Research, Engineering, and Development Advisory Committee (REDAC) Subcommittee on Aircraft Safety (SAS)
- Summer/Fall 2023 -

FY2025 Aviation Safety Research Portfolio
- Budget Narratives (Formulation)

FY2025 Aviation Safety Research Portfolio - Budget Narratives (Formulation)

Domain:
Program Area/BLI **Page**

Domain: Aircraft Safety Assurance
Program Area/BLI: Fire Research and Safety

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11A.FCS.7	1.3 Safe Shipment of Hazardous Materials in Aircraft Cargo Compartments	Reduce the risks due to cargo fires by performing tests to support the development of new standards for fire detection, containment and suppression in cargo containers, and tests to evaluate new fire suppression agents and systems for aircraft cargo compartments. This includes tests as necessary to characterize the hazards posed by various cargo commodities. The Research Question is What are Technologies and methodologies to safely ship hazardous materials in aircraft cargo compartments? The Research Project Design are to develop standardized hazardous materialtest methods for Fire Resistant Containers and Fire Containment Covers, to develop technologies that can provide early detection of fires within containers, and to develop standards for packaging materials to contain lithium battery shipments.	FY17	FY28	Y
A11A.FCS.5	1.1 Characteristics and Classification of Hazardous Materials Fires Including Lithium Batteries	Reduce the risks due to cargo fires by performing tests to support the development of new standards for fire detection and containment and suppression in cargo containers, and tests to evaluate new fire suppression agents and systems for aircraft cargo compartments. This includes tests as necessary to characterize the hazards posed by various cargo commodities. The research question is "what are the characteristics and classification of the fire threats presented by hazardous materials including lithium batteries?" The Research Project Design is to design a test method to classify the fire threat posed by the hazardous material by identifying key characteristics.	FY17	FY27	Y
A11A.FCS.6	1.2 Aircraft Level Fire Detection, Mitigation, and Suppression	Reduce the risks due to cargo fires by performing tests to support the development of new standards for fire detection and containment and suppression in cargo containers, and tests to evaluate new fire suppression agents and systems for aircraft cargo compartments. This includes tests as necessary to characterize the hazards posed by various cargo commodities. The Research Question is What are the fire threats, and available mitigation and suppression technologies at the aircraft level? The Research Project Design is to design test methods that can be part of Minimum Performance Standards that evaluate suppression agents and systems' performance against hazardous material fires.	FY18	FY28	Y

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A11A.FCS.9	2.1 Appropriate Performance Standards & Test Methods for Designated Fire Zones in Propulsion Systems	The ability to safely fly passengers and cargo given changes in the means of aircraft power and propulsion (such as electric engines/ fuel cells), fuels used (such as batteries or hydrogen) and environment impact on design (such as Halon replacement). Given the potential for a different fire threat as a result of new fuel(s), the Research Question is What are the appropriate performance standards and test methods for materials and components in designated fire zones in propulsion systems, key parameters that most influence material and component fire performance, and will harmonize standard settings, equipment, and procedures for performing propulsion fire tests? The Research Project Design is research and development of test fixtures and appropriate methods to conduct tests on new propulsion materials and components while collaborating with partners.	FY17	FY26	Y
A11A.FCS.8	1.4 Information on Fire Risks of Shipping Hazardous Materials	Reduce the risks due to cargo fires by performing tests to support the development of new standards for fire detection and containment and suppression in cargo containers, and tests to evaluate new fire suppression agents and systems for aircraft cargo compartments. This includes tests as necessary to characterize the hazards posed by various cargo commodities. The Research Question is Is information on the fire risks of shipping hazardous materials and potential mitigation strategies readily available? The Research Project Design is to develop task groups to get feedback from industry on modifying website content to provide valuable information to operators transporting hazardous materials.	FY17	FY27	Y
A11A.FCS.10	2.2 Effectiveness of Non-Halon Fire Suppression Agents in Advanced Aircraft Propulsion & Power Syste	The ability to safely fly passengers and cargo given changes in the means of aircraft propulsion (such as electric engines/ fuel cells), fuels used (such as batteries or hydrogen) and environment impact on design (such as Halon replacement). Given the potential for different fire threats as a result of new fuels, the Research Question is How well do non- halon, environmentally friendly powerplant fire suppression agents ensure equivalent or improved performance when compared with Halon, considering evolving technologies in aircraft propulsion and power systems? The Research Project Design will involve the development of test fixtures to evaluate the effectiveness of currently approved agents against new propulsion fuel fires. If current agents are found to be inadequate against new fuels, the development of new updated methods of evaluating agent effectiveness will be researched.	FY17	FY28	Y

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A11A.FCS.15	3.3 Mitigation Techniques for In-Flight Fires Resulting from Portable Electronic Devices (PEDs)	The ability to prevent or minimize the effects of inflight or post-crash fire on crew/passenger survivability given evolving aircraft technology. The Research Question is Are techniques for the mitigation of in-flight fires resulting from personal electronic devices (PEDs) considering evolving portable power sources, new battery chemistries, and increasing power density readily available? The Research Project Design is to test existing extinguishing methods on fires from new PEDs and new power source designs. If the methods prove to be inadequate, develop improved techniques for extinguishing these fires.	FY18	FY28	Y
A11A.FCS.11	2.3 Fire Threats of On-Board Fuel Sources Including Petroleum Fuels, Lithium Batteries, and Hydrogen	The ability to safely fly passengers and cargo given changes in the means of aircraft propulsion (such as electric engines/ fuel cells), fuels used (such as batteries or hydrogen) and environment impact on design (such as Halon replacement). The Research Question is What are the in-flight fire threats posed by on-board fuel sources including petroleum fuels, lithium batteries, gaseous and liquid hydrogen, and other novel fuels and power sources? The Research Project Design is to formulate a test method to evaluate the hazardous effects of failure of new fuel sources within an aircraft. This may involve bench- scale tests of representative fuel systems or full-scale tests in an aircraft environment.	FY17	FY29	Y
A11A.FCS.12	2.4 Hazard to Occupants of Post-Crash Fires Caused by Novel Aircraft Fuel Sources	The ability to safely fly passengers and cargo given changes in the means of aircraft power and propulsion (such as electric engines/ fuel cells), fuels used (such as batteries or hydrogen) and environment impact on design (such as Halon replacement). The Research Question is What are the characteristics of the post-crash fire threat and hazard posed to occupants by aircraft fuel sources, including petroleum fuels, lithium batteries, gaseous and liquid hydrogen, and other novel fuels and power sources? The Research Project Design is to design a test configuration to determine how new fuel sources affect post- crash occupant survivability and compare	FY24	FY28	Y
A11A.FCS.13	3.1 Aircraft Materials Flammability Assessment Considering Advances in Fuels and Power Sources	The ability to prevent or minimize the effects of inflight or post-crash fire on crew/passenger survivability given evolving aircraft technology. The Research Question is Are materials flammability standards commensurate with fires that are likely to occur considering the evolution of aircraft technology and advancements in fuels and power? The Research Project Design is to perform research and test the constantly evolving materials and fire threats in aircraft using the appropriate small, intermediate, or full-scale fire test methods. Update test methods as necessary to ensure adequate results for current fire threats and repeatability and reproducibility.	FY17	FY28	Y

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A11A.FCS.14	3.2 Effectiveness of Non-Halon Fire Suppression Agents in Handheld and Lavatory Extinguishers	The ability to prevent or minimize the effects of inflight or post-crash fire on crew/passenger survivability given evolving aircraft technology. The Research Question is How effective are halon-free, environmentally-friendly fire suppression agents for use in handheld fire extinguishers and lavatory trash receptacles? The Research Project Design is to evaluate environmentally friendly fire extinguishing agents in handheld extinguishers and lavatory fire extinguishers to determine if they meet the minimum performance standard.	FY17	FY28	Y
A11A.FCS.16	3.4 Molecular-Level Research for Detecting Material Formulation Changes that Impact Flammability	The ability to prevent or minimize the effects of inflight or post-crash fire on crew/passenger survivability given evolving aircraft technology. The Research Question is What materials fire research tools and techniques at the molecular level exist to for analyzing materials and detecting changes in material formulation that practically impact flammability performance important for safety? The Research Project Design is to evaluate aircraft materials for flammability using developmental and established test methods. Correlate data generated with chemical structure to elucidate mechanisms and to demonstrate similar or improved performance with respect to flammability.	FY17	FY28	N

Domain: Aircraft Safety Assurance
Program Area/BLI: Propulsion and Fuel Systems

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11B.PS.1	Advanced Damage Tolerance and Risk Assessment Methods for Engine Life- Limited Parts	Service experience of aircraft turbine engines has demonstrated that manufacturing and service-induced anomalies still occur which can degrade the structural integrity of turbine engine rotors. Recent NTSB findings from AA Flight 383 in Chicago demonstrate shortcomings of our understanding of how nickel material anomalies behave under cyclic loading. Likewise, the 2017 uncontained fan disk failure on an Air France flight 66 highlight the need to better understand the conditions in titanium alloys which can lead to cold dwell fatigue and its detrimental impact on service life. The objectives of this work are to gather mechanical testing data on nickel and titanium rotor materials with anomalies to develop crack initiation and propagation models and methodology for advanced damage tolerance and risk assessment methods that can be used to reduce the risk of failures of high energy rotors (life limited engine parts). These developed methods and data will provide the basis for new engine certification and continued airworthiness standards and Advisory Circulars. This research also supports the development of a probabilistic methods that take into account the rare occurrence of manufacturing and service induced anomalies on part life.	FY19	FY26	Y
A11B.PS.4	Improved Nondestructive Evaluation (NDE) to Prevent Uncontained Engine Failures	Service experience has demonstrated that manufacturing and service-induced anomalies still occur in turbine engine rotors which can degrade their structural integrity. Recent NTSB findings from AA Flight 383 in Chicago demonstrate the shortcomings of available nondestructive evaluation (NDE) methods to ensure the structural integrity of these components. Another recent example is the fan disk failure of Air France Flight 66 in 2017 which was caused by the presence of microtextured regions (MTRs) and Cold Dwell Fatigue. Improved NDE methods are needed to detect anomalies in life-limited parts (LLPs), validate process improvements, and to develop POD curves to enable accurate risk assessments. This R&D effort will be addressing NTSB and BEA safety recommendations resulting from the events identified above. Guidance and technical information, including data to support addressing the NTSB and BEA recommendations and future FAA rulemaking on damage tolerance and NDE compliance requirements, are needed for critical nickel and titanium life limited rotors. This proposed research, together with A11B PS.1 "Advanced Damage Tolerance and Risk Assessment for Engine Life Limited Parts", offers a holistic approach to reducing engine rotor failures due to material anomalies by improving the design, manufacturing, and inspection of these critical parts.	FY20	FY28	Y

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A11B.PS.2	Advanced Analysis Methods for Impact of Aircraft Materials from Rotor Burst and Blade Release	Uncontained turbine engine failures continue to pose a serious threat to commercial transport passengers and the safe return flight of the aircraft. Several serious incidents have occurred involving the release of high energy blade and rotor fragments – resulting in a passenger fatality in 2018. At the same time, industry is rapidly pursuing certification of new propulsion concepts such as the CFM RISE open rotor (or unducted) engine and electric propulsion systems which the FAA will need to ensure are introduced safely. This research task develops data and analysis methods to produce publicly available engine fragment impact tools as well as to establish a technical basis to support FAA rules, policy, and guidance for certification and continued airworthiness of propulsion systems. The research products are used to design, analyze, and evaluate turbine engine blade containment systems using dynamic finite element analysis (LS-DYNA) and to minimize the hazards to the airplane and protect critical systems in the event of an uncontained failure using the Uncontained Engine Debris Damage Assessment Model (UEDDAM). This research also works to address safety risks of blade release for new technology open rotor (unducted) engines and electric propulsion systems which lack containment around the most energetic blades.	FY20	FY26	Y
A11B.PS.7	Electric Propulsion	This project will focus on developing standardized tests for evaluating the durability, endurance and reliability of electric engines. Current policy and standards are not well suited for addressing the durability, endurance and reliability requirements of electric engines. The difference in which stress parameters and their respective magnitudes affect these attributes are currently unknown between piston and turbine engines, and electric engines. This limits the FAA's ability to extend existing policy to electric engines, and research must be conducted to develop such tests. Since the application of electric engines in aviation has spawned revolutionary aircraft designs, there will be new mission profiles and therefore new propulsion power demand profiles. This project will begin by defining the various mission profiles (e.g. VTOL, CTOL, etc.) foreseen to be used by electric aircraft and then this information will be correlated to classes of electric engines. This categorization allows for a starting point to identify test cycle parameters such engine loads, durations, temperatures, etc. Once these fundamental pieces of information are established, the FAA will generate test plans and a test rig design for conducting this research.	FY24	FY27	Y

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A11B.PS.6	Engine Safety Event Prevention thru EHM on Turbines & Electric Propulsion	The purpose of this research is to facilitate implementation of On-board Engine Health Alerts using Analytics and Artificial intelligence that would help detect unsafe conditions and precursors before they propagate to major engine events. The approach will establish robust methodologies to detect abnormal engine performance deterioration and vibration signatures in-flight that will enable onboard alerts to the crews to trigger maintenance inspections to verify engine condition prior to the next flight. The robustness of the onboard thresholding analytics is important in order to detect impending hazards while minimizing false positives and unnecessary maintenance actions. This research will address EHM for gas turbine engines and electric/hybrid propulsion systems to enable mitigation of safety-significant events in the field. The research outputs will enable further development of SAE/ASTM standards for electric/hybrid propulsion and refinements to those for gas turbines.	FY23	FY26	Y
A11B.PS.8	Electric Propulsion - fault propagation in a multi-rotor aircraft	This project will focus on understanding the hazard of the failure of one or more propulsors in a multi propulsor system. Many EVTOL aircraft that are being designed have several electric engines that work simultaneously to provide vertical flight capability. A hazard may exist if one or more of these motor/propeller systems fails while hovering. Electric engines fault accommodation capabilities are different than those of existing aircraft engines, so various engine architectures and overdrive attributes will be included in the study. A motor failure would result in an immediate imbalance of load which would cause an immediate need for other motors and propellers to compensate. It is important to characterize this effect because this sudden change in control of the aircraft could overload certain systems causing overheat or over-speed. An additional danger could exist if this type of failure occurred while already in an aircraft stressing environment such as severe weather.	FY25	FY27	N

Domain: Aircraft Safety Assurance
Program Area/BLI: Advanced Materials/Structural Safety

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A11C.SIC.17	Administration of the FAA Joint Centers of Excellence for Advanced Materials (JAMS)	This project is solely to fund the administration and continued operations of COE JAMS as mandated by the FAA Reauthorization Act of 2018. JAMS is co-led by the University of Washington and Wichita State University and administrative funds are split between them. Research grants are administered to all JAMS member schools. There are currently nine core JAMS member universities, which include Wichita State University (Co-Lead), University of Washington (Co-Lead), University of California San Diego, Auburn University, Mississippi State University, University of Utah, Oregon State University, Washington State University, and Florida International University. The research funded through the JAMS COE is designed to evaluate and advance new materials, processes, and structures for safe integration into aviation products. Output of JAMS research will help support development of performance based guidelines (industry documentation) and guidance (FAA documentation). While current advanced material and process guidance is already performance-based, because practices are proprietary and non- standardized, there is much to be gained from sponsoring research to publish best practices and guidelines that ensure successful and safe integration. The FAA COE framework requires %100 matching contributions from non-federal sources for every dollar awarded to COE research. FAA uses this framework to engage with industry through COE schools. Through COE the framework, our industry research partners invest in FAA research. In addition to bringing non-federal resources to the table and doubling investment on FAA dollars spent on COE research, this engagement with public and private partners also enables FAA to leverage other related external research efforts thereby avoiding duplication. This project is an enabler that allows FAA to maintain the COE JAMS framework and use it as a funding vehicle to sponsor research grants through the JAMS COE with dollar-for-dollar industry cost match.	FY17	FY30	Y
A11C.SIC.14	Evaluate fatigue and damage tolerance behavior of bonded joints	In a cost-share partnership (50/50) with Boeing, address safety and structural integrity issues of bond joints and repairs. Current focus is assessing the fatigue and residual strength performance of bonded repair size limits (BRSL) for panels representative of composite wing structures. This task will leverage resources with Boeing to support this research and help establish additional structural test capabilities for the FAA	FY17	FY26	Y

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Program Area/BLI: Advanced Materials/Structural Safety

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A11C.SIC.1	Evaluate Aging Effects on Selected Material or Structural Detail	Many advances with manufacturing methods are inducing part-specific characteristics that require careful consideration for long-term effects. For decades, rotor blades (tail and main) have both metal and composite bonded details in a critical single load path that, if failed, may cause a catastrophic rotorcraft crash. Specific blade locations and history leading to a disbond growth varies along the length of the blade and loading history. In some cases, events can yield slow disbond growth and noises that self-inspect a problem that safely leads to blade retirement. Other disbond locations may generate faster blade growth that, without arrestment features, can be catastrophic. Different parts (segments) of the blade have enough differences in the specific history of loads leading to disbonding that specialized bench tests may be defined to substantiate the design's life in separate bench tests suitable for that segment of the blade. In addition, the specific usage spectrum has been found to make a difference and the largest blades often have different test spectrums based on specific applications. When the rotorcraft is sold to a new owner, there is the possibility that usage changes and potential history-dependent behavior may arise, stymying attempts to certify varying applications. This is further complicated realizing that polymer adhesives used for bonding metals and composites have behaviors that are highly non-linear, viscoelastic and plastic (with strong environment and load history dependence). Recently, it has also been realized that the sandwich cuff portion of the rotorblade, which is often repaired sandwich structure, may also have complex contributions to blade failures. This research will use an integrated product team approach to safety involving interested regulatory, OEM and maintenance organizations to first identify possible root-cause effects and then support laboratory bench tests and analyses to show the failure can be replicated in a test, which has practical acceleration parameters	FY20	FY27	Y

