

Update on UAS Integration Research (Current & Planned)

Presented to: REDAC SAS

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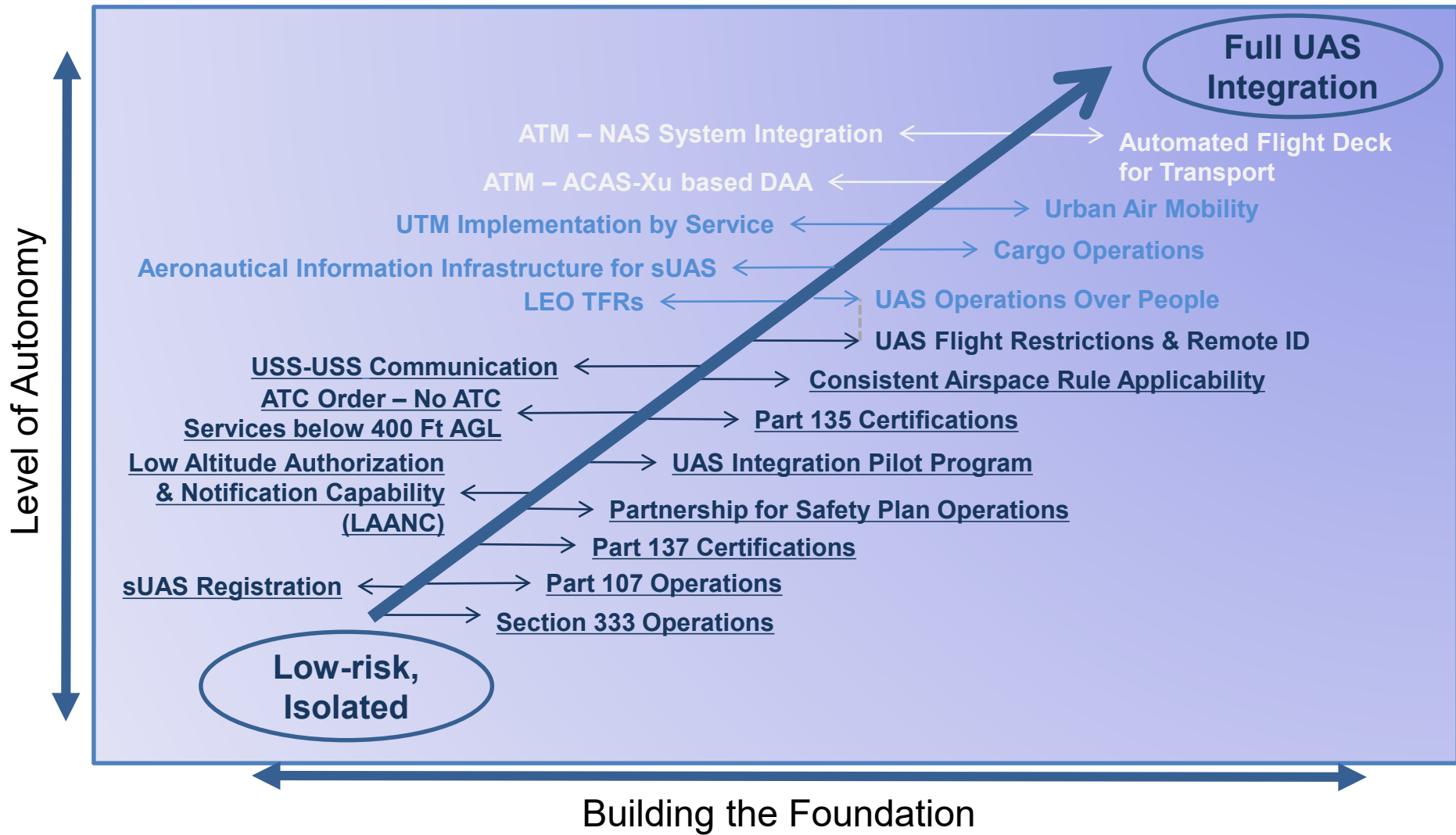
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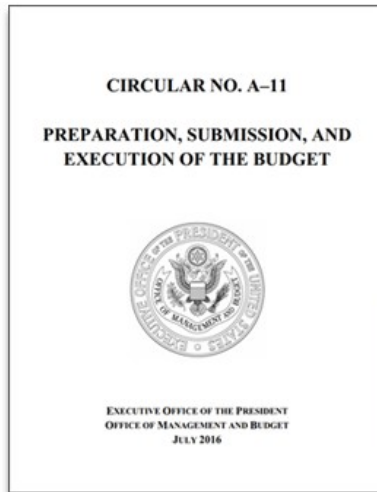


