FY 2018 REDAC Aircraft Safety (SAS)

FAA Research FY18 Report

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Actuals	FY18 Contract Actuals	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Fire Research and Safety	$6,352	$2,481	$7,425	$3,251	$7,200	$2,926	$4,867	$1,680	-	-
Propulsion and Fuel Systems	$2,034	$1,475	$2,074	$1,785	$2,100	$1,140	$555	$0	-	-
Advanced Materials/Structural Safety	$7,409	$6,169	$6,500	$5,139	$10,500	$3,330	$2,300	$1,469	-	-
Aircraft Icing/Digital System Safety/Aircraft Cyber	$5,450	$3,309	$5,102	$2,546	$9,253	$6,390	$7,684	$5,435	-	-
Aircraft Icing		$2,165		$1,030		$3,505		$2,100		-
Digital System Safety & Cyber Security (ASISP)		$1,144		$1,516		$2,885		$3,335		-
Continued Airworthiness	$8,810	$5,311	$9,316	$5,821	$11,269	$6,962	$4,969	$3,304	-	-
Continued Airworthiness - Systems		$2,870		$3,346		$4,171		$1,560		-
Continued Airworthiness - Structures		$2,441		$2,474		$2,792		$1,744		-
Aircraft Catastrophic Failure Prevention Research	$1,433	$1,020	$1,528	$1,154	$1,570	$1,070	$0	$0	-	-
Flight deck/Maintenance/System Integration Humar	$5,000	$949	$7,305	$3,453	$7,305	$0	$5,052	$2,706	-	-
System Safety Management	$5,939	$3,058	$6,453	$3,840	$5,500	$2,706	$799	$0	-	-
System Safety Management		$801		$2,314		$1,928		$0		-
Terminal Area Safety		$2,256		$1,526		$778		$0		-
Aeromedical Research	$8,467	$2,902	$8,538	$3,032	$9,080	$2,435	$3,875	$632	-	-
Unmanned Aircraft Systems Research	$17,635	$13,660	$20,035	$11,021	$24,035	$1,367	$3,318	$2,454	-	-
	$68,528	**$40,333**	**$74,276**	**$41,042**	**$87,812**	**$28,325**	**$33,419**	**$17,680**	**-**	**-**
Alternative Fuels for General Aviation	$7,000	$6,152	$7,000	$5,918	$7,000	$5,862	-	-	-	-
Weather	-	$3,500	-	$3,150	-	$3,150	-	$1,575	-	-

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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 Outputs Delivered in FY18	Status
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. Systems, procedures, and materials to safely contain or mitigate the fire hazards from batteries and fuel cells installed and/or transported in aircraft evaluations. (**FY18**) 2. New fire detection technologies for more effective detection of cargo compartment fires and for fires in hidden areas not currently required to have detection systems evaluations. (**FY18**) 3. Effectiveness of current and proposed replacement fire suppression agents for passenger aircraft and suppression/containment systems on freighter aircraft on fires involving hazardous materials transported as cargo evaluations (**FY18**) 4. Standardization of new flammability test methods, advisory circulars, and training guidance for planned Notice of Proposed Rulemaking. (**FY18**)	1. Participated in RTCA and SAE committee meetings to develop standards for aircraft installed batteries, lithium battery packaging, and fuel cells. Conducted testing on the proposed lithium battery package standard to develop requirements and pass/fail criteria. Conducted testing to compare the effect of hydrogen fires with jet fuel fires in designated fire zones 2. Characterized the properties of several simulated smoke sources used for cargo smoke detector certification tests in terms of particle size distribution. Conducted several task group meetings with industry representatives to develop standardized smoke sources for newly developed false alarm resistant cargo smoke detectors 3. Conducted evaluation testing of CO2 for effectiveness as a halon replacement agent in engine nacelles. Conducted preliminary testing of a proposed cargo compartment replacement agent. Began refurbishment of test article used to conduct cargo minimum performance testing. 4. A vertical flame propagation (VFP) test for measuring the flammability of materials used in inaccessible areas was finalized. The final test configuration was based on 3 generations of apparatuses and associated testing. The finalized test apparatus is now being produced commercially to enable prospective laboratories to purchase the equipment and participate in interlab studies. The progress of the test has been highlighted at International Aircraft Material Fire Test Forum meetings held in October 2017, and March and June of 2018.

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

Outcome	Task Area	Research Outputs Delivered in FY18	Status
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**	5. Computational fluid dynamics (CFD) tool including curvilinear meshing capability in order to simulate heat, smoke, and combustion gas movement in aircraft spaces bounded by curved surfaces (fuselage, engines) and containing cylindrical obstructions (ducting, wiring). (**FY18**) 6. Sources of error in FAR 25.853 heat release rate test identification using numerical (CFD) simulation of thermopile response to changes in apparatus construction and airflow. (**FY18**) 7. Improved accuracy, reproducibility and repeatability of FAA's Microscale Combustion Calorimeter (MCC). (**FY18**)	5. Conducted testing with known heat release fire sources in a 747 fuselage attic space to compare with results of CFD modelling of identical space using curvilinear meshing 6. Modeled FAA required heat release rate material test apparatus and compared model output to physical output. 7. Conducted experiments to measure and correct for the production of carbon dioxide in the calculation of heat release in the FAA developed MCC

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 Actuals	FY18 Contract Actuals	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Fire Research and Safety	$6,352	$2,481	$7,425	$3,251	$7,200	$2,926	$4,867	$1,680	-	-

People	Facilities	Partnerships	Highlights
• 24 GOV FTEs and 17 CTR 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	Challenges include • Lithium Batteries shipped as Cargo on Passenger Aircraft • Implementing standards to include risk mitigation • Shipment of lithium batteries on Freighter Aircraft • The use of non-traditional materials in aircraft construction, aircraft systems and cabin furnishings. • Composite aircraft structure • Newer magnesium alloys • Use of fuel cells powered by compressed hydrogen or hydrocarbons Will seek a better understanding of aircraft manufacturer's intentions for future materials and systems as well as other fire safety related emerging challenges for continued efficient planning in this Program

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 Outputs Delivered in FY18	Status
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. Enhanced capabilities report within the DARWIN design code to allow for the probabilistic damage tolerance analysis of cracks in other life limited parts such as turbine engine shafts and casings. (**FY18**) 2. Deliver DARWIN v9.3 having several significant enhancements including full support for the new titanium hard alpha advisory circulars AC 33.14-1 Change 1 and AC 33.70-3; scripting capability to enable efficient batch processing of large numbers of DARWIN analyses; and new visualization capabilities for internal regions of 3D finite element models. (**FY18**)	1. In FY18, new stress intensity factor (SIF) solutions for cracks in cylindrical geometries life limited parts such as hollow shafts and engine cases were developed by Southwest Research Institute. These solutions will be fully incorporated into DARWIN version 9.4 for release in FY19. 2. DARWIN version 9.3 is on schedule to be released September 2018.

