2018 REDAC Aircraft Safety (SAS)

FAA Research FY20 Report

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Fire Research and Safety	$6,352	$2,481	$7,425	$3,251	$7,044	$3,000	$4,867	-	-	-
Propulsion and Fuel Systems	$2,034	$1,475	$2,074	$1,785	$2,269	$1,200	$555	-	-	-
Advanced Materials/Structural Safety	$7,409	$6,169	$6,500	$5,139	$4,338	$3,305	$2,300	-	-	-
Aircraft Icing/Digital System Safety/Aircraft Cyber	$5,450	$3,309	$5,102	$2,546	$9,253	$6,815	$7,684	-	-	-
- Aircraft Icing		$2,165		$1,030		$3,740		-		-
- Digital System Safety & Cyber Security (ASISP)		$1,144		$1,516		$3,075		-		-
Continued Airworthiness	$8,810	$5,311	$9,316	$5,821	$10,437	$7,251	$4,969	-	-	-
- Systems		$2,870		$3,346		$4,340		-		-
- Structures		$2,441		$2,474		$2,911		-		-
Aircraft Catastrophic Failure Prevention Research	$1,433	$1,020	$1,528	$1,154	$1,570	$1,200	$0	-	-	-
Flight deck/Maintenance/System Integration Huma	$5,000	$949	$7,305	$3,453	$6,825	$2,768	$5,052	-	-	-
System Safety Management	$5,939	$3,058	$6,453	$3,840	$4,149	$1,647	$799	-	-	-
- System Safety Management		$801		$2,314		$1,197		-		-
- Terminal Area Safety		$2,256		$1,526		$450		-		-
Aeromedical Research	$8,467	$2,902	$8,538	$3,032	$9,765	$2,857	$3,875	-	-	-
Unmanned Aircraft Systems Research	$17,635	$13,663	$20,035	$6,022	$6,787	$4,824	$3,318	-	-	-
	$68,528	**$40,337**	**$74,276**	**$36,042**	**$62,437**	**$34,867**	**$33,419**	**$19,000**	**$33,486**	**$16,414**
Alternative Fuels for General Aviation	$7,000	$6,127	$7,000	$5,918	$5,924	$4,798	-	-	-	-

Version 3

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Fire Research and Safety (A11A)

Technologies, procedures, test methods, and fire performance criteria that can prevent and, where necessary, mitigate aircraft fires and improve survivability during a post-crash fire.

Outcome	Task Area	Research Output Anticipated for FY20
Reduce fire fatalities and injuries in the event of an accident, and reduce risk of accidents due to fire, based on improved regulatory standards, with no reduction in fire safety as a result of new materials and technologies.	**Aircraft Fire Safety**	1. Assess the ramifications of carriage of hazardous goods on aircraft fire protection methods and equipment, and consider technical feasibility of addressing such goods at the aircraft level. a. Provide technical report documenting the test results and presentation of the results at the International Aircraft Systems Fire Protection Working Group meetings 2. Develop criteria and test methods for improved detection of fires inside Unit Load Devices (ULDs). a. Provide technical report documenting the test results and presentation of the results at the International Aircraft Systems Fire Protection Working Group meetings 3. Develop standardized methods for evaluating nonmetallic engine components a. Provide technical report documenting the test results and presentation of the results at the International Aircraft Systems Fire Protection Working Group meetings. 4. Integrated airplane fire protection system criteria. a. Provide technical report documenting the test results and presentation of the results at the International Aircraft Systems Fire Protection Working Group meetings.

Fire Research and Safety (A11A)- *Continued*

Technologies, procedures, test methods, and fire performance criteria that can prevent and, where necessary, mitigate aircraft fires and improve survivability during a post-crash fire

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Fire Research and Safety	$6,352	$2,481	$7,425	$3,251	$7,044	$3,000	$4,867	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• 25 FTEs in various technical disciplines including engineering, analytics, material science, chemistry, lab testing, etc.	• FAA Full Scale Fire Test Facility • FAA Component Fire Test Facility • FAA Fire Chemistry Lab • FAA Material Fire Test Facility • FAA Pressure Vessel • B-747, B-737, and B-727 aircraft	• FAA Office of Hazardous Materials (ADG), • ICAO, • SAE, • EASA, • Boeing, • University of Maryland

Propulsion and Fuel Systems (A11B)

This research develops and/or enhances technologies, procedures, test methods, and risk assessment methods to enhance airworthiness, reliability, and performance of engines, propellers, fuels, and fuel systems

Outcome	Task Area	Research Output Anticipated for FY20
Reduce the risk of failures of high energy rotors and other life-limited engine components.	**Advanced Damage Tolerance and Risk Assessment Methods for Engine Life-Limited Parts**	1. Advanced Fracture Mechanics Methods. Develop new technology to address cracks in non-rotor components, alternative failure modes, load interaction and high temperature effects and model Nickel anomaly-to-crack initiation. 2. Advanced Methods for Residual Stress Analysis with applicability to Turned Surfaces 3. Advanced Probabilistic Methods. Enhance methods to improve the scope, speed, and interpretation of both fleet risk and probability of fracture calculations. 4. Develop and enhance Auto-Modeling Methods for Applicability to Turned Surfaces. 5. Improved User Interfaces to improve user access to analysis input, output, and computational options to enhance efficiency, facilitate results interpretation, and reduce the potential of user error. 6. Direct DARWIN Support for Advisory Circulars to develop and update dedicated DARWIN analysis modes in support of new and revised ACs. Work for the FY19-FY22 period will support ACs 33.70-5 on DT of Turned Surfaces and AC 33.70-6 on DT of Nickel Material Anomalies. 7. DARWIN Testing and Evaluation includes formal testing and evaluation of new DARWIN versions by SwRI and the engine OEMs who will validate DARWIN against their own company software, fleet experience, and test data. 8. Technology Transfer - meetings, telecoms, reporting, publications, presentations, and a DARWIN training workshop

Propulsion and Fuel Systems (A11B)- *Continued*

This research develops and/or enhances technologies, procedures, test methods, and risk assessment methods to enhance airworthiness, reliability, and performance of engines, propellers, fuels, and fuel systems

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Propulsion and Fuel Systems	$2,034	$1,475	$2,074	$1,785	$2,269	$1,200	$555	-	-	-

Resources

FY18 People	FY18 Facilities	FY18 Partnerships
• 1 FTE	• None	• Rotor Integrity Subcommittee (RISC) Roto Manufacturing (RoMan) Sub-team • DARWIN Code Development Steering Committee • Jet Engine Titanium Quality Committee (JETQC) • Sonic Infrared NDE Development • NDE for Residual Stress Profiling • Cold Dwell Fatigue Research • NDE Communications Group • Air Force and NASA for Volcanic Ash