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A11C.SIC.12	Develop Certification Protocols for Advanced Materials	This research investigates new material forms and new manufacturing processes that are being introduced into aviation products. This addresses AVS goals for both safety and innovation by investigating fundamental material behaviors and developing standard approaches for specifications, testing protocols, and data reporting. The first requirement of introducing any new material or process is to ensure it is characterized and under control. Different material forms, such as composite prepreg, bonded joints, polymer fused filament additive manufacturing (AM), metal powder bed fusion AM, resin transfer molding (RTM) composite, etc., require different testing protocols to meet regulatory requirements. This research helps establish minimum criteria that are acceptable to the FAA for various material and process combinations. This process of creating initial databases, and publishing the characterization protocols in FAA and industry standards, was successfully used in the mid-90's for prepreg carbon epoxy material forms. Since 2016, FAA has been funding many similar projects to develop databases and protocols for materials such as ceramic matrix composites, thermoplastic composites, polymer AM, and adhesives. This research is expected to be open for many years as FAA selects and investigates various materials from the new ones being proposed by applicants. Work that meets this scope has been funded through SIC.12 (planned budget) and SIC.13 (congressional plus-up funding). For FY24, we are continuing investigation of discontinuous fiber reinforced composites that exhibit unique behaviors compared to "traditional" continuous fiber composites. These unique behaviors affect design performance through relationships with structural geometrical details, material characteristics and the necessary process controls. The design space of practical interest to the industry will require different testing and analysis strategies for material characterization and design value development as a function of allowed process variables.	FY20	FY30	Y

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A11C.SIC.3	Evaluate Analytical Methods for Composite Seat Performance	Current industry standards and test methods for seating systems were developed assuming metallic structure in the load path. Composites are now proposed for application and the current guidance material needs to be expanded to describe how static and dynamic certification test methodologies should be adapted. This research will evaluate comparable composite and metallic seating systems and use that information to update industry guidelines and practices for seat design and certification, as well as FAA guidance documentation and training materials. Research activities will focus on developing data that supports performance based guidelines (industry documentation) and guidance (FAA documentation). The data will be used to support safe test methodologies for seating systems. The outcomes support developing guidance material that will be incorporated in FAA AC's and in industry standards documents such as CMH-17 and SAE. FAA's AC 20-146A will be expanded after successful completion of this project to allow the use of analytical models in seat certification projects. This research supports advanced manufacturing by supporting safe integration of composite seating systems into aircraft, rotorcraft, and personal vehicles. It may also be applicable to space vehicles, which are also implementing composite seating systems.	FY23	FY27	N
A11C.SIM.3	Evaluate fatigue behavior of metallic AM materials	This research is to investigate fatigue and age-related behavior of metallic additively manufactured materials to safely implement them into fatigue-sensitive structures. While some fatigue data will be developed as part of initial material characterization under BLI Item 1.1, it will not be complete in all aspects necessary to safely implement metal AM into fatigue critical structures. This is expected to be an ongoing project to evaluate behavior of various material/process combinations and may include evaluating existing tools. In FY25, this will include two tasks: · Sensitivity Study for Static and Fatigue Behavior of Anomalies and Part/Substrate Interface in Direct Energy Deposition (DED) · Evaluation of Structural Integrity Assessment Tools for Higher-Criticality Metal AM Parts (DARWIN)	FY19	FY30	Y

Domain: Aircraft Safety Assurance
Program Area/BLI: Continued Airworthiness

NOTE: A new program titled "Next Level NAS Oversight" was introduced as a top priority in the Aviation Safety RE&D Portfolio. At this time, the program is being further definded by a working group led by the AVS Chief Scientist and Technical Advisor for Safety and Risk Analysis and consists of placeholder projects in the Continued Airworthiness, Flightdeck/Maintenance/System Integration Human Factors, and System Safety Management/Terminal Area Safety Budget Line Items (BLI). Some projects proposed for FY25 in the Flightdeck/Maintenance/System Integration Human Factors, and System Safety Management/Terminal Area Safety BLIs were also identified as being related to this program and were reprioritized within those BLIs accordingly. These placeholders and related projects are identified in this report with a yellow background and enclosed on all sides with a double line.

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A11E.TBD	Next Level NAS Oversight (Continued Airworthiness)	Data-driven government oversight exercised over practitioners of Safety Management System(s) in the NAS. Details to-be-determined by cross organizational working group led by the CSTA for Safety and Risk Analysis.	TBD	TBD	Y
A11E.ES.8	Large Electric Energy Storage System	This requirement will provide data to identify the best possible configuration of the large electric energy storage system for helicopters and airplanes and large transport airplanes. The aircraft will require MW-range power consumption and MW-hr storage capacity. Safe design, validation and maintenance will be a new challenge. These systems include several modules with hundreds of cells each. These cells, modules, and batteries must be installed in such a way that vibration and shock do not effect battery safety and performance. This effort will provide data on battery safety and performance after cells and batteries are subjected to various impact and vibration conditions. The data will be used for certification and industry standards to maintain or increase the current level of safety. This data would apply to unmanned aerial vehicles, small airplanes, rotorcraft, and transport aircraft. In the United States and abroad, experimental prototypes are pushing the envelope of electric propulsion to new limits in hopes of understanding more about its potential while capturing greater market appeal. Among some of today's key players with commercial availability are Pipistrel's Taurus Electro G2 electric-powered motor glider, Yuneec International's e430 twin seat LSA, and Lange Aviation's Antares 20E self-launching sailplane. There's also a growing variety of electric powered weight-shift control trikes, powered parachutes, and hang gliders surfacing in the market. Hybrid-electric part 23 commuter airplanes and transport category regional airplanes are in conceptual design.	FY21	FY27	Y
A11E.RS.7	Helicopter Fuel System Drop Test	This research should determine the relevance and standardize the use of different materials used in helicopter fuel cell drop tests as prescribed in Fuel Cell Crash Resistance§ 27/29.952 and make it less burdensome for applicants.	FY22	FY26	Y

A11E.FCMS.13	Adoption of New Technologies for Enhancement of GA Safety	There are new and innovative safety systems available that could dramatically improve GA aircraft safety. Some of these systems are small, lightweight, and inexpensive. Lessons learned from previous research shows that these new safety devices can easily be retrofit into existing GA aircraft and applied to novel designs of Advanced Air Mobility Aircraft.	FY20	FY26	Y

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A11E.RS.9	Loss of Control (LOC-I)	This research will examine models, methods, and means that would indicate to a rotorcraft pilot the onset, presence, and potential severity of an impending loss of control condition. Loss of Control in a helicopter can take many forms, however, the most prevalent ones seen in the latest United States Helicopter Safety Team's (USHST) fatal accident analysis highlighted loss of tail rotor effectiveness (LTE), vortex ring state (VRS) or settling with power/insufficient power, dynamic rollover, retreating blade stall, mast bumping, and low rotor rpm conditions. As an example of one of these unsafe conditions, LTE appears suddenly without indication to a pilot upon reaching the performance limitation of the helicopter's tail rotor in various flight/wind conditions. The goals of this research (using LTE as an example) are to: 1) develop and refine existing models to detect the presence of the onset of LTE, 2) provide a warning to pilot(s) of the impending condition and potential severity, 3) create/test potential mechanical and electronic systems that could provide a degree of tail control input to arrest this condition.	FY22	FY27	Y
A11E.SIM.5	Structural Integrity Issues for Emerging Technologies	This research addresses certification and continued airworthiness issues arising from the introduction of emerging metallic structures technologies (EMST) used for aircraft structures in new fatigue critical applications. It leverages FAA resources through cost- share cooperative research and development agreements (CRADAs). In partnership with industry, structural integrity and fatigue behavior of EMST is being assessed through test and analysis of fuselage structure using the FAA's FASTER and Structures and Materials labs. Fuselage panel test data is being generated to assess the effect of EMST fuselage concepts on structural performance as compared to the current baseline aluminum fuselage structures. This proactive work provides FAA certification engineers with the insights necessary to assess these emerging technologies, so that the appropriate questions can be posed to the applicants for certification, to ensure acceptable levels of safety and risk mitigation. FY26 will be the last year of funding for this research	FY17	FY26	Y

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A11E.ES.9	High Voltage Electric Aircraft System	This requirement will provide data to identify the best possible configuration of High Voltage Electric Aircraft System for small, helicopters and airplanes and large transport airplanes. These will require megawatt-range power consumption and MW-hr distribution capacity. Safe design, validation and maintenance will be a new challenge. These system may include several system inovation and implementation of modularized dtributive system and design/validate in a practical method that ensure safe installation and containment of possible failures. High voltage experiments will be conducted on electric aircraft components at various frequencies, temperatures, humidities and altitudes. This data would apply to unmanned aerial vehicles, small airplanes, rotorcraft, and transport. In the United States and abroad, experimental prototypes are pushing the envelope of electric propulsion to new limits in hopes of understanding more about its potential and capturing greater market appeal. High voltage electric systems, such as those proposed on the new eVTOL UAM vehicles such as the Joby aircraft, MagniX electric propulsion unit (EPU) have introduced new hazards that are currently not fully understood. We need to work with industry, academia, and standard organizations to establish a knowledge base and support the development of consensus sbased standards to support fielding of such systems in the near future. Hybrid-electric part 23 commuter airplanes and transport category regional airplanes are in conceptual design. High voltage electric aircraft systems introduce new safety challenges for electrical energy management. This is a disruptive technology that is a key enabler for More Electric Aircraft, new Urban Air Mobility and eVTOL vehicle systems as well as UAS.	FY22	FY26	N
A11E.SIM.9	NASGRO Enhancement, Standardization, and Material Database Generation for Damage Tolerance Analysis	Collaborative government – industry effort to enhance the material databases and damage- tolerance assessment (DTA) tools' capabilities included in the NASGRO suite of software. The output of the research helps to promote consistent and uniform level of safety throughout the aviation industry through standardization of validated DT fracture compliance material data and tools. Standardization of the data and tools enable the FAA and industry to safely and efficiently address compliance to Title 14, Code of Federal Regulations (14 CFR) 25.571.	FY23	FY30	Y

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Program Area/BLI: Continued Airworthiness

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11E.RS.5	Wire Strike Avoidance	Wire Strike Avoidance research addresses one of the key causal factors of the 3rd leading accident precursor of helicopter fatal accidents – Low Altitude Operations. Wires are incredibly difficult to discern, especially at low altitudes where a majority of helicopter operations take place. They are often impossible to see at night, but can also be tough to pickup during daylight conditions and if they impact a helicopter's main rotor or tail rotor blades, the result is almost always catastrophic. Thus, research is needed to examine and approve cost-effective technologies to enhance safety of helicopter low altitude flight operations such as search and rescue, helicopter air ambulance, law enforcement, aerial application, corporate/VIP transport, and others. Research activities will focus on two areas of wire strike avoidance: wire detection and crew alerting and wire cutting. They will comprise trade studies of new technologies and the certification considerations for these technologies, the design and evaluation of new wire cutting technologies utilized as part of drop testing of actual helicopter airframes, examination of new databases of wires and other obstacles/hazards in the low altitude environment, plus human-in-the loop simulation and flight-testing to examine the safety benefits of new alerting detection and alerting tools on helicopter avionics, heads-up/head-worn/helmet-mounted displays, and electronic flight bags. These activities will contribute to the development of recommendations for safety enhancing technologies that could be implemented through future certification applications and/or Technical Standard Orders (TSO's) to increase safety and provide operational benefit to the vertical flight community.	FY19	FY26	N
A11E.SIM.4	MMPDS Support and Design Values for Emerging Materials	The Metallic Materials Properties Development and Standardization (MMPDS) is a collaborative government – industry effort to develop and improve the standardized process to generate statistically-based proprieties for metallic materials and fasteners used in commercial and military aerospace systems worldwide. This proposal addresses the need to have properly vetted compliance data and tools that the aviation industry can use to certify products in a consistent, safe and uniform way. This collaborative process develops data and tools, promotes efficient and standardized certification of aircraft structure and leverages resources via government and industry consortium.	FY17	FY32	Y
A11E.RS.8	Integrated Flight and Propulsion Control	This research will investigate the flight characteristics of multiple rotor vehicles (ex. four rotor helicopter or quad copter but could be more than four), which we will call quad copter plus. Since multiple applicants are pursuing new and novel ways of integrating propulsion flight controls to simultaneously produce lift, thrust and directional control for electric vertical takeoff and landing aircraft, some of the existing airworthiness standards and associated means of compliance are not applicable or need modification.	FY19	FY26	N

Domain: Aircraft Safety Assurance
Program Area/BLI: Continued Airworthiness

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11E.SIM.13	Development of Control Surface and Stabilizer Freeplay Limits	To obtain data and develop the methodology and nonlinear models required to establish safe and realistic limits that will support the development of consensus-based standards for transport category aircraft; with the objective to preclude freeplay-induced vibrations (also known as limit cycle flutter) in operating airplanes and thereby eliminating related dangerous COS issues. The limits will be established for both legacy aircraft and new airplanes equipped with emerging technologies of active flutter suppressions. The result will include numerical models and a fully aeroelastic aircraft wind-tunnel model that could be used as a testbed for developing consensus standards for aeroelastic-related COS issues.	FY19	FY25	Y
A11E.SIM.11	Effect of Turbulence on Aircraft Structural Loading	To examine the current 14 CFR Part 23, Part 25, Part 27, Part 29 loads rules and new rules defined by 14 CFR part 21.17(b) for electrical vertical takeoff and landing (eVTOL) systems to identify the need to relax or strengthen airworthiness requirements.	FY19	FY27	Y
A11E.FCS.4	Evaluating Potential Crash Impact Conditions for eVTOL	The regulations currently base the crash impact conditions on conventional airplanes with relatively low stall speeds and modest flare during landing using a tubular fuselage and wings more or less centrally mounted. Many electric vertical takeoff and lift (eVTOL) designs include multiple rotors, overhead structures, asymmetric rotor locations relative to the cabin, smaller passenger compartments, swept designs, and new seat designs. Some of the original assumptions used for seat certification may not be valid which could result in a lower level of occupant protection if nothing is done.	FY24	FY26	Y
A11E.FCS.1	Dynamic Crash Conditions for Supersonic Transports	The regulations currently base the crash impact conditions on conventional airplanes with relatively low stall speeds and modest flare during landing using a tubular fuselage and wings more or less centrally mounted. Based on this, a crash impact pulse was developed to assess occupant protection. There is a different pulse for small airplanes and rotorcraft. For supersonic transports, some of the original assumptions may not be valid which could result in a lower level of occupant protection if nothing is done.	FY23	FY27	N
A11E.SIM.14	Reliability of Structural Health Monitoring (SHM)	Continued operational safety (COS) is dependent on robust maintenance and inspection practices with defined Probability of Detection (PoD). The goal of this research is to ensure the reliability and detection capability of Structural Health Monitoring (SHM) technologies are equivalent or better than the traditional non-destructive inspection techniques that they are replacing on transport category aircraft. This is accomplished through the generation of data to verify certification and maintenance methodologies to ensure safe and efficient use of SHM. This research will provide the FAA with information (inspection capability and PoD) to determine the appropriateness of SHM techniques and technologies and will provide guidance and training to prepare the industry for implementation of SHM technologies.	FY21	FY28	Y

Domain: Aircraft Safety Assurance
Program Area/BLI: Continued Airworthiness

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11E.SIM.19	Thermal Residual Loads in Metal-Composite Hybrid Structure	This proposal is aimed at developing data needed to benchmark the best industry practice and fill the gaps in the knowledge transfer as related to key aspects important to account for thermally induced loads in hybrid metallic-composite structure during full-scale test. It supports ARAC recommendations on the damage tolerance and fatigue requirements of 14 CFR part XX.571 to more represent a performance-based standard or an industry consensus standard and associated guidance material.	FY21	FY26	Y
A11E.FCS.2	Generalized Occupant Safety in Multiple Configurations	Crash dynamics requirements today are based on extensive research, both experimental and from actual accidents. The current safety standards were developed independently for different types of aircraft and different loading directions. As such, there are many competing requirements and methods of testing and evaluating depending on both the impact direction and seating orientation. A comprehensive set of identified injury criteria is needed for an overall crashworthiness certification program regardless of aircraft type and loading direction. This would support the move to performance based regulations and directly support new classes of aircraft such as Advanced Air Mobility which share many of these common orientations with traditional aircraft.	FY24	FY26	Y
A11E.SIM.15	Inspection Challenges of Emerging Structural Technologies	This research looks to generate data to verify safe and efficient use of existing and advanced inspection technologies for certification and maintenance. The first is to ensure the reliability of advanced inspection technologies, and the second is to assess the applicability of traditional and advanced inspection technologies on novel structures and materials. These products are being introduced without the benefit of the in-service experience on the existing configurations, materials, and operational conditions the operators provide. This research will provide FAA with detailed information to determine the appropriateness of inspection techniques and technologies and will provide guidance and training to prepare the industry for the implementation of these materials and technologies.	FY25	FY28	N
A11E.SIM.20	Airframe Structure Model and Simulation Validation	This proposal uses existing testing facilities at the FAA Tech Center to generate data necessary to evaluate the effectiveness of experimental validation frameworks for advanced Modeling and Simulation (M&S) applications. This work will be informed by the outcomes of the industry-government Airframe M&S working group developing a Credibility Assurance Framework (CAF), and will be performed in close collaboration with industry partners. The outcome is intended to support industry and FAA confidence in the more extensive use of M&S tools for assessment of aircraft structures using the CAF	FY25	FY29	Y