Resources

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Propulsion and Fuel Systems	$2,034	$1,475	$2,074	$1,785	$2,100	$1,140	$555	$0	-	-

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

Resources

People	Facilities	Partnerships	Highlights
• 1 FTE	• FAA Aviation Fuel Research Lab • FAA Propulsion & airpOWer Engineering Research (POWER) Lab	• Rotor Integrity Steering Committee (RISC) and Rotor Manufacturing (RoMan) Sub-team • DARWIN Code Development Steering Committee consisting of 4 major US turbine engine OEMs. • FAA development of DARWIN is leveraging funds from NASA, DOD agencies, and engine OEMs. • Jet Engine Titanium Quality Committee (JETQC) • USAF AFRL on Sonic Infrared NDE Development, NDE for Residual Stress Profiling, and Cold Dwell Fatigue Research	• A DARWIN Workshop was conducted in March with more than 100 attendees from government agencies, engine and airframe manufacturers. An overview of DARWIN capabilities and in-depth, hands on training of the software were provided over three days. • Development of Probabilistic Damage Tolerance Design Code (DARWIN) for Critical Life Limited Components for turned surfaces and nickel alloys will occur in the next grant.

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 Outputs Delivered in FY18	Status
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.	**Composite Maintenance Practices**	1. Consensus from industry and regulators from around the world on standard substantiation methodology for repair certification and continued airworthiness. (**FY18**)	1. In FY18, multiple FAA-sponsored workshops and working group meetings were conducted and data was collected to benchmark existing industry practices for repair substantiation with participation from selected industry and regulatory experts around the world. Collected data will be used in prep for future work on AC 20-107C.
	Continued Operational Safety and Certification Efficiency for Emerging Composite Technologies	1. Effects of fire on structural failure analysis of composite procedures and methods investigative report. (**FY18**) 2. Ignition sources from lightning strike in composite structure characterization. (**FY18**) 3. Assessment and detection techniques. (**FY18**)	1. Preliminary mechanical and fire experiments on CFRP composite have been completed. On time for FY18 to complete Phase 1 coupon experiments, which will identify failure analysis evidence that will survive fire damage. Output will be used to update the Composite Failure Analysis Handbook and establish composite forensic procedures in post-crash fire scenarios. (ON SCHEDULE, ONGOING) 2. Based on the research findings to date, a draft round robin test procedure of color-based evaluation of the image to determine ignition thresholds was developed and under reviewed by the SAE and EUROCAE lightning Committees. Once the procedure is finalized and approved, a round robin test will be conducted. 3. Photographic detection of ignition sources was assessed based on the 200 µJ source from ARP 5416A and found that the ignition can be predicted by analyzing the hue histogram of the detected light emission source

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 Outputs Delivered in FY18	Status
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	**Transport Airplane Ditching**	1. Amount of acceptable airframe damage during ditching Determine most likely range of ditching conditions determination. (**FY18**) 2. Analytical tool applicability demonstration. (**FY18**)	1. A report addressing transport aircraft water mishap kinematics was published. The report included reconstruction of several aircraft accidents to determine aircraft ditching conditions. Results were presented/shared with ARAC on Aircraft Ditching and Crashworthiness. 2. A full-scale finite element model of a Boeing-737 size aircraft and aircraft fuselage section was completed. Initial results hard surface and water impact scenarios are being reviewed
	Damage Tolerance of Composite Structures	1. Effect of design variables (e.g., door cutouts and floor structures) to the extent and detectability of critical damage modes under High Energy, Wide Area, and Blunt Impact Study. (**FY18**) 2. Fracture Mechanics Test Methods for Sandwich Composites evaluation. (**FY18**) 3. Failure of Notched Laminates under Out-Of-Plane Bending. (**FY18**) 4. Damage Tolerance Testing and Analysis Protocols for Full-Scale Composite Airframe Structures under Repeated Loading. (**FY18**) 5. Moisture Diffusion in Sandwich Composites. (**FY18**)	1. Design and fabrication of quarter-barrel section type specimens including floor beams, stringers and frames are in progress 2. Project on track to develop fracture mechanics, damage tolerance, and residual strength tests for sandwich composites 3. Research explored these areas: (i) A sensitivity study for modeling progressive damage; (ii) An experimental investigation of edge-notched carbon fiber panels under mode III loading characterized the material response; and (iii) An investigation of the ability of different Abaqus approaches to model carbon fiber panels under mode III loading.

		6. Environmental Factor Influence on Composite Design and Certification (Sandwich Disbond). (**FY18**) 7. Damage Modes in Lightweight Sandwich Structures Using Analysis and Testing. (**FY18)**	4. A methodology to determine the fatigue life of composite structure subjected to variable amplitude fatigue (spectrum) loading was developed. The approach utilizes the residual strength degradation based on the Sendeckyj analysis of fatigue test data. Fatigue testing is being conducted to validate the proposed methodology 5. Project is on track to determine how moisture ingression contribute to the degradation of honeycomb sandwich composite structures during normal flight operations by FY19. Experiments are underway using an environmental chamber to simulate the ground-air-ground cycles 6. Project is on track to complete sandwich structural panel disbond growth model development and validation by FY 19. 7. Project is on track to advance fundamental knowledge of sandwich disbond

