FY19 AVS RE&D Program Area View

Subcommittee on Aircraft Safety Spring Meeting FY17

AVS RE&D Funding Summary

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Fire Research and Safety (A11A)	$6,550	$2,715	$6,352	$2,481	$7,925	$4,000	-	$3,000	-	$3,000
Propulsion and Fuel Systems (A11B)	$2,000	$1,185	$2,034	$1,475	$2,574	$1,800	-	$1,200	-	$1,100
Advanced Material's/Structural Safety (A11C)	$2,809	$1,905	$7,409	$6,169	$4,113	$3,150	-	$3,305	-	$3,359
Aircraft Icing /Digital System Safety	$5,664	$3,579	$5,450	$3,309	$5,102	$3,175	-	$7,238	-	$6,358
Digital System Safety & ASISP (A11D.SDS)	$2,548	$1,697	$3,122	$1,144		$1,575	-	$4,740	-	$3,023
Aircraft Icing (A11D.A1)	$3,117	$1,882	$2,328	$2,165		$1,600	-	$2,498	-	$3,335
Continued Airworthiness (A11E)	$9,205	$4,663	$8,810	$5,308	$10,269	$7,375	-	$8,180	-	$10,721
Continued Airworthiness - Systems		$1,163		$2,870		$4,783	-	$6,000	-	$5,871
Continued Airworthiness - Structures		$3,500		$2,439		$2,592	-	$2,180	-	$4,850
Aircraft Catastrophic Failure Pre. Res. (A11F)	$1,500	$1,109	$1,433	$1,020	$1,528	$1,200	-	$1,200	-	$900
Flight deck/Maintenance/Sys Integration Human Factors (A11G)	$6,000	$979	$5,000	$941	$8,513	$4,353	-	$3,530	-	$3,706
System Safety Management (A11H)	$7,770	$5,070	$5,939	$3,058	$7,000	$2,438	-	$1,725	-	$3,633
Terminal Area Safety		$2,534		$2,256		$2,000		$0		$2,534
System Safety Management		$2,536		$801		$2,738		$1,725	-	$2,536
Aeromedical Research (A11J)	$8,300	$2,887	$8,467	$2,902	$9,538	$2,601	-	$2,107	-	$4,282
Unmanned Aircraft Systems Research (A11L)	$14,974	$11,826	$17,635	$12,121	$8,422	$6,850	-	$7,347	-	$2,454
	$64,772	$35,919	$68,528	$38,785	$64,984	$39,242	-	**$38,827**	-	$39,512

Alternative Fuels for General Aviation (A11M)	$6,000	$5,534	$7,000	$6,183	$5,792	$4,770	-	$6,080	-	TBD
Weather (A11K)	-	$3,500	-	$3,500	-	$3,500	-	$3,500	-	$3,500

FY19 AVS RE&D Program Area View

Subcommittee on Aircraft Safety Spring Meeting FY17

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Fire Research and Safety (A11A)

This research enables 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 FY19
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. Integrated airplane fire protection system using FY18 criteria development , development of performance standards for high energy storage and finalizing new fire test method for measuring the heat release rate of interior materials a. Provide technical report documenting the test results and presentation of the results at the International Aircraft Systems Fire Protection Working Group meetings 2. Assess 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 3. Develop criteria and test methodologies for detection of fires inside unit load devices

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Fire Research and Safety	$6,550	$2,715	$6,352	$2,481	$7,925	$4,000	-	$3,000	-	$3,000

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Fire Research and Safety (ALLA)- *Continued*

This research enables 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

People	Facilities	Partnerships	Highlights
• 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	• Challenges include o Lithium Batteries shipped as Cargo on Passenger Aircraft o Implementing standards to include risk mitigation o Shipment of lithium batteries on Freighter Aircraft o 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 is needed for continued efficient planning in this Program

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Propulsion and Fuel Systems (ALLB)

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 FY19
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. Develop practical methods and tools to address inherent anomalies in conventional cast and wrought nickel-based super alloys

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Propulsion and Fuel Systems	$2,000	$1,185	$2,034	$1,475	$2,574	$1,800	-	$1,200	-	$1,100

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 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	• Challenges involving development of Probabilistic Damage Tolerance Design Code (DARWIN) for Critical Life Limited Components that implement zoned, stress intensity factor mechanics-based solutions for blade slots and turned surfaces for advisory circulars and fleet assessments are occurring within this Program

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Advanced Materials / Structural Study (ALLC)

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 FY19
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. Identify Composite Aging Mechanisms that Span a Time that Exceeds Practical Maintenance Programs and provide documentation of agreed standards, regulation basis and industry guidelines for compliance as well as gaining consensus from industry and regulatory agencies. 2. Related regulation basis & industry guidelines for compliance a. Determine whether repeated loads, accidental damage, manufacturing defects and environmental issues and other aging phenomena are properly covered by current composite fatigue and damage tolerance structural substantiation approaches 3. Composite Fatigue and Damage Tolerance for Transport Aircraft and documentation of agreed standards, regulation basis and industry guidelines for compliance as well as gaining consensus from industry and regulatory agencies a. Identify and demonstrate fatigue & damage tolerance structural substantiation protocol for transport airframe structures with different levels of manufacturing defects b. Perform analysis and supporting tests to bound the worst case scenarios and parameters (e.g., vehicle speed, mass, stiffness, angle of incident, impacting geometry) for high-energy, wide-area, blunt impact (HEWABI) from vehicle collisions (i.e., most significant structural damage with minimal visual exterior indications). c. Identify laminated skin panel design parameters (e.g., lay-up, thickness, stiffening element stiffness), analysis parameters (strain softening, delamination growth) and other variables (e.g., notch location) important to notched bending and twisting strength predictions as related to pressure released through large penetrations, combined with other fuselage loading considerations d. Update the course modules, which outline the regulatory expectations, guidance and engineering practices for composite fatigue and damage tolerance in a structural safety awareness course, which was previously created in this requirement 4. Composite Fatigue & Damage Tolerance for High Cycle Applications Aircraft and documentation of agreed standards, regulation basis and industry guidelines for compliance as well as gaining consensus from industry and regulatory agencies a. Evaluate the onset, growth and arrestment of delamination for composite rotorcraft dynamic parts. Document suitable fatigue and damage tolerance test and analysis protocol, which can be used for reliable structural substantiation.