Domain: Aircraft Safety Assurance
Program Area/BLI: Continued Airworthiness

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11E.FCS.3	Evaluating Vertical Seat Testing for General Aviation Aircraft	Crash dynamics requirements today are based on extensive research, both experimental and from actual accidents. Based on FAA and NTSB data at the time, dynamic load factors were adopted for all general aviation aircraft. Since that time, the FAA has issued exemptions for certain classes of aircraft from these dynamic seat testing requirements which were identified as the third most costly part of the aircraft. These exemptions are based on the performance of the aircraft, the likely exposure, and the safety risk involved. There are currently proposals being developed to extend these dynamic seat testing exemptions to additional aircraft while including other mitigation features. These methods would be incorporated into the ASTM F44 standard which is an acceptable means of compliance for Part 23 aircraft.	FY25	FY27	N

Domain: Digital Systems Technologies
Program Area/BLI: Digital Systems

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11DS.SDS.7	Aircraft PNT Cyber Safety Resilience	This research is composed of three competencies for aviation PNT Cyber Safety Resilience research consistent with National policy and Executive Order assigned tasks to enable aviation resilience through responsible use of PNT. Each task area is independent and can be executed sequentially in priority order, as well as in parallel (subject to funding availability). Collectively the aggregate effects enhance aircraft resilience through the responsible use of PNT. Research Competency 1: Advanced Antenna Technologies for PNT Cyber Safety (FY21+ appropriated funds). This research enables assessment of aircraft interference protection (antenna, antenna electronics, GNSS receiver interface, and aircraft installation) technical characteristics to establish system performance capabilities and requirements and develop FAA technical standard orders (TSO) and aircraft advisory circular (AC) installation guidance for two categories of civil, commercial aircraft antenna:Baseline Interference Protection (adaptive nulling) antenna systems to enable continued safe operations;Enhanced Interference Protection and Signal Manipulation Protection capable (adaptive nulling and digital beam forming) antenna with intent to enable GPS and Galileo E5/E5a capabilities. Research Competency 2: GPS Avionics/Aircraft Authentication for PNT Cyber Safety. Avionics in-kind authentication (non-cryptological) for GPS and GPS/Galileo services. This research assesses aircraft capabilities to authenticate/validate GPS, and GPS/Galileo data using trend data as well as avionics comparison of the GNSS PNT data with other aircraft PNT sensor data including: inertial systems, all-in-view DME, new commercial services, and/or modernized government C-PNT services as well out-of-band authentication.	FY21	FY28	Y
A11DS.SDS.6	Develop a closer relationship between safety and certification along a safety continuum	The development categories currently in use are labeled and divided into four. The risks levels are continuous but are also divided into distinct levels. These distinctions do not map well in real-world situations where the risks and development techniques are a lot more nuanced. A mechanism should be developed where the certification work should have a more flexible mapping to the risk reduction thereby raising confidence in the software based system without resorting to a "checklist mentality".	FY24	FY26	Y

Domain: Digital Systems Technologies
Program Area/BLI: Digital Systems

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11DS.SDS.10	Develop a better understanding of ML based generalization and rigor	Data is used to train an AI, M/L system. The training data is always incomplete and new meaning must be extracted from the training data in a manner that reduces to total data stored without losing the essence that is required. This is called generalization and is fundamental to the effectiveness of the resulting inference system. The balance between the generalization and the resulting rigor of the resulting system needs to be better understood. While a number of statistical and other techniques have been attempted, the system is is still "surprised" by anomalies in the model that are not visible during the verification process. For AI M/L systems to be trusted, this phenomena must be better understood when it affects risk.	FY24	FY26	Y
A11DS.SDS.11	Develop an approach to scale upwards from low-criticality advisory systems to safety critical system	The training of AI M/L systems is typically accomplished through labeled data, where training data sets consist of inputs and their anticipated outputs. For large data-sets this becomes expensive, so success measures are developed so that AI/ML networks learn from alternative reward systems. As simple advisory systems are introduced, training can continue through experience using combinations of data inputs. An autonomous pilot assistant may initially be trained on individual control instruments, but through subsequent observation can continue to learn from the pilot to build habits that mimic the good behaviors of the pilot. This learning mode needs to be controlled so that bad habits are not rewarded. We need to explore further and assess the safety implications of using this approach.	FY24	FY26	Y
A11DS.SDS.13	Develop an approach that supports explainability of an AI M/L system.	A complete AI M/L based system has many components from Data Management (including Training, Validation and Testing), to Model Development, Transfer (which may include many optimization steps) and deployment on an inference processor. The computers on many of these steps may be different, and many software transformations may be performed. These steps may enhance our visibility into the system or they may conceal it. To understand what is going on the system should be explainable. The explanations should be such that they are understood by humans. As sophistication of the system grows, the risk is that the explainability suffers. Explainability may put a limit on what can be achieved unless a mechanism is found that reduces the risk of not knowing. A bound on explainability needs to be developed.	FY24	FY26	N

A11DS.SDS.12	Develop an approach that permits trust in the model development and model verification processes tha	The training of AI M/L models are typically performed using huge computing resources. Typically such systems are provided by large companies that have built vast networks of specialized processors that operate on data in parallel and replicate their processing using simple but vectorized capabilities in-the-cloud. Existing guidance for using such development and verification tools do not exist, and it is unknown how this should be addressed in a certification environment.	FY24	FY26	N

Domain: Digital Systems Technologies
Program Area/BLI: Digital Systems

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11DS.SDS.8	Develop understanding of software safety at lower levels of criticality	This requirement will analyze airworthiness and certification aspects of highly integrated, complex digital aircraft systems, including the software and airborne electronic hardware. Aircraft Software, Programmable Hardware, Artificial Intelligence and Machine Learning based systems provide tremendous flexibility and power to express how aircraft systems should behave using these technologies. This permits us to add functionality that would be impossible without these technologies, but faults in design and implementation using these technologies can be difficult to eliminate and be disastrous if present. Due to the growth in size and complexity of these systems, our traditional development and verification approaches may reach a point when we are unable trust them. These "soft" technologies are already forcing us to choose between deployment and risks. The diversity of future systems will need new guidance to ensure growth can continue without compromising safety. A research program is needed to understand how industry and regulators can establish confidence in flying vehicles in the presence of rapid technological developments.	FY24	FY26	N
A11DS.SDS.9	Develop improvements of software safety through the use of architectural means	This requirement will analyze airworthiness and certification aspects of highly integrated, complex digital aircraft systems, including the software and airborne electronic hardware. As the availability of computing power continues, the use of more resources to cross-check and mitigate potential vulnerabilities improves. While this seems compelling, the monitoring systems and their effects on overall safety may themselves introduce problems. Are the monitors trustworthy? Are the selection mechanisms trustworthy? Can a safety monitor cause more problems?	FY24	FY26	N

Domain: Environmental and Weather Impact Mitigation
Program Area/BLI: Aircraft Icing

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11DA.AI.11	High Altitude Ice Crystal Icing Effects on Aircraft – Q2.3 Atmospheric Characterization	Conduct research to maintain safe, unrestricted flight through high altitude ice crystal environments. This research requirement addresses current shortfalls in policy and guidance for glaciated and mixed-phased icing conditions and their effect on turbine engine damage and resulting powerloss, along with air-data probe fowling. This activity supports current ice crystal icing ARAC tasking. This specific research task provides a more accurate icing atmospheric definition which will be used by ARAC for a recommended rule change. Current atmospheric definition in 14 CFR part 33, Appendix D is too conservative and does not include air pollution (i.e. aerosols) effect. This research will address that. FY25 will be final year for this research task.	FY19	FY26	Y
A11DA.AI.21	High Altitude Ice Crystal Icing Effects on Aircraft –Q2.4 Ice Crystal Icing Wx Analysis and Document	Conduct research to analyze and document ice crystal icing weather system(s) after an in- service event where severe ice crystal icing conditions are suspected to be the cause of either an engine powerloss or air data probe corruption. Document the procedures for analyzing future in-service difficulties, such as engine damage, powerloss and air data probe corruption from icing. This analysis of in-service events allows the FAA to assess risk and determine safety impact. This specific research task will develop standardized procedures to identify in-service event ice crystal icing weather conditions. Currently only a few atmospheric scientists world- wide know these procedures. This task will identify and document the best practices and provide training to FAA meteorologist for identifying these conditions. FY25 will be final year for this research task.	FY25	FY26	Y
A11DA.AI.22	High Altitude Ice Crystal Effects on Aircraft –Q2.5 Detection Algorithm for Prediction of HIWC-ALPHA	Convective weather high altitude ice crystal conditions are causing turbine engine and air data probe events on commercial aircraft, resulting in power loss, probe errors, incidents and accidents. These conditions are not well understood and cannot be readily detected by current means. This research will further forecasting and detection methods that will allow operators to detect and avoid ice crystal icing conditions, preventing potential multi- engine power loss events. Through using a developed algorithm, ice crystals found in convective weather systems can be remotely detected using a combination of weather radar and satellite imagery, as well as weather forecast model data. Flight crews and dispatch organizations can effectively use this information as a mitigation strategy to avoid ice crystal encounters, pursuit of a path towards operational transition and implementation is necessary.	FY19	FY27	Y

Domain: Environmental and Weather Impact Mitigation
Program Area/BLI: Aircraft Icing

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11DA.AI.10	High Altitude Ice Crystal Icing Effects on Aircraft – Q2.2 Larger Scale Simulation	Conduct research on a larger scale compressor rig for assessment of ice accretion conditions to allow safe, unrestricted flight through high altitude ice crystal environments. This research requirement addresses current shortfalls in policy and guidance for glaciated and mixed-phased icing conditions and their effect on turbine engine damage and resulting powerloss, along with air-data probe fowling. This specific task flows out from prior year's research under A11Da.AI.9 which built and tested the first small scale icing rig. This new task takes the knowledge, experience, and lessons learned from the initial small rig and scales up the rig to identify scale effects and build in new flow-path measurement locations and techniques. This rig is recognized by icing regulators and industry worldwide as the most innovative tool to identify the physics of ice accretion in warm engines. The results of this testing will inform future guidance for compliance to 14 CFR 33.68. FY27 will be final year for this research task	FY24	FY27	Y
A11DA.AI.13	Safe Operations and Take-off in Aircraft Ground Icing Conditions – Q1.2 Allowance times in mixed ici	The FAA is conducting research to develop methods to determine hold over times for two or more simultaneously occurring forms of winter precipitation such as snow mixed with ice crystals. The methods will then be used to develop holdover times for simultaneous conditions. Currently no holdover times exist for simultaneously occurring forms of winter precipitation. Without these holdover times, aircraft cannot takeoff when two or more conditions are observed without performing a pre-takeoff contamination check within 5 minutes of takeoff. Cargo aircraft are more limited because pilots cannot perform this inspection due to the lack of windows to inspect the wings.	FY17	FY27	Y
A11DA.AI.12	Safe Operations and Takeoff in Aircraft Ground Icing Conditions – Q1.1 Vertical Surface Contamination	The FAA is conducting research to determine the impact of various types of frozen contamination on the vertical stabilizer and rudder and its effect on aircraft control during takeoff. This research requirement addresses current shortfalls in policy and guidance for icing on vertical tail surface conditions and their effect on aircraft control, especially in worst-case scenarios such as an engine failure on takeoff in high crosswind conditions. This research is needed to improve winter operational safety by developing test data and analysis to support a decision for vertical surface policy to address safe operational deicing requirements.	FY20	FY26	Y

Domain: Environmental and Weather Impact Mitigation
Program Area/BLI: Aircraft Icing

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11DA.AI.15	Safe Operations and Take-off in Aircraft Ground Icing Conditions – Q1.4 Artificial Snow Machine	Conduct research to maintain safe winter ground operations, evaluate effects of changing ground operations and develop test and analyses methods to support these changes, and address effects of technology changes for fluids and de/anti-icing procedures. Develop a validated artificial snow machine for evaluating de-icing and anti-icing fluids will result in a more effective test method and provide significant savings to the FAA, fluid manufacturers and commercial airlines. Currently it is necessary to wait for natural snow conditions (e.g. very cold conditions) to evaluate fluids. FAA guidance requests calls for more extensive fluid evaluations for all snow conditions, which would be available using the artificial snow machine.	FY17	FY26	Y
A11DA.AI.16	Urban Air Mobility (UAM) Icing – Q3.1 Icing Cloud Effects on Aircraft	There is a need to develop aircraft regulatory requirements and guidance for Urban Air Mobility (UAM)/Advanced Air Mobility (AAM)vehicles to maintain safe operations in instrument meteorological conditions (IMC) and icing environments.Research is needed to determine means of compliance for ice detection systems as well as to define icing conditions that should be in the compliance for inadvertent icing encounters for these vehicles. In order to understand the effects of icing on operational safety of UAM/AAMs, potential icing hazards, such as propeller/rotor vibration, thrust loss, range/flight time reduction, ice shedding, etc., this research needs to be conducted. Icing tests are planned in Penn State Adverse Environment Rotor Test Stand (AERTS) facility and Rail Tech Arsenal (RTA) icing wind tunnel in Austria in order to gather necessary information to develop guidance based on knowledge of ice effects for UAMs. This research proposal describes the planned testing with a particular focus on rotor/propeller wash that may affect the ice accretion on critical electric propulsion cooling inlets and ice detection systems.	FY19	FY27	Y

Domain: Environmental and Weather Impact Mitigation
Program Area/BLI: Aircraft Icing

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11DA.AI.18	Modelling of Ice Accretions on Ice-Protected Surfaces – Q4.1 Assessing Existing Numerical Codes	Critical surfaces of airplanes are covered with anti-icing/de-icing systems to protect them in icing environments. These systems are applied only to the forward portion of the surface, hence, they cannot eliminate the icing threat completely. With a thermal ice protection system (IPS), the supercooled liquid water impinging on the surface, if not fully- evaporated, will run back and freeze, leaving the protection surfaces clean but the unprotected part ice-contaminated. IPSs other than thermal systems can also produce ice build-up in normal operation, both on the protected area and just aft of the protected area at total temperatures near freezing. A similar ice accretion may also occur if the aircraft encounters supercooled large drop (SLD) conditions, where larger droplets impinge directly behind the protection surfaces and form ice protrusions. This research will strengthen the scientific basis for development of means of compliance for aircraft icing regulations and certification standards. In addition, it will lead to publicly disseminated data that can be used to develop new design and certification tools. The ultimate goal of this research is to reduce certification costs while at the same time improving aircraft safety operating in adverse weather conditions.	FY22	FY28	Y
A11DA.AI.19	Modelling of Ice Accretions on Ice- Protected Surfaces – Q4.2 Ice Accretions on unprotected surfaces	Critical surfaces of airplanes are covered with anti-icing/de-icing systems to protect them in icing environments. These systems are applied only to the forward portion of the surface, hence, they cannot eliminate the icing threat completely. With a thermal ice protection system (IPS), the supercooled liquid water impinging on the surface, if not fully- evaporated, will run back and freeze, leaving the protection surfaces clean but the unprotected part ice-contaminated. IPSs other than thermal systems can also produce ice build-up in normal operation, both on the protected area and just aft of the protected area at total temperatures near freezing. A similar ice accretion may also occur if the aircraft encounters supercooled large drop (SLD) conditions, where larger droplets impinge directly behind the protection surfaces and form ice protrusions. This research will strengthen the scientific basis for development of means of compliance for aircraft icing regulations and certification standards. In addition, it will lead to publicly disseminated data that can be used to develop new design and certification tools. The ultimate goal of this research is to reduce certification costs while at the same time improving aircraft safety operating in adverse weather conditions.	FY23	FY28	Y

Domain: Environmental and Weather Impact Mitigation
Program Area/BLI: Aircraft Icing

