REDAC / Human Factors

Air Traffic Control / Technical Operations
Human Factors

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Presenters' Names:
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Review of FY 2021Ongoing Work and FY 2022 - 2023 Plans

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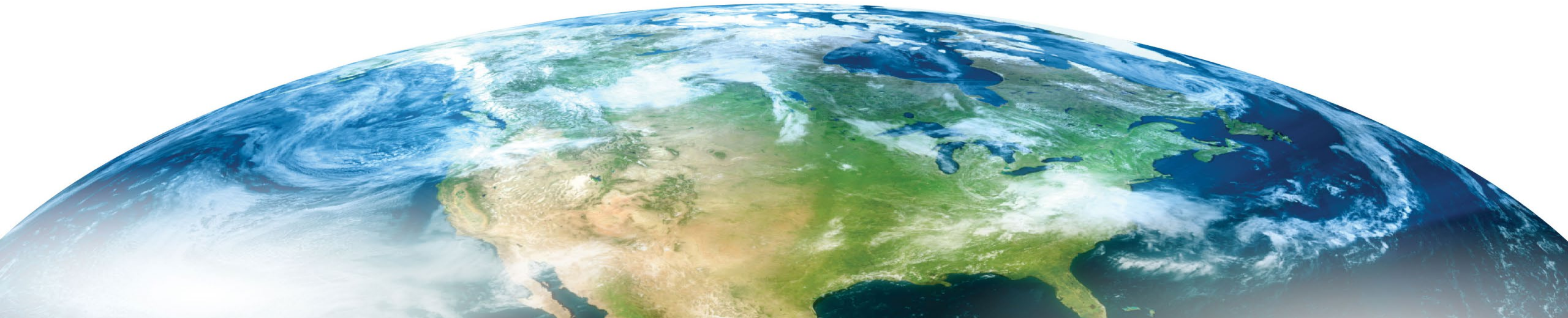

Air Traffic Control / Technical Operations Human Factors **Overview**

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.**

Air Traffic Control / Technical Operations Human Factors

Program Support

People:

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

Laboratories:

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

University Partners:

- University of Chicago
- University of Oklahoma
- The Ohio State 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 FY21 Ongoing Work

Research Area: Improved Safety, Reduced Hazards, And Error Mitigation In ATC	
Research Activity	**Status and Product**
ATO Fatigue Mitigation Effectiveness -- *Examine the effectiveness of air traffic controller fatigue mitigations that ATO has implemented in recent years.*	Completed agreement for consulting support from a MITRE fatigue scientist. Project is currently on hold pending relaxation of COVID-19 restrictions on access to field facility personnel and resumption of typical air traffic volume. Final report expected in FY2022.
Operational ATC Workload and Fatigue Assessment -- *Examine the relation between controller task load and experienced (subjective) workload and fatigue, identify safety outcomes.*	Completed agreement for consulting support from a MITRE fatigue scientist. Project requires collection of subjective workload and fatigue data from controllers at field facilities. That aspect of the work has been on hold pending relaxation of COVID-19 restrictions. Final report expected in FY2022.
ATC Human Factors R&D Support for FAA Response to NTSB Report AIR-18-01 Recommendations -- *This multi-phased study will survey key areas across ATC to identify relevant safety critical information needed, the appropriate timing for distribution, and the most appropriate presentation for usability.*	Final report expected in FY2022 describing best practices to organize and present safety critical information for optimal use. Will potentially include recommendations for changes to ATC procedures and training that support the controller workforce, increasing the likelihood of delivering just-in-time safety critical information to enhance safety in the NAS.

Current FY21 Ongoing Work (continued)

Research Area: Automation Effects And Controller Performance	
Research Activity	**Status and Product**
ATC System Capability Utilization -- *Three year project demonstrating the ability to use data mining to inform program offices and system safety organizations about human factors that are affecting the use of new system capabilities in the field.*	Final report on results to be completed this month. Addresses human factors aspects and operational conditions associated with underuse or misuse of capabilities (e.g., GIM-S / TBFM, DataComm, Runway Assignments). Benefits system users and development programs in support of performance baselining, assessment, and requirements/training formulation.
Human Machine Teaming -- *A multi-year project where its first year objectives are to:* *(1) review the current state of synthetic teammates with an emphasis on human factors considerations that are specific to work with synthetic team members and* *(2) develop a recommended research plan. Although most examples focus on air traffic control, this applies to technical operations and air traffic management as well.*	Final report expected in FY2022 will provide context and milestones in a recommended plan for multi-year R&D that will provide HF design and training guidance. This guidance will address how the controller can effectively manage and communicate with AI-based automation in a human-automation team concept. Another anticipated result will be identification of KSAOs for selecting personnel who would be capable and effective in teaming with AI-based automation.