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 FY19
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**	5. Composite Fatigue & Damage Tolerance for High Cycle Applications and documentation of agreed standards, regulation basis and industry guidelines for compliance as well as gaining consensus from industry and regulatory agencies a. Investigate high energy impact threats with the greatest potential to damage dynamic rotorcraft components and document related test protocol suitable for structural evaluation 6. Critical Defects & Damage Threats for Emerging Composite Technology and provide documentation of agreed standards, regulation basis and industry guidelines for compliance as well as gaining consensus from industry and regulatory agencies a. Assess and document the performance and identify characteristic differences in fatigue and damage tolerance of new materials and advanced processes, including Resin Transfer Molding (RTM), Vacuum-Assisted Resin Transfer Molding (VARTM), Ceramic Matrix Composites (CMC) and thermoplastics. Provide reference information to be used in structural substantiation and aircraft certification plans b. Perform preliminary analyses and tests to determine whether the interlaminar stresses that dominate the performance of lap shear joints with 100% load transfer through discontinuous plies can meet the performance expectations of longitudinal splices for pressurized fuselage skin panel joints without considering real-time effects for repeated load and environmental durability.
	Crashworthiness Issues Unique to Composite Materials	1. Investigate Unique Reactions of Composite Structures in Crash Events- Gain consensus from industry and regulators on crashworthiness rules and guidance materials a. Complete studies and document results from analytical trade studies for composite airframe structures and the associated building block tests for specimens and structural elements & subcomponents for a range of strain rates important to composite crashworthiness

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 FY19
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	**Crashworthiness Issues Unique to Composite Materials**	1. Investigate Unique Reactions of Composite Structures in Crash Events- Gain consensus from industry and regulators on crashworthiness rules and guidance materials b. Document round robin analyses and tests on composite energy absorption, which are performed with industry, in the CMH-17 Volume 3 Chapter on composite crashworthiness c. Benchmark industry practices used in analyses and tests to substantiate crashworthiness for Transport Fuselage with composite and hybrid composite/metal construction that have recently met existing regulations and special conditions in anticipation of the new rules and related guidance needs expected in this area d. Perform research to develop the basis for a course module that outlines the regulatory expectations, guidance, and engineering practices for composite airframe crashworthiness issues in a safety awareness course e. Document the relevant research findings from a combined assessment of Performance Metrics A through D to provide the detailed background needed for new composite transport crashworthiness rules and guidance development f. Assess and document the performance and identify characteristic differences in crashworthiness performance of new materials and advanced processes, including Vacuum-Assisted Resin Transfer Molding (VARTM), and Fiber Metal Laminates g. Evaluate analyses and supporting tests to demonstrate how structural details can be tested at element and subcomponent levels to gain the necessary analytical calibration that includes competing composite failure modes and all significant contributions to the structural performance, which includes progressive damage accumulation and energy absorption, to facilitate subsequent overall structural crashworthiness substantiation.
	Composite Maintenance Practices	1. Identify key process parameters and characteristics that can be controlled or solutions that can be achieved by advancing technology and updating policy, guidance, standards and training a. Establish Composite Repair Design and Evaluation Criteria for COS

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 FY19
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**	i. Evaluate the variability in structural performance of bolted repairs as related to human factors such as the level of experience (as related to formal and on-the-job training) and the issues related to specific design and processing details. Document the guidelines and quality control procedures that demonstrate high levels of reliability. b. Establish information critical to composite repair material and process control, including specification requirements and reliable test standards i. Continue to study the source of bonded repair strength reductions associated with surface moisture exposure and drying for representative materials, processes and designs (past WSU tests). c. Establish training courses for Workforce Education and develop related content to address COS and Certification Efficiency for composite maintenance i. Work with industry in developing a composite repair structural substantiation training course to support safe maintenance for composite transport airplanes, small airplanes and rotorcraft in the field ii. Document controlled studies that demonstrate the problems with using unqualified materials and processes for bonded repairs. Also evaluate the problems that can arise in applying reversed engineering practices to composite bonded repairs d. Evaluate maintenance practices for new composite technologies and facilitate related technology transfer i. Assess and document the performance and identify characteristic differences in repair of new materials and advanced processes, including Resin Transfer Molding (RTM), thermoplastics and Ceramic Matrix Composites (CMC).
	Structural Integrity of Adhesive Joints	1. Substantiation of Bonded Structures for Aircraft a. Work with industry to establish environmental durability test standards for composite bonded joints and document related guidance and final report that defines a durability test standard for bonded structure AC

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 FY19
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**	b. Study the design and manufacturing details of pressurized fuselage and thick transport wing & empennage structures with bonded stiffening attachments, to ensure sufficient process control, certification test and analysis protocol and provide final report c. Evaluate the available methods to determine load and life enhancement factors that adequately cover bonded joint structural reliability demonstrations in practical tests and provide final report. d. Document load and life enhancement factor approach for bonded joints e. Update course module that outlines the regulatory expectations, guidance, design, process control, testing, and other structural engineering practices for composite bonding in a safety awareness course (CSET). 2. Evaluation of Composite Material and Process Conditions that Affect Structural Bonding a. Investigate the effect of processing parameters (moisture exposure and extended cure times) that can cause peel ply to leave a residue on the bonding surface, and the subsequent effect on bond strength and durability and provide final report b. Investigate environmental conditions present during bonding that cause amine blush, its effect on bond strength and durability, and suitable standards that will avoid it. Provide final report. c. Evaluate the advanced material and process combinations pursued by industry for expanding applications. In the past, new adhesives and bond surface preparations considered for structural applications were found to have a strong dependence on the specific composite substrate used in bonding and provide final report. d. Evaluate enhancements to traditional process steps used for bond surface preparations, as they are achieved and implemented by industry and provide final report. e. Develop a subscale test article suitable for evaluating adhesive joints and provide final report.
	Continued Operational Safety and Certification Efficiency for Emerging Composite Technologies	1. Investigate the effects of fire on composite failure analysis procedures and methods and Provide final report documenting testing and results 2. Characterize ignition sources from hot particle ejection in composite structure, develop appropriate detection techniques and provide a final report and a test method for detection

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	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Advanced Material's/Structural Safety	$2,809	$1,905	$7,409	$6,169	$4,113	$3,150	-	$3,305	-	$3,359

People	Facilities	Partnerships	Highlights
• 7 FTEs in various technical disciplines including engineering, analytics, material science, non-destructive evaluation, etc	• FAA 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	• Composite Material Handbook – 17 (CMH-17) updates include additional volumes for covering new material systems

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Aircraft Icing (A11D.AI)

This research enhances the understanding of aircraft icing and develops new engineering tools for certification and operation in icing conditions.