Advanced Materials / Structural Study (A11C)

This research assesses safety implications and techniques associated with composites and structures that can help to reduce aviation fatalities

Outcome	Task Area	Research Output Anticipated for FY20
Guidance, directives, advisories, and special conditions to ensure that composite technologies are adopted and managed safely, ensure Continued Operational Safety, and to improve efficiency of the certification process. Broaden awareness of the related critical safety and certification issues, Standardize the certification approach across the Certification Service, while benchmarking best industry practices in meeting existing regulations and/or special conditions.	**Damage Tolerance of Composite Structures**	1. Composite Fatigue and Damage Tolerance for Transport Aircraft: Provide detailed documentation of agreed standards, background material, the related regulation basis & industry guidelines for compliance. Complete course content updates and gain approval through industry and regulatory SME supporting course review. 2. Identify Composite Aging Mechanisms that Span a Time that Exceeds Practical Maintenance Programs: Explore the analysis and test protocol needed to properly address aging phenomena identified in Phase I of this research task 3. Composite Fatigue & Damage Tolerance for High Cycle Applications (Rotorcraft): Provide detailed documentation of agreed standards, background material for regulation and supplemental guidance for compliance, considering more realistic damage scenarios and loading effects. 4. Critical Defects & Damage Threats for Emerging Composite Technology: a. Define unique test and analysis protocols for new material forms, fabrication processes and unique design details that don't follow current standards for more common composite performance characteristics. b. Perform tests and analyses to characterize the notch sensitivity of chopped fiber composites, considering typical manufacturing defects and service damage. c. Document results, including guidelines on unique material behavior & NDI methods that characterize important defect or damage metrics for analyses

Advanced Materials/Structural Study (A11C)- *Continued*

This research assesses safety implications and techniques associated with composites and structures that can help to reduce aviation fatalities

Outcome	Task Area	Research Output Anticipated for FY20
Guidance, directives, advisories, and special conditions to ensure that composite technologies are adopted and managed safely, ensure Continued Operational Safety, and to improve efficiency of the certification process. Broaden awareness of the related critical safety and certification issues, Standardize the certification approach across the Certification Service, while benchmarking best industry practices in meeting existing regulations and/or special conditions	**Continued Operational Safety and Certification Efficiency for Emerging Composite Technologies**	1. Investigate the effects of fire on composite failure analysis procedures and methods. a. Identify microscopic and physical changes in the failure surface of a composite structure that has been exposed to fire. b. Publish a technical report documenting testing and results. c. Develop a handbook, or revision to the existing composite failure analysis handbook, that documents the research findings for use in future accident and incident investigation. d. Propose guidelines on the failure analysis of a composite structure exposed to fire to the Composite Materials Handbook, CMH-1 2. Characterize ignition sources from hot particle ejection in composite structure. a. Develop a test method for characterizing spark detection and certifying lightning protection of a composite structure. b. Publish a technical report. c. Submit the test method to the SAE AE2 Lightning committee to modify the existing standard test methods 3. Identify key characteristics of carbon fiber production, how they are controlled, and what testing needs to be performed in fiber line qualification. a. Publish a technical report and identify any areas requiring further study in Phase II. b. Phase II effort may include development of testing standards and testing of carbon fiber at various stages of manufacturing. 4. Investigate the sensitivity of composite materials to new fuels and adequacy of current screening test. a. Test composite materials following exposure to new fuels, including unleaded aviation fuel (Avgas) and plant-based biofuels. b. Examine the adequacy of the current standard 20-day exposure screening test for predicting the fuel's long-term effects on composites. c. Publish a technical report documenting results and identifying any areas requiring further study. d. Propose guidelines on the sensitivity of composite materials to the new fuels for publication as part of the CMH-17.

Advanced Materials / Structural Study (A11C) - *Continued*

This research assesses safety implications and techniques associated with composites and structures that can help to reduce aviation fatalities

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Advanced Material's/Structural Safety	$7,409	$6,169	$6,500	$5,139	$4,338	$3,305	$2300	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• 5 FTEs in various technical disciplines including engineering, analytics, material science, non-destructive evaluation, etc	• FASTER (FAA Aircraft Structural Test Evaluation and Research Lab • FAA Material and Structures Lab	• Academia (JAMS COE): Wichita State University, University of California, University of Washington, Oregon State University, Florida International University, University of Utah • Industry: Boeing, Hexcel, Cytec, United Airlines, Airbus, Textron Cessna, Delta Airlines, Spirit Aerosystems, SAE International, ASTM, CMH-17 • Govt: NASA, Army, Air Force Research Lab

Aircraft Icing (A11D.AI)

This research enhances the understanding of risks of failures or malfunctions of software and digital systems.

Outcome	Task Area	Research Output Anticipated for FY20
Mitigate hazardous impact of ice accretions on engine core components, promote safer winter weather ground operations and streamline the methods of compliance for the new Supercooled Large Droplets (SLD) regulations	**Research on Ice Crystal (Appendix C Exceedance) Icing Conditions to Support Means of Compliance**	1. Develop small-scale model rotating rig to conduct simulated compressor studies. 2. Investigate using a small-scale rotating rig the key drivers that cause internal engine ice accretions due to ice crystal icing conditions. 3. Examine altitude scaling physics to develop similitude methods to compensate for these conditions in sea-level test facilities. Initiate in February 2020. 4. Develop and test a large-scale model rotating rig to investigate engine geometric scaling effects in a representative rotational field which includes compressor dynamics. 5. Support information for developing guidance materials for means of compliance and ARAC engine ICI working group.
	Safe Operations and Take-off in Aircraft Ground Icing Conditions	1. Artificial Snow Generation System- Evaluate and improve the capability of a snow generation system ("snow machine") to simulate specified outdoor conditions. 2. Aerodynamic Issues- Investigate aerodynamic issues relating to performance of anti-icing fluids, contaminated and uncontaminated and cold soaked fuel frost (CSFF) during the take-off roll. 3. Operational Issues- Identify technical and operational issues important to the safety and efficiency of ground operations in winter conditions and amenable to research investigation
	SLD engineering tools development and validation	1. Complete collection efficiency tests and undertake analysis of results for the development of new process(s) for measuring collection efficiencies on target geometries. 2. Conduct experiments and analysis to support developing, improving, and evaluating Computation Fluid Dynamics (CFD models) that incorporate large drop dynamics from impact through ice accretion and growth. 3. Identify FZRA test methods and empirical means to support improvements in the freezing rain MOC 4. Develop research plans for SLD ice shape testing. Use existing models and research test strategies from previous Appendix C testing to examine large droplet accretion effects and provide a limited selection of SLD ice shape cases for evaluation and validation of CFD computer codes

Aircraft Icing (A11D.AI) – *Continued*

This research enhances the understanding of risks of failures or malfunctions of software and digital systems.