Advance 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 Outputs Delivered in FY18	Status
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	**Structural Integrity of Adhesive Joints**	1. Structural integrity data collection for composite and metal bonded structure that is representative of the design and processing variables used for aircraft structures currently in service. (**FY18**) 2. Industry process quality control procedures and their tests and analysis methods used for structural integrity that yield an assessment of the strengths and limitations Evaluation. (**FY18**) 3. Training and best industry practices to support guidelines for expanding applications and new rules, policies and guidance. (**FY18**)	1. Project is on track to advance fundamental knowledge of sandwich disbond 2. Literature review completed on process quality control procedures. Methods such as Fourier Transform Infrared Spectroscopy (FTIR) analysis and fluorescence microscopy was explored 3. This research supports the Workforce Education - a key initiative of the AVS Composite Strategic Plan. Based on student feedback, the FAA Composite Structural Engineering Technology (CSET) Safety Awareness and Composite Manufacturing Technology (CMfgT) Courses were updated in FY18. A major update is currently being developed to include new regulatory advances relating to composite and metal hybrid assemblies

Advance 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 Actuals	FY18 Contract Actuals	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Advanced Material's/Structural Safety	$7,409	$6,169	$6,500	$5,139	$10,500	$3,330	$2,300	$1,469	-	-

People	Facilities	Partnerships	Highlights
• 7 FTEs in various technical disciplines including engineering, analytics, material science, non-destructive evaluation, etc.	• FAA Aircraft Structural Test Evaluation and Research Lab (FASTER) • FAA Structures and Materials Lab (SML)	• 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 • International Govt: The European Aviation Safety Agency (EASA), Transport Canada Civil Aviation (TCCA)	• Updates to Composite Material Handbook – 17 (CMH-17) • FAA-sponsored workshops and working group meetings with participation from selected industry and regulatory experts around the world. • Research output is used to develop a draft AC outlining best practices approving modifications to composite structure. • Updated Workforce Education tutorials for the FAA Composite Structural Engineering Technology (CSET) Safety Awareness and Composite Manufacturing Technology (CMfgT) Courses • Research output is used to include specific guidance on bonded structure in Advisory Circular (AC) 65-33, "Development of Training/Qualification Programs for Composite Maintenance Technicians" • Chapter in Order 8900.1 "Flight Standards Information Management System" outlining Bonded Repair Size Limits • Drop test of Fokker F-28 fuselage section on a soft soil surface. • Drop test of a Fokker F-28 fuselage section with pitch and roll on an inclined soft soil surface. • Drop test of a Hawker 4000 composite aircraft on a hard surface.

Aircraft Icing (A11D.AI)

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

Outcome	Task Area	Research Outputs Delivered in FY18	Status
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 Super cooled Large Droplets (SLD) regulations	**SLD engineering tools development and validation**	1. Test and evaluation of liquid water and drop sizing instruments to determine their ability to accurately measure these quantities in SLD conditions. (**FY18**) 2. Ice accretion modeling, including SLD conditions. (**FY18**)	1. This is collaborative research with NASA, NRC (Canada), ECCC (Canada), CIRA (Italy) and others. Six tunnel entries have been completed with a total of 15 instruments tested thus far. 2. AIAA June 2018 Conference Paper: "Ice Accretion on a NACA 23012 Airfoil." This is an expanded version of an FAA report of the same title submitted to editorial department for publication. A FAA report focusing on 2D and 3D ice accretion modeling in SLD conditions is in preparation for submission of completed draft to editorial department in FY2018
	Research on Ice Crystal Icing Conditions to Support Means of Compliance	1. Drivers that cause internal engine ice accretions due To ice crystal icing conditions investigation report. (**FY18**)	1. AIAA June 2018 Conference Paper: "Development of a Small Multi-stage Modular Compressor for Ice Crystal Icing Research" on two stage rotating rig. Design, fabrication and assembly of stage one rig completed. CFD evaluation of second stage design. Aerodynamic testing of second stage alone
	Safe Operations and Take-off in Aircraft Ground Icing Conditions	1. Cold-Soaked Fuel Frost wind tunnel testing. (**FY18**) 2. Correlation of indoor test results with snow machine and outdoor test results in natural snow conditions technical report. (**FY18**)	1. Testing transferred to Baylor University. Requires use of new cold chamber for wind tunnel. Testing to start in first part of next fiscal year. 2. Technical paper completed and submitted for publication in refereed journal

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 Actuals	FY18 Contract Actuals	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Aircraft Icing		$2,165		$1,030		$3,505		$2,100	-	-

People	Facilities	Partnerships	Highlights
• 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)	• Swept Wing Icing Project (SWIP). Completed the 3rd low-Reynolds number aerodynamic test campaign at Wichita University's wind tunnel. The aerodynamic data collected from this 3-week campaign will provide a better understanding of Reynolds and Mach number effects on an iced swept-wing and an understanding of the geometric fidelity required for accurate aerodynamic simulation of swept-wing ice accretion. FY18 Published report - DOT/FAA/TC-17/22 "Effect of Ice Accretion on Full-Scale, Swept-Wing, Aerodynamic Performance and Control Effects." • SWIP: Outcomes of this research include new test methods and a 3-D ice accretion database to support validation of computer codes and means of compliance for certification. • Certification by analysis (CBA) has been a major focus of industry in recent years, including certification for aircraft icing. The FAA Icing Research Program has increased its in-house capability in computational fluid dynamics (CFD) partly in response to the emerging issue. This capability contributes to both SWIP and SLD engineering tools research and to direct support of FAA Certification with respect to use of CFD. • Two additional appendices to 14 CFR Part 25, Appendix O - for super cooled large drop (SLD) icing, mainly on aircraft surfaces, and Appendix D - for engine ice crystal icing (ICI) were enacted in 2015. Task Area - SLD engineering tools development and validation is responsive to compliance issues and engineering tools for Appendix O and Task Area - Research on Ice Crystal Icing Conditions to Support Means of Compliance is responsive to compliance issues and engineering tools for Appendix D.