Outcome	Task Area	Research Output Anticipated for FY19
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	**Safe Operations and Take-off in Aircraft Ground Icing Conditions**	1. Artificial Snow Generation System- Report on algorithm relating indoor and outdoor results for snow and it use in endurance time testing 2. Aerodynamic Issues- wind tunnel testing, characterization of CSFF based on cold chamber testing, and CFD study of flow-off of anti-icing fluids Report 3. Operational Issues- Reports on findings from investigations of selected technical and operational issues
	SLD engineering tools development and validation	1. Identify additional priority research needed to support improved SLD MOC. Conduct tests and analyze results a. Complete collection efficiency tests and analyze results Identify additional priority research needed to support improved SLD MOC b. Develop research plans for SLD swept wing ice shape testing. Use existing models and research test strategies from the SWIP project and conduct testing to develop a SLD database c. Conduct experiments and analysis to support improving CFD models that incorporate large drop dynamics from impact through ice accretion and growth d. Identify FZRA test methods and empirical means to support improvements in the freezing rain MOC

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Aircraft Icing	$3,117	$1,882	$2,328	$2,165		$1,600	-	$2,498	-	$3,335

Aircraft Icing (A11D.AI) - *Continued*

This research enhances the understanding of aircraft icing and develops new engineering tools for certification and operation in icing conditions.

Resources

People	Facilities	Partnerships	Highlights
• 8 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, i	• 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. o Development and validation of means of compliance through testing and analysis for these appendices is a major challenge for industry and the FAA. • 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 capability in computational fluid dynamics (CFD) partly in response to the emerging issue. o This enhanced capability is proving valuable in the swept wing icing project (SWIP); o The research will provide new test methods and a 3-D ice accretion database to support validation of computer codes and means of compliance for certification. o It will also play an important role in the development of engineering tools for SLD conditions.

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 FY19
Obtain insights into information security protection vulnerabilities of, and risks to, aircraft systems, components, networks, and interfaces	**Onboard Network Security and Integrity (Aircraft Systems Information Security Protection)**	1. Define, identify, and assess vulnerabilities and risks associated with wired and wireless aircraft systems interfaces that could affect aircraft safety a. extend beyond risk assessments and to explore how AVS can utilize a systems based approach to determine the best policies and regulations which will reduce the specific ASISP risks being analyzed b. explore an AVS ASISP Safety Risk management process and integrate all of the components developed in phase I & II with all available resources 2. Identify and recommend mitigations for the vulnerabilities and risks found from Task 1 a. extend beyond risk assessments and to explore how AVS can utilize a systems based approach to determine the best policies and regulations which will reduce the specific ASISP risks being analyzed b. explore an AVS ASISP Safety Risk management process and integrate all of the components developed in phase I & II with all available resources 3. Identify and recommend strategies associated with Tasks 1 and 2 for aircraft certification, maintenance, and continued operational safety a. extend beyond risk assessments and to explore how AVS can utilize a systems based approach to determine the best policies and regulations which will reduce the specific ASISP risks being analyzed b. explore an AVS ASISP Safety Risk management process and integrate all of the components developed in phase I & II with all available resources
	Development Assurance Techniques for System Elements)	1. Generic Framework and Metrics for Assurance- explore software and airborne electronic hardware certification streamlining techniques to potentially reduce the certification burden on industry while at the same time not reduce the level of safety 2. Use of Model Checking and Formal Methods Property Abstraction- explore the use model checking to support software and AEH verification

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

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

Outcome	Task Area	Research Output Anticipated for FY19
Obtain insights into information security protection vulnerabilities of, and risks to, aircraft systems, components, networks, and interfaces	**Development Assurance Techniques for System Elements**	3. Automatic Generation of Hardware Description Language Code (HDL). Study the automatic generation of HDL and tools, identify the development assurance issues, and propose objective based guidance to address these issues 4. COTS Assurance Method follow-on. Explore the latest COTS devices not considered under the previous Aerospace Vehicle Systems Institute, COTS assurance research

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Digital System Safety & ASISP	$2,548	$1,697	$3,122	$1,144		$1,575	-	$4,740	-	$3,023

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

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

Resources

People	Facilities	Partnerships	Highlights
• 8 FTEs in various technical disciplines including engineering, analytics, computer science, etc	• 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 • Collaborative relationship between FAA and NASA Langley to develop educational material and technical data for Aviation Safety Engineers training on Assurance Case application to DO-178C Standards. • FAA provides analysis and expertise on the issues and challenges the FAA certification aviation safety engineers experience in the application of assurance cases to DO-178C standards. • NASA compliments with in-depth analysis and experience on similar training and challenges within the space program. • FAA/AVSI cooperative consists of cooperative consists of eleven 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, and (DoD) Defense Standardization Program Office (DSPO), (NASA), and Jet Propulsion Laboratory. • FAA provides analysis and expertise on certification safety related issues of software, hardware and systems, while AVSI complements with in-depth analysis of identified subjects

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Continued Airworthiness – Systems (A11E.SYS)

