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FAA Office of NextGen (ANG)

REDAC / NAS Ops

Review of FY2022 – 2024 Proposed Portfolio

ATC / Technical Operations Human Factors R&D

BLI Number: a11.i

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ATC / Technical Operations Human Factors R&D Overview

What are the benefits to the FAA

- **Improving the safety and efficiency of complex ATC systems by application of R&D to address factors affecting human performance in air traffic control operations and ATC system maintenance through improved guidance, selection, and training.**
- **Recommending and testing improvements to design, procedures, training, selection and placement; and mitigations to address human performance shortfalls.**

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.**

ATC / Technical Operations Human Factors R&D Program Support

People:

- **Program Manager – Dan Herschler, ANG-C1**
- **Subject Matter Expert – Bill Kaliardos, ANG-C1**

Laboratories:

- **ANG-E25 Human Factors Branch, NextGen Aviation Research Division Research and Development Human Factors Laboratory**
- **AAM-520 NAS Human Factors Safety Research Laboratory**
- **John H. Volpe National Transportation Center**

University Partners:

- **University of Chicago**
- **University of Oklahoma**
- **The Ohio State University**
- **Embry-Riddle Aeronautical University**

Research Focus Areas

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

Current FY22 Accomplishments

Representative Research Activities and Products	Anticipated Operational Benefit
Improved Design And Operation Of ATC Systems (NAS Technology Integration) 1. Gap Analysis Report with Research Recommendations for Touch User Interfaces 2. Draft Recommended Touch User Interface Guidelines for the Human Factors Design Standard 3. Draft update to the Human Factors Job Aid 4. Interim Report: Effective Integration of Human Factors Engineering into System Development Acquisition Programs 5. A Handbook for Effective Signaling in Air Traffic Control Phase 2: Signaling Philosophy (https://rosap.ntl.bts.gov/view/dot/58633) 6. Alarms, alerts, and warnings in air traffic control: An analysis of reports from the Aviation Safety Reporting System. Transportation Research Interdisciplinary Perspectives, Vol 12, December 2021, https://doi.org/10.1016/j.trip.2021.100502 7. Recommended updates to the 2016 FAA Human Factors Design Standard (HF-STD-001B): Automation, Workstation Design, and Information Management (draft report)	Developed guidance materials for Air Traffic Control system acquisition programs and human factors practitioners in the ATO Program Management Office (AJM). Application will result in improved integration of human factors methods and requirements into system acquisitions to comply with FAA Order 9550.8 Human Factors Policy. The anticipated benefits include improved usability, human performance, and reduced errors, leading to greater efficiency and safety in NAS operations.

Current FY22 Accomplishments

Representative Research Activities and Products	Anticipated Operational Benefit
Improved Controller Selection And Training 1. Initiated projects to conduct job analyses to inform training recommendations for the ATCSCC controller and NOTAM specialist positions 2. Completing research to identify controller visual scanning best practices and training recommendations for new tower controllers 3. Completed research on effectiveness of virtual training methods for the Air Traffic Basics course at the FAA Academy	Provide recommendations for training: • Address strategic traffic management job functions and strengthen performance of personnel in critical air traffic positions. Anticipated benefits include improved controller performance leading to greater efficiency and safety in NAS operations, including Trajectory Based Operations. • Enable new controllers to adopt effective visual scanning practices to improve performance and safety in airport traffic areas and ground movement areas • Demonstrate improve resilience in delivery of Academy academics through use of virtual training during the pandemic, while reducing training costs.

Anticipated Research in FY23

Planned Research Activities

- **FAA Technical Center - Human Machine Teaming: Current State of Synthetic Teammates and Human Factors Research Plan**
- **Volpe Center – Complete recommendations for updates to the Human Factors Design Standard**
- **CAMI – Stress Management Training Research; Controller PIREP dissemination; Job analyses with training recommendations for ATCSCC controllers and NOTAM specialists; ATSS Competency Model Development**
- **Ohio State, University of Michigan, Emilie Roth - Human Factors Guidance for the Design, Implementation and Evaluation of AI/ML in the Human-Automation ATC Systems Context**
- **Embry Riddle, University of Alaska - Anchorage - Human Performance Considerations for Use of Enhanced Automation in Flight Service Stations**

Expected Research Products

- **Human factors guidance for system acquisition programs and human factors practitioners in the ATO Program Management Office (PMO) for application of ATC automation including AI/ML**
- **Human Factors guidance for Alaska Flight Service Station enhanced automation systems -- evaluation and selection**
- **Stress management guidance and training recommendations for personnel at FAA field facilities**
- **Training recommendations for ATCSCC controllers and NOTAM specialists, including use of advanced automation for trajectory based operations**
- **Human Factors Design Standard recommended updates for Workstation Arrangement and Information Display Management**

Emerging FY24 Focal Areas

- Identify measurement and mitigation strategies for potential controller performance challenges, supporting the NextGen automation evolution strategy and initiatives described in the 2035 Vision (Charting Aviation's Future):
  - Controller performance challenges and mitigations related to automation dependency and deskilling
  - Challenges and mitigations for increases in controller workload and perceived stress with increasing automation and task complexity

- Conduct studies to evaluate media alternatives to improve training effectiveness and efficiency (reduced training time, higher skill acquisition rates), to address anticipated needs for controller and technician hiring and advanced technical skills:
  - Increase use of virtual (remote) training
  - Assess the effectiveness of augmented reality and virtual reality (AR/VR) technologies for developing controller scanning skills and for training complex equipment maintenance skills
  - Recommendations to improve controllers' PIREP handling and dissemination through training, procedures, and controller workstation design features

- Develop "remote laboratory" simulation capabilities:
  - Enable field personnel to participate in human factors evaluations of proposed new and revised technologies and procedures
  - Leverage "Cloud En Route Automation Modernization in a Box" initiative for human factors assessments of new technologies

ATC / Technical Operations Human Factors R&D

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

- Mitigations for controller automation dependency and deskilling
- Proposed approaches to address controller workload and stress with increased ATC automation
- Recommendations for controller training, procedural changes, and controller workstation design features to improve PIREP handling and dissemination
- Job analysis data with training recommendations for ATCSCC controllers and NOTAM specialists, for new automation and TBO

FY 2024 Planned Research

- Identify measurement and mitigation strategies for potential controller performance challenges, supporting the NextGen automation evolution strategy and initiatives described in the 2035 Vision (Charting Aviation's Future)
- Conduct studies to evaluate media alternatives to improve training effectiveness and efficiency (reduced training time, higher skill acquisition rates), to address anticipated needs for controller and technician hiring and advanced technical skills
- Develop "remote laboratory" simulation capabilities

Out Year Funding Requirements

RE&D

FY22	FY23	FY24
$ 5.9M	$5.9 M	$5.9 M