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Aircraft Icing	-	$2,165	-	$1,030	-	$3,740	-	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• 5 FTEs in various technical disciplines including engineering, analytics, atmospheric science, etc	• FAA CASSIE (For CFD modeling)	• NASA Glenn Research Center • Transport Canada • National Research Council (NRC) of Canada • Environment and Climate Change Canada (ECCC) • ONERA (France) • Finnish Transport Safety Agency

Digital System Safety (A11D.SDS)

This research enhances the understanding of risks of failures or malfunctions of software and digital systems.

Outcome	Task Area	Research Output Anticipated for FY20
Obtain insights into information security protection vulnerabilities of, and risks to, aircraft systems, components, networks, and interfaces	**Aircraft Systems Information Security Protection**	1. Incremental versions of the formal Safety Risk Assessment (SRA) Description Document describing the FAA process for conducting cyber risk assessments associated with Aircraft Systems Information Security/Protection (ASISP) 2. Develop specific mitigation techniques and tools to meet the time demands of ASISP Risks. 3. Single SRA report specific for Portable Maintenance Devices (PMD), that identifies vulnerabilities, threats and risks along with supporting conclusions and recommendations for AVS decision-making
	Complex Digital Systems	1. Generic Framework for Software Assurance- directly address the FAA's commitment to certification process efficiencies as mandated by the 2012 Modernization and Reform Act. a. Explore software and airborne electronic hardware certification streamlining techniques. b. Generate a report that identifies the streamlining approaches. c. Identify and evaluate development assurance metrics that could be used to assess an applicant's assurance process and the need for additional oversight 2. Use of Model Checking and Formal Methods Property Abstraction a. Investigate model checking through formal methods and prove that more properties hold based on a given model design and research how the properties flow down as the models are expanded b. Research model checking and formal methods property abstraction as a certification streamlining technique c. Explore approaches for the certification issues as input to future guidance. 3. In-Service Reliability Program

		a. Development of guidance for the reliability of newer material in circuits b. Develop deployable hardware to test devices/assemblies, and conduct flight tests 4. System Architecture Virtual Integration (SAVI) a. Report on the results of the study on the use of NLP tools and recommendations to the certification engineers if an applicant proposes such use in the airborne system development. 5. Commercial off-the-shelf (COTS) Assurance Methods 6. Develop guidance supporting material on Single Event Effects (SEE) assurance and mitigation and submit report

Digital System Safety (A11D.SDS) – *Continued*

This research enhances the understanding of risks of failures or malfunctions of software and digital systems

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Digital System Safety & ASISP	-	$1,144	-	$1,516	-	$3,075	-	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• 4 FTEs in various technical disciplines including engineering, analytics, computer science, etc	• Boeing 757 Aircraft	• Boeing, Airbus, Honeywell, Rockwell Collins, GE Aviation, AirForce, NASA System Wide Safety (SWS) Research Transition Team (RTT)

Continued Airworthiness – Systems (A11E.SYS)

This research enhances the decision making processes and addressing safety risks related to aircraft structures, engines, and systems.

Outcome	Task Area	Research Output Anticipated for FY20
Significant reduction of CFIT and Loss of Control accidents in GA, New and modified airplanes utilizing More Electric Airplane (MEA) concepts and technologies and certified Reduced accident rates due to loss of airplane state awareness (ASA) and loss-of-control (LOC	**Integrated Flight Path Control to Address GAJSC and FAA GA Safety Interventions**	1. Advanced autopilot Implementation to include assured autonomy, such as automatic ground collision avoidance, traffic separation, take-off, auto-land, and 4D NextGen performance-based flight path trajectory management- Submit final report with recommendations for new rules, policy and guidance, 2) requirements for flight path control autopilots intended for GA use, and 3) AIAA or other industry presentations/publications of result
	Transfer of New Technology for Enhancement of GA Safety	1. From list of characterized sensors, avionics, processors, actuators, etc. propose detailed ways these items could be used to enhance GA safety by safe installation and integration into the retrofit GA fleet 2. Execute technology demonstration 3. Document technology demonstration in final report with recommendations for new rules, policy and guidance for transfer of COTs equipment that can be used to enhance GA safety.
	Strategies for Adoption and Certification of Intelligent Systems	1. Examine state of the art in automation in the small UAS industry, GA, experimental research aircraft, and transport aircraft- Provide interim report detailing results

Continued Airworthiness – Systems (A11E.SYS) - *Continued*

This research enhances the decision making processes & addressing safety risks related to aircraft structures, engines, and systems.

Outcome	Task Area	Research Output Anticipated for FY20
Significant reduction of CFIT and Loss of Control accidents in GA, New and modified airplanes utilizing More Electric Airplane (MEA) concepts and technologies and certified Reduced accident rates due to loss of airplane state awareness (ASA) and loss-of-control (LOC.	**Tire Failure Characteristics**	1. Determine in-service failure characteristics: Conduct research to determine in-service failure characteristics for bias and radial tires. The type of tire failures must include those that have resulted in thrown tread, flailing strip, and tire burst plume. 2. Develop test plan that will include details of the test location, the test setup, the test instrumentation, the test parameters that will be recorded, the method to record the test results, and a proposed schedule. The plan will also include methods, plans, or strategies for introducing defects or initiating failures during testing. High speed photography will be used to ensure the failure characteristics of each test are recorded. 3. Conduct testing on bias and radial tires, in accordance with the test plan, and record results. 4. Analyze the test results and prepare a preliminary report with the test results and an analysis of each tire failure to determine the pattern, debris size, mass and energy of the debris form the tire failure. 5. Draft report, prepare and present the final report of the test results and analysis for the tire failure characteristic to FAA sponsor.
	Continued Operational Safety	1. Develop a Design of Experiment. 2. Prepare Statement of Work, initiate PR(s), and award contract(s) in FY20. 3. With contract support, conduct testing of various technologies that may possibly mitigate bird strikes with helicopters as recommended by the Bird Strike Aviation Rulemaking Advisory Committee (ARAC).

Continued Airworthiness – Systems (A11E.SYS) - *Continued*

This research enhances the decision making processes & addressing safety risks related to aircraft structures, engines, and systems.

