember training and certification.	Small UAS Package Delivery Operations	N/A	FY20-FY21	ASSURE COE
Developing and Conducting UAS Research at the ASSURE COE Safety Research Center Facility The 2017 Omnibus Budget directed the FAA to support the expanded role of the COE for UAS by establishing a UAS safety research facility to study appropriate safety standards for UAS and to develop and validate certification standards for such systems.	Integrated Operations	Directly Fulfills: Direction in 2017 Omnibus Appropriation Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY19-FY20	ASSURE COE

Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
Evaluation of UAS Airborne Collisions- Structural Impact Study the impacts of an airborne collision between a UAS and a manned aircraft to identify the probability of impact deflection due to boundary layer interactions and evaluate the severity of small UAS collisions with Rotorcraft and General Aviation.	Integrated Operations	Directly Fulfills: H.R. 636 - The FAA Extension, Safety, and Security Act of 2016, Section 2212 Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY18-FY20	ASSURE COE
Safety Risks and Mitigations for UAS on and Around Airports This research will define the overall concept and use cases for conducting UAS inspection operations on the airport surface, and identify required systems, services, and capabilities.	Integrated Operations	N/A	FY20-FY21	ASSURE COE
Identify Wake Requirements for UAS This research will analyze wake-induced hazards to UAS operations to determine requirements for separation.	Integrated Operations	N/A	FY20-FY21	ASSURE COE

Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
Evaluation of UAS Airborne Collisions - ATO/AJI Safety Office Study Phase I & II Inclusion of large numbers of sUAS into the National Airspace System (NAS) may pose unique hazards to other aircraft sharing the airspace. It is necessary to determine the potential severity of sUAS mid-air collisions with aircraft in order to define an Equivalent Level of Safety to manned aviation.	Integrated Operations	Directly Fulfills: H.R. 636 - The FAA Extension, Safety, and Security Act of 2016, Section 2212 Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY18-FY20	ASSURE COE
<b>Evaluation of UAS Airborne Collisions - Engine</b> <b>Ingestion</b> Study the interaction of a representative high bypass ratio fan (typically used in large commercial transport) and UAV during an engine ingestion scenario to define best practices and fan models for use in further studies.	Integrated Operations	Directly Fulfills: H.R. 636 - The FAA Extension, Safety, and Security Act of 2016, Section 2212 Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY18-FY20	ASSURE COE
Investigate Differences Between Commercial Air Carrier Operations and Unmanned Transport Operations The FAA needs to understand the UAM environment, analyze the differences as they compare to traditional manned air transportation. These analyses will enhance decision making and the research will highlight anticipated needs of the FAA to support further integration of UAS in air transportation operations in and across metropolitan areas including suburbs and exurbs.	Integrated Operations	Supports: 2019 Appropriations (p. 18) of the Report of the Committee on Appropriation (https://www.congress.gov/115/crpt/hrpt 750/CRPT-115hrpt750.pdf)	FY22	ASSURE COE

Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
UAS Parameters, Exceedances, Recording Rates for FAA's Aviation Safety Information and Sharing (ASIAS) Program Support aggregation of UAS flight data with commercial, general aviation and surveillance data, to develop enhanced safety analyses for NAS stakeholders and support UAS integration in the NAS.	Routine/Scheduled Operations	N/A	FY19-FY21	ASSURE COE
Pilot Certification Requirements Needed to Certify UAS for Safe Operations (Multi UAS) This research will result in a certification test case to validate industry standards and support standards development and certification strategies for sUAS, necessary for safe integration.	<ul> <li>Operations Over People</li> <li>Expanded Operations</li> <li>Small UAS Package Delivery Operations</li> <li>Integrated Operations</li> <li>Routine/Scheduled Operations</li> <li>Large Carrier Cargo Operations</li> <li>Passenger Transport Operations</li> </ul>	N/A	FY20-FY21	ASSURE COE
Identify Cybersecurity Requirements for UAS Operations Complete a literature review to support the establishment a baseline model, guide, tool or process that will identify Cyber Security Risk related to UAS into the NAS.	<ul> <li>Operations Over People</li> <li>Expanded Operations</li> <li>Small UAS Package Delivery Operations</li> <li>Integrated Operations</li> <li>Routine/Scheduled Operations</li> <li>Large Carrier Cargo Operations</li> <li>Passenger Transport Operations</li> </ul>	Supports: 1. Public Law115–254 Sec. 509. Review of FAA Strategic Cybersecurity Plan. 2. H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards 3. Public Law 113 - 274 - Cybersecurity Enhancement Act of 2014.	FY20-FY21	ASSURE COE
Urban Air Mobility: Safety Standards, Aircraft Certification and Impact on Market Feasibility and Growth Potentials The UAM ecosystem and its associated technologies are likely to be among the most complex aviation has ever encountered. The FAA needs to understand how the UAM environment could emerge and be pro-active in in assessing and understating the markets, viability, economics and challenges that will arise. This research will highlight, challenges and needs of the FAA to support safe integration and could be used as a tool to assist decision makers in the allocation of personnel and resources	Passenger Transport Operations	N/A	FY20-FY21	ASSURE COE



### Questions?



