REDAC / Human Factors

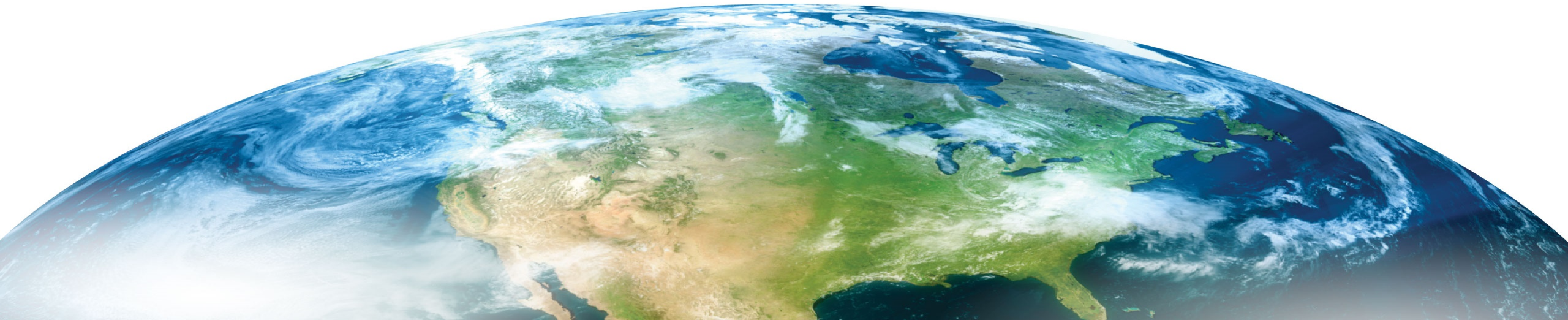*Review of FY 2020 - 2023 Proposed Portfolio*

Name of Program: NextGen Air Ground Integration Human Factors

BLI Number: 111110

Presenter Name: Dr. Victor Quach

Date: August 18, 2020

NextGen Air/Ground Integration Human Factors Overview

Program Scope

- This program addresses research, engineering, and development requirements defined by technical sponsors in the Aviation Safety Organization (AVS). Requirements are driven by the intersection points between FAA policy documents, NextGen changes, and enabling flight deck technologies and procedures

FAA Benefits

- Program outputs are transferred to AVS technical sponsors to develop and maintain, as appropriate, human factors-related rules, guidance, procedures, Orders, standards, job aids, and other materials

- Work products benefit Aircraft Certification and Flight Standards personnel who evaluate and approve emerging aircraft systems (e.g., displays, devices, controls), procedures, and operations which may not be covered by existing human factors documentation

Measures of Success

1. Sponsor Satisfaction – did the research meet AVS's needs?

2. Access to Research – is there sufficient awareness/access to results?

3. Application of Results – did the research support or inform a data-driven decision?

4. NextGen Benefits – how did the research contribute to safety, capacity, and/or efficiency?

NextGen Air/Ground Integration Human Factors Program Managers and Performers

Program Managers

- Tara Holmes, Division Manager (Tara.Holmes@faa.gov)
- Sabreena Azam (Sabreena.Azam@faa.gov)
- Dr. Bill Kaliardos (Bill.Kaliardos@faa.gov)
- Karl Kaufmann (Karl.Kaufmann@faa.gov)
- Dr. Victor Quach (Victor.K.Quach@faa.gov)

Performers and Laboratories

- FAA Civil Aerospace Medical Institute
- FAA William J. Hughes Technical Center
- NASA Ames Research Center, NASA Langley Research Center
- Volpe National Transportation Systems Center, DOT
- MITRE Corporation
- Honeywell
- University of Central Florida
- University of Michigan

NextGen Air/Ground Integration Human Factors Accomplishments in FY20

Project	Description/Product	Vendor
Human Factors Considerations for Multi-Modal Controls (Touchscreens) – Fixed Wing	Interim report describing the results of a human-in-the-loop (HITL) simulation which examined the human factors aspects of multi-function aircraft controls; specifically multi-touch touchscreen controls.	Honeywell
Validation of Cockpit Display of Traffic Information (CDTI) Display Features in a Metered and Non-Metered Environment – Single Runway	Final report describing various implementations of the minimum CDTI display requirements, defined by RTCA SC-186 working group (WG) 4, for single runway interval management (IM) flight operations in a metered and non-metered Terminal environment. Results will inform recommendations to modify or retain the minimum operational, safety, technical, and CDTI requirements as specified in current drafts of avionics standards (DO-328B, DO-361A). The Air Traffic Organization (ATO) will apply results to validate the IM concept of operations and preliminary air/ground function allocations.	MITRE
Human Factors Evaluation of Low Energy Alerting and Awareness Technologies	Interim report describing preliminary results of HITL simulation which examined the contribution of prototype displays to pilot awareness and response to low energy events, high energy events, and loss of control scenarios (i.e., predictive information, alerts, recovery guidance, etc.). Research could help address requirements introduced by CAST SE-207 (Safety Enhancement – 207 Attitude and Energy Awareness Technologies), and to develop initial human factors evaluation criteria for future flight deck technologies.	NASA Langley
Human Factors Evaluation of Predictive System State Awareness Alternatives to Identify Potential Mitigations for Loss of Aircraft Control	Final report describing the results of a HITL simulation which examined the contribution prototype displays, alerts, and icons to flight crew awareness of automated system status and the interaction of systems during normal and non-normal situations. Research could help address requirements introduced by CAST SE-208 (Airplane System State Awareness), and to develop initial human factors evaluation criteria for future flight deck technologies.	

