

Federal Aviation Administration

AVS Research, Engineering and Development

AVS RE&D Portfolio: BLI - Aeromedical Research (A11J) Research Plan: 2022- 2027

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January 26, 2022

Part 1. BLI Definition and Scope

Program Area: Aeromedical Research (A11J)

FAA Domain: Human Performance and Aeromedical Factors

BLI Scope: Aeromedical Research

The Aeromedical Research program is scoped to focus on safety sensitive personnel and airline passenger health, safety, and performance in current and forecasted future civilian aerospace operations. It performs aerospace-relevant applied research in the biomedical, biodynamics and survivability/cabin safety sciences. This research culminates in the transition of knowledge and technology to enable innovation in aerospace operations and mitigation and prevention of aeromedical hazards associated with aerospace mishaps.

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

1.0 Operational Capability: Medical recertification of airmen with neurological and/or psychiatric conditions

Definition: The ability to rapidly measure the adequacy of perceptual, cognitive, and information processing abilities associated with flying for use in the medical recertification evaluation of airmen with known or suspected neurological and/or psychiatric conditions.

Primary Sponsor: Dr. Randy J. Georgemiller, AAM-204; Dr. David O'Brien, AAM-300 **Secondary Sponsor(s):** None

S/O Priority: AAM#2

Outcome: Airmen with newly diagnosed neurological and/or psychiatric conditions are being issued Special Issuances based on a cognitive test other than CogScreen-AE by 2025.

Research Gap Analysis			
Research Questions	Contribution	Research Output	
1.1 Do commercially available tests exist	30%	Literature review	
that reliably measure perceptual,		 Multi-attribute decision matrix for 	
cognitive, and information processing		sponsor selection of 1-2 candidate	
abilities associated with flying?		commercial tests	
1.2 What are the thresholds for	70%	 Technical report summarizing normative 	
minimally acceptable perceptual,		data collection and recommended test	
cognitive, and information processing		thresholds	
abilities for airmen by class of medical		 Normative dataset 	
certificate?			

2.0 Operational Capability: Performance-based medical recertification of airmen with chronic obstructive pulmonary disease

Definition: The ability to forecast if an individual will be able to maintain adequate blood oxygen saturation at altitude without supplemental oxygen for use in the medical certification of airmen with chronic obstructive pulmonary disease.

Primary Sponsor: Dr. David O'Brien, AAM-300

Secondary Sponsor(s): None

S/O Priority: AAM#7

Outcome: Airman diagnosed with chronic obstructive pulmonary disease are being issued Special Issuances based on a Forced Expiratory Volume in one second/Forced Vital Capacity (FEV1/FVC) ratio threshold by 2027.

Research Gap Analysis			
Research Questions	Contribution	Research Output	
2.1 What is the FEV1/FVC ratio that	100%	 Evidence-based aeromedical 	
provides a 90% blood oxygen saturation		statement as input for updates to the	
level in airmen with chronic obstructive		AME Guide	
pulmonary disease at cabin pressures			

altitudes above 12,500 feet (MSL) up to and	
including 14,000 feet (MSL)?	

3.0 Operational Capability: Quantitative risk-based aeromedical certification

Definition: The ability to make system-level, risk-based aeromedical dispositions that consider forecasted innovations in automation and autonomy (e.g., Advanced Air Mobility, etc.).

Primary Sponsor: Dr. Brett Wyrick, AAM-2

Secondary Sponsor(s): None

S/O Priority: AAM#1

Outcome: Quantitative estimates for airman aeromedical risk can be calculated by 2025 and acceptable aeromedical risk thresholds based on system level risk calculations can be determined by 2028.

Research Gap Analysis			
Research Questions	Contribution	Research Output	
3.1 How can a numerical estimate for	70%	Problem success metrics	
aeromedical risk over a medical		Evaluated solutions and associated	
certification interval be calculated for an		success metric scores	
individual airman?		• Software code for the highest quality	
		solutions	
3.2 How can an acceptable aeromedical	30%	Problem success metrics	
risk threshold be determined based on		 Proposed Modeling, Simulation and 	
overall system-level risk that considers		Analysis (MSA) approach	
technological mitigations?		• Evaluation of the MSA approach based	
		on the success metrics as applied to	
		two use cases: current 2-pilot	
		transport aircraft operations and	
		proposed single-pilot transport	
		operations using Garmin-autoland-like	
		capability	

4.0 Operational Capability: Forensic measurement of airman fatigue state

Definition: The ability to objectively measure airman fatigue state in forensic samples obtained during accident investigations and to estimate airman performance impacts.