UAS Integration Strategy – 2020



FAA's Research Approach

OMB Circular A-11, Section 84.2



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

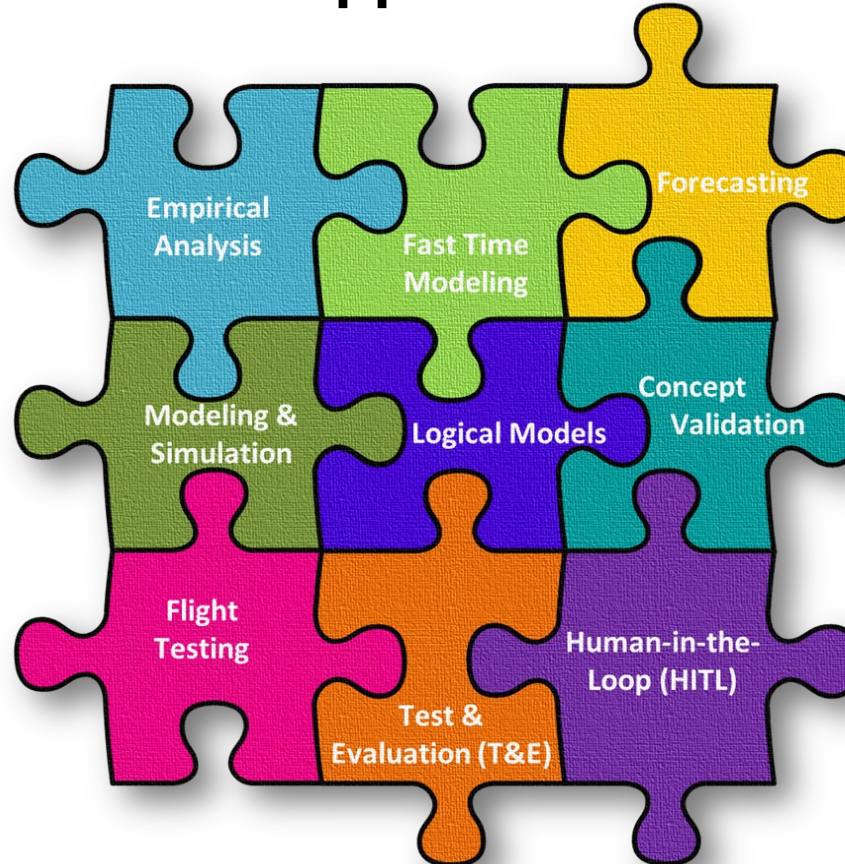
Creative and systematic work directed at producing new products or improving existing products or processes. Experimental development will result in gaining additional knowledge.



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FAA's Applied Research Methods

What is applied research?

