Federal Aviation Administration

AVS Research, Engineering and Development

AVS RE&D Portfolio:

BLI - Fire Safety (A11A)

Research Plan: 2022- 2027

January 26, 2022

Part 1: BLI Definition and Scope

Program Area: Fire Research and Safety (A11A)

FAA Domain: Aircraft Safety Assurance

BLI Scope: Fire Research and Safety

The Fire Research and Safety program focuses on the prevention of accidents caused by in-flight fires and improvement of survivability during post-crash fires. The catastrophic consequences of an uncontrollable fire — large loss of life and the destruction of the aircraft — make this program essential. Research in this program is conducted to understand the fire safety implications of new technologies and materials introduced by the aviation industry in order to decrease aircraft weight and increase operating efficiency.

This research is used to develop effective mitigation procedures and update existing regulations, which often do not address the unique behavior of these new technologies. Research is also conducted to better understand and mitigate the threat of lithium battery cargo fires. These fires continue to cause concern due to the increasing number, sizes, and energy densities of batteries being shipped, and due to the unusual and severe hazards associated with lithium battery fires.

The BLI funding supports the fire safety facilities at the FAA's William J. Hughes Technical Center in Atlantic City, NJ, where the majority of the program's research is conducted.

Part 2: Service/Office Research Requirements and Research Gap Analysis

1.0 Cargo Safety

Reduce the risks due to cargo fires by performing tests to support the development of new standards for fire detection and containment and suppression in cargo containers, and tests to evaluate new fire suppression agents and systems for aircraft cargo compartments. This includes tests as necessary to characterize the hazards posed by various cargo commodities.

Primary S/O: AIR/AFS/AXH (Cargo Safety Executive Oversight Committee)
Secondary S/O:

S/O Priority: 1

Outcome: Continued reduction in the risk of a cargo fire

Research Gap Analysis

Research Questions	Contribution	Research Output
1.1 What are the characteristics and classification of the fire threats presented by hazardous materials including lithium batteries?	15%	Reports and Datasets that describe the relative hazard of a variety of hazardous materials and lithium battery chemistries.
1.2 What are the fire threats, and available mitigation and suppression technologies at the aircraft level?	25%	Reports and Datasets that describe test results for evaluating the effectiveness of halon-alternative fire suppression agents, as well as the improvement of the fire test cargo compartment lining materials
1.3 What are Technologies and methodologies to safely ship hazardous materials in aircraft cargo compartments?	50%	Reports and Datasets shared with Standards Organizations to develop and maintain Standards for hazardous materials packaging, fire-resistant cargo containers and covers, container-based detection and suppression systems
1.4 Is information on the fire risks of shipping hazardous materials and potential mitigation strategies readily available?	10%	Reports, Educational Videos, a dedicated website, and social media campaigns to educate the public on the hazards associated with traveling with or shipping hazardous materials including lithium batteries

2.0 Propulsion, Fuels and the Environment

The ability to safely fly passengers and cargo given changes in the means of aircraft propulsion (such as electric engines/ fuel cells), fuels used (such as batteries or hydrogen) and environment impact on design (such as Halon replacement).

Primary S/O: AIR
Secondary S/O: AFS

S/O Priority: 3

Outcome: Maintained or improved level of safety for aircraft incorporating novel or hybrid propulsion systems

Research Gap Analysis

Research Questions	Contribution	Research Output
2.1 What are the appropriate performance standards and test method for materials and components in designated fire zones in propulsion systems, key parameters that most influence material and component fire performance, and will harmonize standard settings, equipment, and procedures for performing propulsion fire tests?	25%	Reports and datasets shared with Standards Organizations to develop and maintain standards for material and component fireworthiness in designated fire zones in and around aircraft propulsion systems, including the inclusion of the Next Generation Fire Test Burner as an equivalent and preferred test apparatus.
2.2 How well do non-halon, environmentally friendly powerplant fire suppression agents ensure equivalent or improved performance when compared with Halon, considering evolving technologies in aircraft propulsion and power systems?	25%	Reports and datasets that describe test results for evaluating the effectiveness of halon-alternative fire suppression agents in aircraft engines and auxiliary power units.
2.3 What are the in-flight fire threats posed by on-board fuel sources including petroleum fuels, lithium batteries, gaseous and liquid hydrogen, and other novel fuels and power sources?	25%	Reports and datasets that describe tests performed to evaluate the in-flight fire threats posed by on-board fuels and power sources, including petroleum fuels, lithium batteries, gaseous and liquid hydrogen, and other novel fuels and power sources.
2.4 What are the characteristics of the post-crash fire threat and hazard posed to occupants by aircraft fuel sources, including petroleum fuels, lithium	25%	Reports and datasets that describe tests performed to evaluate and characterize the post-crash fire threat posed by aircraft fuel sources, including petroleum fuels, lithium batteries, gaseous and

batteries, gaseous and liquid hydrogen, and other novel fuels and power sources?		liquid hydrogen, and other novel fuels and power sources.