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 Outputs Delivered in FY18	Status
Obtain insights into information security protection vulnerabilities of, and risks to, aircraft systems, components, networks, and interfaces	**Onboard Network Security and Integrity**	1. Technical report identifying the potential associated risks with ASISP access points or apertures. (**FY18**)	1. Released initial technical report on the cybersecurity risks associated with ACARs and Electronic Flight bags. Also released a Methodology based on system engineering and control theory to assess cyber risk associated with aircraft.
Recommendations and technical data to support the development of standards, policy, guidance, and training material for complex airborne hardware/software systems	**System Considerations for Complex Software Intensive Systems**	1. Effectiveness of Airplane Level Architectural Concepts. (**FY18**) 2. Generic Framework and Metrics for Assurance Processes. (**FY18**) 3. In-Service Reliability Program (ISRP) Supplement 1. (**FY18**)	1. Developed a set of tasks to evaluate the airplane level architecture concepts. Working with NASA and industry that can provide data to evaluate the airplane level architecture concepts 2. Prepared a final draft of the Understanding the Overarching Properties paper for review by the Overarching Properties Working Group. Developed a draft evaluation criteria document and will be incorporated with the results from a European case study on the criteria. 3. Developed ISRP flight test plans to install the specially designed hardware to test the Lead Free Solder alternatives and the exposure to Thermal Neutron Environment. Efforts are underway by the AVSI ISRP partners to review the integrated test plan that consolidates all the plans in to one Flight Test Unit (FTU) and qualify/certify/ manufacture 60 ISRP FTU in the next phase.

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 Actual	FY18 Contract Actuals	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Digital System Safety & ASISP		$1,144		$1,516		$2,885		$3,335	-	-

People	Facilities	Partnerships	Highlights
• SDS- 2 GOV FTE, 1 vacancy and partnerships from other organizations and contractors in Systems Engineering, Computer Engineering, and Computer Science disciplines	• Boeing 757 Aircraft	• NASA Langley • Aerospace Vehicles Systems Institute (AVSI	• Retired aircraft with active avionics onboard, used as a test bed for ASISP, in partnership with DHS • SDS-With the collaborative relationship between FAA and NASA Langley and with international consensus, we developed a set of Overarching Properties (alternate means of compliance). • SDS- NASA compliments with in-depth analysis and experience on similar training and challenges within the space program. • SDS- FAA actively works with AVSI a cooperative research entity that consists of several aerospace corporations and three government organizations and includes Airbus, BAE Systems, Boeing, European Aeronautic Defense and Space Company, Eurocopter and Military Airbus, Honeywell International, Inc., Lockheed Martin Aeronautics, Rockwell Collins, General Electric Aviation Digital Systems, Rolls Royce, United Technologies Corporation Aerospace Systems, DoD, and NASA.

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 Outputs Delivered in FY18	Status
ES- New and modified airplanes utilizing More Electric Airplane (MEA) concepts and technologies and certified	**ES- Fuel Cell Energy Supply Systems for Aerospace Applications**	1. Technical report documenting tests conducted to provide feasibility data of using fuel cell systems for aerospace applications while retaining or improving the current level of safety in commercial transport aircraft. (**FY18**) 2. Technical report identifying and quantifying the short and long term safety risks associated with fuel cell aerospace applications including a potential failure mode and effect. (**FY18**)	1. Preliminary data was submitted to the Energy Supply Device Aviation Rulemaking Committee (ARC) as part of the ARC final report which was submitted on Dec. 7,2018 2. A draft report failure mode and effects analysis (FMEA) on Proton-exchange membrane PEM fuel cell (PEMFC) systems for aircraft power applications has been submitted. The final report is on track to be submitted for sponsor review
	ES- Rechargeable Lithium Batteries and Battery Systems for Aircraft Applications	1. Feasibility of using non-flammable electrolytes for lithium battery systems for aerospace application while retaining or improving the current level of safety in commercial transport aircraft evaluation. (**FY18**) 2. Categorization of research data to determine feasibility of adding a requirement for thermal and lifecycle testing for lithium systems for aerospace application while retaining or improving the current level of safety in commercial transport aircraft. (**FY18**)	1. An interim report “Cell Development with Reduced Flammability Electrolyte” was provided to the sponsor Feb. 17, 2018 and update was provided on June 28, 2018 2. An interim report “Considerations for Electrical Storage System Fire Safety” was provided to the sponsor March 28, 2018
	ES- Novel and Unusual Electric Aircraft Systems	1. A Review of current standards , guidance and test methods for incorporating new and novel electrical technology into aircraft applications and its impact on aircraft electrical system architecture. (**FY18**)	1. This information was presented to the sponsors June 18, 2018 in a coordination meeting with internal FAA research groups for the more Electric Aircraft

FCMS - Significant reduction of CFIT and Loss of Control accidents in GA. Reduced accident rates due to loss of airplane state awareness (ASA) and loss-of-control (LOC)	**FCMS Tire Failure Characteristics**	1. Technical report detailing data collected from thrown tread tire tests and flailing strip. **(FY18)** 2. Tests of radial ply and bias ply tires analysis **(FY18)**	1. Reached an initial agreement with United States Air Force for an Interagency Agreement between the FAA and USAF (Wright-Patterson). Two entities cannot resolve their contract differences; therefore, agreement has yet to be signed. 2. FAA sponsor and management in Transport Standards Staff is regrouping and reevaluating requirement.
	FCMS Integrated Flight Path Control to Address GAJSC and FAA GA Safety Interventions	1. Identification of issues not mitigated by current safety assessment processes for integrated systems and their operational use. **(FY18)**	1. Successfully completed flight tests to demonstrate Angle of Attack (AOA) limiting systems on part 23 Aircraft. Research on this task is complete, technical data has been identified, and the final report was delivered to the FAA. This task is part of an ongoing larger research effort to reduce controlled flight into terrain (CFIT) and loss-of-control (LOC) accidents is GA aircraft
	FCMS- Transfer of UAS Technology for Enhancement of GA Safety	1. Technical Report identifying design and certification requirements for flight path control auto pilot technology in GA aircraft. (**FY18**)	1. Performed simulation evaluations of automated envelope protection features of flight control systems for Part 23 aircraft. Received report on certification requirements for flight path control autopilot technology for GA aircraft
RS- This program if successful will diminish bird strikes and fatalities by implementing procedures and/or improving the certification basis for new helicopters and/or revealing new technology to move birds away from rotorcraft flight paths	**RS-Continued Operational Safety of Rotorcraft**	1. Bird strike mitigation techniques that center on visual and/or audio cues that deter birds from approaching the rotorcraft technical report. (**FY18**) 2. Technical report analyzing pilot avoidance technologies/procedures that provide the pilot with knowledge of the birds in the aircraft vicinity and allow the pilot to alter the flight path as needed to avoid contact with the birds, e.g., radar or other similar technology. (**FY18**)	1. A prototype lighting system has been developed to deter birds from approaching the rotorcraft. Ground testing of the light was delayed in the spring of 2018 due to poor weather conditions at the test site. Testing is now scheduled for the fall of 2018 to coincide with bird migratory patterns. 2. An avian radar system has been developed that can detect birds and present their location to the pilot so they can avoid a collision. Ground testing of the system will commence this summer. At the conclusion of ground testing the avian radar will be installed on the FAA's S-76 for flight testing.

