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

FY2023 Aviation Safety Research Portfolio Active Projects

REDAC SAS FY2023 Aviation Safety Research Portfolio Active Projects

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Program Area/BLI **Page**

Domain: Aircraft Safety Assurance Program Area: Fire Research and Safety				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11A.FCS.1	Aircraft Fire Safety	This research will provide the information necessary to make regulatory and policy decisions regarding the use of new materials for aircraft construction, as well as installed systems (e.g., fuel cells), and transportation of hazardous goods	FY15	FY30

Researcher Collaboration and Parnerships	FAA Office of Hazardous Materials (AXH), FAA Civil Aeromedical Institute (CAMI), Interagency Advanced Power Group (IAPG), NIST, ICAO, SAE, EASA, ICCAIA, Boeing, Airbus, University of Cincinnati, Drexel University, University of Maryland, University of Massachusetts, Rutgers University, UN Dangerous Good Panel
Researcher Facilities Utilized	FAA Full Scale Fire Test Facility, FAA Component Fire Test Facility, FAA Fire Chemistry Lab, FAA Material Fire Test Facility, FAA Pressure Vessel, B-757, B-747, B-737, and B-727 aircraft

Domain: Aircraft Safety Assurance Program Area: Propulsion and Fuel Systems				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
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 loading, low cycle fatigue. Likewise, the 2017 uncontained failure on an Air France flight 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 overall objective of this work is to develop advanced damage tolerance and risk assessment methods and data that can be used to reduce the risk of failures of high-energy rotors and other life-limited engine components. These new methods and data will provide the basis for new/revised engine certification and continued airworthiness standards and Advisory Circulars. In addition, they will support the safe and reliable industry use of the new standards and advisory materials. The new regulatory and advisory material will support compliance to §33.70 requirement for damage tolerance and the CAAM guidelines in AC39-8. This proposed research, together with A11B PS.4 "Improved Nondestructive Evaluation (NDE) to Prevent Uncontained Engine Failures", offer a holistic approach to reducing engine rotor failures due to material anomalies by improving the design, manufacturing, and inspection of these critical parts.	FY19	FY26
A11B.PS.2	Advanced Analysis Methods for Impact of Aircraft Materials from Rotor Burst and Blade Release	Since 2015, there have been seven high profile uncontained events involving turbine engine blade and rotor failures including a passenger fatality. This research works to improve engine containment analysis using LS-DYNA dynamic modeling tools and to minimize the uncontained fragment hazards to the airplane using the Uncontained Engine Debris Damage Assessment Model (UEDDAM). The program develops data to produce publicly available tools, FAA certification guidance, and analysis methods to model engine blade containment systems and to protect critical aircraft systems from uncontained engine blade and rotor debris. The tools, data, and guidance developed from this research also have applications for impact related modeling of emerging technology engine and airplane materials, structures, and propulsion system concepts such as lightweight composite shielding, open rotor engine designs and electric propulsion.	FY15	FY24
A11B.PS.4	Improved Nondestructive Evaluation (NDE) to Prevent Uncontained Engine Failures	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 the shortcomings of available nondestructive evaluation (NDE) methods to ensure the structural integrity of these components. Improved NDE methods are needed to detect anomalies in life-limited parts (LLPs), validate process improvements, and to characterize material properties to enable better life prediction. Improved and validated NDE methods applied to critical rotating parts during manufacture and while in-service will greatly reduce the risk of engine on-wing catastrophic failures. Guidance and technical information, including data to support addressing the NTSB recommendations and future FAA rulemaking on damage tolerance and NDE compliance requirements, are needed for critical nickel and titanium alloy rotating hardware. 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

Domain: Aircraft Safety Assurance Program Area: Propulsion and Fuel Systems				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11B.PS.6	Engine Safety Event Prevention thru EHM (engine health monitoring)	The purpose of this research is to facilitate implementation of Engine Health Alerts using Analytics and Artificial intelligence that would help detect unsafe conditions and precursors before they propagate to major engine events such as : - Uncontained rotor burst on the GE90-115 on Boeing 777 (Thai Airways, October 2019) due to a interstage air seal failure - 7 Engine stall/surge events on takeoff on Leap-1A engine on the Airbus A320neo (2018-2019) due to abnormal wear in the 3R bearing causing reduced rotor damping, excessive non-synchronous vibration and affecting compressor clearances (multiple events at different airlines listed under LEAP CARI 2018-004. 63 engines suspected to have similar risk due to manufacturing debris) - High engine vibes and exhaust gas temperature exceedance due to 51 events of LPT (stage 3) blade failure (LPT air seal damage) on Pratt Geared Turbofan PW1100 on the Airbus A320neo during 2017-2020; causing 10 In-Flight Shutdowns and ~ 40 air turnbacks. - 23 events on PW1100 due to IDG gear issues leading to ~ 20 IFSDs and air turnbacks during 2018-2019. The intent of this research project is to establish robust methodology to detect abnormal engine performance deterioration and vibration signatures in a flight and enable the flight crews to trigger maintenance inspections to verify engine condition prior to the next flight. The robustness of the thresholding analytics is important in order to detect impending hazards while minimizing false positives and unnecessary maintenance actions. This is aligned with FAA Reauthorization Act of 2018 (H.R. 302), Sec 309 Congressional Call to Action - Airline Engine Safety Review, and Sec 548. Sense of Congress on Artificial Intelligence in Aviation.	FY23	FY27

Researcher Collaboration and Partnerships	AIA-Rotor Integrity Subcommittee (RISC); Rotor Manufacturing (RoMan) Sub-team; Jet Engine Titanium Quality Committee (JETQC); Jet Engine Nickel Quality Committee (JENQC); AIA Inspection Team; USAF-AFRL, NASA, Naval Air Warfare Center, ANSYS Inc., LS-DYNA Aerospace Working Group (AWG) – include Boeing, GE, P&W, SAE E-32 Committee (Aerospace Propulsion Systems Health Management Committee)
Researcher Facilities Utilized	FAA High Performance Computing Cluster (HPC)

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

Control Account #	Title of Research Project	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding
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. This particular effort has two different areas of study as described below (both starting work in recent years): 1) 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 portion of the requirement will use an IPT 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 to assess life at the time of blade certification. 2) The second part of the studies will evaluate the current Categories of Damage as defined in AC 20-107B, their relationships and the underlying need to envelop the damage and environmental threats for composite applications rather than pursue a specific dominant damage threat (the case of metal crack growth) to determine suitable test and analysis demonstrations of composite foreign object damage threats for damage on the threshold of detection using field techniques (that include the general visual and detailed visual methods often used for initial detection) to more quantitative assessments of damage metrics that more closely related with residual strength, growth and damage tolerance.	FY20	FY27

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

Control Account #	Title of Research Project	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding
A11C.SIC.12	Develop Certification Protocols for Advanced Materials	Operational Capability 1 is to Develop guidelines for characterizing new material forms and assessing manufacturing maturity. This outcome, item 1.1, is to sponsor research that investigates new material forms and new manufacturing processes that are being introduced into aviation products. This achieved by addressing AVS goals for both safety and innovation, by respectively addressing any fundamental manufacturing defects that must be controlled and certification efficiency through enabling shared databases and standard approaches for the development of specification and testing protocols 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 AM, metal powder bed fusion AM, 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, we have been funding many similar projects to develop databases and protocols for materials such as ceramic matrix composites, thermoplastic composites, polymer AM, and adhesives. This Outcome is expected to be open for many years as we select and investigate 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 FY23, 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. This is primarily due to size effects and interactions with part design variations. For example, standard ASTM test methods may not provide sufficient material characterization without updates and design value tests and analyses will likely need to identify any unique semi-empirical limits on the structural details sufficiently covered by their results.	FY16	FY30
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 helped establish additional structural test capabilities for the FAA	FY23	FY28
A11C.SIC.15	Non-Metallic Additive Manufacturing	Non-metallic additive manufacturing is an area of rapidly growing technology with increased industry use. The FAA does not have a good understanding of material behavior and has not published any certification guidance. Research will help advance the public body of knowledge for publication by industry standards groups and incorporation into guidance materials.	FY22	FY24
A11C.SIC.16	Element-level Test Standards for Aviation Composites	Test standards exist for very simple composite configurations at the lamina or laminate level; however properties developed at these levels are not useful for composite design. This research will help the FAA and cost-sharing industry partners to promote higher-level configuration standardization at element or detail levels that can be used for multiple purposes, including the generation of design values and proof of structure. In many cases, an industry company or group of companies will note that they are substantiating structure using "analysis supported by testing". The analysis is often not to predict strength but rather load paths in real structure	FY19	FY24

Domain: Aircraft Safety Assurance Program Area: Propulsion and Fuel Systems				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11C.SIC.17	Joint Centers of Excellence for Advanced Materials (JAMS)	This requirement 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. In prior years, this administrative grant was awarded under A11C.SIC.2 for composite maintenance. As of FY23, it is being administered as its own BLI Plan objective.	FY15	FY30
A11C.SIC.19	Advanced Materials Standardization	In order to comply with congressional direction for use of the FY22 appropriation plus-up funds for the Advanced Materials and Structural Safety BLI, this requirement identifies proposed research activities to advance the use of new non-metallic addively manufactured material and fiber reinforced composite material into the commercial aviation industry. As directed by congress, research will be performed by the COE JAMS.	FY22	FY24
A11C.SIM.3	Evaluate fatigue behavior of metallic AM materials	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, 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 (such as DARWIN for fatigue crack growth modeling or maintenance inspection methods).	FY19	FY30

Researcher Collaboration and Partnerships	Academia (FAA Joint Centers of Excellence for Advance Materials, COE JAMS): Wichita State University - National Institute for Aviation Research (NIAR), University of Washington, Sikorsky, Leonardo Helicopters, Columbia Helicopters, Boeing, Markforged, Supernal, Hexcel, Northrop Grumman, Stratasys, Navy, Air Force, Collins, Blue Origin, AFRL,Lockheed, Spirit Aerosystems, Joby Aviation, Qarbon, Solvay, Toray, Victrex , Beehive 3D, EOS, 3D Logics, GE Additive Government: JMADD is co-sponsored by AFRL through AmericaMakes and is supported by a broad industry advisory group
Researcher Facilities Utilized	FAA Structures and Materials Lab (SML), FAA Full-scale Aircraft Structural Test Evaluation and Research (FASTER) Lab, FAA Structures and Materials Lab (SML) and Aircraft Beam Structural Test (ABST) Fixture