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11DA.AI.20	Modelling of Ice Accretions on Ice-Protected Surfaces – Q4.3 Computational tool validation	Critical surfaces of airplanes are covered with anti-icing/de-icing systems to protect them in icing environments. These systems are applied only to the forward portion of the surface, hence, they cannot eliminate the icing threat completely. With a thermal ice protection system (IPS), the supercooled liquid water impinging on the surface, if not fully- evaporated, will run back and freeze, leaving the protection surfaces clean but the unprotected part ice-contaminated. IPSs other than thermal systems can also produce ice build-up in normal operation, both on the protected area and just aft of the protected area at total temperatures near freezing. A similar ice accretion may also occur if the aircraft encounters supercooled large drop (SLD) conditions, where larger droplets impinge directly behind the protection surfaces and form ice protrusions. This research will strengthen the scientific basis for development of means of compliance for aircraft icing regulations and certification standards. In addition, it will lead to publicly disseminated data that can be used to develop new design and certification tools. The ultimate goal of this research is to reduce certification costs while at the same time improving aircraft safety operating in adverse weather conditions.	FY25	FY28	N
A11DA.AI.23	Terminal Area Icing Wx Information for NextGen (TAIWIN)–Q5.1 Terminal Area Icing Diagnostic Forecast	Address winter weather terminal area operational needs in response to new icing regulation 14 CFR 25 Amendment 140; section 25.1420 and NextGen operational needs to reduce weather impact. Under the new part 25 icing regulations, aircraft that have limited icing operations will have to identify their certification basis and determine if both ground and aloft icing conditions in the terminal area are acceptable for aircraft take-off, approach, and landing. A terminal area capability with increased resolution, discrimination (precipitation type), and accuracy for icing weather are needed to manage reliable, effective flight planning, release of aircraft, and landing of aircraft to support the NextGen Reduce Weather Impact element. Thus, a diagnostic and forecasting capability will be developed that can distinguish between Appendix C, the subsets of Appendix O (discrimination of freezing drizzle and freezing rain icing environments), and non-icing environments within the terminal area at spatial and temporal resolutions sufficient to support terminal area operations.	FY19	FY28	Y

Domain: Environmental and Weather Impact Mitigation
Program Area/BLI: Aircraft Icing

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11DA.AI.17	Urban Air Mobility (UAM) Icing – Q3.2 Ice Detector Effectiveness in UAM	There is a need to develop aircraft regulatory requirements and guidance for Urban Air Mobility (UAM)/Advanced Air Mobility (AAM)vehicles to maintain safe operations in instrument meteorological conditions (IMC) and icing environments. Research is needed to determine means of compliance for ice detection systems as well as to define icing conditions that should be in the compliance for inadvertent icing encounters for these vehicles. In order to understand the effects of icing on operational safety of UAM/AAMs, potential icing hazards, such as propeller/rotor vibration, thrust loss, range/flight time reduction, ice shedding, etc., this research needs to be conducted. Icing tests are planned in Penn State Adverse Environment Rotor Test Stand (AERTS) facility and Rail Tech Arsenal (RTA) icing wind tunnel in Austria in order to gather necessary information to develop guidance based on knowledge of ice effects for UAMs. This research will focus on effectiveness of ice detection systems under supercooled large drop (SLD) icing conditions by conducting ice detection testing under freezing rain and freezing drizzle conditions.	FY23	FY26	N
A11DA.AI.24	Terminal Area Icing Wx Info NextGen (TAIWIN)–Q5.2 Distinguishing between subsets of icing & no-icing	Address winter weather terminal area operational needs in response to new icing regulation 14 CFR 25 Amendment 140; section 25.1420 and NextGen operational needs to reduce weather impact. Under the new part 25 icing regulations, aircraft that have limited icing operations will have to identify their certification basis and determine if both ground and aloft icing conditions in the terminal area are acceptable for aircraft take-off, approach, and landing. A terminal area capability with increased resolution, discrimination (precipitation type), and accuracy for icing weather is needed to manage reliable, effective flight planning, release of aircraft, and landing of aircraft to support the NextGen Reduce Weather Impact element. To identify the performance metrics of a diagnostic and forecasting capability that can distinguish between Appendix C, the subsets of Appendix O, and non-icing environments within the terminal area, a validation and verification activity is necessary. This validation and verification activity consists of performing research test flights in the described icing conditions for select airports where the capability will be running in real-time. The collected dataset will be used for quantitative analysis of the capability.	FY23	FY27	N

Domain: Environmental and Weather Impact Mitigation
Program Area/BLI: Alternative Fuels for General Aviation

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11M.PS.6	Alternative Unleaded Fuels for Piston Engined GA Aircraft	The purpose of this program is to address the number one issue facing General Aviation. That is, how to safely transition the fleet of approximately 222,000 piston engine aircraft, away from the use of leaded aviation gasoline (avgas). Avgas is the only remaining transportation fuel in the U.S. that contains lead additives. These additives protect piston engines against damaging detonation, or engine 'knock' that leads to engine failures. However, there is no known safe exposure level of lead to humans; multiple studies have documented the negative health impacts of lead exposure. The FAA EAGLE initiative (Eliminate Aviation Gasoline Lead Emissions), was initiated to complete the research and industry collaboration necessary to eliminate the use of leaded avgas by the end of 2030. FY25 research will complete the engine test cell, flight, and chemical laboratory testing which will provide data to support the initial Fleet Authorization for unleaded 100LL replacement fuel. To accomplish this, this proposal addresses both the #1 and #2 priority research questions combined, as both questions are part of a complete package of research. There is no 'partial solution' pathway that can be achieved by eliminating, or sidelining a particular test segment (Research Question), as this would leave incomplete data on which to make a determination to authorize a safe unleaded avgas replacement for fleetwide use. Equally important, the research activities and contracted resources for this work are intertwined and overlap such that that it becomes impractical, and in fact would require substantially higher total cost estimates in an attempt to split them separately. For instance multiple questions/estimates would require each to account for the total costs of contract overheads in case one were not funded. Also, you cannot contract for a 'fractional body' for most labor categories. As such, we would have to overestimate, allowing full-time body counts in multiple labor categories, for each separate question that when combined would be able to split a single FTE, and so on.	FY21	FY29	Y

Domain: Environmental and Weather Impact Mitigation
Program Area/BLI: Alternative Fuels for General Aviation

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11M.PS.7	Propulsion Technologies to Reduce the Impact of GA on the Environment	The purpose of the Alternative Fuels program is to address the number one issue facing General Aviation. That is, how to safely transition the fleet of approximately 222,000 piston engine aircraft, away from the use of leaded aviation gasoline (avgas). Avgas is the only remaining transportation fuel in the U.S. that contains lead additives. These additives protect piston engines against damaging detonation, or engine 'knock' that leads to engine failures. However, there is no known safe exposure level of lead to humans; multiple studies have documented the negative health impacts of lead exposure. The FAA EAGLE initiative (Eliminate Aviation Gasoline Lead Emissions), was initiated to complete the research and industry collaboration necessary to eliminate the use of leaded avgas by the end of 2030. With a fleet of aircraft whose average age is approximately 50 years old, and includes aircraft with historic and vintage significance dating back as much as 100 years, there have been, and will continue to be challenges in identifying a single fuel that can meet all the fit- for-purpose needs of all aircraft in the GA fleet. This proposal addresses the #2 and #4 priority questions. The #1 question will have been completed by FY24, and the #3 question is planned to be completed in FY27. The research questions in this proposal are essential to, and complement each other in generating the data needed to meet the goals of EAGLE. We have grouped them in a single proposal, as they need to be conducted as part of a complete package of research. The questions need to be researched for the most part concurrently, as the success in answering one question completely, will require answering the others. This program will collaborate with industry partners under EAGLE, to conduct the research activities detailed in section 3.2.	FY23	FY26	Y
A11M.PS.8	Hybrid Electric Aircraft Systems	Hydrogen fuel cells and piston hybrid systems are an area of active development and design for upcoming electric aircraft. Various architectures can exist with how fuel is converted to electricity. The purpose of this project is to explore these various architectures including types of hydrogen fuel cells and piston generators under various conditions. This activity will look at various hybrid systems and how problems to fuel cell or piston energy sources affect the electric system and ability to propel the aircraft. Specific aspects include throttle response and load management when under a fault condition. Additional aspects to review will include thermal management and required maintenance to minimize possibilities of failures.	FY23	FY27	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

NOTE: A new program titled "Next Level NAS Oversight" was introduced as a top priority in the Aviation Safety RE&D Portfolio. At this time, the program is being further definded by a working group led by the AVS Chief Scientist and Technical Advisor for Safety and Risk Analysis and consists of placeholder projects in the Continued Airworthiness, Flightdeck/Maintenance/System Integration Human Factors, and System Safety Management/Terminal Area Safety Budget Line Items (BLI). Some projects proposed for FY25 in the Flightdeck/Maintenance/System Integration Human Factors, and System Safety Management/Terminal Area Safety BLIs were also identified as being related to this program and were reprioritized within those BLIs accordingly. These placeholders and related projects are identified in this report with a yellow background and enclosed on all sides with a double line.

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.TBD	Next Level NAS Oversight (Human Factors)	Data-driven government oversight exercised over practitioners of Safety Management System(s) in the NAS. Details to-be-determined by cross organizational working group led by the CSTA for Safety and Risk Analysis.	TBD	TBD	Y
A11G.HF.18	Integrating HF into Aircraft Design, Certification, Training, & Operations (ACSAA related)	Research is needed to provide human factors data, which will be used to improve, clarify, and expand human factors regulatory and guidance materials. This will support FAA personnel in both Aircraft Certification (AIR-600, 700, and 800) and Flight Standards (Aircraft Evaluation Division (AED) AFS-100), who evaluate, approve, and oversee human factors aspects of the integration of design, aircraft certification, training, and operational requirements, for the full range of aircraft, including both transport category and general aviation aircraft, as well as rotorcraft, and unmanned aircraft systems. This work will provide research, engineering, and operational data to inform Flight Standards (AFX) and Aircraft Certification (AIR) personnel who will clarify and expand policy, guidance, processes, procedures, and criteria to better integrate human factors throughout design and certification of aircraft. In the field, documentation will be used by multiple AFX and AIR personnel who jointly work with aircraft manufacturers and modifiers throughout the service life of a product including development (design, production), certification (as evaluated by both AIR and AFX as a part of the Flight Standardization (FSB) process), and operations (operational suitability, airworthiness directives). Current FAA human factors documentation to support these personnel is limited and the processes followed can vary by location.	FY21	FY27	Y

A11G.HF.16	HF Data to Inform FAA Decisions on the Adequacy of Policy for Maintenance Training (ACSAA-Related)	This project will provide research and operational data to support the human factors needs of FAA personnel who evaluate, approve/accept, and oversee aviation maintenance related procedures, operations, and training. Results will support and address specific maintenance human factors related Boeing 737 Max Joint Authorities Technical Review (JATR) observations, findings, and recommendations, and Government Accountability Office (GAO) Report 21-94 recommendations on FAA workforce competencies (aviation safety inspectors, aviation safety engineers). Outputs from this project will be documented in 5 technical reports to inform evidence-based decisions on the adequacy of existing FAA policy, guidance, and assumptions related to aviation maintenance training (includes airplane differences).	FY21	FY26	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.11	Single Source Reference Document for Flight Standards Human Factors (RDFSHF) - ACSAA related	Human factors research data is critical to support Flight Standards human factors specialists and other aviation safety inspectors who must evaluate and approve operational suitability, training, procedures, and operations. Currently, human factors considerations for these processes are spread across a range of regulatory and guidance documents and can be difficult to find (or may not exist). Research is needed to collect, review, and synthesize up to date human factors considerations into a Single Source Reference Document for Flight Standards Human Factors (RDFSHF) for operational suitability, training, procedures, and operations in transport aircraft in Part 121 and 135 operations. This research would provide input to the FAA on how to improve pilot training, qualification and procedures. It will inform relevant policy, operational requirements, standards, procedures, limitations, mitigations, and guidance materials and update industry recommended practices. In addition, the research results will provide data to support the FAA in responding to ACSAA and other formal recommendations to integrate human factors considerations throughout the design and evaluation process. Early integration of human factors principles into the evaluation of pilot training, flight deck operations, and pilot procedures has been identified as critical to aviation safety by the Aircraft Certification, Safety, and Accountability Act (ACSAA) and other recommendations following recent accidents and incidents, including those related to the Boeing 737 MAX.	FY18	FY26	Y
A11G.HF.45	Adapting Training and Flight Operations to Emerging Risks	This research will focus on adapting training and qualification to address emerging issues, including 1) pilot shortages and 2) increasing system complexity and information management. This research would provide input to the FAA on how to improve pilot training, qualification and procedures. It will inform relevant policy, operational requirements, standards, procedures, limitations, mitigations, and guidance materials and update industry recommended practices. In addition, the research results will provide data to support the FAA in responding to the NTSB recommendations, and other safety data analyses and recommendations (such as the PARC/CAST Flight Deck Automation Working Group report, recent accidents, the Air Carrier Training Aviation Rulemaking Committee and the upcoming International Civil Aviation Organization (ICAO) Personnel Training and Licensing Panel).	FY20	FY26	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.20	Pilot interactions with advanced technologies (ACSAA related)	Manufacturers often add new systems or equipment to the flight deck without considering their consistency and compatibility with existing flight deck designs, or their impact on human performance. Accidents, such as the B737 MAX (Lion Air and Ethiopian Airlines) demonstrate the importance of understanding the human-machine interface and the underlying automation systems that drive it. This research will investigate how pilots interact with and understand these technologies, regardless of aircraft type (general aviation, transport, or rotorcraft). Most importantly, the research data will support the development of guidance for aircraft certification, effective pilot training, updating industry standards, revising human factors regulatory and guidance material, and responding to Congressional recommendations related to Boeing 737 MAX accident investigations.	FY23	FY26	Y
A11G.HF.39	Flight Deck Information Management	Human factors research must examine how an information-intensive flight deck affects pilot performance and workload-based decisions (manual flight vs. automated systems) during normal and non-normal flight operations. Research must result in scientific and technical information which describes the effect of interdependent flight deck systems, within and between disparate systems, to the performance of pilots with varying levels of experience. Research must consider how the introduction of more advanced information automation and control automation effects the near-term role and required skillset of pilots. It must also quantify the impact of flight deck information accessibility (i.e., balance between information available vs. information required) and information overload to flightcrew task management (i.e. Qantas A380 flight #32, pilots spent 50 minutes solely responding to warning and alert messages), workload (i.e. number of new tasks; Competing Boeing 737 Max alerts - Ethiopian flight #302, Lion Air flight #610), and event outcomes. This research will also consider findings from the FAA Flight Deck Automation Working Group and Joint Authorities Technical Review (JATR, 2019) concerning human factors in the evaluation of increasingly complex systems.	FY20	FY26	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.35	Integrating human factors relating to flightcrew responses to equipment failures into system safety	Current certification system safety assessment guidance provides limited discussion of the variability of the human performance, and does not consider human factors relating to flightcrew responses to equipment failures. Draft AC 25-1309-Arsenal recognizes that quantitative assessments of the probabilities of crew errors in responding to equipment failures are not currently considered feasible in design and certification. It also states that: "If the failure indications are considered to be recognizable and the required actions do not cause an excessive workload, then for the purposes of the analysis, the probability that the corrective action will be accomplished, can be considered to be one" (paragraph 9.b.5.iii). AC 25.1302 provides guidance on demonstrating that systems and proposed equipment, individually and in combination with other systems and equipment, are designed so that qualified flightcrew members can safely perform all of the tasks associated with the installed systems' and equipment's intended function, including responding to equipment failures. The research will address human factors methods, techniques and approaches that may be applicable to integrating human factors relating to flightcrew responses to equipment failures into system safety assessments. This research requirement directly addresses a number of sections of the Aircraft Certification, Safety, and Accountability Act (ACSAA)(2020), and also addresses recommendations for the FAA to better integrate human factors throughout the design and certification of aircraft as provided by:Joint Authorities Technical Review (JATR)Special Committee to Review the FAA's Aircraft Certification Process (SpecComm)Inspector General of the Department of Transportation (OIG)National Transportation Safety Board (NTSB)Komite Nasional Keselamatan Transportasi (KNKT) This requirement supports the integration of human factors into certification considerations relating to system safety at both system and aircraft level.	FY25	FY27	Y
A11G.HF.2	Human Factors Considerations in the Design and Evaluation of Flight Deck Displays and Controls, V.5	Research and empirical data are needed to support the update of the Human Factors Considerations in the Design and Evaluation of Flight Deck Displays and Controls, here after referred to as the Human Factors General Guidance document. It is a comprehensive, one-stop reference for human factors issues and guidance. The document includes:References to over 200 documentsRelevant FAA regulatory and guidance materialIndustry standards (RTCA, SAE, and ASTM)Military standardsFlight deck system and equipment evaluation materialResearch reportsExamples of actual human factors certification issues	FY23	FY26	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.24	Control Automation and Information Automation (ACSAA related)	Manufacturers often add new systems or equipment to the flight deck without considering their consistency and compatibility with existing flight deck designs, or their impact on human performance. Accidents, such as Air France 447, Lion Air JT610, and Ethiopian Airlines 302 demonstrate the importance of understanding the human-machine interface and the underlying automation systems that drive it. This research will investigate how pilots interact with and understand automation on the flight deck. We will study two aspects: control automation and information automation. Control automation, such as autopilots or safe operating/envelope protection systems, control the aircraft or aircraft systems. While information automation, such as moving maps or weather displays, acts on or manages the content and format of the presented information flight deck. It is a means for the pilot to manage and understand relevant information related to the automation. The research data will support the development of guidance for aircraft certification, effective pilot training, updating industry standards, revising human factors regulatory and guidance material, and responding to Congressional recommendations related to Boeing 737 MAX accident investigations	FY24	FY26	Y
A11G.HF.38	Flightcrew Task Management During NextGen Flight Operations	Research is needed to support the NextGen human factors needs of FAA personnel who evaluate, approve, and oversee new NextGen technologies and equipment, pilot training and qualification programs, flight deck operations, and pilot procedures. Research will identify human factors design and operational considerations for highly integrated aircraft systems, operations, and procedures including their impact on air carrier pilots and expectations placed on them. Results will inform FAA personnel who develop evaluation criteria for systems, equipment, functions, operations, and procedures, and incorporate this into human factors related regulations, guidance material, procedures, standards, job aids, and other documentation to support safety, productivity, and efficiency of current and future flight operations. Criteria are used by Flight Standards (AFS) and Aircraft Certification (AIR) personnel to check for human factors installation and operational integration issues, pilot training and qualification programs, and more, including management of safety critical system malfunctions and design related errors.	FY21	FY26	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.13	Human Factors Considerations and Emerging Trends Associated with Helicopter Air Ambulance Operations	Research is needed to evaluate human factors and pilot/crew performance considerations associated with Helicopter Air Ambulance operations (HAA). Helicopter air ambulances operate under challenging conditions. Their flights are often time-sensitive -- putting pressure on pilots and medical personnel -- they fly at low altitudes and under varied weather conditions, and they often land at unfamiliar, remote, or unimproved sites with terrain and obstacle hazards. This research will provide information that can be used to enhance the FAA's understanding of current HAA industry risks, emerging issues and trends, identify gaps in crew resource management (CRM), reduce the number of accidents and incidents attributable to human factors considerations, improve strategies and procedures for controlling risks in HAA operations, and enable the development of fatigue risk measures for HAA operations that will inform improvements in the strategic use of rest facilities, fitness for duty requirements, and scheduling practices. This research will inform policy, operational requirements, standards, procedures, limitations, mitigations, and guidance material pertaining to helicopter air ambulance operations and updates to industry best practices.	FY22	FY26	Y
A11G.HF.27	Operational Acceptability of New Automatic Takeoff and Landing Operations Performed by a Single Pilot	This project will provide research and engineering data to support the human factors needs of FAA personnel who evaluate, approve, and oversee flight deck technologies and procedures for low visibility flight operations. Research will examine whether single pilot workload and optional dual pilot crew (split location) workload is operationally acceptable during new automatic takeoff and new autoland operations not currently authorized. This project is time critical. Results are needed to inform equivalent level of safety decisions for imminent technologies and operational concepts that have outpaced FAA documentation:No automatic takeoff guidance or criteria exists.Current autoland guidance pertains specifically to its use in order to facilitate operations in the lowest visibilities. Further guidance will be required to expand the use of autoland to other types of operations and crew complements. FAA continues to receive applications at an unexpected rate for these technologies and operations. If this project is not funded, then Flight Standards operational approvals will be delayed due to a lack of human factors data. The lack of data will also add time and cost to multiple certification projects. This project will result in 6 technical reports:	FY21	FY26	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.28	Unexpected Airplane State: General Aviation	Research data from this project will inform AVS personnel who develop and update FAA regulations, guidance material, and other documentation for GA pilot training, operations, and procedures. This includes addressing FAA commitments per GAJSC – Loss of Control Working Group Safety Enhancement (SE) 28 "Pilot Response to Unexpected Events". Under the Congress' Safer Skies Initiative (2011), the General Aviation Joint Steering Committee (GAJSC) was revitalized to utilize risk management strategies collaboratively with industry to reduce the fatal accident risk and enhance the safety of the National Airspace System (NAS). One of the first actions of the GAJSC was to target the leading cause of fatal accidents—loss of control. Through analyzing fatal loss of control accidents, the GAJSC was able to produce targeted intervention strategies to prevent future loss of control accidents. At the completion of its Loss of Control study, the GAJSC recognized the need to research and study how pilots respond to unexpected events and what additional training/outreach may be required to further reduce the fatal accident rate. As a result, the GAJSC has recommended a 3-part question to investigate what skills pilots currently have, how effective those skills are during unexpected events, and a gap analysis to understand which skills are lacking. The scaffolded 3-part research project will permit targeted analysis of effective training techniques and skills to better equip pilots as they respond to unexpected events. In addition to responding to the conclusions of the GAJSC's Loss of Control study, this project builds on mandates in the Safer Skies Initiative and work sponsored by FAA on unexpected events during Part 121 operations. While pilot response to unexpected events has been studied for Part 121 operations (including by the Commercial Aviation Safety Team (CAST)), similar research has not been completed for Part 91 and 135 operations. Research into pilot response to unexpected events is integral to reducing the fatal accident rate for General Aviation operations.	FY24	FY28	N