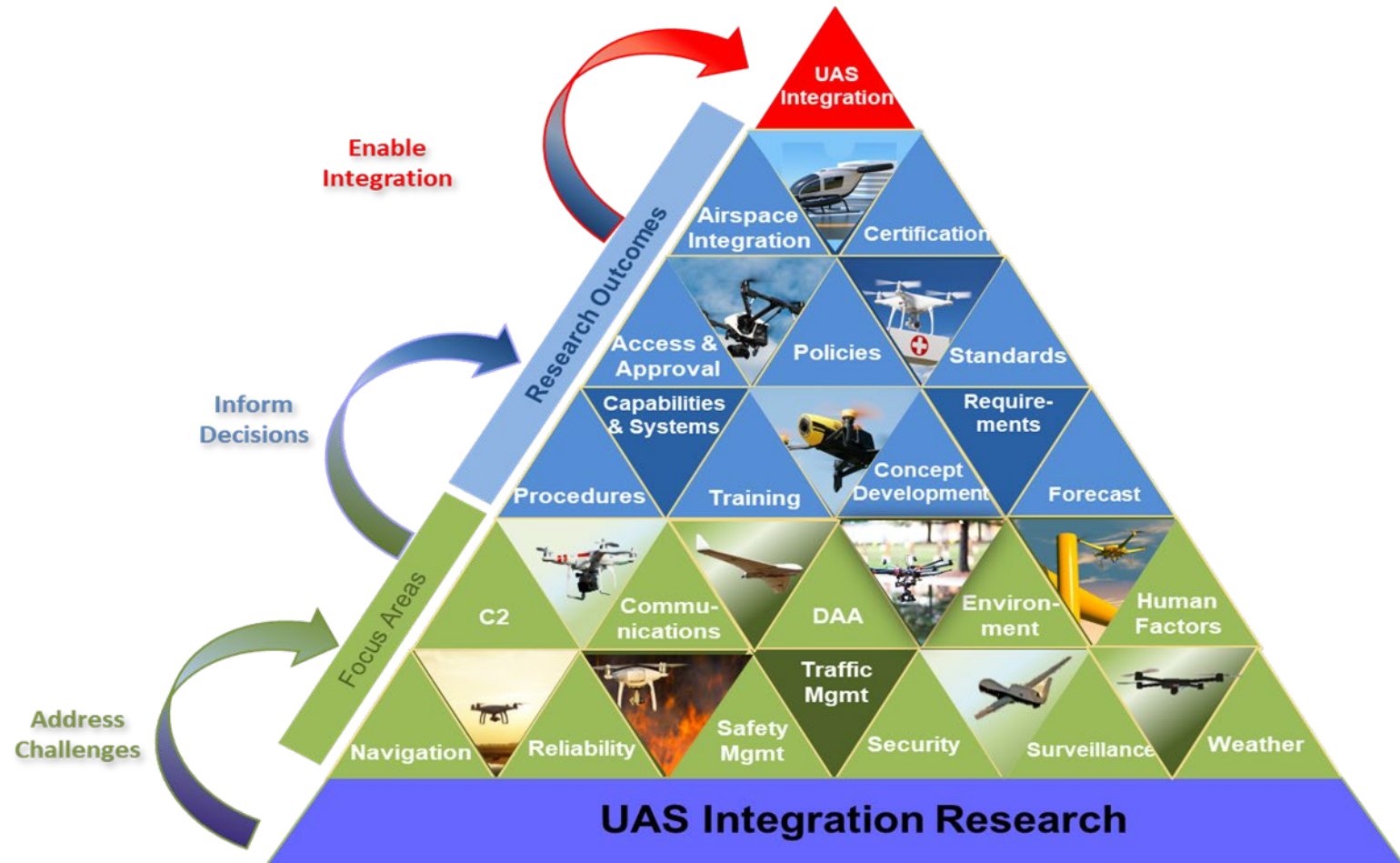


*Applied research
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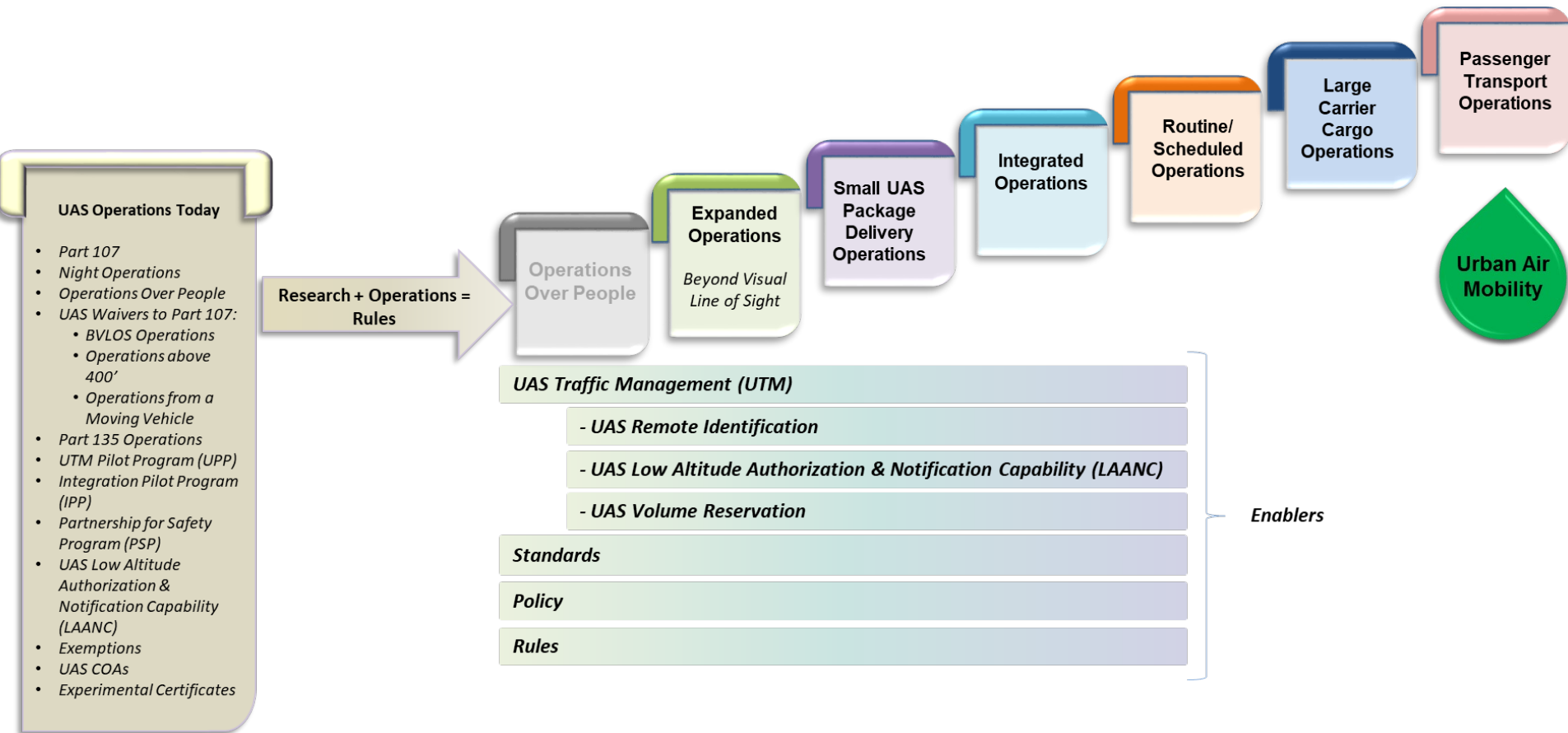
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FAA UAS