Primary Sponsor: Dr. Brett Wyrick, AAM-2

Secondary Sponsor(s): None

S/O Priority: AAM#5

Outcome: The Civil Aerospace Medical Institute's (CAMI) Bioaeronautical Sciences Research Laboratory provides accident investigators with a report of pilot fatigue state and associated performance impacts based on forensic analysis by 2032.

Research Gap Analysis			
Research Questions	Contribution	Research Output	
4.1 What is the association between gene expression patterns and performance under varying fatigue states (i.e., acute total sleep loss for two nights, multiple nights of short sleep, or multiple days with short sleep simulating shiftwork)?	26%	 RNA biomarker panel for fatigue- related impairment from sleep loss or circadian disruption Pilot study of published DNA biomarkers associated with personalized fatigue risk Presentation Publication 	
4.2 What genetic biomarkers are associated with cognitive performance during acute sleep loss for one night with and without a drug countermeasure (modafinil)?	6%	 Preliminary list of RNA gene expression biomarkers associated with current fatigue impairment status from prolonged wakefulness RNA biomarkers responsive to modafinil use Presentation Publication 	
4.3 What is the effectiveness of various fingerstick blood sampling methods in detecting differences in gene expression between individuals?	4%	 Method for collecting low-volume blood samples for use in large validation or field applications Presentation Publication 	
4.4 What is the optimum method of sample purification/concentration and computational analysis pipeline for biomarker discovery?	2%	 Validate and improve methods for detecting differences in RNA gene expression between groups Publication 	
4.5 What are the best protocols to establish a long-term sample resource for assessing fatigue and other biomarkers in postmortem samples?	11%	 Biorepository of samples for assessing RNA gene expression and DNA patterns of aviation accident victims Presentation Publication 	
4.6 What are metabolic alterations that correlate with sleep loss-induced decline in cognitive performance?	8%	 Alternative metabolite-based biomarker panel for fatigue-related performance decline Presentation Publication 	
4.7 What are characteristic gut microbiome changes related to fatigue and/or fatigue-related performance deficits?	6%	 Alternative microbiome method to detect fatigue-related performance decline Presentation Publication 	

4.8 What changes in blood protein	8%	Alternative protein biomarker panel for
composition are indicative of fatigue-		fatigue-related performance decline
related performance deficits and sleep		Presentation
loss?		Publication
4.9 How do measurements from	2%	Understanding of how different types
wearables (gold standard		of sleep loss impact individuals
polysomnography; actigraphy)		Presentation
complement and inform understanding		Publication
of molecular fatigue biomarkers?		
4.10 How do DNA biomarkers inform	5%	DNA biomarkers associated with
understanding of which fatal accidents		personalized fatigue risk
were more likely to involve human		Additional knowledge of inter-individual
fatigue based on individual susceptibility		differences
to fatiguing conditions?		Presentation
		Publication
4.11 Which biomarkers developed from	11%	Test and application of biomarkers
live human studies are most informative		developed from studies of live subjects
of fatigue status in forensic accident		to prediction of fatigue in postmortem
settings?		accident investigation
		Presentation
		Publication
4.12 How do fatigue biomarkers	11%	Validation of biomarkers developed in
developed in live-subject studies perform		previous studies to predicting the
in expanded naturalistic or field-based		prevalence of fatigue in living
studies of larger, more diverse		individuals.
populations?		Presentation
		Publication

5.0 Operational Capability: Enhanced forensic assessment of airman substance use

Definition: The ability to detect RNA-based biological responses to drugs whose metabolic profile or instability hinders direct toxicological measurement of the chemical in forensic samples obtained from airman autopsies.

Primary Sponsor: Dr. Brett Wyrick, AAM-2

Secondary Sponsor(s): None

S/O Priority: AAM#6

Outcome: The Civil Aerospace Medical Institute's (CAMI) Bioaeronautical Sciences Research Laboratory provides accident investigators with an enhanced forensics toxicology analysis report, to include genetic responses to tetrahydrocannabinol (THC) and potentially other drugs, by 2032.

Research Gap Analysis			
Research Questions Contribution Research Output			
5.1 What are methods for detecting RNA-	100%	 Genomics based THC assessment 	
based biological responses to THC in		methodology for incorporation in	
forensic specimens to complement		CAMI's forensic analysis process	
current toxicological analyses, or in		Publication	
tissues from which the drug has cleared		 Presentation 	
prior to postmortem testing?			