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

Outcome	Task Area	Research Output Anticipated for FY19
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. Provide report that identifies acceptable test methods to quantify acceptable more electric power of various technologies such as power sources for all electric and Hybrids aircrafts 2. Provide report that identifies possible sources of energy and specific applications for current and proposed aircraft systems and sub-systems. Develop test plans for various applications
	Integrated Flight Path Control to Address GAJSC/FAA GA Safety Interventions	1. Development of specific technology interventions using flight path control to address the root causes and deficiencies a. Simple autopilots, beginning with two axis autopilots, progressing to basic envelope protection, and eventually implementing full flight path management concepts. b. 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
	Low Energy Alerting and Awareness Systems	1. Evaluate Initial Simulator Study Results. Analyze data from initial simulator study to determine validity of approach and evaluate systems for their capability to improve awareness of low energy states and provide report 2. Select Systems for Further Evaluation: Based on assessment of initial simulator evaluation, select up to three top performing systems for additional evaluation and provide report 3. Develop follow-on simulator evaluation experiment. Develop a simulator test plan to evaluate candidate systems select in Task V for potential failure modes and ranking of functions for effectiveness and provide report
	Displays and Alerting for Airplane Systems State Awareness	1. Analyze Initial Simulator Results. Conduct evaluation and analysis of initial simulator sessions of suitable candidate systems and functions and provide report of initial simulator study findings 2. Second simulator session evaluation. Conduct a follow-on simulator evaluation based on the results of the first evaluation
	Transfer of UAS 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. Identify potential platform for installation and test of safety enhancement in simulation and flight test to proof technology implementation proposals 3. Work with equipment OEM and FAA SMEs to design an experiment to demonstrate technology 4. Execute technology demonstration

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

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

Outcome	Task Area	Research Output Anticipated for FY19
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. Research study to determine what research has already been accomplished and document findings a. Find potential venders that make safety equipment to mitigate wire strikes (i.e. Wire cutters and avionics that can detect and instruct the pilot on how to avoid wires) and learn how they mitigate wire strike b. Determine if any new safety equipment has been developed since the requirement was submitted 2. Testing wire cutters in differing scenarios and possible active cutters for low inertia and light rotorcraft and document findings a. Testing Avionics solutions to wire avoidance and any new safety equipment discovered 3. Literature review & Market survey 4. Develop research plan 5. Conduct tests
	Rotorcraft high mount side floats for ditching stability.	1. Initial review of previous research and a design study to address hydrodynamic, buoyancy and structural aspects of the high side mount float modifications, aerodynamic and systems design aspects, issues relating to passenger egress and survival, and consequences for the aircraft's weight and costs provide report to include findings of the following: a. The amount of additional buoyancy required, taking account of buoyancy already present in the upper part of the fuselage and engine area, possible mounting locations, and the helicopter's required floating attitude and draught b. How best to provide additional buoyancy, taking account of weight, costs, aerodynamic drag, effects on stability and control, the consequences of inadvertent deployment, and the consequences of flotation unit failure c. Flotation system loads, methods of attachment, mountings of existing flotation units, and modifications to the float activation and deployment system. d. Whether life-rafts can be deployed satisfactorily in the normal upright and side floating attitudes e. Any additional measures, such as foot/ hand holds within the helicopter cabin, that will be necessary for efficient egress when side-floating f. Effects of uneven loading, when side-floating, on the release of seat harness buckles 2. Determine specific design specifications of the high mounted floats that contain temperatures from engines, interaction with blades, emergency exits clear, aerodynamics impact, inadvertent deployment, compatibility with other equipment, fixation and loads on the structure, location of the deployment bottles, access to the upper deck, fairings opening and retro-fit

Continued Airworthiness Systems (A11E.SYS) - Continued

This research enhances the decision making processes & addressing safety risks related to aircraft systems

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Continued Airworthiness - Systems	-	$1,163		$2,870		$4,783	-	$6,000	-	$5,871

People	Facilities	Partnerships	Highlights
• 4 FTEs, (3 in various engineering disciplines & 1 mathematician)	• 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.

Outcome	Task Area	Research Output Anticipated for FY19
Efficient certification of Active Flutter Suppression (AFS) systems and Promote standardized acceptable design and certification compliance data and tools necessary to enable the FAA to operate in cost effective and efficient manner, while providing a level-playing field and uniform standards for all certification agents	**Continued Airworthiness of Composite Aircraft**	1. Perform literature review, Establish industry partners, Obtain candidate specimens
	Emerging Technology – Active Flutter Suppression	1. Execute Near-Term Tasks of the AFS Plan to answer the following: a. Collect all data for the current X56A program including models, and ground and flight test data. Develop or use existing control laws to determine appropriate margins of safety and Perform uncertainty and sensitivity analyses
	MMPDS Support and Design Values for Emerging Materials	Development of the 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
	Damage Tolerance and Durability Issues for Emerging Technologies	1. Bonded Repair Technology analysis a. Cost-Share Cooperative Research and Development Agreement (CRDA) with Boeing – identify roles and responsibilities b. Beam Box Test Fixture preliminary Design concepts and requirements c. Beam Box Test Fixture Design and fabrication d. Development of Test Plan e. Conduct Test and Analysis
	Metal Additive Manufacturing for Aircraft, Engine, and Propeller Applications	1. Partner with AM Consortia a. Characterize Ti-6Al-4V direct energy deposition and additional material/technology system(s) using empirical approach b. Define statistical methods for generating static strength generic and point design values c. Assess the use of special factors in conjunction with design values 2. Provide report summarizing the experimental procedure and methodology defined for developing special factors and design values for static strength properties of AM parts

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

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

Outcome	Task Area	Research Output Anticipated for FY19
Efficient certification of Active Flutter Suppression (AFS) systems and Promote standardized acceptable design and certification compliance data and tools necessary to enable the FAA to operate in cost effective and efficient manner, while providing a level-playing field and uniform standards for all certification agents	**Metal Additive Manufacturing for Aircraft, Engine, and Propeller Applications**	3. Powder Reuse for Static Strength Applications Perform chemical and spread ability analysis of powder after each use, Build specimens with reused powder, perform NDI, conduct tests and Compare the data to specimens tested, collect unused powder and repeat
	Ag/SEAT Airframe Usage and Operational Loads Monitoring	1. Record the operational loads and process the data utilizing Digital Flight Data Recorders (DFDR) installed on Agricultural (Ag) and Single-Engine Air Tanker (SEAT) aircrafts so as to address the risk associated with the cracks commonly found in primary structures of these airplanes: a. Continue collecting flight load data and analyze it on wired airplanes and find additional operators who are willing to install the data acquisition system, DFDR, on their airplanes to address the effect of different operators on flight loads and Install instrumentation on empennage and aft fuselage.
	Effect of Turbulence on Aircraft Structural Loading	1. Identify the requirement measurement and data collection devices 2. Identify operators who are willing to have their airplanes instrumented and explore the possibility of using the FAA's R&D aircraft and purchase the data collection devices 3. Begin study on empirical and semi-analytical models that can be used in correlating the EDR values to flight load/stress (milestone)
	Probabilistic Damage Tolerance Based Fleet Risk Management for Small Airplanes	1. Software improvements to improve computer run time for large numbers of simulations improve characterizations of random variables and add fleet risk management tools. a. Incorporate built-in K solutions for a defined set of NASGRO scenarios, incorporate improved mission profile definitions, Improve definitions of random variables to allow 3-dimensional characterizations and incorporate fleet management risk analysis. 2. Develop database for characteristics of random variables used in fatigue and damage tolerance analysis to include edge margin, fracture toughness, crack growth rate, equivalent initial flaw size and hole quality
	Development of Control Surface and Stabilizer Freeplay Limits	1. Establish a consortium with other stakeholders to establish a comprehensive research plan. This will include the selection of candidate configurations, designs, and aero elastic models. Initiate gathering the existing non-linear aero elastic models and initiate performing finite element analysis (FEA) and computational fluid dynamic (CFD) analysis