Integration Research Functional Framework



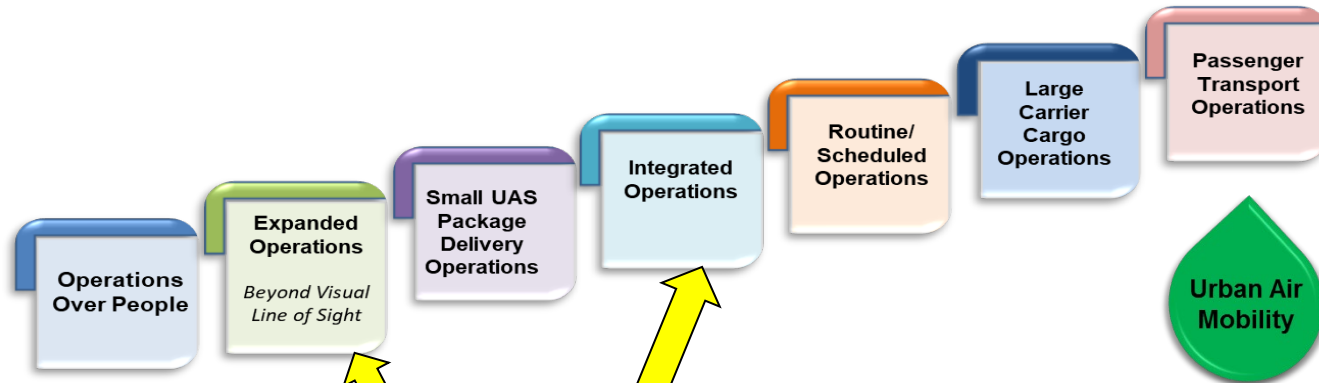
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Categorizing UAS Research Activities: Research Informs Operational Capabilities