6.0 Operational Capability: Medical recertification of airmen with prior COVID-19 infection

Definition: The ability to screen for disease sequelae in airmen with a prior COVID-19 infection that increase the risk for degraded aviation performance or in-flight incapacitation.

Primary Sponsor: Dr. David O'Brien, AAM-300

Secondary Sponsor(s): None

S/O Priority: AAM#3

Outcome: Airmen with history of prior COVID-19 infection screened during medical recertification exams using updated evidence-based guidelines by May 2023.

Research Gap Analysis			
Research Questions Contribution		Research Output	
6.1 What are the aeromedically	100%	 Interim white paper updates 	
significant disease sequelae occurring up		 Technical report of identified sequelae 	
to 3 years after SARS-CoV-2 infection?		and associated population risk	

7.0 Operational Capability: Remote aeromedical certification exam

Definition: The ability to remotely accomplish key elements of the FAA Aviation Medical Examiner encounter using existing telemedicine technologies and validated procedures.

Primary Sponsor: Dr. David O'Brien, AAM-300

Secondary Sponsor(s): None

S/O Priority: AAM#8

Outcome: Remote aeromedical certification exam approved by the Office of Aerospace Medicine for contingency use by FY2027.

Research Gap Analysis			
Research Questions	Contribution	Research Output	
7.1 What minimum set of existing	75%	 Technical report 	
telemedicine technologies and associated		Presentation	
procedures provide the necessary data to			
maximally address the physical exam			
items in FAA Form 8500-8?			
7.2 What is the practical usability of the	25%	Prototype	
remote aeromedical certification exam?		 Technical report 	
		Presentation	

8.0 Operational Capability: Cabin	health safety	y during an epi/pandemic
Definition: The ability to minimize the risk	of transmission	of respiratory diseases of potential public
health significance within transport aircraft	cabins.	
Primary Sponsor: Dr. Brett Wyrick, AAM-2		
Secondary Sponsor(s): None		
S/O Priority: AAM#4		
Outcome: The Office of Aerospace Medicin	e transitions a c	abin health safety response plan and
associated analysis toolkit to Health and Hu	uman Services by	y FY 2028.
Rese	arch Gap Ana	alysis
Research Questions	Contribution	Research Output
8.1 What is a generalizable risk analysis	70%	Technical report
framework and associated set of		MS&A tools
accepted and validated modeling,		
simulation, and analysis (MS&A) tools for		
determining baseline risk and evaluating		
the impact of risk control measures?		
8.2 What are existing and emerging risk	20%	 Technical report of risk mitigations and
mitigations (i.e., engineering and		associated evidence base
administrative controls and personal		 Models (if applicable)
protective equipment) for inflight		
respiratory disease transmission forecast		
to be available by 2027?		
8.3 What is a generalizable cabin health	10%	 Technical report
safety response plan, comprising an		 Cabin health safety response plan
optimized solution set of control		 Analysis toolkit (MS&A tools and
measures, for transition to the		associated data)
appropriate aerospace and public health		
stakeholders?		

9.0 Operational Capability: Assess and manage the risk of cabin air quality events in transport category aircraft

Definition: The ability to identify and measure constituent levels resulting from bleed air in commercial aircraft cabins in operation in the United States, and to assess the potential health effects of such constituents on passengers and cabin and flight deck crew.

Primary Sponsor: Stephen Happenny, AIR-623

Secondary Sponsor(s): None

S/O Priority: AIR#5

Outcome: A regulatory requirement for appropriate onboard sensors to alert the crew of impending air quality events, resulting in an overall decrease in cabin air quality events by FY26.

Research Gap Analysis			
Research Questions	Contribution	Research Output	
9.1 What is the frequency and categories of smoke, odor and fume events on U.S. air carriers?	10%	Technical report	
9.2 How can cabin air quality events caused be bleed air contaminants be detected?	60%	 Technical report Recommended rule modifications or new rule 	
9.3 What is the associated risk for crew impairment and for longer-term health effects of occupants?	20%	 Technical report on risk for crew impairment and for longer-term health effects of occupants. Develop guidance 	
9.4 How can cabin air quality events caused by internal air contaminants (i.e., electrical components) be detected?	10%	 Technical report Recommended rule modifications or new rule requiring contaminant sensors. 	