Outcome	Task Area	Research Output Anticipated for FY20
Significant reduction of CFIT and Loss of Control accidents in GA, New and modified airplanes utilizing More Electric Airplane (MEA) concepts and technologies and certified Reduced accident rates due to loss of airplane state awareness (ASA) and loss-of-control (LOC	**Novel and Unusual Electric Aircraft Systems**	1. Identify and quantify the short term and long term risks to current and future safety risks associated with more electric aircraft for aerospace applications including a potential failure mode and effect 2. Describe mitigating factors that will constitute a FAIL/SAFE electrical energy storage installation for aerospace including investigation of an applications electrical primary propulsion systems. 3. Develop new and novel technology including power generation distribution monitor and control, protective circuitry, system protection, failure mode detection, monitor control and indication 4. Evaluate the feasibility of using nontraditional electrical energy harvesting and storage devices including a look at the effects of the aerospace environment on these technologies 5. Examine current power distribution design of aircraft generators and Auxiliary Power Unit (APUs) and look at how for example multiple smaller generators and energy harvesting can be incorporated into a new aircraft electrical power distribution system 6. Develop methods to mitigate the risks for these novel technologies for aerospace application while retaining or improving the current level of safety in commercial transport aircraft 7. Collaborate with Society of Automotive Engineers (SAE) and the Radio Technical Commission for Aeronautics (RTCA) to provide recommendations of additional certification standards to be considered by the FAA for approval of the technologies researched in tasks 1-4 on aircraft systems.
	Avionics and New Technologies	1. Information Automation a. Survey pilots to identify possible safety issues 2. New charting concepts a. Examine the prioritization of information, clutter control, and managing chart complexity
Diminish wire strikes and fatalities by implementing procedures and/or improving the certification basis for new helicopters and/or revealing new technology to alert pilots to the proximity of wires	**Wire Strike Avoidance**	1. Select best wire cutter technology for low inertia and light rotorcraft- Develop prototype and report with test data 2. Select best avionics system which could contain wire locations to provide pilot information/warnings and conduct testing of avionics solutions to wire avoidance in select helicopters 3. Submit report on feasibility and recommendations of wire cutters/avionics 4. Provide data to sponsors to allow them to develop new rules and/or guidance to mitigate wire strike

Continued Airworthiness – Systems (A11E.SYS) - *Continued*

This research enhances the decision making processes & addressing safety risks related to aircraft structures, engines, and systems

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Continued Airworthiness - Systems	-	$2,870		$3,346		$4,340	-	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• 4 FTEs in various technical disciplines including engineering, analytics, material science, non-destructive evaluation, etc.	• FAA ARC Fault Evaluation/More Electric Air Craft Lab and Flight Controls Test Capabilities	• NASA/DOD/Society of Automotive Engineers (SAE) industry and academia • Will rely on existing CRDAs with, e.g., Boeing, Astronics, and Ametek.

Continued Airworthiness – Structures (A11E.STR)

This research enhances the decision making processes & addressing safety risks related to aircraft structures, engines, and systems

Outcome	Task Area	Research Output Anticipated for FY20
Guidance, directives, advisories, and special conditions to ensure new technologies such as Active Flutter Suppression, Additive Manufacturing, and emerging structural materials and fabrication techniques are adopted and managed safely, to ensure Continued Operational Safety, and to improve efficiency of the certification process. Broaden awareness of the related critical safety and certification issues. regulations and/or special conditions.	**MMPDS Support and Design Values for Emerging Materials**	1. Metallic Materials Properties Development and Standardization (MMPDS): Provide for the planning, coordination, and implementation activity to develop and maintain the core MMPDS Process and Handbook in establishing statistically-based items that comply with material strength requirements in §2X.613 and Implement Spring and Fall Coordination Meetings.
	Metal Additive Manufacturing for Aircraft, Engine, and Propeller Applications	1. Partner with AM Consortia and leverage resources and become a contributing partner in AM consortiums to assess several key issues including use of process maps, effect of material reuse, evaluation of introducing special factors (similar to castings), the effectiveness of several NDI methods in detecting flaws in parts being produced, design for AM, fatigue and damage tolerance evaluation of AM parts, powder spreading, surface properties and finishing, and process modeling for process/material property relationships 2. Static Special Factors for Metal AM Parts- valuate the feasibility for developing the methodologies and application of a set of conservative static strength special factors to statistically based material strength properties 3. Special Considerations for Data Generated from Purpose-Built Test Coupons- evaluate the effectiveness of purpose-built specimens to represent actual part mechanical properties and address if special considerations need to be applied to data generated from purpose-built specimens when used for design 4. Sensitivity Study for Fatigue Behavior of Anomalies and Assessment of NDI Methodologies- identify the types and characteristic of defects/anomalies generated by AM (including frequency and size distributions), validate current and emerging NDI capabilities to detect them and determine their effect on static, fatigue and fracture properties. Conduct testing of specimens to quantify the debit on material properties associated with a specific population (and distribution) of defects

Continued Airworthiness – Structures (A11E.STR) - *Continued*

This research enhances the decision making processes & addressing safety risks related to aircraft structures, engines, and systems.

Outcome	Task Area	Research Output Anticipated for FY20
Guidance, directives, advisories, and special conditions to ensure new technologies such as Active Flutter Suppression, Additive Manufacturing, and emerging structural materials and fabrication techniques are adopted and managed safely, to ensure Continued Operational Safety, and to improve efficiency of the certification process. Broaden awareness of the related critical safety and certification issues. regulations and/or special conditions.	**Metal Additive Manufacturing for Aircraft, Engine, and Propeller Applications**	5. Evaluation of Predictive Modelling: Evaluate the feasibility of using predictive models to understand the results, and to enable development of the quantitative acceptance criteria based on data generated 6. Process Control through Monitoring and Adaptation: Generate data to evaluate the effectiveness of process monitoring technologies and address the potential for using monitoring feedback to actively adapt the AM machine process controls 7. Lessons Learned Database: Create the foundation for a lessons learned database managed by an independent third party, similar to the FAA funded Rotor Manufacturing (RoMAN) database, to collect and catalog in-service history of metal AM parts 8. Effect of Direct Energy Deposition (DED) AM at Interface of Substrate and Deposited Material for New or Repaired Parts: Direct energy deposition typically involves adding material to some form of substrate, whether it be building up a part on a plate of material, adding a feature to a pre-made shape or repairing an in-service part. Develop test plan and select material(s) and AM technology(s) to evaluate. Fabricate, inspect and test specimens

Continued Airworthiness – Structures (A11E.STR)

This research enhances the decision making processes & addressing safety risks related to aircraft structures, engines, and systems