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.43	Digital Air/Ground Communication Technologies and Procedures	Research is needed to examine the expanded use of digital communication technologies and procedures to flight operations below 18,000'. The research will identify potential safety risks, effectiveness of mitigations and tradeoffs for reported human factors issues, operational use of new communication networks (e.g., Air Traffic Network ATN / Internet Protocol Suite IPS), and flight deck human factors considerations for active FAA investments in new digital air/ground communication services and applications. This new communication network will enable line of sight and beyond line of sight (BLOS) operations (e.g., VHF constrained to line of sight), commercial off the shelf technology (COTS) for NAS users, integrated capabilities (e.g., ADS-C, 4D-Trajectories, AOC communication, etc.,) and increased data and voice communication volumes and densities. AVS will use outputs from this research to inform development of regulatory and guidance materials that do not currently exist. Research will inform evidence-based decisions for the operational evaluation and approval of advanced communication technologies and procedures that enable trajectory-based operations (TBO). This project is time critical. Results are needed to inform equivalent level of safety decisions for imminent technologies and operational concepts that have outpaced FAA documentation. If this project is not funded, then Flight Standards operational approvals may be delayed due to a lack of human factors data. The lack of data may add time and cost to future certification projects and delay the use of technologies needed to operationalize FAA investments in NextGen.	FY25	FY29	N
A11G.HF.44	Pilot Training and Operational Effectiveness - ACSAA related	Research is needed to evaluate human factors and pilot/crew performance considerations associated with determining the effectiveness of pilot training, procedures, and flight operations in transport aircraft in Part 121 and 135 operations. This research would provide input to the FAA to inform relevant policy, operational requirements, standards, procedures, limitations, mitigations, and guidance materials and update industry recommended practices. In addition, the research results will provide data to support the FAA in responding to the NTSB recommendations, and other safety data analyses and recommendations (such as the PARC/CAST Flight Deck Automation Working Group report, recent accidents, the Air Carrier Training Aviation Rulemaking Committee and the upcoming International Civil Aviation Organization (ICAO) Personnel Training and Licensing Panel).	FY20	FY26	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.23	Human Factors Design Standards for New and Advanced Flight Deck Alerting Systems (ACSAA related)	Manufacturers often add new systems or equipment to the flight deck without considering their consistency and compatibility with existing flight deck designs, or their impact on human performance. Accidents such as Air France 447, Lion Air JT610, and Ethiopian Airlines 302 demonstrate the importance of understanding the human-machine interface and the underlying automation systems that drive it. This research will investigate the impact of new technologies in flight deck alerting systems to update design standards are appropriate for modern alerting systems. Most importantly, the research data will support the development of effective pilot training, updating industry standards, revising human factors regulatory and guidance material, and responding to Congressional recommendations related to Boeing 737 MAX accident investigations.	FY24	FY26	Y
A11G.HF.37	Customizable Devices for Connected Information Automation Systems	Human Factors research is needed to understand how pilots will interact with the shared display of unapproved and approved information on a certified flight deck display. Research will identify human factors issues associated with imminent and future implementations of connected information automation systems that operationalize the "concurrent use" and "differentiation" concepts. Currently, evaluation criteria do not exist. This project will examine design and operational mitigations for human factors issues. Previously Funded Research (using NextGen BLI funds):Report #1: Technical Report on Anticipated Human-Machine Interface and Interaction Issues with Initial Connected Flight Deck Technologies using Uncertified Source DataReport #2: Technical Report on the Effectiveness and Tradeoffs of Mitigations for Human-Machine Interface and Interaction Issues with Approved / Unapproved Flight Deck Information on Certified Displays	FY21	FY26	N
A11G.HF.22	Human Factors Safety Considerations and Criteria for Reduced Crew in Transport Aircraft	Manufacturers are proposing increasing automation technology in transport aircraft. The FAA needs criteria for determining whether, and how, to allow reduced minimum crew operations while maintaining or improving the current level of safety. This research will investigate the safety considerations and criteria for reduced crew operations in transport aircraft. This includes identifying the impact of increasingly automated systems on pilot workload, roles, and responsibilities and to assure that any changes in crew minimums will have effective risk mitigations. Most importantly, the research data will support the development of effective pilot training, updating industry standards, revising human factors regulatory and guidance material, and responding to Congressional recommendations related to Boeing	FY24	FY26	N

		737 MAX accident investigations.			

Domain: Human and Aeromedical Factors
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CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.40	Flight Deck Impacts of Procedure-Based Concepts	Research data will support the human factors needs of Federal Aviation Administration (FAA) personnel who evaluate and approve pilot procedures and flight deck operations for performance – based navigation (PBN) procedures. Human factors criteria and evaluation methods are needed to support Flight Standards (AFS) personnel who evaluate the use of PBN procedures to ensure that the procedures can be flown safely (e.g., bank angle, airspeed, climb/descent gradients, workload issues, procedure complexity, runway alignment, etc.). Research data will contribute to human factors PBN-related regulations, guidance material, procedures, Orders, standards, job aids, operational evaluation criteria. Research data will support development of criteria and methods for FAA personnel who evaluate the documentation of PBN procedures (charting), and to complete other activities that support instrument flight procedure validation requirements.	FY19	FY26	N
A11G.HF.25	Pilot/Crew Assessment of Flight Visibility and Enhanced Flight Visibility at DA/DH and MDA on Approa	Descent below DA/DH or MDA down to 100' and decision criteria to continue and land or execute a missed approach requires further research. This project will examine how pilots comply with flight visibility requirements, what method(s) they are using to comply, and what contribution flight visibility makes to safety of the operations. Research is needed to examine pilot perception of visual cues and flight visibility at DA/DH or MDA on an approach. This includes identification of measures used to evaluate and determine operational effectiveness of training. Research data will be obtained and analyzed on visibility assessment accuracy, pilot decision-making factors, physiological limitations, and environmental considerations. Data will be compiled to understand how often flight visibility and enhanced flight visibility is assessed, the accuracy of those assessments, whether assessment results in compliance, and current limitations of this requirement. Results of this research will help inform data on the use of EFVS-HDD (and other technology implementations) in low visibility operations.	FY24	FY26	N

A11G.HF.42	Physiological State Monitoring and Alerting Systems: Design and Operation Evaluation Considerations	Driver monitoring systems, or driver state sensing systems, are becoming a standard feature in new cars for detecting drowsiness and inattention. Given progress in the ground transportation system, research is warranted to extrapolate this trend to aviation given the potential role of pilot monitoring systems and technologies to enhance safety, facilitate introduction of more advanced flight deck automation, and enable certification of pilots with heretofore disqualifying medical conditions. This specific project will evaluate current physiological state monitoring and alerting systems and technologies to inform FAA human factors evaluation of emerging flight deck technologies and future concepts of operation. This project addresses a CY2022 recommendation from SAS REDAC that FAA conduct human factors and aeromedical research on physiological state monitoring and alerting systems and technologies.	FY25	FY27	N

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.41	Methods to Identify Root Causes of Human Factors Risks in Maintenance Programs	The Federal Aviation Administration (FAA) Flight Standards Service (AFX) currently provides little guidance in FAA Order 8900.1 which does not include a means in the Safety Assurance System (SAS) to assess, capture, analyze, and provide feedback on findings of an operators' inability to mitigate and control the risks associated with human factors. Additionally, FAA does not provide sufficient human factors guidance and training to its Office of Safety Standards Aviation Safety Inspector (ASI) workforce to enable them to recognize and collect human factors data. There is at least one known instance of a FAA Certificate Management Office developing a local process for identification and recording human factors risks. There may be more such offices, each with their own process; conversely, most may have no process for collecting human factors data at all. These unstandardized, locally developed processes introduce concerns about the quality of human factors data that are being recorded, precluding the full utilization of human factors information for risk-based decision making. Providing guidance, training, and collection of data can be used to help improve FAA inspector consistency, collaboration with industry, and ultimately maintain and improve the overall safety in the National Airspace System. To address this gap, human factors research data is needed. A summary of the proposed human factors research project is provided:	FY25	FY27	N
A11G.HF.19	Integration of HF into Operational Evaluations & Flight Standardization Board Process–ACSAA Related	Research is needed to provide human factors data, which will be used to improve, clarify, and expand human factors regulatory and guidance material. This will support FAA personnel in both Aircraft Certification (AIR-600, 700, and 800) and Flight Standards (Aircraft Evaluation Division (AED) AFS-100), who evaluate, approve, and oversee human factors aspects of the integration of design, aircraft certification, training, and operational requirements for the full range of aircraft, including both transport category and general aviation aircraft, as well as rotorcraft, and unmanned aircraft systems. This work will provide research, engineering, and operational data to inform Flight Standards (AFX) and Aircraft Certification (AIR) personnel who will clarify and expand policy, guidance, processes, procedures, and criteria to better integrate human factors throughout design and certification of aircraft. In the field, documentation will be used by multiple AFX and AIR personnel who jointly work with aircraft manufacturers and modifiers throughout the service life of a product including development (design, production), certification (as evaluated by both AIR and AFX as a part of the Flight Standardization (FSB) process), and operations (operational suitability, airworthiness directives). Current FAA human factors documentation to support these personnel is limited and the processes followed can vary by location.	FY21	FY27	N

Domain: Human and Aeromedical Factors
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A11G.HF.21	Pilot Visual Scanning Techniques of Instruments, Systems and References for Flightpath Management	Manufacturers often add new systems or equipment to the flight deck without considering their consistency and compatibility with existing flight deck designs, or their impact on human performance. Accidents, such as Air France 447, Lion Air JT610, and Ethiopian Airlines 302 demonstrate the importance of understanding the human-machine interface and the underlying automation systems that drive it. This research will investigate visual scanning techniques used by pilots in transport category aircraft to provide the FAA with a data-driven foundation for identifying the acceptability of design assumptions and mitigations, and impact on pilot training. Most importantly, the research data will support the development of effective pilot training, updating industry standards, revising human factors regulatory and guidance material, and responding to Congressional recommendations related to Boeing 737 MAX accident investigations.	FY24	FY26	N
A11G.HF.36	Multimodal Controls for Rotorcraft / Vertical Lift	Research data is needed to support the NextGen human factors needs of FAA personnel who evaluate and approve emerging rotorcraft / vertical lift flight deck systems, displays, and controls. Often, existing FAA regulations and guidance material do not address the proliferation of new aircraft equipment, functions, and procedures that are needed to enable NextGen flight operations. Aircraft Certification anticipates an influx of applications from Original Equipment Manufacturers (OEMs) for rotorcraft / vertical lift systems with new operator control mode inputs (voice/speech, gaze, multi-touch) not fully covered by existing FAA documentation (AC-120-175). Research is needed to identify and understand the effect of new operator control mode inputs, coupled with unique rotorcraft / vertical lift factors (vibration, space limitations, etc.) to human-system performance (single pilot operations, multi-crew operations). Research must identify critical human factors design and operational assumptions, limitations, potential mitigations, and benefits of avionics systems with new operator control mode inputs which could be used with emerging communication, navigation (PBN), and surveillance (ADS-B) capabilities.	FY20	FY26	N
A11G.HF.31	Contribution of HUD Symbology on an HDD to Pilot Performance during Low Visibility Flight Operations	It has been previously determined that the use of a head-up display (HUD) with flight information (e.g., HUD symbology) reduces flight technical error (FTE) during approach to landing. The reduction in FTE has resulted in operational benefits for the use of HUD. Human factors research data is needed to determine if approaches flown using HUD symbology displayed on a head-down display (HDD) results in equivalent FTE as approaches flown with a HUD. The results may inform policy decisions which allow additional benefits for use of HDD utilizing HUD symbology in performance-based low visibility operations.	FY25	FY27	N