10.0 Operational Capability: Occupant safety during adverse events – influencing passenger behaviors

Definition: The ability to influence passenger behaviors through the evaluation, selection, and improvement of both existing and new methods of communicating safety information to the passenger before boarding, and during all phases of flight, to increase safety during adverse events.

Primary Sponsor: DK Deaderick, AFS-220

Secondary Sponsor(s): Jeff Gardlin, AIR-600

S/O Priority: AFS#1

Outcome: Updated guidance on passenger education methods provided to air carriers, resulting in a decrease in observed undesirable passenger behaviors during adverse events by FY28.

Research Gap Analysis				
Research Questions	Contribution	Research Output		
10.1 What are effective passenger education	30%	 Technical report 		
methods and strategies?		 Draft advisory circular 		
10.2 What are effective crew procedures to	20%	 Technical report 		
mitigate cabin safety hazards?		 Draft advisory circular 		
10.3 What is the effectiveness of crew	20%	 Technical report 		
training using virtual cabin/equipment		 Draft advisory circular 		
mockups?				
10.4 How can passenger retention of cabin	15%	 Technical report 		
safety information regarding luggage removal		 Draft advisory circular 		
during emergency egress be improved?				
10.5 How can usage of Child Restraint	10%	 Technical report 		
Systems be increased?		 Draft advisory circular or 		
		regulation		

10.6 Is there an identifiable correlation	5%	Technical Report
between egress slide technique and		 Draft advisory circular
passenger slide related injuries?		

11.0 Operational Capability: Occupant safety during adverse events – certify new and novel cabin interior components and configurations

Definition: The ability to ensure proposed new and novel cabin interior components and configurations, which challenge existing assumptions and certification frameworks, provide the same level of safety to all occupants as provided by conventional seats.

Primary Sponsor: Jeff Gardlin, AIR-600

Secondary Sponsor(s): Catherine Burnett, AFS-270

S/O Priority: AIR#4

Outcome: Updated certification standards and guidance are approved, resulting in the certification of proposed new and novel cabin interior components and configurations by FY28.

Research Gap Analysis					
Research Questions	Contribution	Research Output			
11.1 What are injury criteria and test	40%	 Technical report 			
methods for evaluating the crash safety		 Draft updates to FAA certification 			
of obliquely oriented seats?		standards and guidance			
11.2 What are injury criteria and test	60%	 Technical report 			
methods for evaluating the crash safety		 Draft updates to FAA certification 			
of the range of potential impact		standards and guidance			
scenarios, seat orientations, occupant					
sizes, and restraint configurations?					

12.0 Operational Capability: Occupant safety during adverse events – improve occupant crash protection in legacy aircraft/rotorcraft

Definition: The ability to improve the level of occupant crash protection provided by existing and newly produced aircraft/rotorcraft built to meet only static load qualification standards through complementary improvements to the airframe, fuel systems, seats and restraints.

Primary Sponsor: Joseph Pellettiere, AIR-600

Secondary Sponsor(s): None

S/O Priority: AIR#3

Outcome: Updated certification standards and guidance are approved, resulting in improved occupant survivability in rotorcraft crashes by FY28

Research Gap Analysis				
Research Questions	Research Output			
12.1 What are the most common crash	50%	Technical report		
injuries and their cause in survivable		 Draft updates to FAA certification 		
rotorcraft crashes?		standards and guidance		

12.2 What is the level of protection	50%	Technical report
provided by the most common legacy		 Draft updates to FAA certification
rotorcraft, and what are the potential		standards and guidance
injury mitigation strategies for each of		
those models		

13.0 Operational Capability: Streamline certification – efficiently assess the effect of cabin interior configuration and safety equipment changes on emergency egress/ditching/water survival

Definition: The ability to efficiently certify unconventional cabin interior and structural configurations and the addition or change of safety equipment to the aircraft cabin being proposed by Industry.

Primary Sponsor: Jeff Gardlin, AIR-600

Secondary Sponsor(s): DK Deaderick, AFS-220

S/O Priority: AIR#1

Outcome: New cabin interior and structural configurations certified using performance-based standards by FY30.