Current FY21 Ongoing Work (continued)

Research Area: Improved Design And Operation Of ATC Systems (NAS Technology Integration)	
Research Activity	**Status and Product**
Color Palette and Palette Deployment -- *Implement the new standard color palette in FAA HF-STD-010A on the DESIREE platform at the William J. Hughes Technical Center for Terminal and En Route systems to support a dynamic demonstration and usability assessment.*	Final report, expected in FY2022, will identify any latent human factors considerations that would affect the broad implementation of the new color palette in existing and future ATC automation platforms. Project is currently on hold pending relaxation of COVID-19 restrictions on field facility personnel as demo participants.
Color Palette for High Ambient Lighting Conditions -- *Conduct research to develop recommended modifications to the standard display color palette for use in the air traffic control tower environment, and test the operational suitability of the palette under high ambient lighting conditions representative of ATC towers.*	Study results in FY2022 will include a revised display color palette that can be used in the design of tower displays. This is to address the fact that the tower environment has high ambient lighting during daytime hours. It may be challenging for controllers to determine the color of graphics and text because of glare, making it difficult to identify critical information and potentially compromising safety.
Human Factors Guidance Materials for Air Traffic Systems -- *Developing updated Human Factors Design Standard (FAA HF-STD-001) sections on automated ATC systems, information display and management, and workstation arrangement and display characteristics.*	FY2021 technical report containing results of a literature review and the associated recommended human factors guidance and requirements for inclusion in the Human Factors Design Standard. When these sections have been implemented in a future revision of the design standard, the requirements and guidance will inform the development and evaluation of ATC systems based on the latest available technical information

Current FY21 Ongoing Work (continued)

Research Area: Improved Design And Operation Of ATC Systems (NAS Technology Integration) - Continued	
Research Activity	**Status and Product**
Alarms and Alerts Handbook and Controller Training -- *Developing an Alarms and Alerts Handbook to guide system design regarding signaling systems, and associated training for controllers in the use of these system notifications.*	Handbook deliverable expected in FY2022 will guide HF practitioners with a standardized methodology to determine how and when to use various kinds of alarms and alerts in system design to help reduce the number of each and their potential for repetitiveness, redundancy, conflict or confusion, and nuisance.
Update Human Factors Design Standard Section on Touch Screens -- *Performing literature review and gap analysis, market research to identify best practices and existing standards, assessment of applicability, and recommendation of updates to FAA HF-STD-001B, touch based user-interface section.*	Technical report to be delivered in early FY2022 will support update to the FAA Human Factors Design Standard (FAA HF-STD-001B) with the latest technical information that will enable ATC system developers to address human factors requirements and guidance applicable to touch-based user interfaces.
Update Human Factors Job Aid and Develop HF Practitioner Training -- *Performing literature review and gap analysis, market research to identify best practices and existing standards, and develop guidance to inform the selection and application of human factors tools and techniques in development and evaluation of ATC systems.*	Job Aid update will be completed in FY2022; web-based HF practitioner training course will be completed in FY2024. Study results support ATC system development by providing improved understanding and application of human factors by acquisition program personnel in order to improve compliance with FAA Order 9550.8 and AMS policy and guidance.

Current FY21 Ongoing Work (continued)

Research Area: Improved Controller Selection And Training	
Research Activity	**Status and Product**
Tower Controller Visual Scanning Instructional Methods -- *Tower Scanning was identified as one of AJI's Top 5 ATC Safety Hazards in 2016 after numerous safety incidents had occurred. Collected eye tracking data and subjective reports of controller visual scanning practices in studies conducted during the past five years.*	Enroute Scanning Training Tool Prototype expected to be ready this month. Scanning best practices report expected in early FY2022. Study results will support development of FAA Academy and recurrent field training on tower controller scanning best practices, reducing the likelihood of safety incidents attributed to controller scanning.
Training for ATC New Hires on Common Competencies: Proficiency Level of Academy Graduates -- *Identifying the competencies (or collection of KSAOs) and proficiency levels that can be trained at the Academy, to enable consistent and reduced training time to Certified Professional Controller (CPC) in field training.*	ATC Competency Model expected in FY2022. Increasing the consistency in the time needed to achieve CPC would contribute to greater accuracy in the ATC workforce staffing plan. Reducing the requirement for OJT hours and overall time to certification would ultimately reduce the total cost of field training.
ATCS Selection Process Evaluation -- *Identifying the selection factors influencing training success and determine how changes in selection criteria or qualifications affects the hiring and training pipeline of the ATCS occupation.*	Final report is expected in September. Findings will enable FAA to revise or establish new selection policy for selecting ATCSs, address option placement issues, and the qualifications used under different hiring authorities.

Current FY21 Ongoing Work (continued)

Research Area: Improved Controller Selection And Training - Continued	
Research Activity	**Status and Product**
ATSS and ATCS Competency Alignment – *Development of ATSS competency model can inform classification, training, or career progression programs.* • *Description of changes to the ATSS occupation based on the updated Conops* • *Description of competencies, proficiency levels, and behavioral indicators by job level*	Delivered FY2021 sponsor briefing/report on the mapping of KSAs to ICAO competencies for ATSEPs and ATCS. Technical report and sponsor briefing on competency model are expected in mid-FY2022. The mapping of the ATSS JTA information with ICAO competencies will ensure that ATSS requirements are in line with the ICAO recommendation for the ATSEP occupation.
ATSCC Training Needs Analysis *Update and enhance job task analyses for National Traffic Management Specialists (NTMS) and Traffic Management Coordinators (TMC), identify ATCSCC training needs with emphasis on decision support tools, and plan for expanding new training capabilities to the facilities.*	Technical report expected mid-FY2022. Will improve performance of the ATSCC workforce and efficient use of decision support tools.