Outcome	Task Area	Research Output Anticipated for FY20
Guidance, directives, advisories, and special conditions to ensure new technologies such as Active Flutter Suppression, Additive Manufacturing, and emerging structural materials and fabrication techniques are adopted and managed safely, to ensure Continued Operational Safety, and to improve efficiency of the certification process. Broaden awareness of the related critical safety and certification issues. regulations and/or special conditions.	**Damage Tolerance and Durability Issues for Emerging Technologies**	1. Bonded Repair Technology (ongoing research): a. Conduct Test and Analysis 2. Advanced Metallic Fuselage Structure (ongoing research) a. Conduct Test and Analysis 3. Assessment of Aluminum Lithium for Primary Structure: a. Conduct Test and Analysis 4. Develop Property Standards for Emerging Process Intensive Materials (ongoing research) a. Develop FAA guidance for both the submission of industry data to industry handbook and define acceptable practices and limitations for individual manufactures to utilize industry published values. 5. Thermal Residual Stresses in Metal-Composite Hybrid Structure Generate data through full-scale test for use in evaluating analyses to accurately account for thermally induced stresses in hybrid structure. Assess industry practices to determine under what conditions thermal loads may affect damage tolerance evaluation and WFD assessments, knowing that some of the worse thermal load conditions may be localized within individual fasteners in mechanical joints.
	Probabilistic Damage Tolerance Based Fleet Risk Management for Small Airplanes	1. Develop database for characteristics of random variables used in fatigue and damage tolerance analysis 2. Complete the development of fleet risk management tools with the capability of risk-based inspections and incorporate it into the software 3. Gather Mission profile definitions and incorporate them into the SMART software and add generic interface for external lifting codes 4. Complete development of methodology and instruction for selecting cut off values on the tail of the distributions and publish it in a report.
	Reliability of Structural Health Monitoring	1. Develop an Industry Working Group consisting of statisticians and POD experts, they will provide oversight and guidance to this work. 2. Develop a statistical model for reliability of SHM methodology 3. Validate the model: Working with an aircraft OEM, SHM OEM, perform specimen and component level testing to gather validation data 4. Revise/publish POD standard for reliability - SAE document

Continued Airworthiness Structures (A11E.STR) - *Continued*

This research enhances the decision making processes & addressing safety risks related to aircraft structures, engines, and systems

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Continued Airworthiness -Structures	-	$2,441	-	$2,474	-	$2,911	-	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• 3 FTEs in various technical disciplines including engineering, analytics, material science, non-destructive evaluation, etc.	• FAA Full-scale Aircraft Structural Test Evaluation and Research (FASTER)Lab • FAA Structures and Materials Lab	• Boeing, Arconic, Bombardier, Constellium, Kansas Aviation Research Technology (KART), Textron, Airbus, Spirit Aerospace, Bombardier Metallic Material Properties Development and Standardization (MMPDS)

Aircraft Catastrophic Failure Prevention Research (A11F)

Standardize analysis methods and tools for evaluating potential hazards and risks related to engine rotor burst and fan blade failure to assure that regulatory compliance findings are accurate and consistent

Outcome	Task Area	Research Output Anticipated for FY20
Engine containment and uncontained engine fragment threats technology Refresh	**Advanced Analysis Methods for Impact of Composite Aircraft Materials in Rotor Burst and Blade Release**	1. LSDYNA Aerospace Working Group (AWG) Coordination with NASA/Academia and Industry 2. LSDYNA Metal Failure Analysis: limited LSDYNA computational model development, Material testing and specific metal characterization and validation 3. Rotorburst Vulnerability Analysis: maintaining the codes and correcting issues identified by users

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Aircraft Catastrophic Failure Prevention Research	$1,433	$1,020	$1,528	$1,154	$1,570	$1,200	$0	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• 2 FTEs	• FAA in house Material Testing. • Via FAA CASSIE and High Performance Computing	• NASA • LS-DYNA Aerospace Working Group • Naval Air Warfare Center • Academia: Ohio State University, George Mason University and Arizona State University

Flight Deck/Maintenance/System Integration Human Factors (A11G)

This research enhances decision making related to human factors for flight deck systems, and establishing data to support risk management programs to address hazards in the maintenance environment.

Outcome	Task Area	Research Output Anticipated for FY20
Reduce HF-related accidents/incidents by incorporating human factors best practices, early in the design process. Increase safety, access, efficiency, capacity, and throughput in low visibility conditions using advanced vision systems, head-up displays, and head-mounted displays	**Advanced Vision Systems (EFVS, EVS, SVS, CVS), Head-Up Displays (HUD), and Head Mounted Displays (HMD): Operational Standards & Approval Criteria**	1. Synthetic Vision Guidance System (SVGS) Research- Design an experiment that addresses the necessary areas of research. Submit the completed experiment design, identified statistical analysis methods, completed data definitions, and identified pilot subject requirements. 2. Head Up Display (HUD) Research - Design an experiment that addresses the areas of research pertaining to conducting CAT II and CAT III approaches using other than ALSF I or ALSF II approach lighting systems. Provide completed experiment design, identified statistical analysis methods, completed data definitions, and identified pilot subject requirements. 3. Head Mounted Display (HMD) Research- Based on the previous industry product review, literature search, and gap analysis conducted, identify potential human performance impacts that warrant additional investigation. Develop and submit a research plan that that addresses operationally relevant human performance impacts associated with using HMD to conduct low visibility and advanced vision operations.
	Fatigue Mitigation in Flight Operations	1. Continue relevant data collection and entry into the FRMS database and develop pertinent research questions that will improve the FAA's understanding of pilot fatigue during flight operations exceeding the limitations of the 14 CFR part 117 regulations 2. Develop and refine a research study during FY2020 to characterize human factors/pilot performance considerations in flight operations involving short haul multiple segment workload and cumulative sleep loss across trip pairings 3. Develop and refine a research study to systematically evaluate the behavioral adaptation of pilots to multiple time zone shifts associated with long-haul and ultra long-range flight operations.

Flight Deck/Maintenance/System Integration Human Factors (A11G)- *Continued*

This research enhances decision making related to human factors for flight deck systems, and establishing data to support risk management programs to address hazards in the maintenance environment

Outcome	Task Area	Research Output Anticipated for FY20
Reduce HF-related accidents/incidents by incorporating human factors best practices, early in the design process. Increase safety, access, efficiency, capacity, and throughput in low visibility conditions using advanced vision systems, head-up displays, and head-mounted displays	**Pilot Training, Qualification, Procedures and Flight Operations**	1. Training methods and mechanisms a. Survey current airline training methods and the skills they are used to teach, including the use of bulletins, computer-based training, fixed-based and full-mission lever D simulators and any augmented and virtual reality. b. Conduct a literature review to document current research on training methodology effectiveness. 2. Crew Resource Management (CRM). a. Examine emerging trends in CRM training and checking and select those most suitable for future FAA guidance materials 3. Performance Based Airman Certification a. Examine current ab initio training programs (to include civilian, military and international programs) and collect data on their effectiveness b. Compare data and results from programs with varying mixes of training, checking and flight hours 4. Training the new generation of pilots a. Review the learning science and best practices on effective training for millennials and future generations and provide recommendations b. Examine emerging issues and trends for low-time captains and identify training programs to address these issues

Flight Deck/Maintenance/System Integration Human Factors (A11G) - *Continued*

This research enhances decision making related to human factors for flight deck systems, and establishing data to support risk management programs to address hazards in the maintenance environment.