3.0 Aircraft and Passenger Survivability

The ability to prevent or minimize the effects of inflight or post-crash fire on crew/passenger survivability given evolving aircraft technology.

Primary S/O: AIR
Secondary S/O: AFS/AXH

S/O Priority: 2

Outcome: Reduction in the occurrence of inflight fire accidents and improved post-crash survivability

Research Gap Analysis

Research Questions	Contribution	Research Output
3.1 Are materials flammability standards commensurate with fires that are likely to occur considering the evolution of aircraft technology and advancements in fuels and power?	40%	Reports, datasets, and instructional videos that describe new and updated aircraft materials flammability test methods in support of regulatory actions.
3.2 How effective are halon-free, environmentally-friendly fire suppression agents for use in handheld fire extinguishers and lavatory trash receptacles?	10%	Reports and datasets that describe test results for evaluating the effectiveness of halon-alternative fire suppression agents in
3.3 Are techniques for the mitigation of in-flight fires resulting from personal electronic devices (PEDs) considering evolving portable power sources, new battery chemistries, and increasing power density readily available?	35%	Reports, Educational Videos, Classroom Presentations, and social media campaigns describing the most effective and safe methods to extinguish PED fires.
3.4 What materials fire research tools and techniques at the atomic level exist to for analyzing materials and detecting changes in material formulation that practically impact flammability performance important for safety?	15%	Reports, journal and conference publications, datasets, and new technologies that support the goals of maintaining a high level of safety as aircraft and aerospace technologies advance.

Part 3: RE&D Management Team Programming

BLI Planning 3 Year Funding Profile (FY22-24) as of 1/28/2022

YEAR	Appropriation or Formulation Contract Funding ($)	INITIAL BLI TEAM PLANNING CONTRACT FUNDING – AFN BLI Target minus the Hold Back ($)	AVS-1 APPROVED CONTRACT FUNDING ($)
FY22 formulation or appropriation (if known)	**$2,780,207**		
FY23 formulation	**$2,520,911**		
FY24 AFN funding allocation target		**$2,504,928**	**$2,629,200**

BLI Plan 5 Year Outlook (FY22-27)

Complete (C)	In Progress (IP)	Programmed (P)	Need (N)

Research Activities	FY22	FY23	FY24	FY25	FY26	FY27
Operational Capability 1.0 Cargo Safety						
1.1 What are the characteristics and classification of the fire threats presented by hazardous materials including lithium batteries?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*
1.2 What are the fire threats, and available mitigation and suppression technologies at the aircraft level?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*
1.3 What are Technologies and methodologies to safely ship hazardous materials in aircraft cargo compartments?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*
1.4 Is information on the fire risks of shipping hazardous materials and potential mitigation strategies readily available?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*
Research Activities	**FY22**	**FY23**	**FY24**	**FY25**	**FY26**	**FY27**
Operational Capability 2.0 Propulsion, Fuels and the Environment						
2.1 What are the appropriate performance standards and test method for materials and components in designated fire zones in propulsion systems, key parameters that most influence material and component fire performance, and will harmonize standard settings, equipment, and procedures for performing propulsion fire tests?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*
2.2 How well do non-halon, environmentally friendly powerplant fire suppression agents ensure equivalent or improved performance when compared with Halon, considering evolving technologies in aircraft propulsion and power systems?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*
2.3 What are the in-flight fire threats posed by on-board fuel sources including petroleum fuels, lithium batteries,	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*

gaseous and liquid hydrogen, and other novel fuels and power sources?						
2.4 What are the characteristics of the post-crash fire threat and hazard posed to occupants by aircraft fuel sources, including petroleum fuels, lithium batteries, gaseous and liquid hydrogen, and other novel fuels and power sources?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*
Research Activities	**FY22**	**FY23**	**FY24**	**FY25**	**FY26**	**FY27**
Operational Capability 3.0 Aircraft and Passenger Survivability						
3.1 Are materials flammability standards commensurate with fires that are likely to occur considering the evolution of aircraft technology and advancements in fuels and power?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*
3.2 How effective are halon-free, environmentally-friendly fire suppression agents for use in handheld fire extinguishers and lavatory trash receptacles?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*
3.3 Are techniques for the mitigation of in-flight fires resulting from personal electronic devices (PEDs) considering evolving portable power sources, new battery chemistries, and increasing power density readily available?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*
3.4 What materials fire research tools and techniques at the atomic level exist to for analyzing materials and detecting changes in material formulation that practically impact flammability performance important for safety?	*IP*	*IP*	*IP*	*IP*	*IP*	*IP*

Part 4: BLI Team Members

Participants Name	Role	Routing Symbol
Jorge Fernandez	BLI Chair	AIR - 670
Richard Hill	CSTA	ANG-E2
Jeff Gardlin	Sponsor SME	AIR-600
Robert Ochs	Performer SME	ANG-E21
Stephen Happenny	Member	AIR-623
Mike Dostert	Member	AIR-624
Shannon Lennon	Member	AIR-626
Joseph Pellettiere	Member	AIR-600