Domain: Aircraft Safety Assurance Program Area: Continued Airworthiness				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
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. These will require megawatt-range power consumption and MW-hr storage capacity. Safe design, validation and maintenance will be a new challenge. These system may include several modules up to 200 cells of batteries or energy storage that that have to be modularized and deSign/validate in a practical method that ensure safe installation and containment of possible failures. This effort will provide data on the feasibility and advantage of modularizing the large electrical energy storage system. 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. 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. 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	FY23
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. This effort will provide data on the feasibility and advantage of modularizing the High voltage Electric Aircraft System. 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. 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	FY24
A11E.FCMS.13	Transfer 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	FY18	FY23

Domain: Aircraft Safety Assurance
Program Area: Continued Airworthiness

Control Account #	Title of Research Project	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding
A11E.RS.10	NVG-LED Obstruction Light Compatibility	The objective of this research is to find a means of "seeing" LED obstruction lights while wearing Night Vision Goggles (NVG). Replacement of incandescent obstruction lights with LEDs with little or no IR signature has caused obstructions so lit to "disappear" when viewed through NVG, causing a hazard of collision. Developing a method to regain the visibility to these obstructions is key to the continued use of NVG and the safety enhancements they otherwise bring to EMS and other night VFR operations. The results of this research may be used to update TSO-C164a.	FY23	FY24
A11E.RS.9	Loss of Control Inflight (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	FY25
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	FY25
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.	FY23	FY24
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	FY23

Domain: Aircraft Safety Assurance
Program Area: Continued Airworthiness

Control Account #	Title of Research Project	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding
A11E.SIM.11	Effect of Turbulence on Aircraft Structural Loading	This requirement focuses on operational loads research on two areas: Task 1 examines the current Part 23 and Part 27 loads rules for electrical vertical takeoff and landing (eVTOL) systems to identify the need to relax or strengthen them. Task 2 develops methods to quantify the effect of turbulence on structural integrity, and to provide a method for pilots to understand what specific values of turbulence intensity mean for their particular aircraft. To accomplish this, a standard measure of turbulence will be obtained by usual metrological instruments as well as in-flight operational instrumentation in order to initiate development of a standard consensus for estimation of the level of risk to the aircraft structures by atmospheric turbulence.	FY19	FY26
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
A11E.SIM.14	Existing and Advanced Inspection or Monitoring Technologies	This research looks to generate data to verify certification and maintenance methodologies to ensure safe and efficient use of existing and advanced inspection or monitoring technologies. Continued operational safety (COS) is dependent on robust maintenance and inspection practices with defined Probability of Detection (PoD). The proposed research has two goals. The first is to ensure the reliability of advanced inspection and monitoring technologies, and the second is to assess the applicability of traditional and advanced inspection technologies on emerging materials and structures. 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 (inspection capability and PoD) 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. This research proposal will address advanced inspection practices including Structural Health Monitoring (SHM), inspection challenges of Emerging Metallic Structural Technologies (EMST), and Automated Nondestructive Inspection (ANDI).	FY23	FY26
A11E.SIM.16	Damage Tolerance and Durability Issues	This proposal looks at various aspects relating to damage tolerance and durability issues to address very different needs in two areas: Area 1 investigates certification and continued airworthiness issues arising from introduction of advanced materials and new fabrication and construction methods. Specifically, 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 Area 2 is using probabilistic methods combined with F&DT analysis techniques to develop, validate and improve tools required to assess and manage risk to general aviation.	FY17	FY25

Domain: Aircraft Safety Assurance Program Area: Continued Airworthiness				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11E.SIM.4	MMPDS Support and Design Values for Emerging Materials	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 to develop data and tools promotes efficient, standardized certification of aircraft structure and leverages resources via government and industry consortium.	FY15	FY30
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 toTitle 14, Code of Federal Regulations (14 CFR) 25.571.	FY23	FY30

Researcher Collaboration and Partnerships	Aviation Specialties Unlimited (ASU), PEGASAS Center of Excellence for General Aviation, Georgia Institute of Technology, NASA Ames, NASA Armstrong, NASA Langley, Battelle, Boeing, Arconic, Embraer, Bombardier, Constellium, Wichita State University, Southwest Research Institute, NASA, University of Texas at San Antonio, Textron Aviation, Rutgers University, University of Washington, Politecnico de Milano, Wichita State University MagniX, DENSO, Boeing, Airbus, Dassault, Joby, Acme Aero, EaglePicher, Teledyne, EP Systems, S&T Systems, University of Dayton Research Institute, SAE, NASA (Johnson and Glenn), EASA, Propulsion Power Systems Alliance
Researcher Facilities Utilized	FAA Full-scale Aircraft Structural Test Evaluation and Research (FASTER) Lab, FAA Structures and Materials Lab (SML), Aircraft Beam Structural Test (ABST) Fixture, FAA Arc Fault Evaluation Lab/More Electric Aircraft Lab, POWER Lab, Electric Flight Controls Test Capabilities, FAA's Sikorsky S76-D Helicopter Simulator at the William J. Hughes Technical Center's Cockpit Simulation Facility

Domain: Digital Systems Technologies Program Area: Digital System Safety				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11DS.SDS.6	Complex Digital Systems	This requirement (FY22-FY26) will analyze airworthiness and certification aspects of highly integrated, complex digital aircraft systems, including the software and airborne electronic hardware. Focus will be on streamlining assurance processes for high assurance systems, low risk systems and continuous levels in between. This will include: (1) Implementation and Approval Methodologies for Artificial Intelligence and Machine Learning; and (2) Pilot Programs to assess approaches other than the current acceptable means of compliance. These include Overarching Properties, Abstraction Layer, and others as identified to provide flexible, less-prescriptive, risk-based guidance for development assurance of complex digital systems across the safety continuum.	FY20	FY24
A11DS.SDS.7	Aircraft Cyber Safety – Resilient Aircraft GNSS Receiver and Antenna	Positioning, Navigation, and Timing (PNT) data broadcast by Space Based Augmentation Systems (SBAS), such as the FAA's Wide Area Augmentation System, and GPS enable navigation, surveillance, and a wide variety of other aircraft functions. These signals and data can be disrupted, manipulated or simulated "spoofed," meaning subject to falsification by an "imposter." Aircraft operational threats include national and internationally recognized, unsophisticated and low-cost Software Defined Radios (SDR), improperly or malicious operation of Global Navigation Satellite System (GNSS) maintenance test equipment, and more advanced threats such as those currently impacting maritime transportation operations. Since SBAS and GPS data are intrinsically trusted by the avionics, erroneous data can lead to a degradation of service. Degradation of the services can result in loss (unavailability) of the position solution, or worse—substantial errors while remaining "flagged" as valid PNT data. Authentication is an effective tool to mitigate the hazardous unintended use of manipulated and simulated data. In this context, authentication verifies that the point of origin of the PNT data is the intended satellites and not some other source. Civil anti-jamming/spoofing antenna technologies amplify the intended satellite signals from the legitimate satellites and reduce/eliminate signals arriving at the antenna from inappropriate sources/direction. These antenna are effective in mitigating unintentional interference and jamming as well as hazardous unintended use of manipulated and simulated data. Consistent with the Federal Radionavigation Plan and National policy on resilient and responsible use of PNT, this research develops and validates FAA Technical Standard Order avionics requirements for WAAS and GPS authentication, and civil anti- spoofing antenna for public safety and homeland security purposes. Research also enables U.S. updates to ICAO Annex 10, RTCA/EUROCAE minimum operational performance standards, and FAA Advisory Circular guidance. Additionally, this Aircraft PNT Cyber Safety Resiliency project validates FAA TSO requirements for authenticated GPS/WAAS and civil anti- spoof antenna. This research enables positioning, navigation, and timing (PNT) resiliency consistent with National Policy ...	FY21	FY26

Researcher Collaboration and Partnerships	NASA Langley, Aerospace Vehicles Systems Institute (AVSI), FAA ATO Navigation Programs, GPS Program, U.S. Space Force, Air Force Research Laboratory (AFRL), Integrated Mission & Avionics Test & Evaluation Division, Naval Air Warfare Center, Patuxent River Naval Air Station
Researcher Facilities Utilized	N/A

Domain: Environment and Weather Mitigation Program Area: Aircraft Icing				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11DA.AI.1	Research on Ice Crystal Icing Conditions to Address Fundamental Knowledge of High Altitude Icing on Turbine Engine Damage and Powerloss	The FAA's Aircraft Icing research program focuses on ground icing and inflight icing effects on all types of aircraft. Ground icing focuses on aircraft deicing and anti-icing methods prior to takeoff. Inflight icing focuses on aerodynamic and operational effects of icing on all types of aircraft, rotorcraft and engines. The ground icing program conducts research to maintain safe winter ground operations, evaluate the effects of changing ground operations, develop testing and analysis methods to support these changes, and address the effects of innovative aircraft design, such as folding wing aircraft, and new formulations of fluids and innovative methods used in deicing and anti icing procedures. The pre-takeoff Clean Aircraft Concept is to ensure that the critical surfaces of the aircraft are aerodynamically clean at takeoff, guiding FAA policy for ground icing. The inflight aircraft icing program conducts research on the effects of icing and mitigation techniques and innovative methods to assure compliance with airworthiness standards. Inflight aircraft icing includes both super-cooled droplet icing conditions, which affect aircraft, rotorcraft, and engines, as well as ice crystal icing (ICI) that effects turbine engine operation and aircraft flight data probe functionality. The aircraft icing program includes innovative aircraft that are entering the fleet, in particular urban air mobility (UAM) vehicles. Ensuring the safety of these vehicles in icing conditions requires innovative methods of ice protection and detection and FAA development of innovative facility and analytical approaches to evaluate and ensure their safety in icing conditions. The team uses recent or prior icing incidents and events reported by FAA inspectors, airline operators, airport authorities, deicing facility operators, and original equipment manufacturers to determine areas of research. The FAA works with these organizations to identify safety risks, and define research and development tasks that address safety concerns. For example, an updated list of ICI research needs was recently published in the FAA Technical Center report number DOT/FAA/TC-20/34, "Engine Ice Crystal Icing Technology Plan with Research Needs."	FY17	FY26
A11DA.AI.2	Safe Operations and Take-off in Aircraft Ground Icing Conditions	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.	FY15	FY26
A11DA.AI.6	Urban Air Mobility (UAM) Icing	Proposed UAM designs utilize small diameter, low RPM rotors and propellers to minimize noise. The resulting centrifugal loading, and therefore ice shedding capability, is lower than that of rotors and propellers of currently certified aircraft. Research is needed to determine if the means of compliance to show safe exit from an inadvertent icing encounter needs to address the effect of ice accretion and ice shedding of UAM rotors and propellers. The proposed research will also develop information needed for means of compliance for ice accretion on critical electric propulsion cooling inlets and ice detection systems, which may be affected by rotor or propeller wash. A database will be made public which can be used for validation of computer codes that may be used as part of the compliance process.	FY20	FY25
A11DA.AI.7	Improved Modelling Techniques for Aircraft Icing on Ice- protected Surfaces	Traditional icing modelling is based on aircraft surfaces that are unprotected from ice accretions. This research is focused on a more difficult problem of modelling ic e accretions on ice protected surfaces where deice and anti-ce systems normally are operating, but don't always completely remove the icing threat onnthe surface. Current modelling techniques do not predict whether ice-protected critical surfaces are effective throughout the icing envelope.	FY23	FY26