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

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

Resources

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Continued Airworthiness - Systems		$2,870		$3,346		$4,171		$1,560	-	-

People	Facilities	Partnerships	Highlights
• 5 FTEs in various technical disciplines including engineering, mathematics, material science, sensor technology, etc.	• FAA Air Fault Evaluation Lab/Electric 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.	• The FAA conducts unique aspects of aerospace electrical systems research in the ES lab using collaborative partners. The test capabilities at the WJHTC ES are unique and are designed so research can take place in a collaborative manner with the aviation partners in an environment that tests the safe installation of these new and unusual technologies while protecting the intellectual property of each organization. Safety results regarding the safety of implementing hybrid and electric prolusion (i.e. lithium batteries, nonflammable lithium electrolytes, fuel cells, advanced aircraft power protection and switching, carbon nanotubes wire,... etc.) into the more electric aircraft architecture can be shared while the intellectual property of each partner is protected .

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 Outputs Delivered in FY18	Status
Development of best practices for the successful application of bonded repairs to aged composite structure, Promote safe and efficient certification of Active Flutter Suppression (AFS) systems and Develop standardized acceptable design and certification compliance data and tools necessary to enable the FAA to operate in cost effective and efficient manner and provide a uniform level- for all certification agents	**Continued Airworthiness of Composite Structures**	1. Representative Sample of a documented bonded field repair with a service history. (**FY18**) 2. Technical report in support of mechanical characterization test articles by performing non-destructive evaluation and tear down of specimens. (**FY18**)	1. A set of aircraft structural components with both metallic and composite in-service bonded repairs were acquired to build a representative sample set of test articles for this research task. Documentation pertaining to service history of components and maintenance records of repairs were collected from OEMs, MROs, and airlines. 2. Detailed teardown inspections were conducted on the acquired test articles of in-service bonded repairs. Draft FAA Technical Report was delivered and currently being reviewed by the FAA performer
	Emerging Technology- Active Flutter Suppression	1. Obtain a physical model for wind-tunnel testing. (**FY18**) 2. Prepare mathematic model and initiate development of control laws. (**FY18**)	1. Completed- A physical model has been obtained. 2. A mathematic model is developed based on the acquired physical model. Control laws are being developed.
	Metallic Materials Properties Development and Standardization (MMPDS) Support and Design Values for Emerging Materials	1. Updated MMPDS Handbook and derivative products. (**FY18**)	1. Updated information to be included in MMPDS-13 and derivative products for public distribution

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 Outputs Delivered in FY18	Status
Develop data for policy and regulatory guidance materials that will support the certification and continued airworthiness of emerging metallic structures technologies (EMST). Ensure the safe and efficient implementation of new technologies in aircraft products by providing data on the basic characteristics of these new technologies.	**Damage Tolerance and Durability Issues for Emerging Technologies**	1. In partnership with Boeing, generate data to assess bonded repair technology to generic composite panel's representative of transport wing components using the FAA's Aircraft Beam Structural Test (ABST) facility. (**FY18**) 2. In partnership with ALCOA and Embraer, generate data to assess emerging metallic structures technology (EMST) for fuselage structures using the FAA's Full Scale Aircraft Structural Test and Evaluation Research (FASTER) fixture. (**FY18**) 3. Technical report Phase 1 efforts assessing Aluminum-Lithium for aircraft applications. (**FY18)** 4. Preliminary procedures and guidelines establishing design values for highly process-dependent emerging metallic-based materials including metal additive manufacturing. (**FY18**)	1. Completed initial baseline phase of testing using the ABST facility to characterize the mechanical and fatigue behavior of representative composite wing panels. Results presented at the 2018 AA&S Conference. 2. Initial phase of testing for the baseline panel using the FASTER facility was completed for a two-bay hoop crack with central stringer severed. Additional phases of testing are planned for the baseline panel considering other damage scenarios. Results from the baseline panel test will be used to compare with advanced panels with varying EMST to access damage tolerance performance. Intermediate results presented at the 2018 AA&S Conference 3. A four volume final report submitted summarizing initial phase of work focused on material characterization. Follow-on efforts to assess built-up structure are underway 4. Working with the Emerging Technology Working Group (ETWG) of the MMPDS, developed an approach for material equivalency testing.

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 Outputs Delivered in FY18	Status
Provide data on new metal additive manufacturing (AM) technologies to develop policy and regulatory guidance that will support their application on new products and potential use on legacy aircraft, as well as by aftermarket and MROs. Proactively identify potential hazardous condition and develop guidance on the certification of AM parts of various levels of criticality.	**Metal Additive Manufacturing (AM) for Airplane Structures**	1. AM Consortia Partnership. (**FY18**) 2. Methodology for creating special factors and generating design values. (**FY18**) 3. Technical Report in support of Powder Reuse for Static Strength Applications. (**FY18**)	1. Partnered with Kansas Aviation Research and Technology (KART) Consortium managed by National Institute for Aviation Research (NIAR) and Carnegie Mellon University's NextManufacturing Consortium to leverage resources and strategically address research topics 2. Draft report submitted by NIAR and under FAA review 3. Draft report submitted by NIAR and under FAA review
	Probabilistic Damage Tolerance Based Fleet Risk Management for Small Airplanes	1. Initiate gathering a database of distributions of random variables necessary for fatigue and damage tolerance analyses for small aircraft for safety management determination (**FY18**) 2. Initiate development of methods to quantify and assess the risk of fatigue-related concerns for general aviation fleet based on wide range of input data (**FY18**)	1. A database format has been selected and is being populated with available of random variables and their distributions 2. A database format has been selected and is being populated with available of random variables and their distributions