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Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.46	Fatigue Mitigation in Flight Operations (Reduced Crew)	FY24 research will examine the operational effectiveness of human factors mitigations that could prevent or counteract the negative effects of multiple time zone shifts associated with long-haul and ultra-long-range flight operations on pilots' behavioral and physiological adaptations. This work will complete the final phase of work associated with this multi-year project. It will also support and address for the first time several elements in the Airline Safety and Federal Aviation Administration Extension Act of 2010, Public Law 111-216 Aug. 1, 2010, section 212 titled "Pilot Fatigue". Beginning in FY25 human factors research will address new flight deck technologies and operations which will enable reduced crew operations during short haul multi-segment, long and ultra-long-haul flights in transport category aircraft. Introduction of these new technologies and procedures requires scientific data and research to understand how to manage and mitigate the effects of fatigue for reduced crew operations. This work will build off previous research to examine current and recommended mitigations to manage the effects of fatigue in reduced crew operations.	FY19	FY27	N
A11G.HF.47	Fatigue Mitigation in Flight Operations (Supersonic)	FY24 research will examine the operational effectiveness of human factors mitigations that could prevent or counteract the negative effects of multiple time zone shifts associated with long-haul and ultra-long-range flight operations on pilots' behavioral and physiological adaptations. This work will complete the final phase of work associated with this multi-year project. It will also support and address for the first time several elements in the Airline Safety and Federal Aviation Administration Extension Act of 2010, Public Law 111-216 Aug. 1, 2010, section 212 titled "Pilot Fatigue". FY25 Human factors research is needed to inform FAA on pilot fatigue tradeoffs, mitigations, and their effectiveness for emerging supersonic flight operations in transport category aircraft. Research will identify gaps in data on the impact of supersonic flight operations to human fatigue, and the impact multiple time zone transitions have on human performance. This research will leverage previous FAA related work that examined the operational fatigue related risks of multi-segment short haul, long haul, and ultra-long- haul flights on pilot performance.	FY19	FY27	N
A11G.HF.32	Use of Head-worn Monocular and Binocular Display During Flight Operations	With the development of Head Worn Displays with a monocular, it is necessary to determine if pilot performance is degraded compared to the tradition binocular displays.	FY25	FY27	N

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.30	External Features Referenced During Final Stages of an IAP, Landing, Rollout, & Min. Vis. Needed to	Current visibility requirements to continue an instrument approach below minimums and control the aircraft during landing and rollout are based on experience and expert judgment. An empirical basis for the minimum visual features a pilot must see at various low visibility values was never established. Research data is needed to understand the external features air carrier pilots visually reference in the runway environment to land a transport category airplane and the minimum visibility required to identify these external features using natural vision. Outputs from this research will help AFS address pilot performance and human factors considerations, and inform potential changes to operational policy, operational standards, and approval criteria for instrument approach and landing operations. The research will also allow AFS to evaluate the contribution of emerging alternatives to traditional out the window view and natural visibility to a crews' ability to control the aircraft during approach, landing, and rollout operations.	FY25	FY27	N
A11G.HF.33	Minimum Equipment/Performance Requirements for Pilot Monitoring Display and Use of Forward-Looking V	Operational concepts proposed to industry for conducting EFVS operations in visibilities lower than 1000RVR (no lower than 600 RVR) require the determination of the minimum equipage necessary for the pilot monitoring ability to perform their tasks during an approach in those conditions. Research is needed to understand whether the minimum requirement of sensor imagery on the pilot monitoring display, along with other information available to the PM, is sufficient for the PM to safely carry out PM duties below 1000 RVR down to 600 RVR. Human factors and pilot performance data are needed to determine whether EFVS operations can be safely expanded in this way, and outputs from this research will inform new operational policy, requirements, operational safety assessments and reviews, operational approvals, and guidance materials for operators and AFS inspectors who would approve these new concepts of operation.	FY25	FY27	N
A11G.HF.29	Human Factors Safety Considerations and Criteria for Supersonic Flight in Transport Aircraft	Manufacturers are proposing increasing automation technology and advanced flight capabilities in transport aircraft. The FAA needs criteria for determining whether, and how, to allow supersonic flight operations while maintaining or improving the current level of safety. This research will investigate the safety considerations and criteria for supersonic flight operations in transport aircraft. This includes identifying the impact of increasingly automated systems on pilot workload, roles, and responsibilities and to assure that any changes in flight capabilities and operations will have effective risk mitigations. Most importantly, the research data will support the development of effective pilot training, updating industry standards, revising human factors regulatory and guidance material, and responding to Congressional recommendations related to Boeing 737 MAX accident investigations.	FY25	FY27	N

Domain: Human and Aeromedical Factors
Program Area/BLI: Flightdeck/Maintenance/System Integration Human Factors

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11G.HF.34	Concurrent Use of Multiple Display Implementations to Pilot/Crew Performance: Dual HUD, Hybrid HWD/H	Most current head-up display (HUD) equipped aircraft utilize a single HUD located at the Captain position. With the proliferation of HUD technology and the advent of head-worn displays that provide flight guidance similar to a HUD, it is anticipated that dual HUD, HUD+HWD, and dual HWD installations will become more prevalent. Current HUD credit for low visibility operations is limited based on the single HUD being a single point of failure. This research will examine whether operations at lower visibilities may be authorized based on the redundancy of dual displays and in what combinations (HUD vs HWD) those displays are most advantageous. Additional human factors data on the crew coordination benefits or drawbacks of dual vs single displays, HUD vs HWD, and the use of both a HUD and HWD in the same cockpit. The study may evaluate the use of HUD and Monocular/Binocular HWD both with and without EFVS during Lower than standard takeoff operations EFVS operations to touchdown and rollout – CAT II, SA CAT II, and CAT III.	FY25	FY27	N

Domain: Human and Aeromedical Factors
Program Area/BLI: Aeromedical

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11J.FCMS.2	Detect Cabin Air Quality Events from Bleed Air Contaminants *(This is an ongoing research project using PC&B and no contract funding.)*	Final year of a multi-year, multi-phase research project that began in FY20. Phase 1 research (tasks 1-3; started in FY20 and completed in FY21) identified sensors that measure specific bleed air contaminant signatures (e.g., particulate size and range, selected chemical species, etc.). Phase 2 research (tasks 4-7; started in FY22 and continues through FY24) involves experiments that inject fluid contaminants (e.g., oil, hydraulic fluid, and deicing fluid) into a ground test engine at Kansas State University (KSU) and selected aircraft and will measure/evaluate the performance of sensors identified in Phase 1. If the ground test engine experiments are successful, fluid contaminant injection will be repeated with ground-based on-wing airplane tests using airplane engines/Auxiliary Power Units (APUs) to determine the interaction of injected fluid contaminants with airplane environmental control system (ECS) components (e.g., air cycle machines, ozone converter, etc.). Ground-based on-wing airplane tests will be conducted on an FAA owned airplane at the FAA Technical Center or an airline owned airplane. Sensor measurements will be made at multiple locations throughout the ECS and within the airplane cabin to determine sensor reliability and validity. In addition, air samples will be collected and provided to FAA/CAMI. FAA/CAMI, in partnership with the U.S. Navy, will perform chemical analyses and a toxicological interpretation of the bleed air contaminants and sampled cabin air to determine potential adverse health effects of such contaminants to passengers and crew (Phase 3 research [task 8]).	FY20	FY26	Y
A11J.AM.19	Communicable Disease Preparedness: M&S Framework for Analyzing Cabin Health Hazards	As evidenced during the SARS-CoV-2 pandemic, the federal government lacks suitable risk analysis tools to evaluate efficiently the health safety hazard posed by communicable diseases of potential heath significance in transport aircraft cabins. This research project will answer the question, what is a generalizable risk analysis framework and associated set of accepted and validated modeling, simulation, and analysis (MS&A) tools for determining baseline risk and evaluating the impact of risk control measures? The project will define an analysis framework for cabin health safety hazards; conduct a survey of existing MS&A tools, data sources, and non-destructive testing methods suitable for studying pathogen movement in transport aircraft cabins; select the preferred MS&A tool set and testing methods; and plan and conduct MS&A validation and analysis studies. The resulting analysis framework and associated MS&A tools and data will be transitioned for use in communicable disease transmission preparedness planning.	FY24	FY27	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Aeromedical

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11J.AM.12	Identify alternative neurocognitive tests & obtain pilot normative data for medical certification	The FAA is currently reliant on only one neurocognitive test (CogScreen – Aeromedical Edition [AE]) from a single vendor. CogScreen-AE is used as an initial screening tool to detect aeromedically significant cognitive deficits in aviators with certain medical conditions. The purpose of this study is to identify alternative neurocognitive test batteries for CogScreen-AE and to obtain updated pilot normative data for the legacy and alternative test batteries. Data and analyses will be used to potentially revise the Aviation Medical Examiners (AME) Guide, update clinical practices, and make changes to aviator medical certification protocols.	FY22	FY26	Y
A11J.FCS.18	Determine the influence of delta-wing design on egress paths and evacuation efficiency for supersonic	Supersonic transport (SST) airplanes are being proposed that would have multiple exits using the delta wing as part of their egress pathway. This research project will look at the effect on an evacuation when multiple exit pairs use the same platform as part of their egress pathway, and the implications that may have for exit rating and allowable passenger limit onboard new SST airplanes. This research will use human subjects in comparative evacuations using aircraft cabin evacuation simulators with both single exit- per wing and multiple exits per wing to evaluate the differences in egress times and behaviors.	FY23	FY26	Y
A11J.FCS.21	Extended reality for cabin safety use in research and certification	Conducting cabin safety research and certification currently depends on data obtained from human subjects' tests with physical assets, which can involve elevated risk for participant injury. Extended reality refers to technology that augments or replaces the real world with the digital world, including augmented reality and virtual reality. This research project will determine if extended reality can and should be used for cabin safety research and certification. This project will compare the results of cabin evacuation tests involving human subjects using physical mockups vs. extended reality.	FY24	FY27	Y
A11J.AM.27	Aeromedical Collaboration Environment for Fusing Pilot Medical Certification and Operational Data	The purpose of this project is to fuse FAA pilot medical certification decisions with operational safety outcomes beyond the historical outcomes of interest of mishap and pilot incapacitation events. Achieving this objective requires enhancing the traditional aerospace medicine safety management system data environment to make it a collaborative innovation environment with joint FAA and industry participation. This project addresses the question of how the FAA can form a Public-Private Partnership (PPP) with the commercial airline industry to obtain pilot operational performance and safety data for linking to agency medical certification data to support advanced risk analyses. This project will include an industry outreach to create a PPP with one or more commercial airline partners, a feasibility assessment for creating an Aeromedical Collaborative Environment (ACE), and the design and construction of the ACE.	FY22	FY26	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Aeromedical

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11J.AM.14	Performance-Based Medical Recertification of Aviators with Chronic Obstructive Pulmonary Disease (CO	The purpose of this study is to identify performance-based, physiological criteria (e.g., respiratory/lung function metrics, blood oxygen saturation via pulse oximetry [SpO2]) to forecast if an individual is able to maintain adequate blood oxygen saturation at altitude without supplemental oxygen. These criteria will be used in the medical recertification of aviators with chronic obstructive pulmonary disease (COPD).	FY23	FY26	Y
A11J.AM.43	Algorithms for Forecasting Pilot Aeromedical Risk Using Commercial Healthcare Data	The Office of Aerospace Medicine needs the ability to define aeromedical hazards and characterize risk, as informed by all relevant data sources, during pilot medical certification in a manner that aligns with the FAA's approach to safety risk management. Existing aeromedical data produced from the FAA's pilot medical certification business processes is limited in terms of scope, quantity, and quality, which has stymied efforts to calculate relatively unbiased risk estimators for aeromedical hazards. One approach to mitigate this situation is to use alternative data sources, such as commercial and government-generated healthcare datasets, to calculate risk estimators for aeromedical hazards such This project will seek to identify the best algorithms for forecasting a pilot's aeromedical risk using commercial healthcare data. The project will develop, apply, and compare several algorithms for forecasting a pilot's aeromedical risk using commercial healthcare datasets. Additionally, it will provide recommendations for using model performance metrics to choose the best algorithm for forecasting pilot aeromedical risk.	FY25	FY26	Y
A11J.AM.10	Comparison Across Multiple Types of Sleep Deprivation	This project seeks to identify associations between molecular biomarkers and performance under varying fatigue states (i.e., acute total sleep loss for two nights, multiple nights of short sleep, or multiple days with short sleep simulating shiftwork). The study will build upon prior work to identify gene expression patterns that correlate with fatigue-induced declines in cognitive performance, and develop a diagnostic biomarker panel for use in detecting fatigue-related cognitive performance deficits. Outputs will improve ability for detecting fatigue in accident investigation, and have applications for improving fatigue risk management towards accident prevention.	FY19	FY27	Y
A11J.FCS.16	Develop modeling and simulation guidance to support performance based rules for aircraft seating sys	Current safety standards for seats are partially prescriptive in that the crash condition is defined with no regard for the individual aircraft model's structural design features. Credible modeling and simulation (M&S) provides an opportunity to move the standards towards fully performance based. This project will support regulatory/guidance efforts to create standards for the use of M&S to certify seating systems using a performance based systems approach. Tasks include evaluation	FY23	FY26	Y

		of existing model credibility standards and the development of new standards focused on aircraft cabin interiors.			

Domain: Human and Aeromedical Factors
Program Area/BLI: Aeromedical

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11J.AM.20	Gene expression patterns in response to Modafinil as countermeasure to sleep deprivation	This project seeks to identify associations between gene expression biomarkers and performance under acute sleep loss for one night with and without a drug countermeasure (modafinil). The study will build upon prior work to identify gene expression patterns that correlate with fatigue-induced declines in cognitive performance, and develop a diagnostic biomarker panel for fatigue-related cognitive performance deficits during total sleep loss. This study also will produce insights on the impact of a drug countermeasure on fatigue and biomarker assessments. Outputs will improve the FAA's ability to detect fatigue in accident investigation, and have applications for improving fatigue risk management towards accident prevention.	FY17	FY26	Y
A11J.RS.2	Rotorcraft Injury Mechanism Analysis - Procedure Development and Validation	Rotorcraft policy makers lack comprehensive accident investigation results to support safety analysis and cost-benefit analysis. This research aims to identify what kind of injuries are being sustained in crashworthy and non-crashworthy rotorcraft. This research proposes to develop and demonstrate procedures for identifying and gathering pertinent crash and injury information, with the goal of identifying safety improvements to reduce the fatalities and serious injuries occupants sustain in survivable crashes. Safety improvements identified and implemented by these analyses result in reduced deaths and injuries.	FY19	FY27	Y
A11J.AM.21	Postmortem blood genomics biorepository	This project seeks to develop a long-term sample repository for investigating biomarkers of safety risks, such as fatigue, in postmortem samples. The result will be establishment of protocols and creation of a sample biorepository, or biobank, to archive aviation accident samples that are optimally preserved for use in forensic molecular analysis. This resource will enable expansion of CAMI's analysis of aviation accident autopsy specimens from its current focus on toxicology results, to molecular insights for reporting on additional human factors. Outputs of studying samples in the biobank will improve the FAA's ability to detect fatigue and other safety risks during accident investigation.	FY19	FY26	Y
A11J.AM.22	Metabolomic biomarkers for fatigue impairment	This project seeks to identify associations between blood metabolites and performance under varying fatigue states (i.e., acute total sleep loss for two nights, multiple nights of short sleep, or multiple days with short sleep simulating shiftwork). The study will build upon prior work to expand understanding of molecular changes under sleep disruption, and develop a diagnostic metabolomics biomarker panel for use in detecting fatigue- related cognitive performance deficits. Outputs will improve ability for detecting fatigue in accident investigation, and have applications for improving fatigue risk management and thus accident prevention.	FY23	FY27	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Aeromedical

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11J.FCS.22	Egress through furniture	Novel aircraft cabin configurations, which may include furniture installed immediately adjacent to an emergency exit or adjacent to evacuee seating, create uncertainty about cabin evacuation performance. This research project will evaluate what, if any, impact installed furniture in an airplane egress pathway would have on an airplane evacuation. This project will involve human subjects testing comparing a control evacuation (no furniture) to experimental furniture placements to determine the effect on evacuation on an individual and group basis.	FY25	FY27	Y
A11J.AM.24	Proteomic biomarkers for fatigue impairment	Literature suggests proteins in human blood change during sleep disruption. This research will measure blood proteins from individuals subject to sleep loss and circadian disruption. The result will be a protein biomarker panel diagnostic of fatigue-related performance deficits and sleep loss. This will advance development of a molecular report of fatigue status for accident investigation, and could be applied by airlines toward accident prevention as an alternative method of compliance for fatigue risk management strategies.	FY24	FY27	Y
A11J.FCS.15	Develop safety standards for omnidirectional seats to support urban air mobility/eVTOL	Current safety standards exist for seats installed 0-45 degrees and 90 degrees (with respect to aircraft centerline). Industry has proposed seats beyond 45 degrees and based on trends in all modes of transportation, UAS will likely allow for seats installed in any direction (0-360 degrees). This project will support regulatory efforts to create a continuum of certification for 0-100 degrees. Tasks include evaluation of ATDs, review of injury criteria, and development of test methods.	FY23	FY26	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Aeromedical