Domain: Environment and Weather Mitigation Program Area: Aircraft Icing				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11DA.AI.8	Ground De-Icing Fluid Effectivity in Snow	Conduct research to 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.	FY20	FY23

Researcher Collaboration and Partnerships	National Research Council Canada (NRC), Environment & Climate Change Canada (ECCC), Transport Canada (TC), Australian Bureau of Meteorology (BOM), French Aerospace Lab (ONERA), Italian Aerospace Research Center (CIRA), UK Met office, Meteo-France, German Meteorological Office (DWD), Aviation Planning Services (APS), NOAA National Severe Storms Laboratory (NSSL) , NOAA Global Systems Laboratory (GSL), NASA (Glenn, Langley, and Armstrong), National Center for Atmospheric Research (NCAR), Boeing, Airbus, Bombardier, University of Illinois, Penn State, Baylor University, Nagoya University (Japan) , Rail Tec Arsenol (RTA), Collins Aerospace, University Corporation For Atmospheric Research (UCAR)
Researcher Facilities Utilized	FAA CASSIE (For CFD modeling)

Domain: Environment and Weather Mitigation Program Area: Alternative Fuels for General Aviation				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11M.PS.5	Alternate Fuels for General Aviation	The alternative fuels for general aviation (GA) program performs research to support the resolution of the number one issue facing general aviation today. That is to identify and qualify (through testing), an unleaded replacement fuel that will maintain the safety of the GA fleet, before regulatory and/or market forces eliminate the availability of current leaded aviation gasoline. Working through the Piston Aviation Fuels Initiative (PAFI), the research is generating data as the basis of a fleet authorization for an unleaded fuel, in accordance with Section 565 of the 2018 FAA Reauthorization Act.	FY21	FY29

Researcher Collaboration and Partnerships	Afton Chemical, Air BP, Air Repair, Aircraft Owners and Pilots Association (AOPA), American Petroleum Institute (API), ASTM International, AVFUEL Corp, Calumet Specialty Products, Cape Air, Chevron, Cirrus Aircraft, Commemorative Air Force, Continental Motors, Denso, Dixie Services, Embry Riddle Aeronautical University, Enstrom Helicopter, Epic Aviation, Ethyl Corp, Everts Air, Experimental Aircraft Association (EAA), Exxon Mobil, General Aviation Manufacturers Association (GAMA), Haltermann Solutions, Hartzell Propeller, Honeywell, Innospec, Lycoming Engines, LyondellBasell, magniX, McCauley Propeller, Meggitt Polymers & Composites, Mooney Aircraft, National Air Transportation Association (NATA), National Business Aviation Association (NBAA), National Research Council Canada (NRC), Phillips 66, Piper Aircraft, Precision Airmotive, Precision Engines, Purdue University, PEGASAS Center of Excellence (COE), Raytheon, Robinson Helicopter Company, Rotax Engines, SAE International, Shell Oil Products US, Supernal, Swift Fuels LLC, Teledyne, Textron Aviation, TOTAL S.A., Transport Canada, Universal Hydrogen, University of Dayton Research Institute, US Environmental Protection Agency,
Researcher Facilities Utilized	FAA Aviation Fuel Research Lab (AFRL), FAA Propulsion & airpOWer Engineering Research (POWER) Lab

Domain: Human and Aeromedical Factors Program Area: Flightdeck/Maintenance/System Integration Human Factors				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11G.HF.11	Improved Transport Operational Safety through Pilot Training, Qualification, Procedures and Flight Operations	Research is needed to evaluate human factors and pilot/crew performance considerations associated with pilot training, procedures, and flight 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 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)AO Personnel Training and Licensing Panel). This program will focus on the following key areas: 1.1 Pilot Training for Response to Failures 1.2 Single Source Reference Document for Flight Standards Human Factors (RDFSHF) 1.3 Crew Resource Management performance indicators 1.4 Pilot Training and Operational Effectiveness 1.5 Adapting Training and Flight Operations to Emerging Risks	FY20	FY26
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 and emerging issues and trends, 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 also inform policy, operational requirements, standards, procedures, limitations, mitigations, and guidance materials pertaining to helicopter air ambulance operations and update industry best practices. This requirement will advance research outcomes associated with FY23 A11G BLI Plan Objectives 5.1 – 5.5 which are located under Operational Capability #5: Human Factors Considerations and Emerging Trends Associated with Helicopter Air Ambulance Operations. In summary, these objectives are:5.1 Evaluate HAA accidents and incidents for causal or contributing human factors elements.5.2 Conduct fatigue risk research: Develop and validate a fatigue risk baseline for the HAA industry.5.3 Evaluate HAA operations for human factors-related emerging issues and industry trends.5.4 Assess pilot risk-based decision-making processes in HAA operations.5.5 Update industry best practices for assessing and mitigating risk factors in HAA operations.	FY22	FY26

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

Control Account #	Title of Research Project	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding
A11G.HF.15	Improved Integration of Human Factors into Aviation Safety Regulatory Policy and Processes for Aircraft Certification and Flight Standards	Based on recent accidents and incidents, there is a need for improved integration of human factors into Aviation Safety regulatory policy and processes for Aircraft Certification and Flight Standards (as recommended in reports from the Joint Authorities Technical Review (JATR), U.S. Department of Transportation, Special Committee (SpecComm), and NTSB, related to the Boeing 737 MAX accidents). JATR recommended (R7) that the FAA integrate human factors and human systems integration throughout the certification process. Research is need 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)), 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. It also supports the new human factors specialists within the AED, and within Aircraft Certification, hired based on congressional direction, who are responsible for supporting aircraft certification evaluations, supporting operational suitability evaluations, and the Flight Standardization Board process.	FY23	FY25
A11G.HF.16	Supporting Improvements in Aviation Maintenance	This requirement will provide research data to support the human factors needs of Federal Aviation Administration (FAA) personnel who evaluate, approve, and oversee maintenance – related procedures and operations, including training requirements. This requirement will provide research data to support 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 (aviation safety inspectors, aviation safety engineers) competencies. Research data will inform as appropriate FAA personnel responsible for Policy documented in Section 2.1 of this requirement. FAA. (2019) Boeing 737 Max Flight Control System JATR Observations, Findings, and Recommendations. https://www.faa.gov/news/media/attachments/Final_JATR_Submittal_to_FAA_Oct_2019.pdf GAO. (2020) FAA's Office of Aviation Safety Should Take Additional Actions to Ensure Its Workforce Has Needed Skills. https://www.gao.gov/assets/720/710570.pdf	FY23	FY26

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

Control Account #	Title of Research Project	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding
A11G.HF.17	Identify and Evaluate Human Factors and Pilot Performance Considerations Associated with Flight Deck Operations, Pilot Procedures, and Pilot Performance During Current Arrival, Departure, and Surface Operations	Numerous improvements have been made to increase access and throughput in the NAS through enhancements to arrival, departure, and surface operations. Simultaneous parallel approach operations, including those to closely spaced parallel runways, provide many access, capacity, and throughput benefits; however, several operational challenges associated with navigation source transition issues and flying certain simultaneous parallel approaches using non-VNAV capable aircraft have resulted in concerns of decreased operational benefits and increased pilot/flightcrew workload during critical and closely spaced parallel approach operations. ALPA, in particular, has expressed safety and workload concerns pertaining to specific aspects of these operations. Another concern is that NextGen improvements are not able to be fully implemented as a result of current operational limitations resulting from the non-VNAV equipage issue. As equipage and procedures change to enable more operational capability and flexibility, it is essential to understand how those changes impact pilot performance as their tasks, workload, and the way in which they interface with a complex and dynamic operating environment changes. This research requirement is intended to help Flight Standards understand how these operating conditions change pilot performance, workload, tasks, pilot interactions with flight crewmembers, pilot/flightcrew interactions with other critical elements of the operating environment, and the pilot's ability to manage threats. Research will also support near term operational recommendations and decisions, respond to ALPA's concerns with data, and inform revisions to operational policy, standards, and guidance materials. This requirement will advance research outcomes associated with FY23 A11G BLI Plan Operational Capability #8: Identify and Evaluate Human Factors and Pilot Performance Considerations Associated with Flight Deck Operations, Pilot Procedures, and Pilot Performance During Current Arrival, Departure, and Surface Operations. The BLI Plan objectives associated with this operational capability are:8.1 Evaluate pilot performance, workload, tasks, crew interactions, and ability to handle threats during simultaneous closely spaced parallel approaches (including PRM) that are conducted with non-VNAV capable aircraft.8.2 Evaluate navigation source transition issues on simultaneous closely spaced parallel approaches (including PRM) and their impact on pilot performance, workload, tasks, crew interactions, and ability to handle threats.	FY23	FY26
A11G.HF.2	Advances and Innovation in Equipment, Technology, Systems, and Operations	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 these technologies, regardless of aircraft type (general aviation, transport, or rotorcraft). Most importantly, the research data will support the development of effective pilot training, updating industry standards, and revising human factors regulatory and guidance material. Below is a summary of the specific research activities:7.1: Human factors aspects of pilot interactions with new flight deck technologies7.2: Pilot visual scanning techniques of instruments, systems, and outside references for flightpath management7.3: Single source reference document for aircraft certification human factors information7.4: Human factors safety considerations and criteria for reduced crew in transport aircraft 7.5: Human factors design and considerations in control automation and information automation	FY18	FY26