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

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

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Continued Airworthiness -Structures	-	$3,500		$2,439		$2,592	-	$2,180	-	$4,850

People	Facilities	Partnerships	Highlights
• 12 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)	• Processing Emerging Issues o Being Proactive to keep pace with industry advances through partnerships to obtain data o Lack of standards and public specifications for emerging materials o Data and specifications for emerging materials held proprietary by industry o Difficulties establishing partnerships with OEMs as FAA is primarily viewed as regulating body

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 FY19
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. Advanced Analysis Methods for Impact of Composite Aircraft Materials in Rotor Burst and Blade Release" a. LSDYNA Metal Failure Analysis: maintain the codes and correct issues identified by users b. LSDYNA Composite Failure Analysis: Second generation composite failure models is expected to be developed and under verification. Both testing and analysis are expected to be required for composites in this phase. c. Rotor burst Vulnerability Analysis: maintain the codes and correct issues identified by users. d. Open Rotor Engine Designs: Work will continue with industry, NASA and NAWC to improve shielding modeling design practices, weight assessment and installation.

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Aircraft Catastrophic Failure Prevention Research	$1,500	$1,109	$1,433	$1,020	$1,528	$1,200	-	$1,200	-	$900

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

People	Facilities	Partnerships	Highlights
• Two 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	• 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 6 PhD's, 17 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 T80/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: o MAT_214-MAT_DRY FABRIC o MAT_224- Von Mises o MAT_224- Generalized Yield o MAT-_264- Tabulated Anisotropic Metal o MAT_213-Beta Version- Generalized Orthotropic Model • This program initiated the LS-DYNA Aerospace Working Group in 2003, which now has two sub groups working on certification by analysis.

FY19 AVS RE&D Program Area View

Subcommittee on Aircraft Safety Spring Meeting FY17

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 FY19
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	**Avionics and New Technologies**	1. Pilot distraction a. Conduct human-in-the-loop research to investigate the effects of display compellingness on pilot actions and perform analysis 2. Information Automation Safety Reports a. Develop research plan to address key human factors issues identified in safety reports. 3. Charting symbology a. Design experimental research plan and Conduct symbol comparison study with pilots and perform analysis 4. General Guidance document annual update a. Human Factors Considerations in the Design and Evaluation of Flight Deck Displays and Controls – a comprehensive, one-stop reference for human factors issues and guidance. i. Incorporate information from the new RTCA SC-233 standard Addressing Human Factors/Pilot Interface Issues for Avionics as well as any issues identified from safety reports.
	Advanced Vision Systems (EFVS, EVS, SVS, CVS), Head-Up Displays (HUD), and Head Mounted Displays (HMD): Operational Standards & Approval Criteria	1. Analyze and characterize data collected from pilot-in-the-loop simulations 2. Based on pilot performance data collected, produce a report that addresses the following a. Differences in pilot performance by display type and location (SVS HDD & SVS HUD), operational concept (SA CAT I, SA CAT II), decision height, visibility, Experimental conditions compared to baseline operations, Approach and landing performance, Human factors/pilot performance issues and considerations associated with conducting SVS operations on SA CAT I and SA CAT II approaches, Recommended operating conditions, limitations, and mitigations, Recommended minimum training, recent fight experience, and proficiency requirements for SVS operations conducted on SA CAT I approach procedures 3. Combined Vision Systems (CVS) Research – Identify potential pilot performance and operational impacts associated with using CVS in low visibility operations 4. Head up Display (HUD) Research -- Operational standards and approval criteria for specific HUD operations 5. Head Mounted Display (HMD) Research -- Operational standards and approval criteria for specific HMD operations. Identify potential pilot performance and operational impacts associated with using HMD in place of HUD in low visibility operations and operations using advanced vision systems

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 FY19
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	**Fatigue Mitigation in Flight Operations**	1. Conduct analyses of the FRMP databases on day to day operational fatigue to evaluate the effectiveness of fatigue mitigation outcomes both before and after implementation of the new rule 2. Provide continuous data tracking and analyses of the two databases for effective fatigue mitigation
	Maintenance Human Factors to Support Risk-Based Decision Making (RBDM) and Maintenance Safety Culture	1. Experimental Implementation and Evaluation- propose and experimentally test solutions to underpin guidance materials in support of advancements in the research topic areas. The implementation and evaluation phase will include both small and large scale implementations, depending on what is most appropriate for the research question a. Provide report that details the evaluation results. The evaluation will assess such measures as use ability, reliability, correlation of users inputs, and the overall validity of the process. 2. SMS-Human Factors Integration: Provide report of the experiences of organizations that tried to incorporate human factors data into their SMS 3. GA Maintenance Error: Provide a report on how the classification taxonomy not only helped to categorize human factors maintenance errors but also helped to identify corrective actions/interventions 4. R&D Impact: Provide a report that summarizes a variety of impact measures resulting from R&D products and recommendations.