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11J.AM.28	Aviation Medical Examiner Office-Based Pilot Functional Capability Assessment for Certification	The Aviation Medical Examiner evaluates a pilot to ascertain his/her/their health state and exercises subject matter expertise, aided by policy guidance, to determine the pilot's ability to safely perform aviation duties and arrive at a medical certification decision. In the occupational medicine domain, the gold standard for making similar decisions is the functional assessment – i.e., can the individual demonstrate the ability to perform job essential tasks. At present, such an assessment for a pilot involves an observed live or simulated flight. Such an approach is not practical from a time, cost, and resource perspective for general application in aeromedical certification. The purpose of this project is to develop the ability to assess objectively a pilot's ability to perform certain piloting tasks, taking into consideration health-related factors, in the Aviation Medical Examiner's office setting. The research approach will leverage General Systems Performance Theory to define a set of pilot basic performance resources and associated resource availability measures; define a representative pilot high level task and associated task performance measures; empirically understand the relationship between resource availability and high level task performance in a flight simulator; and derive a set of minimum performance resource availabilities. A synthetic screening task will then be developed to efficiently assess performance resource availabilities relative to the minimums. The validity of the synthetic task will be subsequently validated and performance specifications developed for technology transition and commercialization.	FY22	FY26	Y
A11J.AM.40	Determination of neurocognitive assays best suited to identifying THC-related functional impairment	This project will review the current state of the literature and determine what assays have been seen to be most responsive and/or indicative of neurocognitive impairment, both immediately and over several days following acute cannabis exposure. Emphasis will be placed on aspects of cognition with a higher likelihood of importance to safe operations in the national aerospace.	FY25	FY27	N
A11J.FCS.24	Evaluation of Ditching Equipment: Sea State Testing I	Conduct a study that evaluates current TSO-C69c certification testing requiring sea state conditions with currently available ditching equipment to determine the practicality of the certification requirements, and the practicality of the tests to meet the requirements.	FY25	FY27	Y

Domain: Human and Aeromedical Factors
Program Area/BLI: Aeromedical

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11J.AM.25	Wearables for understanding the effects of sleep loss	This project will complement a larger investigation of molecular biomarkers and performance under varying fatigue states (i.e., acute total sleep loss for two nights, multiple nights of short sleep, or multiple days with short sleep simulating shiftwork). Specifically it will analyze data of traditional gold standard and wearable devices (polysomnography, actigraphy) to improve understanding of the physiological impacts of different forms of sleep loss. Results will also improve understanding of changes in biomarker profiles during sleep loss.Outputs will improve ability for detecting fatigue in accident investigation, and have applications for improving fatigue risk management towards accident prevention.	FY25	FY29	Y
A11J.AM.39	Identification of neurocognitive impairment biomarkers in response to acute cannabis exposure	This project will determine 1) what blood RNA biomarkers correlate neurocognitive impairment under acute cannabinoid exposure in infrequent cannabis users, and 2) the degree to which these biomarker indicate post-exposure neurocognitive impairment for several days following the acute cannabis exposure. Cognitive performance of subjects in response to acute cannabis challenge will be evaluated in conjunction with gene expression data to determine what expression changes are correlated with functional impairment from cannabis.	FY25	FY28	N
A11J.AM.23	Microbiome biomarkers for fatigue impairment	This project seeks to identify associations between gut microbes and cognitive performance under varying fatigue states (i.e., acute total sleep loss for two nights, multiple nights of short sleep, or multiple days with short sleep simulating shiftwork). The study will build upon prior work to expand understanding of molecular changes under sleep disruption, and develop a diagnostic microbiome biomarker panel for use in detecting fatigue-related cognitive performance deficits. Outputs will improve ability for detecting fatigue in accident investigation, and have applications for improving fatigue risk management towards accident prevention.	FY23	FY27	N
A11J.AM.26	DNA sequencing for individualized fatigue risk	The study will build upon prior research by adding understanding of individual susceptibility biomarkers to biomarkers for current fatigue status. Previous research shows that individuals have different tolerance of sleep loss and this is partially due to genetic variation. The proposed project will use whole genome sequencing to improve understanding of DNA biomarkers for individual variation in cognitive changes during sleep loss. Outputs will improve ability for detecting fatigue in accident investigation, and have applications for improving fatigue risk management towards accident prevention.	FY23	FY27	N

Domain: Human and Aeromedical Factors
Program Area/BLI: Aeromedical

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11J.FCS.23	Over-wing Exit Escape Route Marking Study	Conduct a study that investigates passenger awareness and understanding of the escape route markings from over-wing exits. This research is intended to assess the adequacy of existing over-wing exit escape route markings to assist evacuees from over-wing exits to the ground under certain emergency conditions. This research topic is associated with FAA Safety Recommendation 20.071.	FY25	FY27	N
A11J.AM.38	Alternative Recertification Pathways for Pilots with General Health Conditions	The purpose of this project is to drive collaborative innovation to produce new and potentially powerful opportunities to move the Office of Aerospace Medicine and the pilots it medically certifies from the status quo to breakthroughs in processes for managing pilot health-related risk. This project will facilitate an open innovation challenge to explore opportunities to decrease the time to medical recertification in pilots with general health conditions while maintaining the currently level of safety. The open innovation challenge will explore the feasibility of integrating approaches used in other risk management industries as well as the potential role of biomedical monitoring devices as a risk mitigation approach for use in medical recertification.	FY25	FY26	N
A11J.AM.41	Postmortem Fatigue Biomarkers	This project will assess the performance of fatigue impairment biomarkers developed previously in studies with live volunteer subjects, when applied to postmortem aviation accidents. Molecular biomarkers will be tested for their ability to differentiate among accidents involving fatiguing versus non-fatiguing circumstances (e.g., day or nighttime crashes).Outputs will contribute to biomarker validation and improved ability for detecting fatigue in accident investigations.	FY25	FY28	N
A11J.AM.42	Biomarkers for Noise-Induced Sleep Disruption	This project will test for biomarkers associated with cognitive impairment during sleep disruption. Sleep disruption will occur via exposure to noisy conditions, as part of a larger project aimed to understand the impacts of aviation noise on sleep. Biomarkers will inform understanding of human responses to sleep loss, and contribute to the overall goal of developing a biomarker panel to test for fatigue impairment as a novel aviation accident investigation tool. Outputs will improve understanding of the specificity of biomarkers for different types of sleep disruption, and contribute towards diagnostics for improved postmortem accident investigation.	FY25	FY28	N

Domain: Aerospace Performance and Planning
Program Area/BLI: System Safety Management/Terminal Area Safety

NOTE: A new program titled "Next Level NAS Oversight" was introduced as a top priority in the Aviation Safety RE&D Portfolio. At this time, the program is being further definded by a working group led by the AVS Chief Scientist and Technical Advisor for Safety and Risk Analysis and consists of placeholder projects in the Continued Airworthiness, Flightdeck/Maintenance/System Integration Human Factors, and System Safety Management/Terminal Area Safety Budget Line Items (BLI). Some projects proposed for FY25 in the Flightdeck/Maintenance/System Integration Human Factors, and System Safety Management/Terminal Area Safety BLIs were also identified as being related to this program and were reprioritized within those BLIs accordingly. These placeholders and related projects are identified in this report with a yellow background and enclosed on all sides with a double line.

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11H.TBD	Next Level NAS Oversight (System Safety Management)	Data-driven government oversight exercised over practitioners of Safety Management System(s) in the NAS. Details to-be-determined by cross organizational working group led by the CSTA for Safety and Risk Analysis.	TBD	TBD	Y
A11H.SSM.9	Helicopter Flight Data Monitoring and Analysis	Helicopter Flight Data Monitoring (HFDM) and Analysis research addresses the issue of identifying and preventing the precursors of fatal accidents for rotorcraft via analysis of flight data records. The research project aims to develop novel analysis tools, metrics, and capabilities that joint industry and government safety teams, including the USHST (U.S. Helicopter Safety Team) and the Rotorcraft Issue Analysis Team (R-IAT) will use to tackle leading vertical flight accident causal factors. HFDM research will create these tools by collecting flight data, encouraging the adoption of flight recorders within the rotorcraft community, and examining/advancing the state of the art in data analytics, machine learning/artificial intelligence, and other areas relevant to this topic. This approach will enhance safety and mitigate risk for helicopter operators via advanced analytical techniques, safety analysis methods, and operational hazard identification; items designed to further reduce the fatal accident rate for rotorcraft/vertical lift.	FY22	FY26	Y
A11H.SSM.32	AI and Advanced Analytics to Estimate Collision Risk During Departure and Arrival	The initiative will develop advanced methods to improve the safety performance of the National Airspace System (NAS) and to enable implementation and integration of new operational concepts. Using artificial intelligence (software that learns), this research will enhance overall operational safety in the NAS by improving the quantification of aircraft-to- aircraft collision risk for proposed operational concepts to maintain a target level of safety (TLS) and prevent accidents and incidents in commercial, general aviation, and rotorcraft operations. Researchers will identify opportunities to apply advanced analytics, such as Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), Markov Chain Monte Carlo (MCMC), etc. to collision risk data modeling and safety data monitoring in the terminal environment.	FY22	FY26	Y

Domain: Aerospace Performance and Planning
Program Area/BLI: System Safety Management/Terminal Area Safety

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11H.SSM.25	Extracting Risk Information from Event Reports for Safety Analysis and ISAM	This project uses advancements in Natural Language Processing (NLP) in combination with other software techniques to automatically extract safety data from accident/incident/abnormal-event reports. Gaining access to this valuable and lengthy body of information will allow analysts to estimate the rate of precursor occurrence and account for precursors that are currently unmeasurable. Consequently, data on precursors allows models, like ISAM, to quantify the risk across the aviation system, identify areas of highest risk, and compare levels of risk against proposed means of mitigation. This research continues developing processes for automatically extracting safety data from the circumstantial information written in individual occurrence reports within aviation reporting systems such as the Safety Assurance System (SAS), National Transportation Safety Board (NTSB) accident reports and Aviation Safety Reporting System (ASRS) incident disclosures, and applying the extracted safety data to the ISAM safety models to improve risk-informed decision making at the FAA.	FY21	FY26	Y
A11H.SSM.37	Emerging Risk	For many years, the FAA has been striving to move from a reactive to a more predictive approach to safety in which hazards are recognized before they manifest into accidents or serious incidents. Because traditional safety techniques require the hazards to be known, they are blind to emerging risk. This project evaluates forecasting and prediction techniques from other industries and adapts them for aviation safety.	FY25	FY26	Y
A11H.SSM.33	Safety Culture Metrics for Ongoing Assessment	The purpose of this project is to develop metrics for assessing safety culture in the National Aerospace System through the aggregation of safety culture metrics used by product and service providers so that safety culture of the entire system of systems can be assessed. Safety culture is currently only assessed sporadically and at the individual service provider level. The intent of this research project is to develop a means to assess safety culture within the aerospace system and its component parts using data that is already being collected. Using the methods identified in FY24, study the methods as applied to safety culture in the aviation industry.	FY24	FY27	Y

Domain: Aerospace Performance and Planning
Program Area/BLI: System Safety Management/Terminal Area Safety

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11H.SSM.38	Measuring Level of Safety	How safe is aviation? Historically, the FAA has measured safety with Safety Indices -- a half- dozen accident rates covering the major classes of aviation. However, the count of accidents over flight hours is a rather course Safety Index. The number jumps with each accident rather than indicating a smooth change in the level of safety. FAA needs safety metrics that reflect the true risk in the system, show where that risk lies, and track how that risk changes over time. Executives need these metrics to be actionable. After careful study, this project will recommend integrated safety metrics that reflect the most important precursors underlying the Safety Indices. These recommended safety metrics will be based on the wide array of safety indicators that LOBs and S/Os currently use in their management of aviation safety, and will be integrated to reflect the relative safety contribution of associated LOBs and S/Os. Newly recommended safety metrics must be consistently measurable and will be evaluated against their utility in signaling changes in risk, informing good decision making, and in comparing the wide array of risk across aviation domains.	FY25	FY26	Y
A11H.SSM.35	General Aviation Safety Culture	The General Aviation Joint Steering Committee has enabled the Federal Aviation Administration to work in conjunction with general aviation industry partners to develop a nascent safety culture for non-part 121 operations. This research question will identify and develop metrics to better understand and standardize general aviation safety culture in order to implement targeted strategies to bolster safety within the general aviation community. The wide range of operations included under the umbrella of general aviation often requires disparate means of effectively addressing safety culture; however, research into methods and metrics intended to measure the efficacy of safety programs and internal safety cultures will facilitate a more robust education and outreach campaign tailored to the various sectors of the general aviation community. This research project will first identify key quantifiable metrics to expedite the standardization of safety culture within the general aviation community as well as encourage the efficient identification of gaps within safety cultures. Once the research project has identified key metrics for safety culture measurement, the research project will then look to identifying weaknesses within general aviation safety culture as well as developing interventions and mitigations for any identified weaknesses.	FY25	FY28	Y

Domain: Aerospace Performance and Planning
Program Area/BLI: System Safety Management/Terminal Area Safety

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11H.TAS.5	Helicopter Enhanced Flight Vision Systems (H-EFVS)	Helicopter Vision Systems research assesses new operational concepts for the use of vision systems in all-weather conditions and varied mission environments during critical phases of flight (approach, departure, takeoff, landing, and hover). Helicopter Enhanced Flight Vision Systems (H-EFVS) research will examine performance criteria that will allow helicopters to achieve higher levels of safety and efficiency by using vision systems technologies. Research activities will comprise human-in-the loop simulation and flight- testing coupled with trade studies and workshops featuring significant contributions from industry and government partners. These activities will contribute to the development of operational specifications (Ops Specs), policy (FAA Orders), guidance (Advisory Circulars), and regulatory material (i.e. rule changes) to enable H-EFVS operations to increase safety and provide operational benefit to the vertical flight community.	FY23	FY27	Y
A11H.TAS.13	Vertical Flight (i.e. Helicopter, Tilt-Rotor, eVTOL/UAM/AAM) IFR Infrastructure	Vertical Flight (i.e. Helicopter, Tilt-Rotor, eVTOL/UAM/AAM) IFR Infrastructure research is required to assess new operational concepts for the use of IFR heliports in all-weather conditions and varied mission environments during critical phases of flight (approach, departure, takeoff, landing, and hover). Research into Vertical Flight Infrastructure will examine performance criteria that will allow helicopters to achieve higher levels of safety and efficiency by operating to/from an IFR Heliport (Vertiport). Research activities will contribute to the development of operational specifications (Ops Specs), policy (FAA Orders), guidance (Advisory Circulars), and regulatory material (i.e. rule changes) for IFR Infrastructure.	FY25	FY28	Y
A11H.TAS.11	Immersive Flight Simulation	The purpose of this project is to reduce the accident rate via pilot training with emerging technologies that potentially enhance a pilot's immersive training experience. Specifically, the technologies investigated will be (1) virtual reality, in which a pilot dons goggles, and (2) simulated air traffic control, which uses voice recognition, voice synthesis, and artificial intelligence to mimic the external air-and-ground traffic environment. The research question will be to determine both the rules and guidance associated with the use of these specific technologies, which are targeted for commercial operators and, in some instances, general aviation. The basic design is for the FAA to procure sets of these technologies, integrate them with its extensive simulation capability in Oklahoma City, and evaluate their strengths and weaknesses in piloted experiments.	FY23	FY26	Y

Domain: Aerospace Performance and Planning
Program Area/BLI: System Safety Management/Terminal Area Safety

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11H.TAS.12	Reducing Pilot Error Through Raising Awareness of Cognitive Biases	The purpose of this project is to develop flight simulator scenarios that show pilots, first hand, the insidious nature of cognitive biases that occur in aviation operations. The research question is how to competently create these scenarios such that they are both effective and can be easily implemented in today's part 121 training environment. The basic design of the project is to partner with academia and industry to first design a set of scenarios and then evaluate their potential effectiveness in the FAA's extensive flight simulation capability in Oklahoma City. If successful, the scenarios and associated guidance for their use will be transmitted to airline training centers.	FY23	FY26	Y
A11H.TAS.10	Improved Helicopter Simulation Models	In order to reduce the helicopter fatal accident rate, the FAA and industry need to improve the fidelity of simulator mathematical physics models present in Aviation Training Devices and Full Flight Simulators. Research is needed to effectively improve the modeling of outside the envelope flight conditions (i.e. Quick Stop/NOE Deceleration, Loss of Tail Rotor Effectiveness, Settling with Insufficient Power, Vortex Ring State, Low Rotor RPM, etc.) to enable more realistic training and facilitate the development of basic skills in a low-risk and safe operational environment. Research activities including simulator model development of various conditions of interest coupled with data obtaiend from flight testing, helicopter performance/certification, and simulation trials of a vast array of simulator/training device platforms to contribute to the development of revisions to FAA policy (FAA Orders), guidance (Advisory Circulars), and regulatory material (i.e. rule changes to 14CFR Part 60) related to ATD's, AATD's, and FFS's for helicopters.	FY20	FY26	Y

Domain: Aerospace Performance and Planning
Program Area/BLI: System Safety Management/Terminal Area Safety

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11H.SSM.36	Methods and Tools to Utilize Statistical Wake Encounter Data in Risk-Based Safety Decisions	This research continues development of new data analysis methods and tools required to translate quantitative wake turbulence encounter data into information needed for NAS system level safety decisions regarding changes to ATC separation procedures and supporting FAA automation systems. Per the FAA Safety Management Systems (SMS), monitoring of risks in the NAS is mandated after procedural changes and/or modifications to wake turbulence separation minima are implemented. Today, the FAA must rely on subjective voluntary reporting systems to assess risks in the NAS associated with aircraft wake turbulence encounters. These voluntary reporting systems have known biases therefore assumptions must be applied to estimate both the frequency and severity of reported encounters. However, the FAA has developed and successfully demonstrated a capability to acquire quantitative risk data by identifying potential encounters with wake turbulence in Flight Operations Quality Assurance (FOQA) data. The Screening Utility for Wake Vortex Encounters (SU) provides quantitative data (normally in statistical form) regarding the frequency, severity, and phase of flight associated with potential wake turbulence encounters. These data are specific to the aircraft types and ATC procedures in use where post-flight FOQA data are available. To develop risk-based probability density functions for use in operational safety decisions severity thresholds, rare event data analyses techniques, and methods to identify potential sampling biases must be applied. Included in SU-derived data are potential wake encounters not likely to be reported by pilots and biases associated with the sources of FOQA data (i.e. because not all types of aircraft are included in the scanned data set(s)). The SU is capable of simultaneously processing thousands of full flights to detect potential wake turbulence encounters in any phase of flight without pilot or controller actions. The proposed research continues an iterative development process that commences in FY24 involving subject matter experts in wake turbulence; rare event analyses and aircraft response characteristics to produce	FY24	FY27	N