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

Control Account #	Title of Research Project	Executive Summary	First Fiscal Year of Programmed Funding	Last Fiscal Year of Proposed Funding
A11G.HF.4	Advanced Vision Systems (EFVS, EVS, SVS, CVS), Head-Up Displays (HUD), and Head Mounted Displays (HMD): Operational Standards & Approval Criteria	Research is needed to characterize human factors and pilot performance considerations using Advanced Vision Systems, HUD, and HMD for new low visibility concepts of operation. This research will inform development of operational requirements, standards, conditions, limitations, mitigations, and authorizations for the use of these technologies and will contribute to increasing safety, access, and throughput to more runways during low visibility conditions. This requirement will advance research outcomes associated with FY23 A11G BLI Plan Objectives 4.1 – 4.4 which are located under Operational Capability #4: Advanced Vision Systems (EFVS, EVS, SVS, CVS), Head-Up Displays (HUD), and Head Mounted Displays (HMD): Operational Standards & Approval Criteria. In summary, these objectives are:4.1 Pilot performance/human factors for low visibility flight operations using SVGS: a. SVGS on SA CAT I with reduced lighting b. AEG pilot evaluation tools for new SVGS systems c. SVGS -- Lower LPV minima d. SVGS -- Lower than standard takeoff minima e. Use of SVGS as a CAT III Rollout Aid4.2 Pilot performance/human factors for low visibility flight operations using EFVS: a. EFVS using a head down display to 100 feet above TDZE b. AEG Pilot Evaluation Tools for New EFVS Systems4.3 Pilot performance/human factors for low visibility flight operations using HUD: a. Contribution of HUD to pilot performance in certain visual segments b. Dual HUD/CAT III – HF, crew coordination, hybrid applications c. Pilot performance/human factors to inform lowering standard CAT I minima d. Reduced lighting on CAT II/III approaches4.4 Empirical basis for the minimum physical features, runway visual aids, and other visual features a pilot needs to see for lower than standard takeoff minima (below 1600 RVR down to 300 RVR) using natural vision, HUD, advanced vision systems.	FY15	FY26
A11G.HF.8	Fatigue Mitigation Flight Operations	Fatigue Mitigation in Flight Operations research supports the effective implementation of recent changes to 14 CFR Part 117 (Flight and Duty Limitations and Rest Requirements for Flightcrew Members). The research proposed for FY23 herein will enable two research tasks for Fatigue mitigation in flight operations. 1) The continued development and support of the Fatigue Risk Management System (FRMS) database for Flight Standards will allow increased efficiency in operator application review and approval as well as identify trends in industry. This work is important to maintain the operational data required to assess and monitor the reported pilot performance impact(s) of flight operations conducted outside the limits of 14 CFR Part 117 (Flight And Duty Limitations And Rest Requirements: Flightcrew Members), and 2) A longitudinal study will be conducted to evaluate the behavioral adaptation of pilots to multiple time zone shifts associated with long- haul and ultra-long-range flight operations.	FY19	FY26

Researcher Collaboration and Partnerships	Department of Transportation (DOT) Volpe National Transportation Systems Center, RTCA, SAE, ASTM, FAA Civil Aerospace Medical Institute (CAMI), FAA Flight Research and Analysis Group (AFS-430), Part 121/135 operators, MITRE CAASD, University of Central Florida (UCF),
Researcher Facilities Utilized	Department of Transportation (DOT) Volpe National Transportation Systems Center, FAA Civil Aerospace Medical Institute (CAMI), FAA Flight Research and Analysis Group (AFS-430), NASA AMES

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11J.AM.10	Fatigue biomarker panel: identifying a metric for performance impairment from sleep loss	This proposal funds development of an innovative tool, a fatigue biomarker metric (human black box), to address the question of how we can measure the safety risk of pilot fatigue. The Sponsor is FAA-CAMI's Bioaeronautical Sciences Branch Mgr., who seeks incorporation of the fatigue metric for expanding toxicology reports to NTSB and accident investigation. Potential tech transfer applications exist in any field in which fatigue degradation of performance presents a safety risk – e.g., fields with 24/7 operations or shiftwork including essential workers in the transportation, healthcare, first responder, and military sectors. Fatigue is thought to impact over 20% of NTSB-investigated aviation accidents, but this likely is an under-estimate due to lack of an objective metric.	FY17	FY27
A11J.AM.11	Gene expression and biomarker utility in postmortem samples	This research is sponsored by the Bioaeronautical Sciences Research Laboratory Manager within the Office of Aerospace Medicine (AAM). The work proposed here addresses operational capability 6, "Biomarkers to Enhance Safety Management System with Improved Postmortem Drug Detection", by developing methods to enhance FAA forensic investigations to include means of identifying genetic indicators of cannabinoid use. Detecting such genetic indicators will enhance current FAA toxicological investigations by providing evidence that cannabinoids that are detected during toxicological examination produce a measurable biological effect in those samples. This capability will provide evidence that any cannabinoids detected in a sample produced a biological response in the victim, providing further evidence supporting the toxicological finding.	FY20	FY24
A11J.AM.12	Identify alternative neurocognitive test battery and obtain pilot normative data	Research Question: This project seeks to discover alternative neurocognitive testing resources and to compare efficacy using pilot normative data. Research Objective: This research will identify an alternative neurocognitive test battery for CogScreen-AE (currently used as an initial screening assessment tool to detect aeromedically significant cognitive deficits) and obtain updated pilot normative data for the legacy and alternative assessment tools. Data and analyses from this project will be used to potentially revise the Aviation Medical Examiners (AME) Guide, update clinical practices, and make changes to airmen certification protocols.	FY22	FY24
A11J.AM.19	Communicable disease preparedness: M&S framework for analyzing cabin health hazards	The Federal Aviation Administration (FAA) has assumed a leadership role in developing a preparedness plan for communicable disease in air travel and identifying associated research needs. The FAA's approach to the planning effort is to use its existing Safety Risk Management (SRM) process, as documented in FAA Order 8040.4B, to determine the risk of transmission of a disease requiring flight-related contact tracing within a population of airline passengers and cabin crewmembers between the times of population formation and dispersion and the expected impacts of mitigation activities. 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.	FY23	FY27

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
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	FY25
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	FY25
A11J.AM.8	Smoke, Odor and Fumes (SOF) events on US airlines	The frequency of cabin air contamination events has increased with the growth of commercial aviation. Smoke, odor and fume events resulting from contaminated air have caused adverse symptoms and health impairments in occupants, reduced performance in aircrew and reduced margins of safety. In compliance with Section 326 of the FAA Reauthorization Act of 2018 AAM-1 will work with AIR-600 to evaluate cabin air contamination events with data from the Service Difficulty Reporting System (SDRS) and other government data, to assess the health effects on passengers, cabin and flight deck crew. The purpose of this research is to collect and analyze SDRS reports and other available government data to determine the rate of occurrence of contamination events on U.S. air carriers, and categorize the symptoms resulting from occupant exposure to cabin air contaminants.	FY19	FY23
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	FY25

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
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	FY25
A11J.AM.29	Designing and Deploying an Aerospace Medicine Safety Management System Data Environment	The purpose of this project is to provide the initial data management environment needed to support aeromedical certification and drug abatement safety risk management and safety assurance functions. This project addresses the question of the design of a suitable data environment for an aeromedical data mark encompassing and linking all data currently available to the FAA on an individual pilot. This data mart will enable the Office of Aerospace Medicine to perform integrated queries across multiple databases, search an warehouse of aeromedical safety data, and display pertinent elements in an array of useful formats to support an aerospace medicine safety management system. Project tasks include designing, architecting, building, and deploying the data environment.	FY22	FY24
A11J.AM.30	Improving the Computational Usability of Unstructured Pilot Medical Certification Data	The purpose of this project is to continue development of the Office of Aerospace Medicine's data management environment to support aeromedical certification and drug abatement safety risk management and safety assurance functions. Presently, the Office of Aerospace Medicine receives a large volume of medical documentation developed by healthcare providers external to the FAA in support of individual pilots' applications for medical certification. This documentation primarily takes the form of unstructured, scanned documents. This project addresses the question of how FAA obtained, externally generated, scanned medical data can be transformed to improve data availability for exploration and analysis. This project will research and implement efficient means for scanning and transcribing FAA-obtained medical data. It will also identify processes or methodologies for extracting and transforming information from scanned medical data, as well as providing recommendations and/or tools for data exploration and analysis. Lastly, it will design and implement a database for transcribed data for inclusion in the overall aerospace medicine safety management system data environment.	FY22	FY24

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11J.AM.31	Aviation Medical Examiner Telemedicine Requirements Engineering	During the public health emergency caused by the SARS-CoV-2 virus, pilots were unable to schedule medical examinations with Aviation Medical Examiners (AMEs), necessitating the FAA to extend arbitrarily the duration of medical certification for several months. This situation was undesirable because it removed one of the safeguards for ensuring human reliability in aerospace operations. A future public health emergency may prevent the accomplishment of the in-person AME medical certification exam visit for a sustained period, thereby potentially invalidating certification risk estimates made at the last medical certification exam. The Office of Aerospace Medicine seeks to leverage the general wave of innovation in telemedicine driven by the current public health emergency for application in support of aviation safety. This project addresses the question: what minimum set of existing telemedicine technologies and associated procedures provide the necessary data to address the maximum number of physical exam items on FAA Form 8500-8? This project will be accomplished through an open innovation challenge to identify proven / validated technologies for elements of the AME exam, culminating in a demonstration to FAA medical officers.	FY22	FY24
A11J.AM.32	Federal Legalization of Cannabis and its Implications for Pilot Fitness for Duty	Flying an aircraft is a highly complex task requiring a significant level of cognitive function and psychomotor coordination. Cannabis can impair performance of complex tasks. Given the potential for federal legalization of cannabis in the near future, the Office of Aerospace Medicine needs to prepare to formulate a policy recommendation for determining a pilot's fitness for duty after cannabis use. This project will seek to answer question, given recreational cannabis use, what is the elapsed time from last use until a pilot is reasonably likely to be (1) without impairment and (2) below the DOT drug testing detection threshold? This project will involve a comprehensive literature review and analysis, culminating in the formulation of evidence-based recommendations along with an assessment of the level/quality of evidence relied upon for the recommendations.	FY22	FY24
A11J.AM.33	Alternative Recertification Pathways for Pilots with Mental 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 mental health-related risk. This project will facilitate an open innovation challenge to explore opportunities to decrease the time to medical recertification in pilots with mental 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.	FY22	FY24
A11J.AM.34	Aeromedical Certification Data Standardization for Improved Data Management and Interoperability	The purpose of this project is to continue development of the Office of Aerospace Medicine's data management environment to support aeromedical certification and drug abatement safety risk management and safety assurance functions. Presently, the Office of Aerospace Medicine's aeromedical certification data is stored in a FAA-unique format developed prior to the advent of Electronic Health Record (EHR) systems. This project addresses the question of how FAA generated structured aeromedical certification data can be translated into a data model compatible with the healthcare sector. This project will research and present potential pathways on how FAA generated legacy aeromedical certification data can be translated into an EHR data model compatible with the commercial healthcare industry. By using an EHR- interoperable data model, the Office of Aerospace Medical will be able to implement directly data management and analytic tools developed for the commercial healthcare sector and conduct comparative analyses leveraging data from across the U.S. healthcare sector.	FY22	FY24