Research Gap Analysis				
Research Questions	Contribution	Research Output		
13.1 What is the effect of equipment	10%	Technical report		
changes, interior configurations, exit size		 Draft updates to FAA certification 		
and location on emergency egress on		standards and guidance		
land and water?				
13.2 What computer simulation-based	20%	 Technical report 		
methods are credible for demonstrating		 Draft updates to FAA certification 		
compliance to the airframe and seating		standards and guidance		
regulations?				
13.3 What methods are suitable to	10%	 Technical report 		
evaluate water survival equipment?		 Draft updates to FAA certification 		
		standards and guidance		
13.4 What is the influence of delta-wing	10%	 Technical report 		
design on egress paths and evacuation		 Draft updates to FAA certification 		
efficiency for supersonic transports?		standards and guidance		
13.5 What virtual reality methods are	20%	Technical report		
suitable for evaluating the effects of		Draft updates to FAA certification		
cabin configuration?		standards and guidance		
13.6 What is the credibility of the current	10%	 Technical report 		
state of the art in modeling and		 Draft updates to FAA certification 		
simulation for cabin evacuation and		standards and guidance		
aircraft ditching?				
13.7 What are the appropriate factors to	10%	Technical report		
establish ditching exit ratings?		 Draft updates to FAA certification 		
		standards and guidance		

13.8 What is the effect on egress of	10%	Technical report
furniture in the egress pathway?		 Draft updates to FAA certification
		standards and guidance

14.0 Operational Capability: Streamline certification – performance-based certification strategies for cabin interior components and configurations

Definition: The ability to certify cabin interior components and configurations using performancebased standards that take into account the whole aircraft response to impact and provide greater design flexibility

Primary Sponsor: Joseph Pellettiere, AIR-600

Secondary Sponsor(s): None

S/O Priority: AIR#2

Outcome: New test methods and test equipment are approved, allowing the performance-based certification of cabin interior components and configurations by FY30.

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Researc	n Gap	Alla	y 513

Research Questions	Contribution	Research Output		
14.1 What new/improved test methods	50%	 Technical report 		
and test equipment are needed to		 Draft updates to FAA certification 		
support implementation of performance-		standards and guidance		
based standards for General Aviation				
aircraft?				
14.2 What new/improved test methods	50%	Technical report		
and test equipment are needed to		 Draft updates to FAA certification 		
support implementation of performance-		standards and guidance		
based standards for Transport aircraft?		-		

15.0 Operational Capability: Streamline certification – performance-based certification strategies for oxygen systems

Definition: The ability to provide an equivalent level of safety using performance-based standards rather than prescriptive-based standards when certifying new oxygen mask designs, oxygen delivery systems (e.g., continuous, pulse, on demand, etc.), and oxygen regulators. This operational capability has implications for all types of airplane oxygen systems – e.g., flight deck crew, passenger, emergency/first aid, supplemental carry-on systems for small aircraft, etc.

Primary Sponsor: Robert Hettman, AIR-623

Secondary Sponsor(s): None

S/O Priority: AIR#6

Outcome: 14 CFR oxygen regulations and oxygen system Technical Standard Orders (TSOs) are updated, resulting in the certification of new oxygen systems using performance-based standards by FY26.

Research Gap Analysis					
Research Questions	Research Output				
15.1 Are there performance-based,	100%	 Technical report 			
physiological metrics for the certification		 Draft updates to FAA certification 			
of new oxygen delivery systems (e.g.,		standards and regulations			
continuous flow, pulse delivery, on-					
demand, etc.) and new passenger and					
crewmember oxygen masks that provide					
the equivalent level of safety to					
prescriptive-based standards?					

16.0 Operational Capability: Pilot monitoring technology and aircraft automation mitigations for airman aeromedical risk

Definition: The ability to provide special issuances to airman with disqualifying medical conditions based on the use of pilot monitoring technology to identify unsafe pilot states and triggering compensatory automation.

Primary Sponsor: Dr. Brett Wyrick, AAM-2

Secondary Sponsor(s): None

S/O Priority: AAM#9

Outcome: The Office of Aerospace Medicine provides special issuances contingent on airman use of pilot monitoring technology coupled to aircraft automation by FY2029

Research Gap Analysis					
Research Questions	Contribution	Research Output			
16.1 What are the minimum	80%	 Technical report 			
standards/requirements for pilot state					
monitoring to be considered an					
acceptable mitigation for sudden pilot					
incapacitation, assuming aircraft with a					
Garmin-autoland like capability?					
16.2 What are the minimum	20%	Technical report			
standards/requirements for pilot					
state/behavior monitoring to be					
considered an acceptable mitigation for					
the risk of pilot suicide by aircraft,					
assuming aircraft with a Garmin-autoland					
like capability?					