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Flight deck/Maintenance/System Integration Human Factors	$5,000	$949	$7,305	$3,453	$6,825	$2,768	$5,052	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• FAA project managers and principal investigators along with researchers and industry partners through contracts and agreements that include Human Factors Subject Matter Experts, Flight Deck Professionals, and Air Traffic Controllers • 16 FTEs	• Civil Aerospace Medical Institute (CAMI) • William J Hughes Technical Center (WJHTC) • Private Industry	• Industry • NASA • Volpe • Radio Technical Commission for Aeronautics (RTCA) • Universities

System Safety Management – SSM (A11H)

This research program improves safety through development of advanced data collection methods, risk/data analysis techniques, and prototypes of risk-based decision making capabilities to mitigate emerging system-wide safety issues in the air transportation system in a cooperative nature with the aviation stakeholders

Outcome	Task Area	Research Output Anticipated for FY20
Enhance use of Risk-Based Decision Making in Oversight of the Air Traffic Organization	**Safety Oversight Management System (SOMS)**	1. SOMS Prototype 2. Technical transfer package including all technical reports and user guide 3. Case Study demonstration
	Integrated Domain Safety Risk Evaluation Tool (ID-SRET)	1. ID-SRET prototype 2. Technical transfer package that documents the ID-SRET functions, implementation, user guide, and case study 3. Case study demonstration

System Safety Management – SSM (A11H) - *Continued*

This research program improves safety through development of advanced data collection methods, risk/data analysis techniques, and prototypes of risk-based decision making capabilities to mitigate emerging system-wide safety issues in the air transportation system in a cooperative nature with the aviation stakeholders

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
System Safety Management	-	$801	-	$2,314	-	$1,197	-	-		-

FY18 People	FY18 Facilities	FY18 Partnerships
• 6 FTEs in various technical disciplines including engineering, computer science, analytics, safety and risk management, etc.	• Computing and Analytics Shared Services Environment (CASSIE) to develop prototype software, utilize radar and communication data available for analysis and utilizes CASSIE's analytics capabilities for analysis • WJHTC Flight Program S76 Helicopter	Include, but not limited to: NASA, Volpe PEGASAS, Mitre, MIT LL, MMAC, Helicopter Association International (HAI), TruthData, LZControl, NJ State Police and US Coast Guard.

Terminal Area Safety – TAS (A11H)

This research program improves the safety of operations near or at an airport. Research projects in the program focus on developing training solutions and identifying effective technologies to mitigate key causes of fatal accidents such as the loss of control, runway excursions, and runway overruns.

Outcome	Task Area	Research Output Anticipated for FY20
Reduce "potentially hazardous outcome reports" from go-arounds by a factor of 5; and Reduced runway excursions on wet runway; and reduce helicopter accidents.	**Enhanced Helicopter Vision Systems (EHVS)**	1. Report describing Examine the role of Vision Systems Technology and interoperability with other helicopter navigation and surveillance systems for Head-Worn/Helmet-Mounted/Heads-Up Displays 2. Feasibility of landing system technologies and augmented reality concepts with Enhanced/Synthetic/Combined Vision for Helicopters for both onshore and offshore operations as well as visual cueing to mitigate obstacles 3. Concept evaluation of a "Pseudo-Visual environment" to enable closer operations for offshore and onshore domains for faster obstacle detection in decreased visibility conditions.
	Wet Runway Wheel Braking Testing	1. Comprehensive experiment design for high speed flight tests on wet runway conditions including runways and aircraft of interest. 2. Report including preliminary data analysis determining the effect of rain condition and runway characteristics on wet runway aircraft braking performance
	Improved Helicopter Simulation Flight Models)	1. Review and document current simulator/flight training device models for fidelity and gaps in model data for outside-of-the-envelope flight regimes. 2. Partnership agreements with helicopter flight simulators or training devices manufacturer or training centers

Terminal Area Safety- TAS (A11H)- *Continued*

This research program improves the safety of operations near or at an airport. Research projects in the program focus on developing training solutions and identifying effective technologies to mitigate key causes of fatal accidents such as the loss of control, runway excursions, and runway overruns.

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Terminal Area Safety	-	$2,256	-	$1,526	-	$450	-	-		-

FY18 People	FY18 Facilities	FY18 Partnerships
• 3 FTEs in various technical disciplines including engineering, computer science, analytics, safety and risk management, etc.	• WJHTC NextGen Integration and Evaluation Capability and Cockpit Simulation Facility • MMAC Flight Operations Simulation Lab • WJHTC's Flight Program S76 Helicopter and Global 5000 aircraft • Airport Branch's research helipad • Cape May Airport Research Taxiway	MMAC, CAMI, NASA Ames, NASA Langley, DOD, Several CRDAs (Elbit Systems, Thales, MaxViz, etc.), EUROCAE WG-79, Leonardo, Sikorsky, Rega. Netherlands Ministry of Environment (MoC)

Aeromedical Research (A11J)

Provide up-to-date guidance and standards to enhance human safety, security, and survivability in civilian aerospace operations.

Outcome	Task Area	Research Output Anticipated for FY20
Maximize the strengths of the human link in the NAS and minimize inherent human weaknesses to prevent accidents and improve safety through evidence-based medicine; Harmonize aeromedical standards across Civil Aviation Authorities; Manage risk by identifying hazards and strengthening aeromedical safety management systems; Enhance aeromedical education programs.	**CAMI Aerospace Medical Systems Analysis (AM-1)**	1. BASICMED. Analyze the effect on aeromedical safety resulting from BASICMED regulations (H.R. 636/S. 571/PL 114-190). Technical Report, AAM-631-MED. Technical Report (3Q21) AAM-631-MED 2. TRANSPORTATION ACCIDENT RATES - CANNABINOIDS. Assess transportation accident rates involving operators at various concentrations of cannabinoids (Delta-9-THC and/or 11-Nor-9-Carboxy-THC). Provide Technical Report, AAM-631-NUM. Technical Report (4Q20) AAM-631-NUM 3. Analyze accident injuries and biological data to derive methods, recommendations, and/or tools to enhance aircrew health, medical certification decision-making processes, accident investigation practices, and aerospace medical education programs. 4. Evaluate trends in physiological, human factors, clinical, and forensic findings from civil aviation aircraft accidents and incidents to support accident investigation processes and develop strategies to mitigate aerospace medical risks. 5. Develop and maintain comprehensive aerospace medical research databases and data visualization tools to support epidemiological, data-mining, and probabilistic risk analyses towards the realization of aerospace medical safety management systems. 6. Assess the impact of commercial space transportation (e.g., suborbital flight) including the effects of ionizing and non-ionizing radiation on living systems (e.g., cancer and genetic defects) and developing recommendations for radiation exposure limits. 7. Develop software that calculates radiation dose in-flight and associated warning systems which assist the aircrew and aircraft cabin personnel in monitoring and maintaining their occupational exposure within safe level 8. Evaluate emergent biomedical techniques, devices, and screening procedures for their suitability in the aviation environment and their impact on human safety. 9. Provide guidance to national and international AMEs, RAMs, accident investigators, and other aviation specialists in support of aerospace medical education & training programs and the harmonization of aerospace medical standards and policies. 10. Guide Aviation Medical Examiners (AMEs), Residents in Aerospace Medicine (RAMs), Accident Investigators, Engineers, students, and other aviation specialists in support of aeromedical education and training programs

