

# REDAC / Human Factors



Next**GEN**

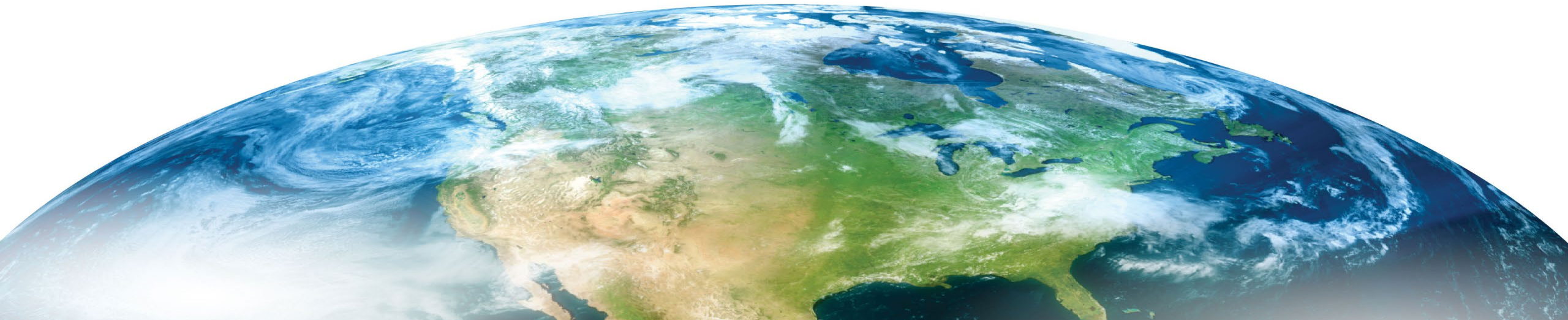
*Air Traffic Control / Technical Operations  
Human Factors*

*BLI Number: A11.h*

*Presenter Name: Dan Herschler (ANG-C1)*

*Date: August 18, 2020*

*Review of FY 2020 - 2023  
Proposed Portfolio*



# Air Traffic Control / Technical Operations Human Factors

## Overview

### **What are the benefits to the FAA**

- The research program contributes scientific and technical information to the Air Traffic Organization to inform policies and system design decisions that will prevent and reduce transportation-related fatalities and serious injuries across the transportation system.
- The research is mandated by 49 USC Section 445 and the public benefit results from application of the research that enables improvements to air traffic safety and efficiency.

### **What determines program success**

- R&D Sponsors and Stakeholders in the ATO are able to make important workforce policy, acquisition, and operational management decisions based on the results of thorough, timely, and focused R&D efforts.
- When programs embrace human factors processes and requirements during system acquisition, they reduce human factors risks.
- Reducing human factors risks increases the likelihood for successful system implementation and operation, while reducing the likelihood for system design and engineering rework.



# Air Traffic Control / Technical Operations Human Factors

## Program Support

### People:

- Program Manager: Dan Herschler
- Subject Matter Expert: Bill Kaliardos, Human Factors Integration Lead

### Laboratories:

- ANG-E25 Human Factors Branch, Aviation Research Division  
Research and Development Human Factors Laboratory
- AAM-520 NAS Human Factors Safety Research Laboratory



# Air Traffic Control / Technical Operations Human Factors

## Significant Accomplishments in Current FY

Project	Description/Product
GIM-S capability utilization	Analyzed three year trend data about GIM-S usage, using mining and analysis of big data collected from ERAM systems, as well as operator display settings to identify human factors limiting utilization, and recommend potential mitigations
ATC Information Display Optimization	The project is phase 2 of a HITL study investigating the impact of integrating multiple new capabilities into the current air traffic control systems. Different capabilities, if designed and developed separately from one another, may implement different designs, information representations, and interaction strategies. Inconsistencies may result in the use of color, symbology, and the way that users interact with display elements. Displays may also become cluttered. These human factors issues influence how effectively air traffic controllers can use the systems. This project identifies these human factors issues and proposes mitigations.
Effectiveness of Stress Management Training for New Hire Controllers	We found that the stress management training was associated with gains in objective and perceived stress management knowledge and that these gains were maintained over a one to two month period. Additionally, the training was associated with gains in stress management confidence immediately following the training as well as reported changes in the use of stress management technique.