Part 3: RE&D Management Team Programming

BLI Planning 3 Year Funding Profile (FY22-24) as of 01/28/2022

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)	\$8.166.602		
FY23 formulation	\$3,921,540		
FY24 AFN funding			
allocation target		\$6,823,644	\$6,823,644

BLI Plan 5 Year Outlook (FY22-27)

Complete (C) In Progress	(IP)	Programme	d (P)	N	eed (N)			
Research Activities	Research Activities				FY24	FY25	FY26	FY27
Operational Capability 1.0: Medica	al recer	tification of ai	rmen w	ith neur	ological	and/o	psychiat	ric
		conditions						
1.1 Do commercially available tests exis	st that r	reliably						
measure perceptual, cognitive, and info	ormatio	on 						
processing abilities associated with flyin	ng? (Co	ntrol						
Account No: A11J.AM.12) [Completed i	<u>n FY21</u>							
1.2 What are the thresholds for minima	ally acce	eptable						
perceptual, cognitive, and information	process	sing abilities	Р	Р	Р			
for airmen by class of medical certificat	e? (Cor	ntrol						
Account No: AIIJ.AM.12)					•	بر ما م		
Operational Capability 2.0: Performan	ce-base	ed medical rec	ertifica	tion of a	irmen w	ith chr	onic obsti	ructive
2.1 What is the FFV(1/FV/C ratio that are	pu puidos a		ise					
2.1 What is the FEV1/FVC fatio that pro	obropio							
bygen saturation level in airmen with	utitudo.			р	NI	N	N	
12 EOO foot (MSL) up to and including 1				Р	IN	IN	IN	
(Control Account No: A111 AM 14)	.4,0001	eet (IVISL)!						
(Control Account No. A11).AW.14)	0. Our	antitativo rick	bacad r	oromoo	lical cort	ificatio	<u> </u>	
2 1 How can a numerical estimate for a	s.v. Que	dical risk	baseu a			incatio	· ·	
over a medical certification interval be	calcula	ted for an	D	D	D			
individual airman? (Control Account No	over a medical certification interval be calculated for an individual airman? (Centrol Account No: A111 AM 16)		Г	F	г			
2.2 How can an accontable acromodical rick threshold be								
determined based on overall system-level rick that		that						
considers technological mitigations?								

Operational Capability 4.0: Forensic measurement of pilot fatigue state						
4.1 What is the association between gene expression						
patterns and performance under varying fatigue states						
(i.e., acute total sleep loss for two nights, multiple nights	Р	Р	Р	Ν	Ν	Ν
of short sleep, or multiple days with short sleep simulating						
shiftwork)? (Control Account No: A11J.AM.10)						
4.2 What genetic biomarkers are associated with cognitive						
performance during acute sleep loss for one night with	Р	Р	Ν	Ν		
and without a drug countermeasure (modafinil)? (Control						
Account No: A11J.AM.20)						
4.3 What is the effectiveness of various fingerstick blood						
sampling methods in detecting differences in gene	Р	Р	Р			
expression between individuals? (Control Account No:						
A11J.AM.10)						
4.4 What is the optimum method of sample						
purification/concentration and computational analysis	Р					
pipeline for biomarker discovery? (Control Account No:						
A11J.AM.10)						
4.5 What are the best protocols to establish a long-term						
sample resource for assessing fatigue and other	Р	Р	Р	Ν		
biomarkers in postmortem samples? (Control Account No:						
A11J.AM.21)						
4.6 What are metabolic alterations that correlate with		D	D	NI	NI	NI
sleep loss-induced decline in cognitive performance?		Р	Р	IN	IN	IN
(Control Account No: A11J.AM.22)						
4.7 What are characteristic gut microbiome changes		р	р	NI	NI	NI
related to fatigue and/or fatigue-related performance		P	P	IN	IN	IN
deficits? (Control Account No: A11J.AM.23)						
4.8 What changes in blood protein composition are			D	N	N	N
indicative of fatigue-related performance deficits and			F	IN	IN	IN
sleep loss? (Control Account No: A11J.AM.24)						
4.9 How do measurements from wearables (gold standard						
polysomnography; actigraphy) complement and inform				Ν	N	Ν
understanding of molecular fatigue biomarkers? (Control						
Account No: A11J.AM.25)						
4.10 How do DNA biomarkers inform understanding of						
which fatal accidents were more likely to involve human		N	N	N	N	Ν
fatigue based on individual susceptibility to fatiguing						
conditions? (Control Account No: A11J.AM.26)						
4.11 Which biomarkers developed from live human				Ν	Ν	Ν
studies are most informative of fatigue status in forensic						
accident settings? (Control Account No: A11J.AM.10)						
4.12 How do fatigue biomarkers developed in live-subject						
studies perform in expanded studies of larger, more					Ν	Ν
diverse populations?						