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Flight deck/Maintenance/System Integration Human Factors	$6,000	$979	$5,000	$941	$8,513	$4,353	-	$3,530	-	$3,706

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

People	Facilities	Partnerships	Highlights
• 16 FTEs: 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	• Research on HMD applications for civil aviation will study the human factors aspects for certification and approval of such display-system technologies. Specifically, this research will identify the pilot interface and usability aspects of head-up and head-mounted display technologies, with special attention to synthetic-vision applications. Baseline reference will be to certified head-down synthetic-vision systems. The goal is to identify criteria for evaluating the equipment, which are not presently contained in applicable regulations that address proper function, intuitive use, and potential hazards. • Determine and develop information/measures/data criteria for on-going evaluation of the effectiveness of both Fatigue Risk Management Plan (FRMP) and Fatigue Risk Management Systems (FRMS) OpSpecs (A317 and A318) to mitigate flight crew member fatigue and for the evaluation of improvements offered by the new regulation. Develop data to support recommendations for updating fatigue mitigation guidance and educational materials. • There are multiple complementary phases to support effective risk-based decision making in maintenance. These phases span the evaluations of safety culture in maintenance, operationalizing risk-based decision making, and methods for improving collection and use of voluntary data. • Evaluate the effects of CDTI/airport moving map display compellingness on pilot attention, alerting, field of view, and workload.

FY19 AVS RE&D Program Area View

Subcommittee on Aircraft Safety Spring Meeting FY17

System Safety Management (A11H.SSM)

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 Output Anticipated for FY19
Enhance use of Risk-Based Decision Making in Oversight of the Air Traffic Organization	**Safety Oversight Management System (SOMS)**	1. Develop SOMS Prototype 2. Transfer SOMS Prototype for implementation
	Integrated Domain Safety Risk Evaluation Tool (ID-SRET)	1. Develop ID-SRET Prototype 2. Transfer ID-SRET Prototype for implementation
	NAS Asset Metadata System (NAMS)	1. Develop NAMS Model

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
System Safety Management		$2,536		$801		$2,738		$1,725		$2,536

People	Facilities	Partnerships	Highlights
• 7 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	• Include, but not limited to: NASA, Volpe, Mitre, MIT LL, MMAC	• Aligns with the Big Data effort and improved system-wide analysis capabilities.

FY19 AVS RE&D Program Area View

Subcommittee on Aircraft Safety Spring Meeting FY17

Terminal Area Safety (A11H.TAS)

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

Reduce "potentially hazardous outcome reports" from go-arounds by a factor of 5 and Reduced runway excursions on wet runway	**Improving Go Around Safety**	1. Develop training and technology improvements through award of two broad agency announcements for contracted assistance to accomplish project plan - one for training improvements and one for technology improvements a. Provide report that details the evaluation results. The evaluation will assess such measures as use ability, reliability, correlation of uses inputs, and the overall validity of the process.
	Wet Runway Wheel Braking Testing	1. Develop study team with manufacturers and air carriers a. Determine consensus of manufacturers and regulators on flight tests for wet runway performance

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Terminal Area Safety		$2,534		$2,256		$2,000		$0		$2,534

People	Facilities	Partnerships	Highlights
• 4 FTEs in various engineering disciplines	• WJHTC Labs (i.e., NextGen Integration and Evaluation Capability) and MMAC Flight Operations Simulation Lab	• NASA	• Challenge: access to data could be a challenge due to privacy issues. • Challenge: finding an avenue to conduct the flight tests as well as collect proprietary data for research use only given that the agency is reviewed primarily as regulatory body.

FY19 AVS RE&D Program Area View

Subcommittee on Aircraft Safety Spring Meeting FY17

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 FY19
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. DETERMINE CRITERIA FOR MEDICAL CERTIFICATION OF AIRMEN WITH Chronic Obstructive Pulmonary Disease (COPD): IRB approved Research Protocol 2. ASSESS ATRIAL FIBRILLATION (AFIB) COMBINED WITH STROKE RELATIVE TO AIRCRAFT ACCIDENT CAUSATION: Abstract and Technical Report 3. Support accident investigation processes and develop strategies to mitigate aeromedical risks by conducting aeromedical reviews of all fatal accidents: Aeromedical Accident Investigation Reports 4. Assessment of the impact of commercial space transportation (e.g., suborbital flight) including the effects of ionizing and non-ionizing radiation on living systems: Enhanced Solar Alert System Software 5. Enhancement & maintenance of comprehensive integrated aeromedical research databases and software tools: Epidemiological Reviews, Probabilistic Risk Analyses Reports, and 5 databases (a) Medical Analysis and Autopsy Tracking System (MANTRA), (b) In-Flight Incapacitation Registry, (c) Aerospace Accident – Injury and Autopsy Data System (AA-IADS), (d) Aeromedical Data Visualization Operational Reporting Safety System (ADVISORSS); and (e) Aerospace Medical Research Scientific Information System (SIS). 6. Evaluate trends in human factors, clinical, and forensic findings from accidents and incidents: Datasets, Consults, and White Papers. 7. Develop world-wide Aviation Medical Examiners (AMEs), Residents in Aerospace Medicine (RAMs), Accident Investigators, Students, Scientists, Air/Cabin Crew, Flight Inspectors, and other Aviation Specialists: Didactic Materials, Internships & Mentorship Programs, Workshops, Case Reports, and Scientific Abstracts.
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. DETECTION OF ANTIPSYCHOTIC MEDICATIONS: Forensic Tox. Lab. Method & Technical Report 2. ASSESSMENT OF FEMALE PILOT MEDICATIONS: Technical Report 3. GENE EXPRESSION- MODAFINIL AS COUNTERMEASURE TO SLEEP DEPRIV: Technical Report 4. COMPARISON ACROSS MULTIPLE TYPES OF SLEEP DEPRIVATION: Technical Report 5. Develop advanced toxicological and biochemistry methods to detect and analyze human biological samples for emerging drugs and other substances that may impact pilot performance: Forensic Toxicology Reports, QA/QC Laboratory Methods, and two Toxicology SW Systems 6. Develop gene expression (biomarker) methodologies to detect and quantify impairment from alcohol, drugs, fatigue, hypoxia, pathology, and/or other aeromedical stressors: Molecular Biology Laboratory Methods. 7. Serve as an advisory resource in the areas of forensic toxicology, genomics, and biochemistry: White Papers, Data Sets, Affidavits/Court Testimony, and Proficiency Testing Program