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11J.AM.35	Integrating Commercial Healthcare Datasets for Aeromedical Risk Analyses	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 are 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. This project will seek to identify the best set of healthcare datasets and an applicable common data model to facilitate analyses across datasets. The outputs of this research project will be integrated into the Office of Aerospace Medicine's safety management system data environment.	FY22	FY24
A11J.AM.36	Exploring Industry Medical Risk Management Best Practices for Application to Aerospace Medicine (Exploring acceptable medical risk management best practices)	Benchmarking allows organizations to compare themselves to others in an industry to see where they excel and where they can improve. The FAA's Office of Aerospace Medicine contributes to aviation safety, in part, by managing pilot medical risk through its pilot medical certification process. This project will explore the applicability of insurance industry best practices for medical risk management to the problem of assessing and managing risk in pilot medical certification. This project will facilitate an open innovation challenge with the insurance industry to explore how the industry would determine acceptable aeromedical risk as well as how it would comprehensively approach medical certification of pilots with degraded health. The Office of Aerospace Medicine will use the outputs of this project as potential inputs for future improvements and/or reengineering of its pilot medical certification process.	FY22	FY24
A11J.AM.37	Designing a NHTSA Crash Injury Research Analog Program for General Aviation/Advanced Air Mobility	While the Federal Aviation Administration has the goal of zero fatal accidents, pilot fatalities continue to occur in general aviation at a relatively consistent rate over the past 5-7 years. The majority of mishaps involve private pilots operating single-engine aircraft. Moreover, personal flights account for 74% of accidents and 81% of fatal accidents. The Office of Aerospace Medicine supports the Office of Accident Investigation and Prevention and the National Transportation Safety Board by performing a medical case review and toxicological analysis on all pilot fatalities. As part of this process, the Office of Aerospace Medicine actively coordinates and obtains autopsy reports for each pilot fatality. Presently, this data informs an assessment of pilot medical fitness relative to the circumstances of the mishap. Given the relative stability in the frequency of general aviation mishaps, this project seeks to evaluate whether the Office of Aerospace Medicine could leverage its current processes and data to improve the survivability of general aviation mishaps and thus improve progress towards the goal of zero fatal mishaps. Specifically, this project will benchmark the National Highway Traffic Safety Administration's Crash Injury Research (CIREN) program, the latter having the stated mission to improve the prevention, treatment, and rehabilitation of motor vehicle crash injuries to reduce deaths, disabilities, and human and economic costs. This project will develop a proposed analog program model for application to general aviation and potential extension to advanced air mobility in the future.	FY22	FY24
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.	FY23	FY26

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
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.	FY23	FY25
A11J.AM.44	Communicable Disease Preparedness: Risk Matix for Health Safety Hazards	The Federal Aviation Administration (FAA) has assumed a leadership role in developing a preparedness plan for communicable disease in air travel and identifying associated research needs. The FAA's approach to the planning effort is to use its existing Safety Risk Management (SRM) process, as documented in FAA Order 8040.4B, to determine the risk of transmission of a disease requiring flight-related contact tracing within a population of airline passengers and cabin crewmembers between the times of population formation and dispersion and the expected impacts of mitigation activities. The FAA will then use the SRM outputs as inputs to the preparedness planning activity, thereby making the later risk-based and data-driven. The FAA established a SRM team in February 2022, which quickly identified a challenge in extending the existing 8040.4 risk matrices to the hazard of a passenger with a communicable disease. This research project will explore how the FAA Order 8040.4B risk assessment matrix can be adapted for application to health safety risks, with communicable disease transmission in air travel serving as the archetype. The research will output a risk matrix and documentation of its derivation.	FY22	FY23
A11J.AM.45	Development, Verification and Validation of G-LOC Model	There is continued interest in acceleration (G) effects in civil aviation, as G-induced loss of consciousness (G-LOC), impaired consciousness, and visual effects play a role in aerobatic, agricultural, and military aviation accidents. A model (the Civil Aerospace Medical Institute G-Effects Model [CGEM]) based on physical and physiological variables related to inflight tissue resupply, using oxygen flow as a proxy for supply availability, was developed to evaluate risk of G-LOC and related phenomena in aeronauts. Aeronauts were modeled using several parameters, including sex, cardiovascular fitness, and other common modifiers such as G-suits, positive pressure breathing gear, anti-G straining and other muscle-tensing. The model was validated with experimental data from the peer-reviewed literature. CGEM is a new tool for civil and military aviation. Rather than providing a simple G tolerance number, through proper selection of parameters flight surgeons, pilots, and accident investigators can gain insight into changes in risk from factors such fatigue, medications, dehydration, and anti- G equipment used. Results support the conclusion of earlier studies that the current warning attached to Federal Aviation Administration special issuance waivers for cardiac disease seems sufficient.	FY21	FY23

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11J.AM.46	Hierarchy of Controls for Disease Transmission in Air Travel	The Federal Aviation Administration (FAA) has assumed a leadership role in developing a preparedness plan for communicable disease in air travel and identifying associated research needs. The FAA's approach to the planning effort is to use its existing Safety Risk Management (SRM) process, as documented in FAA Order 8040.4B, to determine the risk of transmission of a disease requiring flight-related contact tracing within a population of airline passengers and cabin crewmembers between the times of population formation and dispersion and the expected impacts of mitigation activities. This research project will answer the question, what are existing and emerging risk mitigations (i.e., engineering and administrative controls and personal protective equipment) for inflight respiratory disease transmission forecast to be available by 2027? The project will conduct a comprehensive analysis of risk control measures applicable to the gate-to-gate airline travel epoch to inform Modeling, Simulation, and Analysis (MS&A) tool development and risk analyses. The resulting analysis report and associated data will be transitioned for use in communicable disease transmission preparedness planning.	FY23	FY23
A11J.AM.47	Utility of Capillary Blood for Gene Expression Studies	This project will develop a miniaturized method of collecting, preserving, isolating, and performing useful analyses on RNA from fingerstick blood samples. This method will prove useful in collecting blood samples where classic blood tube collections and phlebotomy practices are prohibitive, and will expand the FAA's ability to collect a wider range of blood samples at lower cost than current methods. This study will also develop blood collection methods for biomarker validation studies, where samples can be collected in the field from a broad range of subjects.	FY19	FY24
A11J.AM.48	Assessment of RNA-seq Sample Preparation Methodology	This project will examine methods of bioinformatic analysis with the aim of determining optimum computational methods for RNA biomarker discovery. The project sequenced a standardized RNA pool, subjected that standardized RNA to various treatments and aliquots to assess proper sample preparation methods, and then performed RNA sequencing on each of those treatments. Data files were then run through several bioinformatic pipelines to assess software performance in both mapping and differential expression detection. The end result of this work will be recommendations for ideal 1) sample processing and 2) bioinformatic software pipelines for use in generating useful RNA biomarker panels to be applied in detecting aviation-relevant consditions, such as fatigue and drug use, in postmortem samples and potentially in individuals performing safety-sensitive operations.	FY20	FY23
A11J.AM.49	Human physiologic response comparison in three hypoxic environments	Airman hypoxia training makes use of three different devices, each with unique characteristics. The Altitude chambe, or hypobaric chamber, subjects airment to hypoxia via decreased atmospheric pressure. The Restricted Oxygen Breathing Environment is an airtight enclosure allowing gas mixture control, the percentage of oxygen is artificially lowered in this device. The Restricted Oxygen Breathing device is a mask used for breathing controlled gas mixtures. This study will examine blood gene expression profiles to determine what differences, if any, exist in the transcriptional response induced by each device. The outcome will be useful in determining if there is any difference in the biological response induced by use of these devices, and if any device is seen to induce a more realistic response to hypoxia for the purpose of airman training.	FY19	FY23