## Ongoing and Anticipated Research in FY21+

Project	Description/Product	Vendor	
<i>ATC Alarms and Alerts Handbook</i>	<ul style="list-style-type: none"><li>Literature Review</li><li>Draft Handbook</li><li>Final Handbook</li><li>Controller Training for Use and Tuning of ATC Signaling Systems</li></ul>	University of Chicago	FY21 Q1 FY21 Q4 FY22 Q4 FY23 Q4
<i>Updates to Human Factors Design Standard</i>	Outlines for updates to sections on: <ul style="list-style-type: none"><li>Automated ATC systems</li><li>Information display and management</li><li>Workstation arrangement and display characteristics</li></ul> Recommended requirements and guidance for:	Volpe Center	FY21 Q4
	<ul style="list-style-type: none"><li>ATC touch screens</li></ul>	Honeywell	FY22 Q2
<i>Update the Human Factors Job Aid and Develop Web-based Training for HF Practitioners</i>	<ul style="list-style-type: none"><li>Updated Job Aid</li><li>Web-based Training</li></ul>	The Ohio State University	FY21 Q4 FY23 Q4
<i>ATC Display Color Standard, Updated Color Palette Implementation</i>	Dynamic scenario-based demonstration for ERAM and STARS operations	ANG-E25	FY21 Q4
<i>Job Analysis Methodology Development</i>	Develop and document a job analysis methodology using Career Planning Tool 2.0 (CPT2) database for new ATO position profiles and career paths	CAMI AAM-520	FY22 Q2



# Anticipated Research in FY21+

Planned Research Activity	Description/Product
Improved Safety, Reduced Hazards, And Error Mitigation In ATC	49 USC 44505(b)(4). Develop a validated ATC and Technical Operations alerting guidance document and a training outline for a controller and technical operations training course on managing alerts and tuning alarms and alerts.
Automation Effects And Controller Performance	<ul style="list-style-type: none"> <li>49 USC 44506(b)(1). Develop a report including a literature review and industry survey on human supervisory control interactions in aviation and relevant industries, with recommendations for performance measures for ATC methods using advanced AI decision aiding approaches.</li> <li>49 USC 44506(a)(2). Create a report to document prospective workload, performance, and fatigue measures that could be used to establish criteria that would underpin recommendations for controller workload-based fatigue mitigation guidance and training.</li> </ul>
Improved Design And Operation Of ATC Systems	49 USC 44506(b), 49 USC 44506(b)(2), 49 USC 44507(e). Incorporate the latest scientific and technical information into the Human Factors Design Standard (HF-STD-001) in the areas of design of automated ATC systems, information display and management, and design requirements for workstation arrangement and display characteristics.
Improved Controller Selection And Training	49 USC 44506(a)(4). Develop a report identifying controller performance measures that are sensitive to use of ATC automation capabilities, and initial candidate recommendations for controller training.
Controller And Technical Operations Workforce Optimization	49 USC 44507(g). Create a research plan and execution roadmap to address key human factors competencies and knowledge bases to aid in ATC task automation, reducing errors, improving system design, and enhancing effectiveness of training.

# Backup information



# Air Traffic Control / Technical Operations Human Factors

## Research Requirements

1. Improved Safety, Reduced Hazards, And Error Mitigation In ATC
2. Automation Effects And Controller Performance
3. Improved Design And Operation Of ATC Systems
4. Improved Controller Selection And Training
5. Controller And Technical Operations Workforce Optimization

## FY 2023 Planned Research

- Develop a human factors investigator's guide
- Develop a deployable human factors simulation capability
- Develop guidance for ATC alerts and information displays and controller training
- Develop training and procedural guidance to mitigate potential deskilling effects of long-term use of automation
- Develop facility operational guidance and training for recognition and mitigation of workload effects on controller fatigue and performance
- Develop recommendations for controller training that measurably increase use of ATC automation capabilities and controller performance (efficiency).

## Outputs/Outcomes

- Guidance for HF field investigations
- Deployable simulation tools for remote data collection and evaluation of proposed new ATC capabilities
- Training and procedural guidance to mitigate deskilling effects from long-term use of automation
- Analysis of job tasks and cognitive tasks for ATC and technical operations to support improved selection, placement, and training of new hires
- Recommendations for controller training for better use of automation capabilities

## Out Year Funding Requirements

RE&D	FY20	FY21	FY22
	\$5.9M	\$5.9M	\$ 5.9M

F&E	FY20	FY21	FY22	FY23	FY24	FY25
	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0