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 FY19
Enhance human protection and survival from stressful environments and emergency events	**CAMI Human Protection & Survival (AM-3)**	1. DETERMINE CRITERIA FOR MEDICAL CERTIFICATION OF OF AIRMEN WITH CHRONIC ANEMIA: IRB approved Research Protocal and Technical Report 2. ENHANCE PASSENGER EVACUATION FROM ALTERNATIVE HORIZONTAL CABIN CONFIGURATIONS: IRB approved Research Protocol and Technical Report 3. Develop designs, certification test methods, and criteria to ensure occupant survival at maximum airframe impact tolerance; validate mathematical models to simulate, facilitate, and improve such methods: Engineering Certification Criteria and Testing Standards, Advisory/Regulatory Language, Simulation and Modeling Tools, Predictive Safety Algorithms, and Risk Analysis Models 4. 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 5. Serve as an advisory resource in in areas relating to biodynamics, altitude/environmental/acceleration physiology, and cabin safety issues: Cabin Safety and Biodynamics Engineering Workshops, Leading in Committees developing standards (SAE, IEEE, ISO), White Papers, and Data Sets.
Formulate risk management strategies that maximize human survivability from rotorcraft accidents.	**System Level Crashworthiness (F&CS-4)**	1. SYSTEM LEVEL CRASHWORTHINESS INJURY CRITERIA AND CERTIFICATION METHODOLOGY. Development of data for the formulation of a performance based crashworthiness/injury criteria: Methodology, Technical Report, and Advisory/Regulatory Language
Enhance aircraft safety equipment to decrease fatalities in rotorcraft operations.	**Occupant Protection - Rotorcraft (RS-1)**	1. OCCUPANT PROTECTION FOR LEGACY ROTORCRAFT. Development of new safety equipment/ technology that can be retrofitted onto legacy rotorcraft: Technical Report and Advisory/Regulatory Language
Improve human safety assessments and mitigation strategies for rotorcraft operations.	**Occupant Protection - Rotorcraft (RS-1)**	1. ROTORCRAFT INJURY MECHANISM ANALYSIS – PROCEDURE DEVELOPMENT AND VALIDATION. Development of procedures to gather and organize crash and injury information from rotorcraft accidents, create methods of using the data to identify causes of the injuries and potential mitigation strategies, and identify gaps in accident data collected to improve human safety assessments: Analytical Procedure and Technical Report

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	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Aeromedical Research	$8,300	$2,887	$8,467	$2,902	$9,538	$2,601	-	$2,107	-	$4,282

People	Facilities	Partnerships	Highlights
• 50 GOV FTE • Physicians, Scientists, and Engineers: (>51% with advanced degrees). 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 (Grants) o AM-2, Task 4 o RS o FCS	• > 40 National o US Navy o University of Central Oklahoma o Flight Attendants Medical Research Institute o University of Wisconsin o SW Research Institute • > 40 International o National University of Colombia o University of Italy - Udine o Iberoamerican Association of Aerospace Medicine o Royal Canadian Air Force o University of Australia	• FY19 increased funding for Sleep Deprivation (AM-2 Task 4) • AM tasks approved by AM TCRG and Federal Air Surgeon • FCS and RS tasks sponsored by AIR • All CAMI laboratory facilities and technical expertise are part of the total BLI budget request

FY19 AVS RE&D Program Area View

Subcommittee on Aircraft Safety Spring Meeting FY17

Unmanned Aircraft Systems Research (A11L)

This research provides data to enhance the decision making process related to the safe, efficient, and timely integration of UAS into the NAS.

Outcome	Task Area	Research Output Anticipated for FY19
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 Human Factors Control Station Design Standards**	1. Develop minimum requirements and best practices to ensure that UAS Control Stations are held to appropriate minimum standards to ensure their safe integration into the NAS. a. Development of literature review to outline current state of research supporting UAS Control Station Standards/Guidelines and planned follow-on work in this study to expand, refine and validate the results of the prior work. 2. Evaluate potential safety and workload issues with the CS environment, develop appropriate minimum requirements and best practices to ensure that UAS CS (e.g. the buildings, trailers, ships, onboard other aircraft, and outdoors) are safe for pilots and crew and also enable the safe and efficient operation of the UAS a. Development of literature review to outline current state of research supporting UAS Control Station Ergonomics, Safety, and Security and planned follow-on work in this study to expand, refine and validate the results of the prior work. 3. Develop recommended UAS crewmember procedures and operational requirements Development of literature review to outline current state of research supporting UAS crewmember procedures and operational requirements and planned follow-on work in this study to expand, refine and validate the results of the prior work.
	High Visual Contrast for UAS	1. Development of literature review to outline current state of research supporting UAS visibility requirements and planned follow-on work in this study to expand, refine and validate the results of the prior work

Unmanned Aircraft Systems Research (A11L) - *Continued*

This research provides data to enhance the decision making process related to the safe, efficient, and timely integration of UAS into the NAS.

Outcome	Task Area	Research Output Anticipated for FY19
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. Review current state-of-the-art of Unmanned Aircraft FDM (UFDM), explore safety benefits from UFDM, and explore the associated list of parameters, exceedances, and recording rates.
	Air Carrier Operational Considerations for Unmanned Aircraft Systems	1. Develop a literature review on the required crew and staffing for operating UAS in various kinds of operations, Identification of required knowledge, skill and tests for operating UAS in various kinds of operations, and a review on duty and rest requirements. This review would include operations outside of the current Part 107. Provide report that describes gaps in regulations, standards and guidance
	Minimum Detect and Avoid (DAA) Display and Flight Path Information	1. Research how ACAS-XU fits into UAS Detect and Avoid capabilities and provide technical report detailing results of experiment and implication for supporting use of ACAS-XU with UAS Detect and Avoid
	UAS Automation/Autonomy	1. Development of literature review to outline current state of research supporting UAS Human-Automation Interaction requirements and planned follow-on work in this study to expand, refine and validate the results of the prior work

Unmanned Aircraft Systems Research (A11L) – Continued

This research provides data to enhance the decision making process related to the safe, efficient, and timely integration of UAS into the NAS.