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11J.AM.50	Off-flight Pilot Incapacitation - Pilot Mortality Data Match	The purpose of this project is to determine pilot off-flight incapacitation by mortality data match. The target cohort will be those former aeromedical certificate holders in the United States whose certificates expired in a recent time frame who did not seek to recertify. Then, such required data fields as names and SS numbers will be collected from each pilot's most recent application of aeromedical certificate to provide to the National Death Index (NDI) program supplied by the U.S. Centers for Disease Control (CDC) for potential death matches. Off-flight death rates and causes of death of these former aeromedical certificate holders will be assessed. Causes of death will also be evaluated for relevance to the aeromedical certification process. The project will result a dataset holding aggregated results of the death matches and the causes, provide an outcome for pilot off-flight incapacitation, and contribute to data-driven safety management system (SMS).	FY23	FY23
A11J.AM.51	Automation of Pilot Incapacitation Identification	The purpose of this project is to identify and extract pilot incapacitation events from databases or datasets available in FAA, and to develop a process to monitor the in-flight pilot incapacitation. The project leverages FAA EIM platform and develops computer programs (Python, SQL, and NLP) to auto-screen relevant databases/datasets that are available in EIM centralized data repository. All events relevant to pilot incapacitation recorded in the databases or datasets will be collected and merged to a single data file. Duplicate events will be identified and removed. The pilot incapacitation events will connect to aeromedical certification when the pilot information is available.	FY23	FY24
A11J.AM.52	Determining the acceptable pilot incapacitation rate for FAA class 1 medical certificates	Research to determine the acceptable pilot incapacitation rate for FAA class 1 medical certificates from an evidence-based, Safety Management System (SMS) perspective.	FY23	FY23
A11J.AM.53	Investigating the medical vs. human factors/experience risk tradeoff in Basic Med pilots	Research to determine if there is a medical vs. human factors/experience risk tradeoff for pilots operating under Basic Med.	FY23	FY23
A11J.AM.55	Physiological effects of face mask use at airline cabin altitudes	The Federal Aviation Administration (FAA) has assumed a leadership role in developing a preparedness plan for communicable disease in air travel and identifying associated research needs. The FAA's approach to the planning effort is to use its existing Safety Risk Management (SRM) process, as documented in FAA Order 8040.4B, to determine the risk of transmission of a disease requiring flight-related contact tracing within a population of airline passengers and cabin crewmembers between the times of population formation and dispersion and the expected impacts of mitigation activities. This research project will answer the question, are there significant changes in cardiopulmonary physiology between the following conditions: no mask at sea level, mask (surgical and N95) at sea level, mask (surgical and N95) at 8,000 ft altitude, and mask (surgical and N95) at 8,000 ft during exercise consistent with cabin crew peak workload? This project will conduct a high-quality systemic review to (1) develop evidence-based statements answering the aforementioned questions with associated GRADE level of evidence, (2) identify data gaps as derived from evidence-based statements with low GRADE certainty levels, and (3) as applicable, develop research protocol(s) to address #2. The resulting analysis report and associated data will be transitioned for use in communicable disease transmission preparedness planning.	FY23	FY23

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11J.FCMS.2	Detection of air contaminants in the cabin	AVS has identified the issue of cabin air quality events as an area of elevated concern. The FAA Reauthorization Act of 2018, Section 326, directed the agency to commission a study to (1) identify and measure bleed air constituents in commercial aircraft, (2) assess the potential health effects of those constituents on passengers and crew, (3) identify technology for the detection and warning of bleed air contamination, and (4) identify potential mitigation/ prevention methods for fume events. This research will address the risk associated with bleed air contaminants entering the cabin air.	FY20	FY26
A11J.FCS.15	Develop safety standards for omni-directional seats to support urban air mobility/eVTOL	This project is sponsored by AIR-600. Current safety standards exist for seats installed 0-45 degrees and 90 degrees (with respect to aircraft centerline). 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	FY25
A11J.FCS.16	Develop modeling and simulation guidance to support performance based rules for aircraft seating systems	This project is sponsored by AIR-600. Current safety standards for seats are partially prescriptive in that the crash condition is defined with no regard for the individual aircrafts structural design features. Credible modeling and simulation (M&S) provides an opportunity to move the standards to fully performance based. This project will support regulatory efforts to create standards for the use of M&S to certify seating systems using a performance based systems approach. Tasks include evaluation of existing model credibility standards from standards and the development of standards focused on aircraft cabin interiors.	FY23	FY25
A11J.FCS.17	Passenger retention of cabin safety information: luggage	AIR-600 is working with the Civil Aerospace Medical Institute (CAMI) and the Air Carriers Operation Branch (AFS-220) to develop and conduct a study on the understanding and retention of cabin safety information by passengers, emphasizing prohibiting passengers from bringing their carry-on baggage to the exits in an emergency. The FAA will determine a course of action based on the results of the research	FY22	FY23
A11J.FCS.18	Determine the influence of delta-wing design on egress paths and evacuation efficiency for supersonic transports	This research project sponsor is AIR-600. Supersonic transport (SST) airplanes are being proposed that would have multiple exits using the delta wing as part of their egress pathway. This project is being proposed to 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.	FY23	FY24
A11J.FCS.19	Ditching exit ratings evaluation	The research sponsor for this project is AIR-600. This project is an evaluation of existing ditching exit ratings to see if they are still applicable or require updating. This requirement would derive the appropriate passenger credit for various exit types under ditching conditions.	FY22	FY23
A11J.FCS.8	Expanded use of analytic modeling in cabin safety applications	This project is sponsored by AIR-600. The requirement will explore the potential applications for numerical modeling in various cabin safety areas and establish criteria for validation, as well as credibility, of models for use in certification. Modeling could overcome some of the limitations (e.g., cost, risk) to physical testing.	FY20	FY23
A11J.FCS.25	Extended Reality for Cabin Safety II: Flight Attendant Training	This project aims to determine the application (actual and potential), efficacy,and effectiveness of XR flight attendant training. This will allow CAMIresearch staff to provide consultation to stakeholders on such topics (2023).The results of this study is anticipated to inform those seeking to certifyalternative means of flight attendant training (2026).	FY23	FY23

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11J.FCS.26	Egress Slide Technique and Passenger Slide Related Injuries Review	This project is an archival review of evacuation research and training events to attempt to differentiate and correlate slide use techniques with observed injuries. The goal is to identify safe and unsafe slide techniques for making recommendations to improve the safety of training and research utilizing aircraft evacuation slides.	FY23	FY23
A11J.FCS.27	Emergency exit operation and location	This project investigates multiple proposed transport airplane cabin and door configuration changes to evaluate their general impact on safety and speed of egress. The goal is to provide rulemakers a generalizable result to address the specific configuration requests and future, similar requests to modify airplane exits for the purpose of increasing the allowed number of passengers and accommodating cabin design changes directly adjacent to the exit. Project outputs include a knowledge product and recommended updates to FAA standards and guidance.	FY19	FY26
A11J.FCS.28	ATD Construction Harmonization and Modernization	The condition of an Anthropomorphic Test Device (ATD) can effect the results of certification testing of aircraft seats. Current ATD calibration methods are based on the automotive environment and do not properly evaluate the ATD's suitability for aircraft unique loading (specifically vertical loading). This project will evaluate deterioration of the ATD pelvis over repeated use and look to develop a non-destructive calibration test. The research will use component testing to determine the pelvis wear and tear.	FY17	FY24
A11J.RS.1	Occupant Protection for Legacy Rotorcraft	The goal of the research is to add safety to legacy rotorcraft but not necessarily to bring them up to the current certification basis (to do so would be cost prohibitive and require extensive redesign of the rotorcraft). This research will look at new safety equipment/technology that can be retrofitted onto legacy rotorcraft. Tasks include testing proposed alternate crash severities and testing of existing and prototype seating systems.	FY20	FY25
A11J.RS.2	Rotorcraft injury mechanism analysis: procedure development and validation	This project is sponsored by AIR-600. 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	FY25
A11J.RS.3	Replacement of Cushions in Energy Absorbing Seats – EA Seat performance	Evaluate potential methods for replacement of worn seat cushions used in energy absorbing seats. Streamlined approaches to the replacement of worn cushions in aircraft seats have been requested by the aviation industry. The FAA developed a method for seats that do not require energy absorption (Part 25 and Part 23 passenger) based on rigid seat performance as a reference point. This method may not be valid for energy absorbing seats used in Part 27/29 and Part 23 pilot seats. As part of an effort to evaluate streamlined approaches, this project will characterize the seat and occupant response of typical energy absorbing seats.	FY17	FY23

Domain: Human and Aeromedical Factors Program Area: Aeromedical Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11J.RS.4	Replacement of Cushions in Energy Absorbing Seats – Use of Modeling to Better Understand Test Variab	Aircraft seat cushions play a crucial role in the protection of occupants during crash landings. Testing has shown that only changing the material composition of the cushion can change the risk of injury to the occupant from less than 5% to greater than 50%. Dynamic testing of aircraft cushions shows significant variability that makes evaluation of replacement cushions risky. This project will use a physics based numerical model of a seat system to evaluate the effect of the variation seen in physical testing of the cushions.	FY17	FY23

Researcher Collaboration and Partnerships	Aerospace Medical Association, American Society of Mechanical Engineers, Baylor College of Medicine, Brigham and Women's Hospital, Canadian Royal Air Force, Center for Child Injury Prevention Studies, Customs and Border Protection, Department of Homeland Security, General Aviation Joint Steering Committee, International Cabin Safety Research Technical Group, International Civil Aviation Organization, Medical College of Wisconsin, MedAire, National Air and Space Administration (NASA), National Highway Traffic Safety Administration, National Institute for Occupational Safety and Health, National Oceanic and Atmospheric Administration, National Transportation Safety Board, Naval Medical Research Unit-D, Oklahoma Medical Research Foundation, SAE International, SAFE Association, Southwest Research Institute, Transportation Safety Institute, United States Helicopter Safety Team, United States Marshals, United States Navy, Wichita State University.
Researcher Facilities Utilized	> 20 at CAMI: 747 Aircraft Environment Research Facility (AERF), Flexible Aircraft Cabin Evacuation Simulator, FlexSim), Water Survival Research Facility (WSRF), Biodynamics Impact Sled, Anthropomorphic Test Device, Staging Area, Altitude Chambers (Research and Training), Functional Genomics Research Laboratory, Friedberg Numerical Sciences Laboratory