Operational Capability 5.0: Enhanced forensic assessment of airman substance use						
5.1 What are methods for detecting RNA-based biological						
responses to THC in forensic specimens to complement			N			
current toxicological analyses, or in tissues from which the	N	Р	IN			
drug has cleared prior to postmortem testing? (Control						
Account No: A11J.AM.11)						
Operational Capability 6.0: Medical recertification of	of airme	n with p	rior CO\	/ID-19 ir	fection	
6.1 What are the aeromedically significant disease	р					
sequelae occurring up to 3 years after SARS-CoV-2	Р	Р				
infection? (Control Account No: A11J.AM.9)						
7.0 Operational Capability: Remote aero	omedica	al certifio	cation ex	kam		
7.1 What minimum set of existing telemedicine						
technologies and associated procedures provide the			N	N		
necessary data to maximally address the physical exam			IN	IN		
items in FAA Form 8500-8?						
7.2 What is the practical usability of the remote					NI	
aeromedical certification exam?					IN	
8.0 Operational Capability: Cabin health s	afety du	uring an	epi/pan	demic		
8.1 What is a generalizable risk analysis framework and						
associated set of accepted and validated modeling,			D			
simulation, and analysis (MS&A) tools for determining			r	Ν	Ν	
baseline risk and evaluating the impact of risk control						
measures? (A11J.AM.19)						
8.2 What are existing and emerging risk mitigations (i.e.,						
engineering and administrative controls and personal						
protective equipment) for inflight respiratory disease						
transmission forecast to be available by 2027?						
8.3 What is a generalizable cabin health safety response						
plan, comprising an optimized solution set of control						
measures, for transition to the appropriate aerospace and						
public health stakeholders?						
9.0 Operational Capability: Detect Cabin Air Qua	ality Sm	oke, Od	or and F	<mark>ume Eve</mark>	ents	
9.1 What is the frequency and categories of smoke, odor	D	р				
and fume events on U.S. air carriers? (Control Account No:	r	r -				
A11J.AM.8)						
9.2 How can cabin air quality events caused be bleed air	Р	Р	Р	N	N	
contaminants be detected? (Control Account No:			•			
A11J.FCMS.2)						
10.0 Operational Capability: Occupant safety during adverse events – influencing passenger behaviors						
10.1 What are effective passenger education methods and						
strategies?						
10.2 What are effective crew procedures to mitigate cabin						
safety hazards?						
10.3 What is the effectiveness of crew training using	Ν	N				
virtual cabin/equipment mockups?						

10.4 How can passenger retention of cabin safety				
information regarding luggage removal during emergency				
egress be improved? (Control Account No: A11J.FCS.17)				
10.5 How can usage of Child Restraint Systems be N				
increased?				
10.6 Is there an identifiable correlation between egress N				
slide technique and passenger slide related injuries?				
11.0 Operational Capability: Occupant safety during adverse events - certify new and novel cabi	interior			
components and configurations				
11.1 What are injury criteria and test methods for				
evaluating the crash safety of obliquely oriented seats?				
(Control Account No.: A11J.FCS.2)				
11.2 What are injury criteria and test methods for				
evaluating the crash safety of the range of potential				
impact scenarios, seat orientations, occupant sizes, and				
restraint configurations? (Control Account No:				
A11J.FCS.15)				
12.0 Operational Capability: Occupant safety during adverse events – improve occupant crash p	otection			
in legacy aircraft/rotorcraft				
12.1 What are the most common crash injuries and their				
cause in survivable rotorcraft crashes? (Control Account				
No: A11J.RS.2)				
12.2 What is the level of protection provided by the most				
common legacy rotorcraft, and what are the potential P P P				
injury mitigation strategies for each of those models				
(Control Account No.: A11J.RS.1)				
13.0 Operational Capability: Streamline certification – efficiently assess the effect of cabin in	erior			
configuration and safety equipment changes on emergency egress/ditching/water survival				
13.1 What is the effect of equipment changes, interior				
configurations, exit size and location on emergency egress				
on land and water?				
13.2 What computer simulation-based methods are				
credible for demonstrating compliance to the airframe PPN				
A111 ECS 16)				
ATTI.FCS.10)				
15.5 What methods are suitable to evaluate water survival				
12.4 What is the influence of dolta wing design on egross				
naths and evacuation efficiency for supersonic transports? P N N				
(Control Account No: A111 ECS 18)				
13.5 What virtual reality methods are suitable for				
evaluating the effects of cabin configuration? (Control	Ν			
Account No: A111 FCS 21)				
13.6 What is the credibility of the current state of the art				
in modeling and simulation for cabin evacuation and P P				