# Statutory Basis for Human Factors Research

49 US Code Section	
*44505(b)	
*44505(c)	
44506(a)	
44506(b)	
*44513(b)(1)(A)(iii)	
44516(a)	

\* In-scope for REDAC per 49 USC Section 44508, Research Advisory Committee



# Statutory Basis for Human Factors Research (cont.)

49 US Code Section	Title
*44505(b)	Research on Human Factors and Simulation Models
	<p>The Administrator shall conduct or supervise research—</p> <p>(1) to develop a better understanding of the relationship between human factors and aviation accidents and between human factors and air safety;</p> <p>(2) to enhance air traffic controller, mechanic, and flight crew performance;</p> <p>(3) to develop a human-factor analysis of the hazards associated with new technologies to be used by air traffic controllers, mechanics, and flight crews;</p> <p>(4) to identify innovative and effective corrective measures for human errors that adversely affect air safety;</p> <p>...</p> <p>(6) to develop a better understanding of the relationship between human factors and unmanned aircraft system safety</p>
*44505(c)	Research on Developing and Maintaining a Safe and Efficient System
	<p>—The Administrator shall conduct or supervise research on—</p> <p>...</p> <p>(3) human performance in the air transportation environment;</p> <p>(4) aviation safety and security;</p> <p>(5) the supply of trained air transportation personnel, including pilots and mechanics; and</p> <p>(6) other aviation issues related to developing and maintaining a safe and efficient air transportation system</p>
*44513(b)(1)(A)(iii)	Regional Centers of Air Transportation Excellence, Responsibilities. -- Conducting research on—



# Statutory Basis for Human Factors Research (cont.)

49 US Code Section	Title
44506(a)	<b>Research on Effect of Automation on Performance</b>  To develop the means necessary to establish appropriate selection criteria and training methodologies for the next generation of air traffic controllers, the Administrator of the Federal Aviation Administration shall conduct research to study the effect of automation on the performance of the next generation of air traffic controllers and the air traffic control system. The research shall include investigating— (1) methods for improving and accelerating future air traffic controller training through the application of advanced training techniques, including the use of simulation technology; (2) the role of automation in the air traffic control system and its physical and psychological effects on air traffic controllers; (3) the attributes and aptitudes needed to function well in a highly automated air traffic control system and the development of appropriate testing methods for identifying individuals with those attributes and aptitudes; (4) innovative methods for training potential air traffic controllers to enhance the benefits of automation and maximize the effectiveness of the air traffic control system; and (5) new technologies and procedures for exploiting automated communication systems, including Mode S Transponders, to improve information transfers between air traffic controllers and aircraft pilots.
44506(b)	<b>Research on Human Factor Aspects of Automation</b>  The Administrators of the Federal Aviation Administration and National Aeronautics and Space Administration may make an agreement for the use of the National Aeronautics and Space Administration's unique human factor facilities and expertise in conducting research activities to study the human factor aspects of the highly automated environment for the next generation of air traffic controllers. The research activities shall include investigating— (1) human perceptual capabilities and the effect of computer-aided decision making on the workload and performance of air traffic controllers; (2) information management techniques for advanced air traffic control display systems; and (3) air traffic controller workload and performance measures, including the development of predictive models



# Statutory Basis for Human Factors Research (cont.)

49 US Code Section	Title	
44516	Human Factors Program	
	<p>(a) HUMAN FACTORS TRAINING.—</p> <p>(1) AIR TRAFFIC CONTROLLERS.—The Administrator of the Federal Aviation Administration shall—</p> <p>(A) address the problems and concerns raised by the National Research Council in its report “The Future of Air Traffic Control” on air traffic control automation; and</p> <p>(B) respond to the recommendations made by the National Research Council.</p>	
The Future of Air Traffic Control: Human Operators and Automation © 1998 The National Academy of Sciences, Washington, DC: National Academy Press	49 recommendations over 21 topic areas:	<ul style="list-style-type: none"><li>• Levels of automation</li><li>• Adaptable automation</li><li>• Recovery</li><li>• Locus of authority</li><li>• Teamwork</li><li>• Cross-cultural issues</li><li>• Communication: Data Link</li><li>• Flight Management System</li><li>• Flight data</li><li>• Traffic Alert and Collision Avoidance System</li><li>• Converging Runway Display Aid</li></ul>
		<ul style="list-style-type: none"><li>• Precision Runway Monitor</li><li>• Avoiding collisions on the ground</li><li>• Center TRACON Automation System</li><li>• Conflict Probe and interactive planning</li><li>• Four-dimensional contracts</li><li>• Surface Movement Advisor</li><li>• Support functions</li><li>• The future National Airspace System</li><li>• Development and installation of advanced systems</li><li>• Long-range planning</li></ul>

