REDAC / NAS Ops

Air Traffic Control / Technical Operations Human Factors

BLI Number: A11.h

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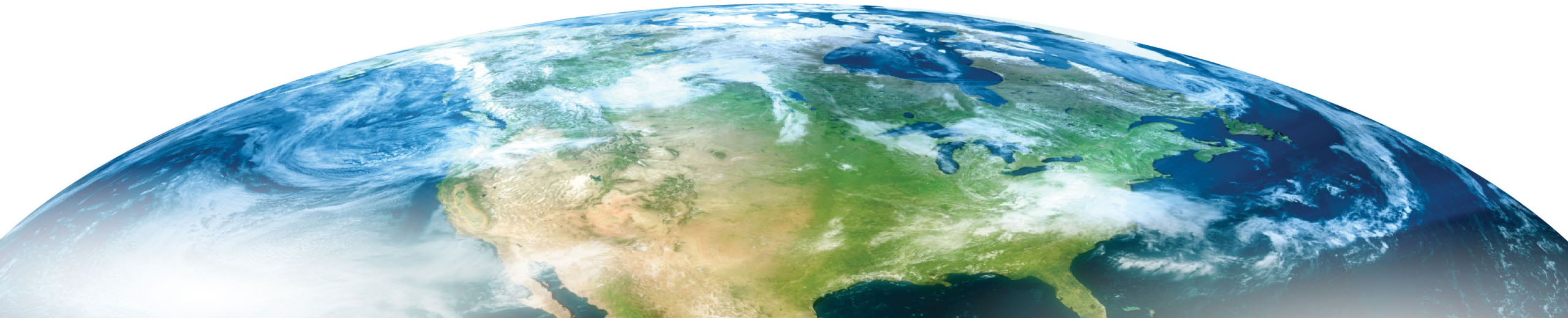
Review of FY 2020 - 2023 Proposed Portfolio



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

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Significant Accomplishments in FY20

- Completing three-year trend study of Ground Interval Management Spacing (GIM-S) capability utilization using mining and analysis of big data collected from ERAM systems
  - *Analyze the conditions under which controllers accept GIM-S advisories.*
  - *Analyze trend data about GIM-S usage as well as operator display settings to identify human factors limiting utilization, and recommend potential mitigations."*
- Completing phase 2 "Human-In-The-Loop" (HITL) study of ATC Information Display Optimization
  - *Integrates multiple new capabilities into the current air traffic control systems.*
  - *Different capabilities, if designed and developed separately from one another, information representations, and interaction strategies. Inconsistencies may result in the use of color, symbology.*
- Publishing report on Effectiveness of Stress Management Training for New Hire Controllers
  - *Based on psychological research and provides background information on stress, stressors, consequences of stress, and stress management techniques. Stress management training was assessed with 118 En Route and Terminal trainees enrolled in Initial Qualification training at the FAA Academy.*

Anticipated Research in FY21

Planned Research Activities and Products

- Complete a literature review on ATC signaling systems (https://rip.trb.org/View/1670686)
- Outline and develop updates to the Human Factors Design Standard (FAA HF-STD-001)
  - Automated ATC systems
  - Information display and management
  - Workstation arrangement and display characteristics
  - ATC touch screens
- Update the Human Factors Job Aid to guide the ATO Program Management Office's human factors practitioners
- Conduct dynamic simulation scenario-based demonstrations of the new ATC display color palette (from the update to FAA HF-STD-010) for field user and NATCA review as part of the color palette transition strategy for existing ATC systems
- Develop and document a job analysis methodology utilizing the existing Career Planning Tool 2.0 (CPT2) database to support the development of new ATO position profiles and career path linkages

Anticipated Research in FY22

Planned Research Activities and Products

- 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
  - 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.

  - 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.

Anticipated Research in FY22 (continued)

Planned Research Activities and Products

- 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.

Emerging FY23 Focal Areas

- For AJI (ATO Safety and Technical Training):
  - Human factors investigator's guide for obtaining ATC field reports including equipment issues, and supporting incident and accident investigation, with documentation of recommendations
  - Facility operational guidance and training for recognition and mitigation of workload effects on controller fatigue and performance
  - Training and procedural guidance recommendations for mitigating the potential deskilling effects of long-term use of automation
  - Recommendations for controller training that measurably increase use of ATC automation capabilities and controller performance (efficiency)

- For AJM (ATO Program Management Office):
  - Deployable human factors simulation capability enabling remotely sited controllers to review and comment on proposed new ATC technologies and procedures
  - Guidance for ATC alerts and information displays and controller training to address commonly occurring errors
  - Develop human supervisory control interactions and performance measures for shared computer-human ATC methods using advanced artificial intelligence decision aiding approaches

- For AJG (ATO Management Services):
  - Develop comprehensive task domain model for air traffic controllers using job task analysis and cognitive task analysis data with current and anticipated technologies and procedures enabling capabilities for terminal and en route ATC
  - Develop ATC maintenance task guidance and standards for Technical Operations personnel
  - Develop new selection tests, ATC option placement guidance, and training approaches for air traffic controllers using JTA and CTA data for technologies and procedures in terminal and en route ATC, considering the latest training technologies

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

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

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).

Out Year Funding Requirements

RE&D

FY20	FY21	FY22
$5.9M	$5.9M	$ 5.9M

Backup information

Statutory Basis for Human Factors Research

49 US Code Section	Title
*44505(b)	Research on Human Factors and Simulation Models
*44505(c)	Research on Developing and Maintaining a Safe and Efficient System
44506(a)	Research on Effect of Automation on Performance
44506(b)	Research on Human Factor Aspects of Automation
*44513(b)(1)(A)(iii)	Regional Centers of Air Transportation Excellence, Responsibilities. --
44516(a)	Air Traffic Controllers

* 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
	The Administrator shall conduct or supervise research— (1) to develop a better understanding of the relationship between human factors and aviation accidents and between human factors and air safety; (2) to enhance air traffic controller, mechanic, and flight crew performance; (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; (4) to identify innovative and effective corrective measures for human errors that adversely affect air safety; … (6) to develop a better understanding of the relationship between human factors and unmanned aircraft system safety
*44505(c)	Research on Developing and Maintaining a Safe and Efficient System
	—The Administrator shall conduct or supervise research on— … (3) human performance in the air transportation environment; (4) aviation safety and security; (5) the supply of trained air transportation personnel, including pilots and mechanics; and (6) other aviation issues related to developing and maintaining a safe and efficient air transportation system
*44513(b)(1)(A)(iii)	Regional Centers of Air Transportation Excellence, Responsibilities. -- Conducting research on–
	… human performance in the air transportation environment…

Statutory Basis for Human Factors Research (cont.)

49 US Code Section	Title
44506(a)	Research on Effect of Automation on Performance
	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)	Research on Human Factor Aspects of Automation
	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	
	(a) HUMAN FACTORS TRAINING.— (1) AIR TRAFFIC CONTROLLERS.—The Administrator of the Federal Aviation Administration shall— (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 (B) respond to the recommendations made by the National Research Council.	
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: • Levels of automation • Adaptable automation • Recovery • Locus of authority • Teamwork • Cross-cultural issues • Communication: Data Link • Flight Management System • Flight data • Traffic Alert and Collision Avoidance System • Converging Runway Display Aid	• Precision Runway Monitor • Avoiding collisions on the ground • Center TRACON Automation System • Conflict Probe and interactive planning • Four-dimensional contracts • Surface Movement Advisor • Support functions • The future National Airspace System • Development and installation of advanced systems • Long-range planning