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Research Alignment



Research Outcome	Activity Description	FY19	FY20	FY21	FY22	FY23	FY24	Focus Area
Forecast	<u>Impacts</u> Provide forecasting to determine the impact on traffic trends and safety due to integrating expanded and non-segregated UAS operations into the NAS.		FAA: ASSURE					Safety Management



UAS Research Collaboration & Partnerships



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FAA SPONSORED UAS RESEARCH



Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
UAS Lithium Batteries This research will search, test, and develop data and recommendations for FAA and global partners to create appropriate standards, regulations, and means of demonstrating safe compliance of UAS lithium batteries fuel cells.	Operations Over People	N/A	FY17-FY19	FAA Technical Center
Evaluation of UAS Operations Over Moving Vehicles This research will continue the FAA's UAS Ground Collision Severity by performing a literature review of studies of safety risks and potential mitigations related to UAS operations over moving vehicles, including causing distractions to drivers. This research will help to inform rulemaking.	Operations Over People	Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY19-FY20	FAA Technical Center
Evaluation of UAS Ground Collisions 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 COE



Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
<p>Identify FAA Decisions Needed for UAS Operations</p> <p>This research will identify the key decisions and milestones needed to allow repeatable UAS operations, and assess ongoing research and operational evaluations against these decisions. It will identify where there are remaining gaps that need to be addressed to inform these decisions.</p>	<p>Operations Over People</p> <p>Expanded Operations</p>	N/A	FY18-FY20	FAA/AUS-300
<p>Part 107 Operational Waiver Assessment: Conduct Analysis to Identify Trends in Approved and Denied Waiver Requests</p> <p>This research evaluates UAS operational data from part 107 waiver requests to identify trends and characterize the sufficiency of information provided in those waiver requests that resulted in approvals, and the insufficiency of information provided in those waiver requests that did not receive approval. The purpose of this evaluation is to help understand the attributes of waiver requests with viable safety cases, and to share lessons learned from past approvals and denials.</p>	<p>Operations Over People</p> <p>Expanded Operations</p>	N/A	FY19-FY20	FAA/AUS-300



Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
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
UAS Fuel Cells This research will search, test, and develop data and recommendations for FAA and global partners to create appropriate standards, regulations, and means of demonstrating safe compliance of UAS fuel cells.	Expanded Operations	N/A	FY17-FY19	FAA Technical Center
UAS Flight Data Collection and Analysis This research is working to develop a safety case framework to enhance integration of UAS into the National Airspace System (NAS). 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.	Expanded Operations	N/A	FY18-FY20	FAA/AUS-300



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	FAA/AUS-300
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
Integrate UAS Traffic Management (UTM) Architecture to Enable Low Altitude Traffic Management of Small UAS Operations This research is being conducted in response to a Congressional Directive for FAA and NASA to partner in order to advance safe sUAS Integration at the lower altitudes through traffic management. FAA will collaborate with NASA to develop an infrastructure, as well as evaluate and demonstrate UTM technologies and capabilities while supporting development of enterprise capabilities, testing, and evaluation leading up to a successful UTM Pilot Program (UPP) demonstration. In turn, the pilot program will provide insight into the FAA's implementation plan for the UTM system.	Expanded Operations	Directly fulfills H.R. 302 –The FAA Reauthorization Act of 2018: Section 376 – Plan for Full Operational Capability of Unmanned Aircraft Systems Traffic Management. Supports H.R. 302 –The FAA Reauthorization Act of 2018: Section 377 – Early Implementation of Certain UTM Services and Section 2208 in the Security Act of 2016. From a high-level perspective, the UTM Project will fulfill the requirements established by the FAA Extension, Safety, and Security Act of 2016 (PUBLIC LAW 114–190—JULY 15, 2016). Under this statute, the establishment of a UTM pilot program is required.	FY18-FY19	FAA Technical Center



Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
Propose SARP sUAS Well Clear and Collision Avoidance for V2V This research will ensure the proper coordination of the separation volumes for UAS to UAS interactions between the different government agencies to ensure that any recommendations can properly address each agencies mission.	Expanded Operations	Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY19-FY20	MIT Lincoln Labs
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
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
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
Identify Air Carrier Operational Considerations for Unmanned Aircraft Systems This research addresses safety concerns specific to Air Carrier Operations for UAS to include air carrier staffing, training, testing, duty and rest requirements. It could help establish a separate rulemaking activity specific to air carrier operations.	Small UAS Package Delivery Operations	Supports the National Defense Authorization Act of 2010. As directed by this act, the FAA and DoD developed a NAS Access Plan for public UAS. Per that plan, the FAA has committed to "develop validated airspace integration requirements and associated standards" in the mid-term (2015-2020) and approve technical standards and performance specifications by the far-term (2020-2025).	FY19-FY20	FAA Civil Aerospace Medical Institute



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
UAS Automation and Intelligent Systems This research will develop a long-term automation strategy to work towards approval of intelligent systems. This program proposes a phased approach beginning with UAS and moving toward cargo and passenger carrying aircraft. The intent is to identify considerations for certification, including general human factors.	Small UAS Package Delivery Operations	N/A	FY18-FY20	FAA Technical Center
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



Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
<p>Section 383 UAS Detection and Mitigation The FAA Reauthorization Act of 2018, Section 383 directs the FAA to work with the DOD and DHS, and other relevant federal departments and agencies, to ensure that Counter UAS (C-UAS) technologies do not adversely impact or interfere with safe airport operations, air navigation, air traffic services, or the safe and efficient operation of the NAS. This section also directs the FAA to develop a plan for the certification, permitting, authorizing, or allowing the deployment of C-UAS technologies or systems, and requires the FAA to test UAS detection and mitigation systems at five airports.</p>	Operations Over People, Integrated Operations	<p>H.R.636 - FAA Extension, Safety, and Security Act of 2016, Section 2206, Pilot Project for Airport Safety and Airspace Hazard Mitigation (July 2016)</p> <p>Supports standards development for H.R. 302 – The FAA Reauthorization Act of 2018, Section 383, Airport Safety and Airspace Hazard Mitigation and Enforcement</p>	FY20-FY21	FAA Office of Airports
<p>Evaluate the Command and Control (C2) Link Compatibility for Use of L-Band Frequencies for UAS Control and Non Payload Communications (CNPC) Operations The UAS Command and Control Link Compatibility testing will complement the current validation efforts for Control and Non Payload Communications (CNPC) standards by evaluating the operating compatibility with other L-band avionics equipment.</p>	Expanded Operations, Small UAS Package Delivery Operations, Integrated Operations	<p>Supports standards development for H.R. 302 – The FAA Reauthorization Act of 2018, Section 345, Small Unmanned Aircraft Safety Standards and BVLOS operations.</p> <p>This research will contribute to RTCA 228's effort to mature standards for command and non-payload communications for UAS flying within point-to-point of a ground transmitter for the UAS ground control station. The results from this task will help determine the viability of use of L-Band frequencies for CNPC operations.</p>	FY16-FY20	FAA Technical Center

Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
WJHTC Evaluation of Multi-Sensor Data Fusion Strategies The research on Unmanned Aircraft Systems (UAS) Sense and Avoid (SAA) Multi-Sensor Data Fusion Strategies will determine the best SAA system architecture for UAS, allowing UAS to detect and avoid other aircraft, which may or may not have location transponders.	Integrated Operations	N/A	FY15-FY22	FAA Technical Center
Evaluate Methods to Increase Visual Conspicuity of Unmanned Aircraft Systems This research explores ways to increase the visibility of UAS for people on the ground and pilots of manned aircraft, in an effort to decrease the chances for mid-air collisions or collisions with people on the ground. The idea is to incorporate design strategies based on this research into future airworthiness approval guidance to address the minimum standards required to make UAS easily visible to other aircraft and people on the ground.	Integrated Operations	N/A	FY19-FY20	FAA Civil Aerospace Medical Institute
Minimum Detect and Avoid (DAA) Display and Flight Path Information This research requirement supports the design of Detect and Avoid (DAA) display and/or flight path guidance information required for an UAS pilot to execute a maneuver to remain well clear and will in turn support the safe integration of this new technology into the NAS.	Integrated Operations	N/A	FY19-FY20	FAA Civil Aerospace Medical Institute



Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
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
Propose sUAS Terminal Area Well Clear Means of Compliance This research will provide a recommendation for sUAS to remain well clear in "under flight" conditions in Class B/C/D airspace.	Integrated Operations	Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY18-FY19	Science and Research Panel (SARP)
Evaluation of UAS Airborne Collisions - Engine Ingestion 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



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
Icing, Snow and Rain Means of Compliance for UAS Manufacturer's means of compliance need to include FAA accepted performance standards and safety levels. The streamlined TC process for UAS will have no MOC for icing, snow or rain. ASTM F2910 "Standard Specification for Design and Construction of a Small Unmanned Aircraft System (sUAS)" has no MOCs for these environmental conditions. The streamlined TC process will require the UFM to prohibit flight in these conditions. Research is needed to help the FAA and industry develop these MOCs	Integrated Operations	Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY22	ANG C6



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Unmanned Aircraft Systems (UAS) Weather Research Weather gaps exist for UAS operations in the National Airspace System (NAS). Part 107 regulatory requirements only require UAS flight 500 feet below clouds, 2000 feet horizontally from clouds, and with 3 miles minimum slant range visibility. Currently, no other requirements exist for weather gathering or weather knowledge for Part 107 operations.	Integrated Operations	Supports: H.R. 302 – The FAA Reauthorization Act of 2018, Section 345: Small Unmanned Aircraft Safety Standards	FY22	ANG C6
Unmanned Aircraft Systems (UAS) Weather Hazards Research Weather hazards have historically impacted manned aviation operations in the National Airspace System (NAS). Thus, weather information and products have evolved overtime to help reduce these impacts. The unique characteristics of UAS, such as flying at altitudes below 400 feet with reduced speed capabilities and new control system design, introduce new weather hazards that are not fully understood.	Integrated Operations	N/A	FY22	ANG C6
From Manned Cargo to UAS Cargo Operations: Future Trends, Performance, Reliability, and Safety Characteristics Towards Integration into the NAS The FAA needs to understand the manned cargo delivery environment and take facilitating steps to prepare when the gradual transition to autonomy eventually arrives. This research will highlight anticipated needs of the FAA to support further integration of UAS in cargo operations.	Integrated Operations	Supports: 2019 Appropriations (p. 18) of the Report of the Committee on Appropriation (https://www.congress.gov/115/crpt/hrpt750/CRPT-115hrpt750.pdf)	FY22	ASSURE COE



Research	Operational Capability	Legislative Direction	Period of Performance	Research Performer
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/hrpt750/CRPT-115hrpt750.pdf)	FY22	ASSURE COE
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 style="list-style-type: none"> • Operations Over People • Expanded Operations • Small UAS Package Delivery Operations • Integrated Operations • Routine/Scheduled Operations • Large Carrier Cargo Operations • Passenger Transport Operations 	N/A	FY20-FY21	ASSURE COE



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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 style="list-style-type: none"> • Operations Over People • Expanded Operations • Small UAS Package Delivery Operations • Integrated Operations • Routine/Scheduled Operations • Large Carrier Cargo Operations • Passenger Transport Operations 	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.		
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.				

Questions?