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 Actuals	FY18 Contract Actuals	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Continued Airworthiness -Structures		$2,441		$2,474		$2,792		$1,744	-	-

People	Facilities	Partnerships	Highlights
• 4 (3 filled and 1 open) 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 • FAA Airframe Beam Structural Test (ABST) fixture	• Industry: Boeing, Airbus, Arconic, Bombardier, Constellium, Embraer, Textron, Spirit Aerospace • Gov't: NASA, DoD, DHS • Consortia and SDOs: MMPDS, KART, AmericaMakes,	• By leveraging resources with industry and using FAA facilities (FASTER, SML and ABST), characterize and assess emerging metallic structures technologies (EMST) including additive manufacturing. Generate data to allow FAA regulators to proactively draft policy and guidance that will support their safe implementation in aircraft products. • Provide data to address certification and continued airworthiness issues arising from industry introduction of EMST including advanced materials, hybrids, additive manufacturing and new fabrication and construction methods. • Develop a state-of-the-art probabilistic fatigue management methodology and software for general aviation to reduce the risk and to support certification and rulemaking activities.

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 Outputs Delivered in FY18	Status
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. Updated guidelines for metal impact to support development of tabulated failure models. (**FY18**) 2. High rate testing with DIC and IR cameras to improve the material data for Aluminum, Titanium, Inconel and Composites Report. (**FY18**) 3. Technical report addressing Australian Transportation Safety Board recommendation on the Airbus A-380 uncontained engine failure by incorporating any lessons learned from this accident into revision of the FAA Large Engine Uncontained Engine Debris analysis Report. (**FY18**)	1. Work is continuing on Metal Impact tabulated material models. Significant improvement has been made refining the material models and working to streamline the tabulation process. Revised material models for Aluminum, Titanium and Inconel are being worked with new test data. Two reports were presented at the 2018 LSDYNA Users conference and one FAA report is in review. 2. High Rate testing with DIC and IR cameras has proven to be essential to the tabulated input. In 2018 many of the test cases have been repeated and the new data is being incorporated into the model. A new failure test series called backed small punch was approved and provides three additional points on the failure surface. One paper on this work was presented at the 2018 LSDYNA Users Conference. 3. Draft report has been delivered to sponsor and we are waiting for comments and approval to publish.

Aircraft Catastrophic Failure Prevention Research (A11F) - *Continued*

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

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Actuals	FY18 Contract Actuals	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	$1,070	$0	$0	-	-

People	Facilities	Partnerships	Highlights
• Two FTEs	• 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	• This program began in FY2013 with a planned 4 phased effort. As of today, this Program is in Phase 3 and FY19 will begin the final phase of this program- developing guidance for aircraft certification by analysis. • Accomplishments within Program has produced 5 PhD's, 18 Masters students and 30 refereed journal papers • Since 1996, the Program has published 63 FAA reports related to uncontained engine failure, fuselage shielding and engine containment modeling. • Tabulated test data has been compiled for multiple materials: Aluminum 2024, Titanium 6-4, Inconel 718 and testing is underway on T800/F3900 composite panels • LS- DYNA users currently have the following material models in their toolbox as a direct result of the research conducted within this BLI: ○ MAT_214-MAT_DRY FABRIC ○ MAT_224- Von Mises ○ MAT_224- Generalized Yield ○ MAT-_264- Tabulated Anisotropic Metal ○ MAT_213-Beta Version- Generalized Orthotropic Model

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 Outputs Delivered in FY18	Status
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, and CVS), Head Up Displays (HUD), Helmet Mounted Displays (HMD): Certification and Operational Approval Criteria**	1. Quantified contribution of HUD to pilot performance on approaches where HUD is used, but not required, to transition to landing analysis Report. (**FY18**) 2. Human factors and crew coordination aspects of dual HUD CAT III Evaluation to include whether active monitoring improves crew performance over a baseline condition. (**FY18**)	1. 2.
	Avionics & New Technologies – Certification and Operational Approval Criteria	1. Recommendations to identify and document FAA human factors policies, guidance and other related research on a variety of flight deck systems (e.g., EFB/PED, Global Positioning System, and electronic map displays) in one document for use by Aircraft Certification personnel who are responsible for conducting human factors evaluations for certification of flight deck equipment. (**FY18**)	1.

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 Actuals	FY18 Contract Actuals	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Flight deck/Maintenance/System Integration Human Factors	$5,000	$949	$7,305	$3,453	$7,305	$0	$5,052	$2,706	-	-

People	Facilities	Partnerships	Highlights
• 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	• 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)

Anticipation of system-wide operational risks, Additional data-driven approaches, Lower accident rate due to loss-of-control, Fewer runway excursions and Improved helicopter safety, Support Risk-Based Decision Making for oversight of the Air Traffic Organization

Outcome	Task Area	Research Outputs Delivered in FY18	Status
Enhance use of Risk-Based Decision Making in Oversight of the Air Traffic Organization	**Safety Oversight Management System (SOMS)**	1. Technical report detailing user requirements and concept of operations and for the SOMS prototype. (**FY18**) 2. SOMS Methodology Report. (**FY18**)	1. Initial report delivered. 2. Final report will be delivered in September 2018.
	Integrated Domain Safety Risk Evaluation Tool (ID-SRET)	1. NAS critical system architecture information and associated safety data integration model. (**FY18**) 2. Evaluating Safety Risk Management Documents and NAS change impact to support AOV's surveillance activities guidance. (**FY18**) 3. Separation-Minima Related System Model. (**FY18**)	1. NAS critical systems and associated SRMDs were modeled. This task was completed 2. The systems associated changes and Safety Risk Management Documents (SRMDs) have been evaluated, and ATC procedures associated changes and SRMDs are under on-going evaluation 3. Model is in development and will be completed by September 30, 2018
	General Aviation Airman Certification Standards (ACS)/Practical Test Standards (PTS) for Maneuvers Training Research	1. Review of current maneuvers training for understanding and preventing Loss of Control conditions. (**FY18**)	1. Preliminary work was completed. This is a new FY18 research project, which could not be initiated during the CR. A grant with General Aviation Center of Excellence,