Aeromedical Research (A11J)- *Continued*

Provide up-to-date guidance and standards to enhance human safety, security, and survivability in civilian aerospace operations.

Outcome	Task Area	Research Output Anticipated for FY20
Identify current and emerging medications and other substances requiring regulator action; Enhance the evaluation of risks as reported or not in medical certification processes; Develop countermeasures to aviation stressors.	**CAMI Aeromedical Accident Prevention & Investigation (AM-2)**	1. STABILITY OF QUETIAPINE IN AQUEOUS SOLUTIONS AND BIOLOGICAL MATRICES: Determine the stability of quetiapine STABILITY OF QUETIAPINE IN AQUEOUS SOLUTIONS AND BIOLOGICAL MATRICES: Determine the stability of quetiapine in aqueous solutions (drug standards), and in blood and urine (biological matrices). Technical Report (4Q20), AAM-611-TOX 2. SIMULTANEOUS DETECTION AND QUANTITATION OF ANTIHISTAMINES IN BIOLOGICAL MATRICES: Develop and validate a Gas Chromatography-Tandem Mass Spectrometry (GC/MS/MS) method for the simultaneous detection and quantitation of antihistamines in biological matrices. Technical Report (4Q21), AAM-611-CHE 3. HUMAN PHYSIOLOGIC RESPONSE COMPARISON IN THREE HYPOXIC ENVIRONMENTS: Compare gene and cytokine expression changes between three different methods of Airmen Hypoxia Physiology Training. Technical Report (4Q20), AAM-612-GEN 4. COMPARISON ACROSS MULTIPLE TYPES OF SLEEP DEPRIVATION. Compare biomarkers across multiple types of sleep deprivation. Technical Report (4Q23) AAM-612-GEN 5. Develop advanced toxicological and biochemistry methodologies to detect and analyze human biological samples for emerging drugs, toxins, and other substances that may impact pilot performance or assist in determining accident causality. Provide Forensic Toxicology Reports for all US fatal aircraft accidents to AVP and NTSB. 6. Develop gene expression (biomarker) methodologies to detect and quantify impairment from alcohol, drugs, fatigue, hypoxia, and other environmental or aeromedical stressors (e.g., disease or impairment) relative to human safety and performance in aerospace operations. 7. Investigate current and anticipated aeromedical issues and technology that may impact human safety in aerospace operations, particularly in the fields of biochemistry, toxicology, and genomics. 8. Serve as an advisory resource in areas relating to aeromedical factors affecting or expected to affect aerospace safety. 9. Guidance to Aviation Medical Examiners (AMEs), Residents in Aerospace Medicine (RAMs), Accident Investigators, students, and other aviation specialists in support of aeromedical education and training programs
Reduced deaths and injuries in survivable accidents.	**Rotorcraft Injury Mechanism Analysis - Procedure Development and Validation (RS-2)**	1. Demonstrate the procedures developed in Phase 1 by gathering and processing data from a selected sample of aircraft types and accidents. Technical Report (4Q22), AAM-632-DYN

Aeromedical Research (A11J) - *Continued*

Provide up-to-date guidance and standards to enhance human safety, security, and survivability in civilian aerospace operations.

Outcome	Task Area	Research Output Anticipated for FY20
Enhance human protection and survival from stressful environments and emergency events	**CAMI Human Protection & Survival (AM-3)**	1. EVALUATION OF ELEVAID – FLEXSIM AND CAB LAB. The Electronic Emergency Evacuation Aid for Aircraft Passengers (ELEVAID) tool will be evaluated in the Cabin Safety Laboratory and the Flexible Aircraft Cabin Simulator (FlexSim) to assess issues such as information retention, substitution of a virtual environment for a physical laboratory for testing, and certification of new aircraft signage and equipment. Provide A. CAB Lab - 1-IRB Approved Protocol (1Q20) and 2-Draft Report (4Q21). B. FlexSim - 1-IRB Approved Protocol (1Q20) and 2-Draft Report (4Q21), AAM-632-CAB 2. MODERNIZATION OF ATD APPAREL. Investigate any differences in ATD kinematics caused by the modern clothing and provide the FAA policy makers with information to update guidance material on the subject, including FAA Advisory Circular (AC) 25.562-1B, Dynamic Evaluation of Seat Restraint Systems & Occupant Protection on Transport Airplanes, and the SAE Aerospace Standard (AS) AS 8049-C. Provide Technical Report (4Q21), AAM-632-DYN 3. Assess emergency procedures, safety equipment, and other methods that influence cabin crew performance and passenger survival from aircraft accidents and other emergency events. Technology Evaluations in CAMI facilities: B-747 Aircraft; Flexible Aircraft Cabin Simulator; Pool; B-727 Aircrew Firefighting; Cabin Safety; Physiology Lab., Hypobaric Chamber, and Impact Sled. 4. Assess the injury potential of new aircraft materials, configurations, and structures by utilizing advanced computational and impact test techniques under simulated crash environments. 5. Provide recommendations for the development of industry-wide standards and coordinate/participate in these standardization efforts through professional associations and workshops. 6. Investigate aviation environmental factors including biological/chemical threats, hypoxia exposure, adequacy of protective technology (oxygen masks, restraints, airbags, escape slides), and other issues that influence human performance, physiology, safety, and health in civilian air operations. 7. Serve as an advisory resource in areas relating to biodynamics, altitude physiology, environmental physiology, and cabin safety issues affecting or expected to affect aerospace safety. 8. Guide Aviation Medical Examiners (AMEs), Residents in Aerospace Medicine (RAMs), Accident Investigators, Engineers, students, and other aviation specialists in support of aeromedical education and training programs.
Enhance aircraft safety equipment to decrease fatalities in rotorcraft operations.	**Occupant Protection - Rotorcraft (RS-1)**	1. OCCUPANT PROTECTION FOR LEGACY ROTORCRAFT. Evaluate by test and/or computer modeling the safety benefit provided by the restraint/seat/airframe modifications 2. Support development of guidance material based on research findings. Technical Reports (4Q20, 4Q22), AAM-632-DYN

Improve safety and efficiency by providing the necessary guidance for the expanded use of analytical modeling.	**Expanded use of analytical modeling in cabin safety applications**	1. Identify potential applications of analytical modeling and establish general validation criteria.