Domain: Aerospace Performance and Planning
Program Area/BLI: System Safety Management/Terminal Area Safety

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11H.SSM.34	Absolute metrics to quantitatively determine wake turbulence risks	The proposed research acquires quantitative data to mature and validate absolute wake turbulence encounter metrics and/or algorithms. These absolute metrics can then be applied to quantitatively determine wake turbulence risks in all phases of flight for piloted aircraft types. Absolute metrics encompasses physical impacts on the encountering aircraft (e.g. induced rolling moments) phase of flight operational considerations (e.g. height above the ground), and pilot perceptions of unacceptable risks (e.g. excessive roll and/or pitch rates). The end goal for these wake turbulence absolute metrics is to supplement and/or replace the relative risk assessments currently used in FAA wake turbulence safety risk management processes and development of wake risk mitigations. Currently, no accepted absolute metric for wake encounter risks exists. Surrogates such as induced rolling moment coefficient, strength of the wake vortex encountered, and percentage of roll control authority are used in various combinations in relative risk assessments. The initial data gathering phase of research will be conducted as Human-In- The Loop (HITL) studies in aircraft simulators equipped with modules to simulate encounters with wake turbulence at the Mike Monroney Aeronautical Center (MMAC). Previous HITL wake turbulence studies conducted at the MMAC developed the necessary wake turbulence encounter simulation modules. In follow on phases, these wake encounter simulation modules will be ported to commercial aircraft simulators for HITL studies involving more aircraft types. The analysis phase will distill candidate absolute metrics from data that includes both pilot subjective feedback regarding risks and quantitative aircraft encounter responses parameters. Knowledge gained will be extended to UAM/UAS aircraft where feasible. Existing FAA analytical tools for assessing impacts on aircraft that encounter wake turbulence will be modified/enhanced to utilize the new metric(s). These analytical tools are required to enable safe reductions in wake turbulence separation standards and insure ATC's separation of the aircraft	FY25	FY28	N

Domain: Aerospace Performance and Planning
Program Area/BLI: System Safety Management/Terminal Area Safety

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11H.TAS.14	Modernization of Flight Simulation Training Device (FSTD) Qualification Standards	The purpose of this project is to modernize the Flight Simulation Training Device (FSTD) technical evaluation standards that are published in 14 CFR Part 60. Currently, in order for an FSTD to be qualified for use in air carrier or aircraft type rating training, an FSTD must meet a set of objective testing standards that are published in part 60. For the validation of aerodynamics and flight controls, the performance of the simulator must be compared with aircraft flight test data and matched within the published tolerances in part 60. While the FAA's published simulator standards have been incrementally updated many times over the years, the basic methodology of conducting time-domain based testing to validate simulated aerodynamics and flight controls has remained the same for over 40 years and do not address aircraft types other than airplane and helicopters. This research work seeks to examine the current requirements for the validation of FSTDs and develop more efficient and effective testing alternatives that may be included in a future update to part 60. Applications of this work will be in the initial and continuing qualification of conventional FSTDs as well as validating the performance of FSTDs for new and novel aircraft types for which simulator standards do not currently exist.	FY25	FY28	N

Domain: Aerospace Performance and Planning
Program Area/BLI: Unmanned Aircraft Systems Research

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11L.UAS.68	Evaluate UAS Disaster Preparedness and Emergency Response Operations	This research will provide insight into the safe integration of UAS into the disaster preparedness and emergency response and recovery areas. This research will explore the use of UAS in providing effective and efficient responses to different natural and human- made disasters and emergencies, with a focus on wildfires, hurricanes, tornados, and flooding events. It will focus on procedures to coordinate with UAS operators from within federal agencies such as DOI and DHS (including FEMA), as well as local and state disaster preparedness and emergency response organizations, to ensure proper coordination during those emergencies. The results will help inform requirements, technical standards, and regulations needed to enable disaster preparedness and emergency response and recovery operations for UAS.	FY19	FY27	Y
A11L.UAS.126	Investigate Data Exchange and Interoperability Requirements of UAS Detection and Mitigation Systems	Research is needed to establish operator safety assurances and standardization including the secure exchange and collection of data from C-UAS detection and mitigation systems. This effort will determine C-UAS technologies and processes for the detection, tracking, and identification of UAS, the methods and means of differentiating between legitimate and unauthorized operations, and how various systems collect data and identify legitimate from illegitimate UAS activity. Further, this research focuses on establishing processes and recommendations for standardizing data collection and integration with existing and new FAA databases/systems. This will enable the FAA to mitigate the use of multiple, disparate systems that my cause communication and signal interference with other systems, create non-standardized UAS identification and classification, and provide overall lack of data integrity. Deliverables include data obtained from simulations, testing, and modeling to guidance for effective and secure data exchange. This includes recommendations for implementing data exchanges and interoperability standards to support the variety of UAS detection and mitigation systems, technologies, vendors, operations, etc. Potential development of centralized database for collection and analysis of C-UAS detection and mitigation data.	FY25	FY26	Y

Domain: Aerospace Performance and Planning
Program Area/BLI: Unmanned Aircraft Systems Research

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11L.UAS.108	Evaluate the Impacts and Operational System Needs to Support Deployment and Use of Counter-UAS	Currently, there is a need for enhanced security associated with UAS integration, including interagency coordination to protect the safety of the NAS as well as people and property, enforcement requirements, and suggested recommendations for the effective deployment and use of systems to detect and mitigate wayward or non-compliant UAS operations. This research project will: 1. Provide threat identification and analysis to support FAA decision-making regarding emerging threats to aviation safety including, but not limited to, UAS. 2. Support interagency efforts to safely integrate UAS into the national airspace, facilitate C-UAS testing (detection and mitigation) and employment under different conditions and environments as well as provide input to national security partners on options to address various UAS security concerns. 3. Provide guidance for the safe integration of C-UAS detection and mitigation systems and technologies into the NAS 4. Provide guidance and technical support to Law Enforcement and Public Safety partners to effectively identify and safely mitigate errant or non-compliant UAS operations. this research focuses on identifying the risks created by errant and/or non-compliant UAS and the necessary C-UAS systems, technologies, training, and operating requirements needed to mitigate interference with aviation and non-aviation activities (i.e. public safety, firefighting, air traffic management, critical infrastructure, etc.) at various locations (i.e., urban, suburban, ports, rural, etc.) and under various conditions (i.e., freezing temperatures, high winds, etc.)	FY24	FY26	Y
A11L.UAS.122	Analyze Drone Traffic & Collision Risks	In order for the FAA to maintain the safety of the NAS and accommodate new types of drone operations, it is important to monitor the effectiveness of existing drone regulations and forecast future drone integration needs. Using detection data, first of its kind, this research will provide data to support those needs by analyzing drone traffic and drone traffic collision risks at several urban locations across the NAS.	FY25	FY27	Y
A11L.UAS.124	Derive Requirements for Multi-vehicle Architectures	Multi-vehicle architectures are susceptible to risks that simultaneously impact more than one vehicle at a time. The risks of these types of common mode failures scale with the number of aircraft vehicles that are simultaneously operated. This project will identify and assess the risks unique to multi-vehicle systems and then derive the requirements necessary to mitigate those risks.	FY25	FY27	Y

A11L.UAS.125	Derive Terrain and Obstacle Avoidance Requirements for Drones and Remotely Piloted Passenger Ops	Currently there are not approved standards for many drones and Advanced Air Mobility aircraft operating Beyond Visual Line of Sight to avoid terrain and ground obstacles while in flight. This research project will perform requirements analysis to derive, justify, and propose these requirements for consideration to the FAA and to Standards Development Organizations.	FY25	FY27	Y

Domain: Aerospace Performance and Planning
Program Area/BLI: Unmanned Aircraft Systems Research

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11L.UAS.109	Identify and Evaluate UTM Risks and Establish Threat Management Mitigation Recommendations	Research is needed to address Congressional directives including threat identification and analysis to support FAA decision-making regarding emerging threats to aviation safety including, but not limited to, UAS. This effort will support interagency efforts to safely integrate UAS/AAM into the national airspace and provide input to national security partners on options to address various UAS/AAM and/or UTM security concerns. Additionally, it will provide guidance and technical support to Law Enforcement and Public Safety partners to effectively identify and safely mitigate errant or non-compliant UAS operations. This research will evaluate the potential security risks to UTM and the integration of UAS, AAM and other related technologies into the NAS. It will evaluate effective mitigations for systems that potential could cause a security risk to the NAS and/or people or property on the ground. Ultimately, the desired outcome of this effort is to:Define the elements of the drone/uncrewed system security risk or threat (i.e., size/ construction/ autonomy/ number of vehicles, etc.) and, Identify/address potential vulnerabilities and risk mitigation requirements	FY24	FY26	Y
A11L.UAS.128	Increase Small Unmanned Aircraft Systems Conspicuity in Terminal Environments	The intent of the research is to identify the lighting scheme(s) that best increase the conspicuity of UAS operating in the terminal environment. The findings of this research will inform FAA policy on conspicuity schemes for sUAS operating in terminal environments.	FY25	FY27	N
A11L.UAS.121	Derive Safety Requirements for Beyond Visual Line of Sight System Mode Transitions	Requirements are needed for larger drones and Advanced Air Mobility aircraft operating Beyond Visual Line of Sight (BVLOS) to transition between different modes of operation to include modes of Detect and Avoid (DAA), modes of navigation, and modes of automation. Separation distances, requirements for dealing with false tracks, interaction with Air Traffic Control, operating procedures, modes of system control, user interface requirements, and even the type and location of DAA sensors and navigational sensors to support BVLOS operations may change throughout a flight. This research project will perform concept exploration, the development of DAA and navigational concepts of operation, and requirements analysis to derive, justify, and propose requirements for safely transitioning between Detect and Avoid modes of operation and navigational modes of operation. Project results will inform the maturation of industry standards and provide insights to the FAA to be used for system waiver reviews, policy development, and rulemaking.	FY25	FY27	Y

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Program Area/BLI: Unmanned Aircraft Systems Research

CA#	FY 2025 Research Project Title	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding	Currently in Budget Narratives (Formulation) for FY25
A11L.UAS.81	Identify Weather Research and Knowledge Gaps in the Boundary Layer for UAS	This is a continuation of the previous year's approval as it's envisioned this R&D effort will take several years to complete Weather cuts across all operational capabilities in a similar way. 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. Commercial UAS operations will be conducted under 14 Code of Federal Regulations (CFR) part 91, part 121 part 135, and part 137. Those regulations require approved sources of weather for aeronautical decision making. Few, if any, weather products exist for UAS flight planning. In addition, forecasting of weather at altitudes below 400 feet above ground level are outside of the current manned forecasting capabilities and currently do not exist. In addition, challenges exist with terrain variances, in geographically mountainous regions versus plains regions, as well as urban environments that pose a significant mechanical turbulence risk which is difficult to ascertain. Currently, no published standards or regulations exist to determine and mitigate the risk of weather incursion. Research is required to 1) develop and verify a Visual Weather Observation System (VWOS), 2) determine procedural changes for UAS operations in the NAS with respect to establishing a means to accept and/or approve weather detection, prediction, application, and integration systems for use in all UAS operations.	FY25	FY29	Y
A11L.UAS.123	Derive Advanced Automation Monitoring Requirements for Larger Drones and Air Mobility Systems	Deriving monitoring requirements for larger drones and Advanced Air Mobility operating Beyond Visual Line of Sight (BVLOS) is vital for safe, secure and efficient integration into the NAS. One of the responsibilities of an onboard pilot is to monitor the suitability of the operating environment, the performance and behavior of their aircraft system in performing its intended functions, and the health and integrity of their aircraft system. For systems without an onboard pilot, monitoring responsibilities will need to be managed by monitoring systems. Without comprehensive monitoring functions, potential hazards may persist until they lead to incidents and accidents. This research project will explore advanced BVLOS systems and their concepts of operation	FY25	FY28	N

		in order to perform risk analysis and requirements analysis for monitoring systems. Proposed requirements will be supported by safety justification and operational limitations. Project results will inform the maturation of industry standards and provide insights to the FAA to be used for system waiver reviews, policy development, and rulemaking for BVLOS operations with advanced automation.			

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Program Area/BLI: Unmanned Aircraft Systems Research

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A11L.UAS.82	Identify Weather Hazards for Unmanned Aircraft Systems (UAS)	This is a continuation of the previous year's approval as it's envisioned this R&D effort will take several years to complete. Weather cuts across all operational capabilities in a similar way. 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. Research is required to understand the ability to detect and forecast UAS weather hazards so the NAS can maintain a high level of safety.	FY25	FY29	N
A11L.UAS.130	Develop Risk Based UAS Operator Medical Certification Standards	This project will develop a reference risk-assessment framework and knowledge base for the medical certification of individuals directly involved in UAS operations. The project scope will include current UAS operations and crew positions and scale to address future UAS with increasing levels of automation/autonomy (e.g., SAE level 3-4) performing integrated cargo and passenger carrying operations in the national air space. This research will answer the question regarding the minimum standards needed for individuals operating UAS to be considered medically fit to perform safety-related duties. The outcome of this research will be "right sized" medical standards for UAS operations that do not unnecessarily constrain the population participating in UAS operations while appropriately mitigating aeromedical hazards in unmanned operations to maintain aviation safety.	FY25	FY26	N

A11L.UAS.131	Derive Air Mobility requirements for off- board Detect and Avoid	Off-board Detect and Avoid (DAA) services and capabilities are an important part of future Air Mobility architectures needed for safe operations. These off-board services will be provided by surveillance systems on the ground and Provider of Services of Urban Air Mobility (PSU) systems. Currently, the service architectures proposed by industry for off-board DAA services lack adequate safety performance. They also lack adequate safety assurance and protection mechanisms to validate the data that they receive, process, and transmit. This lack of data validation is a potential barrier for service use in safety critical applications such as Air Mobility aircraft separation, collision avoidance, obstacle avoidance, bird strike avoidance, safe landing approach, and other functions connected with DAA. Proposed DAA services also lack the harmonization needed with other system requirements for end-to-end Air Mobility operations at vertiports and runways. This project will document the need for off-board DAA systems and services. Researchers will identify risks, derive requirements, and perform research activities that support proposed requirements. Research findings will inform industry standards and FAA policy decisions.	FY25	FY27	N

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A11L.UAS.129	Identify Electric Vertical Takeoff & Landing Passenger Transport Accessibility, Equity Metrics& Gaps	Advanced Air Mobility (AAM) encompasses many concept of operations including cargo and passenger transport operations. For the purposes of this work, AAM will be narrowed in scope to passenger transport via electric Vertical Takeoff and Landing (eVTOL) vehicles. The social and economic equity of this aviation paradigm is not well understood. This includes access to such services, and any potential mitigations. For example, previous FAA- sponsored work conducted by MITRE (reference report 0221BB06-FT) indicated that the AAM market would not be viable for households with annual incomes less than $160,000 (this excludes nearly 0% of the US population). As a precursor, this work will focus on developing metrics to access equity of AAM, identifying specific gaps in this area, and providing the FAA a current and accurate assessment of AAM (based on a literature review) so federal agencies can facilitate a level- set discussions around AAM with communities. This is a high impact, and a much needed research effort that will ensure that the FAA advances the interests of the American public, as AAM progresses forward.	FY25	FY26	N
A11L.UAS.127	Assess the Vulnerabilities of Packaging and Package Containment Systems	Identifying potential hazards, vulnerabilities and package faults with UAS small package delivery systems is crucial to safe, efficient and safe UAS operations. Currently, sections of the 49 CFR provide a great guidance and summation of general requirements for packaging and packages for a "typical" shipper, however as we are steadily finding out the UAS operators are NOT your typical shipper. Specifically, many of these new operators are experimenting with various means of package delivery systems such as: dropped via tether, delivered via parachute drop, delivered via free-fall drop, etc. Another item that should be considered during the course of the research effort should be environmental effects. Unlike manned operations, UAS packages will be exposed to a myriad of weather conditions outside of the aircraft fuselage and the effects of certain atmospheric conditions should be assessed. Because of these new dynamics, we believe many of the current standards and testing are inadequate for these type of operations. The goals of any packaging standard would be to adequately protect the contents against shock, vibration, compression and/or atmospheric hazards during the delivery environment. For those operators that intend to carry Hazmat, the FAA evaluates the operator's Safety Cases to ensure the appropriate mitigations/safety controls are being applied in order to decrease the risk of people on the ground. Unfortunately, much of what we assess reflects the standards for the "typical" shipper and the impacts of potential research delay or execution would negatively impact the safety of package delivery.	FY25	FY26	N