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

Anticipation of system-wide operational risks, Additional data-driven approaches, Lower accident rate due to loss-of-control, Fewer runway excursions and Improved helicopter safety, Support Risk-Based Decision Making for oversight of the Air Traffic Organization

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Actuals	FY18 Contract Actuals	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
System Safety Management		$801		$2,314		$1,928		$0	-	-

People	Facilities	Partnerships	Highlights
• 23.5 GOV FTE; 98.25 CTR FTEs in various technical disciplines including engineering, computer science, statistics, safety and risk management	• Computing and Analytics Shared Services Environment (CASSIE) • FAA Flight Program's helicopter located at WJHTC	• NASA • United States Helicopter Safety Team (USHST) • HAI • Bell • Five-Alpha • LZ Control • TruthData • Skytrac • Appareo • Outerlink • FAA's WJHTC Flight Program	• Delivered a Technical Report titled "Identification of Air Traffic Procedures for Modeling in the Integrated Domain - Safety Risk Evaluation Tool (ID-SRET)" December, 2017 • Delivered a Technical Report titled "Integrating Air Traffic Control Procedures Into Integrated Domain – Safety Risk Evaluation Tool (ID-SRET)" March, 2018. • Delivered a Technical Report titled "Safety Oversight Management Tool (SOMS) Concept of Operations and Model Update" February 2018). • Delivered a Technical Report titled "Initial Technical Report on Safety Oversight Management Tool (SOMS) Methodology" (March 2018). • Organized and conducted outreach efforts for Rotorcraft HFDM research for ASIAS/H-SE #82 on Helicopter Flight Data Monitoring at two HFDM Seminars (Titusville, FL – Nov. 2017, Philadelphia, PA – Dec. 2017). • Released a new version of Helicopter Flight Data Monitoring (HFDM) prototype available at https://hfdm-asias.rotor.com

Terminal Area Safety – TAS (A11H)

Anticipation of system-wide operational risks, Additional data-driven approaches, Lower accident rate due to loss-of-control, Fewer runway excursions and Improved helicopter safety, Support Risk-Based Decision Making for oversight of the Air Traffic Organization

Outcome	Task Area	Research Outputs Delivered in FY18	Status
Reduce "potentially hazardous outcome reports" from go-arounds by a factor of 5 and Reduced runway excursions on wet runway	**Improving Go Round Safety**	1. Survey of go-around safety literature. (**FY18**) 2. Novel technology solutions for go-around safety and assessment and evaluation. (**FY18**)	1. Conducted and moderated a workshop entitled Stabilized Approach and Go-Around Safety at Aviation Safety InfoShare meeting in Baltimore, MD on March 22. Reviewing feedback received during the workshop. Participating in ASIAS/Mitre go-around safety Working Group meetings to learn about safety issues surrounding go-arounds. 2. Developed a Statement of Work (SOW) for a BAA Announcement and posted over FAA's contracts website on March 30, 2018. Received white papers are being reviewed.

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

Anticipation of system-wide operational risks, Additional data-driven approaches, Lower accident rate due to loss-of-control, Fewer runway excursions and Improved helicopter safety, Support Risk-Based Decision Making for oversight of the Air Traffic Organization

Resources

Program Area	FY16 Total Actuals	FY16 Contract Actuals	FY17 Total Actuals	FY17 Contract Actuals	FY18 Actuals	FY18 Contract Actuals	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Terminal Area Safety		$2,256		$1,526		$778		$0	-	-

People	Facilities	Partnerships	Highlights
• 2.5 Gov FTEs and 3 CTR FTE in various technical disciplines including engineering, computer science, statistics, safety and risk management, etc.	• WJHTC Labs (i.e., NextGen Integration and Evaluation Capability) • Mike Monroney Aeronautical Center (MMAC) Flight Operations Simulation Lab • NASA Ames Boeing 747 Level D simulator	• NASA • United States Helicopter Safety Team (USHST) • Sikorsky • Leonardo • Airbus Helicopters • U.S. Coast Guard • NJ State Police • FAA Flight Program • MaxVis • Thales • Elbit Systems • Rockwell Collins • Honeywell • CMC • Kerr Avionics	• Conducted and moderated a workshop entitled Stabilized Approach and Go-Around Safety at Aviation Safety InfoShare meeting in Baltimore, MD on March 22. The semi-annual meeting allows aviation safety professionals from industry, government, and academia to share their safety concerns and best practices in a protected environment. • In collaboration with NASA Langley Research Center and Flight Operations Simulation Branch (AFS-440), System Safety Section (ANG-E272) research team completed a human-in-the-loop simulation experiment evaluating the effectiveness of angle-of-attack (AOA) displays for transport category airplanes. Dr. Campbell of ANG-E272 presented preliminary results at the AIAA Aviation forum during the week of June 25th, 2018. • In collaboration with NASA Ames and with support from AFS-440, System Safety Section (ANG-E272) research team completed a human-in-the-loop simulation experiment to develop universal and simplified missed approach criteria with the goal of improving go-around compliance and reducing the risk of approach and landing accidents. Dr. Campbell of ANG-E272

		• Hensoldt • LifeFlight of Maine • Rega Swiss Air Ambulance	presented preliminary results at the AIAA Aviation forum during the week of June 25th, 2018. • Integrated and flight tested Advanced Vision Systems Devices onto the FAA's Helicopter (N38) for Thales' TopMax Head-Worn Display (HWD), Elbit Systems' SkyLens/SkyVis (HWD/HMD), and MaxVis' 1500/2300 Enhanced Vision System (EVS). • Conducted flight tests with the FAA's S76 Helicopter, NJ State Police, and U.S. Coast Guard. • Presented the results of the research activities for Vision Systems and ASIAS at the 2018 HAI Heli-Expo held in Las Vegas, NV, TX on Feb. 27-Mar. 1, 2018. Heli-Expo is the premier annual gathering of helicopter industry, manufacturers, government officials, and associated vendors.