Aeromedical Research (A11J) – *Continued*

Provide up-to-date guidance and standards to enhance human safety, security, and survivability in civilian aerospace operations.

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Aeromedical Research	$8,467	$2,902	$8,538	$3,032	$9,765	$2,857	$3,875	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• 56 In-House at the Civil Aerospace Medical Institute (CAMI): 48 GOV FTE; 8 CTR FTE • Physicians, Scientists, and Engineers: Associate (20%); Baccalaureate (67%), Master (51%), and Doctorate (32%). • Disciplines: Medicine, Human Factors, Cabin Safety, Genomics, Bioinformatics, Biodynamics, Radiobiology, Physiology, Physics, Chemistry, Toxicology, Mathematics, Computer Science, and Knowledge Management	• > 100 at CAMI • 1 at USN (WPAFB-NAMRU): AM-2 Task 3 • TBD (Grant) • AM-2, Item 4 • RS-1	• > 40 National • US Navy • University of Central Oklahoma • Flight Attendant and OK Medical Research Institutes • University of Wisconsin • SW Research Institute • > 40 International • National University of Colombia • European Aviation Safety Agency • Airbus Industries • Iberoamerican Association of Aerospace Medicine

Unmanned Aircraft Systems Research (A11L)

Develop certification standards, policy, and guidance needed to safely integrate UAS into the NAS

Outcome	Task Area	Research Output Anticipated for FY20
Support the safe, efficient, and timely integration of UAS into the NAS by reducing incident and accident rates due to mid-air collisions between UAS and other aircraft and collisions with people on the ground while supporting risk mitigation.	**Air Carrier Operational Considerations for Unmanned Aircraft Systems**	1. Design and conduct experiment to expand, refine and/or validate the prior related research results to fill the gaps in air carrier remote/manned crew requirements. 2. Design and conduct experiment to expand, refine and/or validate the prior research results on air carrier remote pilot knowledge and skills testing
	UAS Automation/Autonomy	1. Human operator considerations and System certification criteria - Identify state-of the-art in automation across all modes of transportation as well as for military and civilian applications to provide a picture of what advances in automation have been made and what is still needed. Specifically, identify the feasibility of current automation concepts (i.e., identify the difference between marketing hype and technology capabilities). a. As part of this survey, review core flight path augmentation technology and identify their current and planned future capabilities. Identify policy gaps for the approval of these automated concepts. b. Based on the technology survey, identify key human factors considerations and research gaps for the ground station, which would allow the UAS operator to fly remotely. Develop research plan based on the findings. c. Develop research plan to evaluate automation technology identified in Phase 1 for UAS d. Identify policy gaps for the approval of these automated concepts.

Unmanned Aircraft Systems Research (A11L)- *Continued*

Develop certification standards, policy, and guidance needed to safely integrate UAS into the NAS

Outcome	Task Area	Research Output Anticipated for FY20
Support the safe, efficient, and timely integration of UAS into the NAS by reducing incident and accident rates due to mid-air collisions between UAS and other aircraft and collisions with people on the ground while supporting risk mitigation.	**UAS Flight Data Research in Support of ASIAS (Aviation Safety Information and Analysis Sharing) Program**	1. Develop the methodology for UFDM participation in ASIAS. 2. Collect UFDM data on a routine and regular basis within research efforts supporting ASIAS. 3. Determine and collaborate with a mitigation partner for UAS safety issues.
	UAS High Performance Command and Control (C2) Link Systems and Networks	1. Validate by simulation and flight testing functional performance of UAS Pilot-On-The-Loop (POTL) AFGCS with different levels of automation.

Unmanned Aircraft Systems Research (A11L)- Continued

Develop certification standards, policy, and guidance needed to safely integrate UAS into the NAS

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Target	FY19 Contract Request	FY20 Target	FY20 Contract Target
Unmanned Aircraft Systems Research	$17,635	$13,663	$20,035	$6,022	$6,787	$4,824	$3,318	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• 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) • 8 Federal FTEs as Subject matter experts in UAS detect and avoid capability, air carrier operations, human factors, and safety data collection	• FAA Technical Center • FAA Civil Aerospace Medical Institute (CAMI) • FAA UAS Test Sites: North Dakota DOC, State of Nevada, New Mexico State University, University of Alaska Fairbanks, Texas A&M University Corpus Christi, Virginia Polytechnic Institute & State University, Griffiss International Airport (NY)	• UAS Center of Excellence • Alliance for System Safety of UAS through Research Excellence (ASSURE): 23 leading research institutions and a hundred leading industry, academic, and government partners.

Alternative Fuels for General Aviation (ALLM)

Alternative and renewable fuels for use by the GA community to lessen aviation environmental impacts (air and water quality)

Outcome	Task Area	Research Output Anticipated for FY20
Safe introduction of an unleaded aviation gasoline to replace 100LL for a majority of the existing fleet through a fleet-wide authorization by the FAA	**Aviation Engine Test**	Plan to address out of scope aircraft and engines is unknown at this time.
	Aircraft Flight Test	Plan to address out of scope aircraft and engines is unknown at this time.
	New Fuel Deployment Support	Plans to support the introduction and deployment of new unleaded aviation fuels into the existing general aviation infrastructure are unknown at this time.

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Request	FY18 Contract Request	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Alternative Fuels for General Aviation	$7,000	$6,127	$7,000	$5,918	$5,924	$4,798	-	-	-	-

FY18 People	FY18 Facilities	FY18 Partnerships
• 6 FTEs in various technical disciplines including engineering.	• FAA Propulsion & airpOWer Engineering Research (POWER Lab • FAA Aviation Fuels Research Lab • FAA Flight Test Aircraft	• Cooperative Research and Development Agreements with Shell Global and Swift Fuels • Piston Aviation Fuels Initiative (GAMA, AOPA, EAA, NBAA, NATA) • Textron, CMI, Lycoming, Cirrus, Robinson, Rotax, • Cape Air, National Resources Canada

		• Partnership to Enhance General Aviation Safety, Accessibility and Sustainability (PEGASAS) Center of Excellence • Embry Riddle Aeronautical University • Purdue University