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Unmanned Aircraft Systems Research	$14,974	$11,826	$17,635	$12,121	$8,422	$6,850	-	$7,347	-	$2,454

People	Facilities	Partnerships	Highlights
• 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 – NextGen Integration and Evaluation Capability (NIEC) lab • 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.	• The FAA and the UAS community face unique operational challenges to safe integration into the NAS that are quite different from those associated with manned aviation. • Keeping research in pace with the rapidly evolving UAS trends is challenging • New levels of autonomy and new automation applications require research to determine the potential impact of the automation and potential ways to design the user interface for the pilot

FY19 AVS RE&D Program Area View

Subcommittee on Aircraft Safety Spring Meeting FY17

Weather (A11K)

Perform applied research to minimize the impact of weather on the NAS.

Outcome	Task Area	Research Output Anticipated for FY19
Improve the operations of aircraft in environments conducive to thunderstorm activity, Promote safer terminal area operations by providing highly resolved, accurate diagnoses and forecasts of icing conditions to allow flight planning, release, alternate planning of aircraft consistent with the new icing regulations certification basis and Reduce accidents and incidents due to icing, severe convective events, lightning, hail, volcanic ash, and clear air turbulence.	**Mitigating the Ice Crystal Weather Threat to Aircraft Turbine Engines**	1. Follow-on ice crystal icing field campaign a. Conduct additional campaign in a non-pristine environment
	Terminal Area Icing Weather Information for NextGen	1. Determine spatial and temporal variability of precipitation at the ground within the terminal area. a. Report on spatial and temporal variability of precipitation freezing rain and freezing drizzle at the ground using closely-located ASOS sites 2. Assess current capabilities of Numerical Weather Prediction (NWP) models to meet TAIWIN needs, and develop and test new methods to address identified shortcomings. a. Report on development of a cloud fraction scheme that takes into account sub-grid cloud formation. A number of candidate schemes will be evaluated in comparison to observations from NexRad radar and satellite and utilizing Large Eddy Simulations (LES) b. Transfer improved assimilation method to the HRRR group at NOAA, ESRL for evaluation in their test version of the model c. Report describing improvement of the aerosol emission scheme and methodology to account for sub-grid nucleation (cloud formation) scavenging of aerosols due to turbulence 3. TAIWIN/IFI Flight Campaign Planning. a. Archive of processed and analyzed data from campaign
	Validation of Advanced Airborne Weather Hazards Detection	1. Performance Validation of (i) Advanced Airborne Radar Severe Convective Events Detection; and (ii) Airborne Lidar a. Assess the performance of current Lidar techniques and validate the performance assessments with flight and/or ground test measurements and provide report

Weather (A11K) - *Continued*

Perform applied research to minimize the impact of weather on the NAS

Outcome	Task Area	Research Output Anticipated for FY19
Improve the operations of aircraft in environments conducive to thunderstorm activity, Promote safer terminal area operations by providing highly resolved, accurate diagnoses and forecasts of icing conditions to allow flight planning, release, alternate planning of aircraft consistent with the new icing regulations certification basis and Reduce accidents and incidents due to icing, severe convective events, lightning, hail, volcanic ash, and clear air turbulence.	**Validation of Advanced Airborne Weather Hazards Detection**	2. Performance Validation of (i) Advanced Airborne Radar Volcanic Ash Detection; and (ii) Airborne Lidar a. Assess the performance of current Lidar techniques and validate the performance assessments with flight and/or ground test measurements
	Weather Reporting Requirements and Dissemination for Helicopter Emergency Medical Services (HEMS) and Unmanned Aerial Systems (UAS) for off-Airport Operations	1. Shortfall Analysis (also Opportunity Analysis) to enumerate the shortfalls in aviation WX information for HEMS and UAS with stakeholder input and meetings 2. An analysis to determine and formally specify weather requirements for HEMS and UAS operations, and how best to collect and disseminate the information 3. A document conceptually proposing and evolving mitigation strategies for meeting these requirements 4. Cost/Benefit Analysis of the proposed mitigation strategies; for example, how could HEMS accident/fatality stats be reduced

FY19 AVS RE&D Program Area View

Subcommittee on Aircraft Safety Spring Meeting FY17

Weather (A11K) – Continued

Perform applied research to minimize the impact of weather on the NAS

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Weather	-	$3,500	-	$3,500	-	$3,500	-	$3,500	-	$3,500

People	Facilities	Partnerships	Highlights
• AVS-sponsored research. Two of the initiatives managed by ANG-E28/6DB staff •FAA Meteorologists, physical scientists, human factors experts, and operational weather SMEs	• William J Hughes Technical Center (WJHTC) including weather specific support from the Aviation Weather Demonstration and Evaluation (AWDE) Services lab • National Weather Service Aviation Weather Testbed	• NASA Glenn Research Center • Transport Canada • National Research Council (NRC) of Canada • Environment and Climate Change Canada (ECCC) • Australian Bureau of Meteorology • National Weather Service • FFRDCs including National Center for Atmospheric Research, MIT Lincoln Laboratory, NOAA Earth System Research Laboratory • Private Industry including commercial airlines • Ice Crystal work includes Australia BOM, MeteoFrance, KNMI (Royal Netherlands Meteorological Institute), Airbus, and Boeing	• Terminal Area Icing Weather Information for NextGen (TAIWIN) –In FY19, the plan is to conduct TAIWIN/IFI flight campaign. Then the researchers will process and analyze data from flight campaign and utilize data for improvement of Numerical Weather Prediction models and other methods. • High Ice Water Content (HIWC)) - The plan is to conduct additional campaign in a non-pristine environment.

FY19 AVS RE&D Program Area View

Subcommittee on Aircraft Safety Spring Meeting FY17

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 FY19
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.

Resources

Program Area	FY15 Total Actuals	FY15 Contract Actuals	FY16 Total Actuals	FY16 Contract Actuals	FY17 Policy Request	FY17 Contract Request	FY18 Policy	FY18 Contract Target	FY19 Policy	FY19 Contract Target
Alternative Fuels for General Aviation	$6,000	$5,534	$7,000	$6,183	$5,792	$4,770	-	$6,080	-	TBD

Alternative Fuels for General Aviation (A11M) – *Continued*

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

Resources

People	Facilities	Partnerships	Highlights
• 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 • NTextron, CMI, Lycoming, Cirrus, Robinson, Rotax, • Cape Air, National Resources Canada Partnership to Enhance General Aviation Safety, Accessibility and Sustainability (PEGASAS) Center of Excellence	• Plan to address out of scope aircraft and engines is unknown at this time • Working within the agency to scope and secure funding for the next phase of research.