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 Outputs Delivered in FY18	Status
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.	**Human Protection & Survival**	1. ATD CONSTRUCTION HARMONIZATION PHASE I (#10086). Technical Reports. 2. PHOTOLUMINESCENT FLOOR PROXIMITY ESCAPE PATH MARKING SYSTEMS - AERF/B-747 (#10071). Technical Report.	1. Progressing as scheduled. 2. On 5/22/2018 the PI was changed to M. Beben, due to K. Larcher retirement (July 2018). Also, to accommodate workload and AIR's priorities, delivery date of the IRB protocol was changed from 1Q19 to 4Q19 and for the report from 1Q20 to 4Q20.
	Aeromedical Accident Prevention & Investigation	1. DESIGNER DRUGS. Forensic Toxicology Laboratory Methodology and Technical Report (#10006). 2. ANALYTICAL METHOD DEVELOPMENT FOR TETRAHYDROCANNABINOL (THC) AND ASSOCIATED ANALOGS (#10014). Biochemistry Laboratory Methodology and Technical Report. 3. INCAPACITATING CONDITIONS – STROKE (#10024). Technical Report.	1. Progressing as scheduled 2. Progressing as scheduled 3. Progressing as scheduled

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 Outputs Delivered in FY18	Status
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.	**Aerospace Medical Systems Analysis**	1. TRUTH IN REPORTING (#10039). Abstract and Technical Report. 2. MAPS OF IONIZING RADIATION IN THE ATMOSPHERE (#10054). Software and its Documentation. (**FY18**) 3. REVIEW OF MEDICAL TRANSPORT BY HELICOPTER (#10057). Abstract and Technical Report.	1. The project entitled Assessment of Accident Rates in Class Three Pilots was replaced with this Truth in Reporting project due to illness of the original PI. Review fatal and high-profile accidents to determine the reporting accuracy of airmen medical certification applications and provide insight on possible corrective measures. Results of CAMI toxicology testing will be compared to medications and other substances, such as marijuana, reported in the DIWS to determine the accuracy/truthfulness of information reported on pilot FAA physical examinations. Abstract is due 4Q18 (on track) and Technical Report is due 4Q19. PI is now Dr. DeJohn. 2. Software completed: Copeland K, Keller F, Davidson M. MIRA 2017 with utility programs and scripts. Technical Report completed; undergoing FAA Clearance Review: K Copeland. MIRA 2017: A CARI-7 Based Solar Radiation Alert System 3. Progressing as scheduled
New safety equipment/technology that can be retrofitted onto legacy rotorcraft to decrease fatalities.	**Occupant Protection for Legacy Rotorcraft**	1. (#10087) Technical Reports.	1. SOW completed, undergoing processing at Contracts (AAQ).

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 Actuals	FY18 Contract Actuals	FY19 Request	FY19 Contract Request	FY20 Target	FY20 Contract Target
Aeromedical Research	$8,467	$2,902	$8,538	$3,032	$9,080	$2,435	$3,875	$632	-	-

People	Facilities	Partnerships	Highlights
• 56 In-House at the Civil Aerospace Medical Institute (CAMI): 48 GOV FTE; 8 CTR FTE • Physicians, Scientists, and Engineers: Associate (19%); Baccalaureate (71%), Master (49%), and Doctorate (27%). • Disciplines: Medicine, Human Factors, Cabin Safety, Genomics, Bioinformatics, Biodynamics, Radiobiology, Physiology, Physics, Chemistry, Toxicology, Mathematics, Computer Science, and Knowledge Management.	• > 20 at CAMI	• 40 National: OK Medical Research Foundation, Naval Medical Research Unit-D, USAFSAM, Wichita State U., Walter Reed Army Inst. of Research, SW Research Institute, Medical College of Wisconsin, U. Michigan Transp. Research Institute, Cleveland Clinic Foundation • 40 International: Airbus; Bahamas CAA; European Aviation Safety Agency; German Aerosp. Center; Intl. Cabin Safety Res. Tech. Gp.; ICAO; Natl. U. of Colombia; Republic of Korea Radio Research Agency; Royal Canadian AF; SAE International; Czech Technical U.; Università degli Studi di Udine, Italy.	• AM tasks approved by AM TCRG and Federal Air Surgeon • RS tasks sponsored by AIR

Unmanned Aircraft Systems Research (A11L)

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

Outcome	Task Area	Research Outputs Delivered in FY18	Status
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.	**SAA Multi Sensor Surveillance Data Fusion Strategies**	1. RTCA Phase One MOPS Sample Tracker in support of Sensor Fusion Trade-Off Study. (**FY18**) 2. A11L.UAS.2-FY17: DAA Multi-Sensor Surveillance Data Fusion Strategies – Phase 5 Report. (**FY18**)	1. Final Report documenting simulation support provided to M&S subgroup in validating surveillance performance standards was delivered. 2. Phase 5 report delivered in Jan 2018
	UAS Command and Control Link Compatibility	1. L-Band CNPC and TACAN Compatibility Validation. (**FY18**)	1. L-Band research funding secured. Contract scheduled to begin in September
	ASSURE Center of Excellence (COE) Management Budget	1. Oversight of ASSURE Administration. (**FY18**)	1. Grant request submitted to fund UAS COE administration through January 2019. Cost share will be provided at 100% of the FAA award

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 Actuals	FY18 Contract Actuals	FY19 Target	FY19 Contract Target	FY20 Target	FY20 Contract Target
Unmanned Aircraft Systems Research	$17,635	$13,660	$20,035	$11,021	$24,035	$1,367	$3,318	$2,454	-	-

People	Facilities	Partnerships	Highlights
• 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.	• ASSURE Airborne Collision Severity Report was briefed to Congress. The briefing was also followed by a media event and a public release of the report. • The final report for the UAS Detect and Avoid (DAA) Beyond Visual Line of Sight (BVLOS) was published. This program evaluated BVLOS operations survey of DAA criteria, survey of existing DAA technologies, assessment of risks, and flight testing.