Domain: Aerospace Performance and Planning Program Area: System Safety Management/Terminal Area Safety				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11H.SSM.25	Adapting a NAS-Wide, Top-Down Safety Risk Model to Accommodate Bottom-Up Safety Risk Assessment	The FAA and EASA have recognized that "the greatest risk is what we don't know about yet". Accident data alone cannot drive safety management any longer. The aviation community has made great strides in collecting safety data to support safety management. The challenge that remains however is converting safety data into actionable information. As an example, in the present year 2020, an FAA airline Certificate Management Office (CMO) described their challenge as being "data rich and analysis poor". SSMT, in partnership with EUROCONTROL, develops and maintains the Integrated Safety Assessment Model (ISAM). ISAM provides a framework to model and identify precursors, hazards and associated risk control failures that lead to incidents and accidents, and assess the safety impact of operational changes due to new procedures, technology, rules and new entrants such as UAVs. While safety models such as ISAM have been maturing, the challenge safety organizations are facing is the volume of safety data that needs to be managed, analyzed and interpreted. To meet this need, this research will identify the best strategy 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 apply the extracted safety data to the ISAM safety models to improve risk-informed decision making at the FAA.	FY21	FY24
A11H.SSM.26	ANSP Sector Risk Profile Tool - Surface Safety (SRPT-Surface)	This research establishes a Sector Risk Profile (SRP) for airport surface safety that AOV will use to plan and prioritize safety oversight activities. The SRP helps AOV determine surveillance scope and frequency based on emerging safety risks and historical safety performance in concert with FAA commitments to Risk-Based Decision Making (RBDM) and an Integrated Oversight Philosophy (IOP). The initial focus is to model wrong runway landings and departures, runway incursions, runway excursions, and arrival / takeoff traffic conflicts to identify causal and contributing factors. Machine learning and other artificial intelligence algorithms will be developed and trained to detect patterns that contribute to associated safety risks for known incidents and applied to predict unknown, future cases so that the AOV can proactively coordinate corrective actions and risk mitigations.	FY21	FY24
A11H.SSM.30	ANSP Sector Risk Profile Tool – Aeronautical Information Services (ANSP-SRPT-AIS)	Safety lapses in Aeronautical Information Services (AIS) and products such as aeronautical charts, Notices to Airmen, obstruction and airport construction data, terminal instrument approach and departure procedures, and critical navigational aid(navaid) data can impact operational safety risks for controlled flight into terrain / obstructions, airspace violations (which may lead to loss of air traffic separation), inadvertent landings at closed airports / runways, and other hazards for air navigation. This research initiative defines and develops a surveillance monitoring tool for Air Traffic Safety Oversight Service (AOV)'s oversight of Aeronautical Information Services (AIS), including data, systems and applications. The research focuses on development of a Sector Risk Profile for AIS which includes an understanding of safety incidents and risks where aeronautical information development, distribution, and application are identified as causal or contributing factors. Machine learning and other artificial intelligence techniques will be used to develop descriptive and predictive analytics to recognize safety patterns, characterize risk exposure given AIS sector changes, and support proactive coordination of AOV surveillance actions and risk mitigation activities.	FY22	FY24

Domain: Aerospace Performance and Planning Program Area: System Safety Management/Terminal Area Safety				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11H.SSM.32	Artificial Intelligence 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	FY27
A11H.SSM.9	Helicopter Flight Data Monitoring and Analysis	This effort encompasses research to provide analysis of helicopter risk through flight data monitoring for the vertical lift community. The efforts described herein allow the FAA to lead by developing analysis tools, metrics, and capabilities used by industry and government safety teams, including the USHST (U.S. Helicopter Safety Team), in pursuit of reducing the fatal accident rate for rotorcraft/vertical lift.	FY22	FY26
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 Insufficent 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 will 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	FY25
A11H.TAS.11	Immersive Flight Simulation	Industry is actively developing technologies that potentially improve a pilot's immersive experience during training. The two most prominent technologies are termed (1) virtual reality, which has a pilot don goggles, and (2) simulated air traffic control, which uses voice recognition, voice synthesis, and artificial intelligence to mimic the external air and ground traffic world. Prototypes of both technologies have been created, and the FAA is asked how it will certify their use. This research aims to answer that question by procuring the technologies and performing experiments with them to assess both their strengths and weakness, and how they might be certified for pilot use.	FY23	FY25

Domain: Aerospace Performance and Planning Program Area: System Safety Management/Terminal Area Safety				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11H.TAS.12	Reducing Pilot Error Through Raising Awareness of Cognitive Biases	Pilot error remains as the leading contributing factor to aviation accidents worldwide. Often, errors arise from typical human failings, such as confirmation bias, attentional tunneling, etc. Although most well-trained individuals, such as pilots, understand these typical human failings, it is also common to acquire the false belief that such failing do not apply to them. This research aims at developing flight simulation scenarios to show pilots, first hand, that these typical human failings also apply to well trained pilots. The goal is to create a broad-based introspection among the pilot workforce, which is expected to lead to reduced pilot error.	FY23	FY26

Researcher Collaboration and Partnerships	NASA, United States Helicopter Safety Team (USHST), Vertical Flight Society (VFS), Helicopter Association International (HAI), Vertical Aviation Safety Team (VAST), PEGASAS COE for General Aviation, Georgia Institute of Technology, Rowan University, Sikorsky, Airbus Helicopters, Leonardo, United States Coast Guard, Five-Alpha, LZ Control, TruthData, HeliOffshore, Helicopter Safety Advisory Committee (HSAC), RTCA SC-213/EUROCAE WG79, Universal Avionics/Elbit Systems, Astronics/MaxViz, Iowa University Operator Performance Laboratory (OPL), Dept. of Defense (multiple segments), L3/Harris, VRM Simulations, Flight Safety, CAE, Saab, University of Liverpool, United States Helicopter Safety Team (USHST), Thales, Universal Avionics Systems Corporation/Elbit Systems, Rockwell Collins, Honeywell, Saab, Lifeflight of Maine, NYPD, HeliOffshore, Helicopter Safety Advisory Committee (HSAC), AMOA, EUROCAE WG-79/RTCA SC-213, Sikorsky, Airbus Helicopters, Leonardo, Bell, United States Coast Guard, Astronics/MaxViz, Iowa University Operator Performance Laboratory (OPL), Dept. of Defense (multiple segments)
Researcher Facilities Utilized	FAA's Computing and Analytics Shared Services Environment (CASSIE), FAA's Sikorsky S76-D Helicopter Simulator at the William J. Hughes Technical Center's Cockpit Simulation Facility, Rowan University's CAVE Virtual/Augmented Reality Laboratory, FAA WJHTC VFAST/CSF Lab. - H125, & R22 Helicopter Flight Simulators, The virtual reality device and training device at the FAA Tech Center has been investigated by this project's sponsors.

Domain: Aerospace Performance and Planning Program Area: Unmanned Aircraft Systems Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11L.UAS.100	Investigate Detect and Avoid (DAA) Track Classification and Filtering	UAS Detect and Avoid (DAA) systems use sensors to surveille non-cooperative air traffic. Example non-cooperative sensing technologies include radar, optical, and acoustic systems. Besides surveilling air traffic, these sensors may also track other real non-aircraft targets such as cars and birds. They may also generate false tracks from sensor noise, clutter sources, and weather effects. These non-aircraft tracks can have a major impact to DAA system behavior. They may result in excessive DAA alerts, unnecessary DAA maneuvering, and reduced confidence in the system. For UAS receiving air traffic services, unnecessary maneuvers may also disrupt controller efforts to manage traffic flow and keep aircraft separated. For automated DAA systems, DAA alerts on non-aircraft may result in sudden unexpected maneuvering. For usable and efficient Beyond Visual Line of Sight (BVLOS) operations, DAA systems should filter out tracks of non-interest. This research will assess the risks and develop recommendations for DAA track classifier performance. Neither RTCA nor ASTM DAA standards include track classification requirements as of 2020. Because of this requirements gap, systems compliant with DAA standards may not always have acceptable safety performance. This research is expected to inform DAA standards, FAA assessments of waiver applications, FAA policy on DAA, and FAA rulemaking related to DAA operations.	FY21	FY25
A11L.UAS.101	Identify Flight Recorder Requirements for Unmanned Aircraft Systems (UAS) Integration into the National Airspace System (NAS)	The importance of fully understanding the root causes of accidents and incidents for Unmanned Aircraft System (UAS) operations increases as the UAS market matures towards passenger transport and cargo delivery. This research will perform a risk assessment and explore flight recorder requirements for a variety of UAS to include small UAS (sUAS), medium sized UAS, large UAS, and remotely piloted Urban Air Mobility (UAM) aircraft. The research will investigate potential unique flight data recorder (FDR) and cockpit voice recorders (CVR) differences between UAS types and traditional manned aircraft. It will also investigate requirements for remotely piloted UAM aircraft. It will perform flight crash testing of data recorders intended to support sUAS and medium sized UAS. Research findings will be shared with EUROCAE and ASTM standards bodies.	FY20	FY24
A11L.UAS.2	Detect and Avoid (DAA) Multi Sensor Surveillance Data Fusion Strategies	The current A11L.UAS.2 research is currently funded to conduct research on the viability of an omni antenna to validate ADS-B for DAA (Class 3 sensor). The preliminary results are promising, and suggests that the omni antenna may be viable to conduct active surveillace (Class 2 sensor). This work aims to develop the MOPS for a Class 2 omni antenna. This scope increase leads to the completion of the ongoing A11L.UAS.2 research activity of developing the standalone MOPS for 1030/1090 MHz Active Surveillance support for DAA and CA - Class 3 Validation Only Active Surveillance with Omni-Directional Antenna. The primary research question is, " Is the omni antenna capable	FY17	FY24
A11L.UAS.43	Develop a Support Framework for UAS Flight Data Aggregation that Advances Integration with ASIAS and UAST II	Interactions between manned and unmanned aircraft steadily increase, with the FAA receiving 785 reports of unmanned sightings between April and June 2018. https://www.faa.gov/uas/resources/uas_sightings_report/	FY18	FY24