Current FY21 Ongoing Work (continued)

Research Area: Improved Controller Selection And Training - Continued	
Research Activity	**Status and Product**
Assessment and Evaluation of transition of Initial Qualifications En Route ATC course from resident training to virtual/blended learning -- *Evaluating the impact of blended (virtual and classroom) training on knowledge and skill acquisition of new hire trainees in the En Route ATC option.*	Convened FAA Academy focus groups. Research results will inform ATC training policy decisions regarding use of virtual/blended learning for new hire ATC En Route training.
Evaluation of the Virtual Air Traffic Training Environment -- *(1) Evaluated new hire trainees' experience in the virtual classes, knowledge retention, and the impact of training delays on AT Basics and Initial Qualification training performance.* *(2) Evaluated pass rates for the AT Basics and Initial Qualifications courses in the virtual training environment, and compared to historical pass rates in the classroom-only training delivery environment.*	Research results (expected in September) will inform ATC training policy decisions regarding use of the virtual learning for new hire training.

Current FY21 Ongoing Work (continued)

Research Area: Controller And Technical Operations Workforce Optimization	
Research Activity	**Status and Product**
Develop and Document an Efficient and Cost Effective Job Analysis Methodology -- *AJG needs guidance and examples for how to conduct job analyses for the AJT and AJW workforces. Project phases:* *(1) Create a job analysis report defining an efficient and cost effective methodology. Contents of the report should include data collection and data analysis methods that reduce SME requirements, timelines, resources, and materials;* *(2) Apply the job analysis methodology on one position in AJT and one position in AJW to demonstrate its use and to provide instructional materials for AJG analysts.*	The job analysis methodology report will be used to support ATO Management Services (AJG) efforts to define job task requirements by applying the method in multiple job task domains in AJT and AJW.
NOTAM Specialist job requirements study to identify and align training and certification needs -- *Conducting a job/task analysis (JTA) for NOTAM Specialists, who are responsible for editing and cancelling domestic NOTAMs, as well as preparing international NOTAMs following the ICAO format. In order to perform these duties, NOTAM Specialists must be trained in the proper procedures, especially in the FSS field.*	JTA results will provide guidance and a set of standards that can be used for NOTAM Specialist certification and a training progress assessment. Currently, no formal training exists even though there are formal training standards, so this job task analysis and training needs assessment project will help AJV to define requirements for the NOTAM specialist position. A training analysis report is expected later in FY2022.

Anticipated Research in FY22-FY23

Research Area: Improved Safety, Reduced Hazards, And Error Mitigation In ATC
Planned Research Activity
Improve Human-Automation Teaming – *Continued work to define user needs for system automation features that enable seamless integration for Air Traffic Control operations. To improve controller performance, research will enable development of user-system interface guidance for system developers, and controller training to support implementation of AI in ATC decision aids*

Research Area: Automation Effects And Controller Performance
Planned Research Activity
Identify and Mitigate Undesirable Automation Effects *Develop training and procedural guidance recommendations for mitigating the potential deskilling effects of long-term use of automation*
Address Controller Fatigue Issues *Develop facility operational guidance and training for recognition and mitigation of workload effects on controller fatigue and performance. Facility guidance and controller training will increase awareness of fatigue effects and drive improvements in facility operation to mitigate fatigue and improve controller performance.*

Research Area: Improved Design And Operation Of ATC Systems (NAS Technology Integration)
Planned Research Activity
Human Factors Design Guidance – *Develop guidance for ATC alerts and information displays and controller training to address commonly occurring errors.*

Anticipated Research in FY22-FY23 (continued)

Research Area: Improved Controller Selection And Training
Planned Research Activity
Controller Training – *Develop recommendations for controller training that measurably increase use of ATC automation capabilities and controller performance*
Develop a report identifying controller performance measures that are sensitive to use of ATC automation capabilities, and initial candidate recommendations for controller training.
Improve effectiveness and efficiency in controller Academy and field facility training using the variety of training technologies and methods that are available.

Research Area: Controller And Technical Operations Workforce Optimization
Planned Research Activity
Maintain and Develop Human Factors R&D Capabilities at CAMI and the WJHTC to Meet Future Needs for Scientific Information in System Design for Automated Systems, Personnel Selection and Training, and Successful Integration of NAS Systems – *(1) Develop and execute a research plan to address key human factors research competencies and knowledge bases in areas supporting decisions to automate ATC tasks, reduce errors, improve system design, and enhance effectiveness of training.* *(2) Develop a deployable human factors simulation capability enabling remotely sited controllers to review and comment on proposed new ATC technologies and procedures*

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

- 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 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	FY23
$5.9M	$5.9M	$ 5.9M	$ 5.9M

F&E

FY20	FY21	FY22	FY23	FY24	FY25
$ 0	$ 0	$ 0	$ 0	$ 0	$ 0

Note: RE&D FY23 and beyond is notional.