13.7 What are the appropriate factors to establish		Р	Р			
ditching exit ratings? (Control Account No: A11J.FCS.19)						
13.8 What is the effect on egress of furniture in the egress			N	N	N	
pathway? (Control Account No: A11J.FCS.22)						
14.0 Operational Capability: Streamline certification – pe	erforma	nce-base	ed certif	ication s	trategie	s for
cabin interior components and configurations						
14.1 What new/improved test methods and test	new/improved test methods and test					
equipment are needed to support implementation of P P		Р				
performance-based standards for General Aviation	performance-based standards for General Aviation					
ircraft? (Control Account No: A11J.FCS.10)						
14.2 What new/improved test methods and test						
equipment are needed to support implementation of	equipment are needed to support implementation of P					
performance-based standards for Transport aircraft?						
15.0 Operational Capability: Streamline certification – performance-based certification strategies for						
oxygen system	is					
15.1 Are there performance-based, physiological metrics						
for the certification of new oxygen delivery systems (e.g.,						
continuous flow, pulse delivery, on-demand, etc.) and P P						
new passenger and crewmember oxygen masks that						
provide the equivalent level of safety to prescriptive-						
based standards? (Control Account No: A11J.AM.13)						
16.0 Operational Capability: Pilot monitoring technology and aircraft automation mitigations for airman						
aeromedical risk						
16.1 What are the minimum standards/requirements for						
pilot state monitoring to be considered an acceptable	Р		N			
mitigation for sudden pilot incapacitation, assuming						
aircraft with a Garmin-autoland like capability?						
16.2 What are the minimum standards/requirements for						
pilot state/behavior monitoring to be considered an						
acceptable mitigation for the risk of pilot suicide by						
aircraft, assuming aircraft with a Garmin-autoland like						
capability?						

Part 4: BLI Team Members

Participants Name	Role	Routing Symbol		
Baisden, Denise	Medical Clearances and	ASW-300		
	Certification Sponsor			
Copeland, Kyle	Numerical Sciences Research	AAM-631		
	Performer Lead			
Crane, Martin	Rotorcraft Sponsor	AIR-616		
Deaderick, DK	Aviation Safety Inspector	AFS-220		
DeJohn, Charles	Medical Research Performer Lead	AAM-631		
DiPasquantonio, Maria	REDMT-AIR	AIR-600		
Fernandez, Jorge	REDMT-AIR	AIR-600		
Gardlin, Jeff	STS Aircraft Cabin Security and	AIR-600		
	Survivability			
Giovanetti, Penny	Medical Clearances and	AAM-200		
	Certification Sponsor			
Happenny, Stephen	Environmental Controls and Fire	AIR-625		
	Protection Systems Sponsor			
Hettman, Robert	AIR Sponsor	AIR-623		
Jay, Susan	Aerospace Physiology Research	AAM-631		
	Performer Lead			
Lewis, Russell	Forensic Analyses Sponsor	AAM-610		
Lennon, Shannon	Cabin Safety Sponsor	AIR-626		
Moorcroft, David	Biodynamics Research Performer	AAM-632		
	Lead			
O'Brien, David	Medical Clearances and	AAM-300		
	Certification Sponsor			
Pellettiere, Joseph	CSTA Crash Dynamics	AIR-600		
Rodzon, Douglas	REDMT-AFS	AFS-430		
Stegeman, Robert	Technical Innovation Sponsor	AIR-621		
Tvaryanas, Anthony	BLI Chair/REDMT-AAM	AAM-600		
Uyhelji, Hilary	Functional Genomics Research	AAM-612		
	Performer Lead			
Weed, David	Cabin Safety Research Performer	AAM-632		
	Lead			
Wyrick, Brett	Medical Clearances and	AAM-2		
	Certification & Pandemic Response			
	Sponsor			
Zinke, Stacey	Research Performer Manager	AAM-600		