Domain: Aerospace Performance and Planning Program Area: Unmanned Aircraft Systems Research				
Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11L.UAS.53	Conduct Science Technology Engineering and Math (STEM) Outreach to Minority K-12 Students Using Unmanned Aircraft Systems (UAS) as a Learning Platform	The FAA COE/ASSURE is conducting STEM minority outreach activities using UAS as the central learning planorm	FY23	FY23
A11L.UAS.77	Track Standards to Analyze and Improve Research Efforts (Year 2)	Previously titled UAS Standards Tracking, Mapping, and Analysis. As UAS standards bodies identify new standard needs, the FAA is expectedto track existing UAS standards, standards in progress and any gaps where standards need to be developed. This research will continuously evaluate the UAS roadmap, identify standards that are complete, those that are needed, and examine potential areas of research needed to support standards development for UAS integration. This multiyear research effort will keep the earlier identified links between the UAS Roadmap – which is continuously updated - to the UAS Integration Research Plan (UIRP).Keeping such linkage up-to- date shall aid FAA in timely identifying and funding the most relevant safety centered UAS research.	FY21	FY23
A11L.UAS.83	Investigate and Identify the Key Differences Between Commercial Air Carrier Operations and Unmanned Transport Operations	The vision to revolutionize mobility within metropolitan areas and beyond is one of the new frontiers in modern aviation. Building on the gradual successes of Part 135 applications under the Integration Pilot Program (IPP) paving the way to unmanned air cargo followed eventually by unmanned passenger transport. An emerging role for the FAA will develop by working with the community to identify and address the key differences between unmanned and manned operations, opportunities and challenges ahead underlying this likely development. The passenger transportation network ecosystem and its associated technologies are likely to be among the most complex aviation has ever seen and the opportunities to facilitate the full integration of UAS into the National Airspace System (NAS) are enormous. The FAA needs to understand this environment, analyze the differences as they compare to traditional manned air transportation. These analyses along with developing timelines will enhance decision making and the research will highlight anticipated needs of the FAA to support further integration of UAS in air transportation operations in and across metropolitan areas including suburbs and exurbs.	FY22	FY23
A11L.UAS.84	From Manned Cargo to UAS Cargo Operations: Future Trends, Performance, Reliability, and Safety Characteristics towards integration into the NAS	The vision to revolutionize mobility is one of the new frontiers in modern aviation. Building on the anticipated successes of Part 135 applications under the Integration Pilot Program (IPP) while supporting accessible air transport systems, unmanned air cargo would be first to emerge to integrate unmanned mobility with the need to carry cargo. An emerging role for the FAA will develop by working with the community to identify and address the key differences between unmanned and manned operations, opportunities and challenges ahead underlying this near-term development. The passenger transportation network ecosystem and its associated infrastructure and technologies are likely to be among the most complex aviation has ever seen and the opportunities to facilitate the full integration of UAS, by using what is available and outlining what will be needed, into the National Airspace System (NAS) are enormous. The FAA needs to understand this environment and take facilitating steps to prepare when the gradual transition to autonomy eventually arrives. This research will highlight anticipated needs of the FAA to support further integration of UAS in cargo operations.	FY22	FY23

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Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11L.UAS.85	High-Bypass Turbofan UAS Engine Ingestion Test	Since there is no similarity of a UAS to any other foreign body currently being regulated, understanding the severity of the ingestion event is critical to be able to estimate the extent of damage encountered in a typical incident/accident. To aid in the longevity of the information gathered during this research, high fidelity data gathering, instrumentation, and model validation is crucial for future FAA regulatory and policy development surrounding safe UAS integration into the NAS." "Inclusion of large numbers of small Unmanned Aircraft Systems (sUAS) into the National Airspace System (NAS) may pose unique hazards to other aircraft sharing the airspace. It is necessary to determine the potential severity of sUAS mid-air collisions with aircraft in order to define an Equivalent Level of Safety to manned aviation.	FY19	FY25
A11L.UAS.86	Mitigating GPS and ADS-B risks for UAS	Unvalidated or unavailable GPS and “ADS-B In” data poses security and safety risks to automated UAS navigation and to Detect and Avoid operations. Erroneous, spoofed, jammed, or drop outs of GPS data may result in unmanned aircraft position and navigation being incorrect. This may result in a fly away beyond radio control, flight into infrastructure, or flight into controlled airspace. Erroneous, spoofed, jammed, or drop outs of “ADS-B In” data may result in automated unmanned aircraft being unable to detect and avoid other aircraft or result in detecting and avoiding illusionary aircraft. For automated Detect and Avoid, a false ADS-B track can potentially be used to corral the unmanned aircraft to fly towards controlled airspace, structures, terrain, and so on. This research is to assess the risks and explore effective, low cost, and easy to implement solutions to mitigate GPS and ADS-B risks for sUAS operations. This research is necessary to enable safe and secure automated sUAS navigation and safe and secure automated sUAS Detect and Avoid operations	FY20	FY22
A11L.UAS.87	Shielded UAS Operations (DAA)	Certain sUAS Beyond Visual Line of Sight (BVLOS) operations such as structural inspection may be in close proximity to structures that are collision hazards for manned aircraft. These types of operations that are in close proximity to manned aviation flight obstacles such that they provide significant protection from conflicts and collisions with manned aircraft are termed "shielded" operations. This work effort is intended to identify risks and recommend solutions to the FAA that enable shielded UAS operations. The work effort will identify risks, determine whether shielded operations can be made safe, to what degree UAS Detect and Avoid requirements can be reduced, and recommend UAS standoff distances from manned aviation flight obstacles.	FY20	FY22
A11L.UAS.88	Validation of Visual Operation Standards for sUAS	This research will measure Visual Observer (VO) / Remote Pilot (RP) performance in maintaining separation from manned aircraft. Research tasks will be traced to Part 107.29, 107.31, 107.33, and Part 107.37. The research will also identify visual observer failure modes and visual illusions in order to develop training recommendations for daytime, dusk, and nighttime operations. Past industry research has focused on visual detection of manned aircraft. This research will add to that by focusing on both the visual detection as well as the avoidance of manned aircraft. Potential benefits of the research include informing future VO/RP training standards, informing FAA risk assessments and waivers for extended visual line of sight operations, and informing potential updates to Part 107.	FY20	FY20

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Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11L.UAS.89	sUAS Mid-Air Collision (MAC) Likelihood	Complete Mid-Air Collision (MAC) risk assessments require estimates of both collision severity and collision likelihood. This research focuses on sUAS MAC likelihood analysis with General Aviation and Commercial aircraft. Because severity research varies based on where a collision occurred on a manned aircraft, this likelihood research will not only look at the probability of MAC, but also the likelihood of colliding with different parts of a manned aircraft.	FY20	FY23
A11L.UAS.90	Evaluate Unmanned Aircraft System(s) (UAS) Detection and Counter-UAS (C-UAS) Technologies & Enforcement Actions in the National Airspace System (NAS) Program II	After years of close coordination, the FAA and our "security partners" Departments of Defense, Energy, Justice, and Homeland Security (DOD, DOE, DOJ, and DHS) obtained congressional relief in order to test, operate, and evaluate systems that detect, track, identify and mitigate UAS in the United States under specified circumstances. The National Defense Authorization Act (NDAA) of 2017 granted the DOD and DOE detection and counter-UAS (C-UAS) "mitigation" authorities. The NDAA of 2018 expanded the DOD's authorities by increasing the types of facilities and assets that could be covered by this technology. The FAA Reauthorization Act of 2018 provided DHS and DOJ with detection and C-UAS authorities for specific mission sets. FAA also received authority in the FAA Reauthorization Act of 2018 to employ detection and C-UAS exclusive to test and evaluation at 5 airports. The FAA is conducting UAS detection and C-UAS technology evaluations and deployment with the security partners. The Government's primary objective for this research is not to approve systems for use in the NAS, but rather to develop a plan for cross-agency standards against which to test prospective systems including egregious environments such as wildfires. Further, Section 372 calls for the development of a mechanism for enforcement. The FAA plans to develop a prototype, initially for evaluation purposes. The Consolidate Appropriations Act of 2019 calls for the FAA to develop a detection prototype for wildfires. Share results to inform UTM. This work specifically support 2018 FAA Reauthorization through a UAS COE effort: Sec 383 (b) (Airport Safety): NAS-Wide Plan for Deployment of SystemsConduct Northern Border operations and data analysis in support of Sec 383 Plan Sec 372 (Enforcement): (a) Pilot ProgramConduct operations, data analysisDevelop secure prototype [some SSI and some SECRET] 2019 Consolidated Appropriations Act UAS Firefighting InterferenceConduct operations and data analysis Sec 376 (c) (3) (Full UTM): plan for implementation to includeSec 376 (c) (3) (A) (Full UTM): identification of non- cooperative This work specifically support 2018 FAA Reauthorization through In House Contract Support effort: Sec 383 (b) (Airport Safety): NAS-Wide Plan for Deployment of SystemsSupports development of Sec 383 Plan that includes results from Northern Border and 5 airports work, harmonization with 5-Eyes on international standards & RE&D activities Sec 372 (Enforcement): (a) Pilot ProgramDevelop and manage research plan	FY20	FY24
A11L.UAS.95	Illustrate the Need for UAS Cybersecurity Oversight and Risk Management	To address proactively the need to have UAS Cybersecurity Oversight and Risk Management processes.	FY23	FY23

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Control Account #	**Title of Research Project**	**Executive Summary**	**First Fiscal Year of Programmed Funding**	**Last Fiscal Year of Proposed Funding**
A11L.UAS.97	Propose UAS Right-of-Way Rules for Unmanned Aircraft Systems (UAS) Operations and Safety Recommendations	Right-of-Way rules govern the interactions between aircraft in order to preserve safety. Right-of-Way rules are derived in part from the See-and-Be-Seen safety concept, the maneuverability limitations of aircraft types to give way, and other safety considerations. Ambiguity exist for certain UAS operations and the right-of-way rules that they should follow. Part 107.37 applies to sUAS and states that sUAS must give way to all other aircraft including those that overtake the sUAS. RTCA DO365 and RTCA DO365 UAS standards have been developed suggesting compliance with Part 91.113 where non- cooperative manned aircraft overtaking the UAS must give way and pass on the right of the UAS. There is ambiguity for mid- sized UAS that may be difficult for other pilots to see. Rules have yet to be developed for interactions between two unmanned aircraft or for UAS swarms. Right-of-way rules impact UAS Detect and Avoid requirements and the development of industry standards. This research will explore right-of-way rules for diverse UAS operations and make safety-based recommendations for consideration by FAA decision makers and UAS standards bodies.	FY20	FY24

Researcher Collaboration and Partnerships	Non-COE task: FAA William J Hughes Technical Center, ARCON Corporation, MIT Lincoln Labs, FAA William J, Hughes Technical Center, FAA Civil Aerospace Medical Institute, MITRE Center for Advanced Aviation System, Development, DoT Volpe, Alliance for System Safety of UAS through Research Excellence: Center of Excellence Civil Aerospace Medical Institute (CAMI) OKC, OK, Center of Excellence, National Aeronautics and Space Administration, Interagency Partnerships (e.g., UAS Executive Committee), Industry Partnerships , International Partnerships , UAS Test Sites, Standards Organizations
Researcher Facilities Utilized	FAA UAS Lab (Leveraging past tasks in developing an end-to-end DAA simulation environment), ARCON Corporation (DAA sensor and tracker development), MIT LL (Leverage existing encounter model architecture to develop UAS specific ones), FAA Center of Excellence (COE) for UAS, FAA Aviation Safety including: UAS, Integration Office (AUS), Aviation Safety (AVS), Aircraft Certification (AIR), Small Airplane Directorate (ACE), Flight Standards (AFS)