NextGen Air Ground Integration Human Factors Accomplishments in FY20

Project	Description/Product	Vendor
Operational Complexity in Performance-Based Navigation Arrival and Approach Flight Operations	Final report describing the results of a human factors ASRS analysis to understand the affect Performance Based Navigation (PBN) operational complexity to pilot performance, flight deck procedures, and resilient flightcrew behaviors.	**Volpe**
Flight Deck Human Factors Issues in Lateral Deviations During North Atlantic Flight Operations	Final report describing the observed contribution of partial degree waypoints (on/off Organized Track System routes), system limitations, and flight deck procedures to lateral route deviations in en route North Atlantic (NAT) flight operations.	**Volpe**
Use of Enhanced Flight Vision Systems (EFVS) for Low Visibility Takeoffs	Final report describing the results of a HITL simulation which examined human factors considerations when using an Enhanced Flight Vision System (EFVS) on a head-up display in lieu of required airport infrastructure for low visibility takeoffs, versus pilot performance using natural vision with the required infrastructure. Results have the potential to inform operational credit changes which could allow more reduced visibility takeoffs and increase the number of viable airports for takeoff under low visibility conditions	**CAMI**

Ongoing and Anticipated Research in FY21+

Project	Description/Product	Vendor	Est. Completion
Human Factors Considerations for Electronic Data-Driven Charts	Evaluate the perceived importance of information elements/features depicted on paper (static) charts. Identify the minimum elements/features needed for pilots to complete a thorough verbal chart briefing. Examine the pilot performance impact(s) of configurable charts that may or may not include all of the elements/features verbally briefed by the flightcrew.	CAMI, Volpe	FY21 Q1
Validation of CDTI Display Features in a Metered and Non-Metered Environment – Dependent Staggered Approaches (DSA)	Conduct a HITL simulation to evaluate various implementations of the minimum CDTI display requirements, defined by RTCA SC-186 WG4, for IM DSA flight operations in a metered and non-metered Terminal environment.	MITRE	FY21 Q3
Human Factors Evaluation of Low Energy Alerting and Awareness Technologies	Final report describing results of HITL simulation which examined the contribution of prototype displays to pilot awareness and response to low energy events, high energy events, and loss of control scenarios.	NASA Langley	FY21 Q3
Human Factors Aspects of Emerging Head-Mounted Display (HMD) Applications – Small Aircraft	Conduct a HITL simulation in a fixed-based simulator to evaluate the initial pilot performance implications which may be introduced by emerging HMD features (i.e. mixed reality) and functions in small aircraft. This study will also examine the initial human-system performance impacts of monocular vs. binocular displays.	CAMI	FY21 Q3
Human-System Safety / Human Factors Risk Analysis Method Alternatives	Evaluate and document current-day methods used by the FAA and other high-risk industries to factor and include human performance in safety assessments and human factors risk assessment.	NASA Ames	FY21 Q3
Enhanced Helicopter Vision System (EHVS) Technologies	Conduct a study to evaluate the contribution of emerging EHVS technologies to pilot performance, including their use as a potential safety enhancement, and to potentially conduct low visibility approach and landing operations in a helicopter.	WJHTC	FY21 Q3

Ongoing and Anticipated Research in FY21+

Project	Description/Product	Vendor	Est. Completion
Human Factors Considerations for Multi-Modal Controls (Combined Controls) – Fixed Wing	Final report describing the results of a HITL simulation which examined the human factors aspects of multi-function aircraft controls; specifically multi-touch touchscreen controls and voice activated/recognition controls.	**Honeywell**	**FY21 Q4**
Evaluate the Impact of Current and Planned National Airspace System (NAS) Procedures to Flight Deck Operations in the Northeast Corridor (NEC)	Conduct an analysis to understand current-day flight deck human-system integration issues related to PBN, and opportunities to prevent these issues from resurfacing in future procedure-based concepts with a PBN dependency.	**Volpe**	**FY22 Q1**
Pilot Response to Unexpected Events	Conduct an analysis to provide efficacy data on potential training interventions which could promote resilient behavior during unexpected events.	**University of Central Florida**	**FY22 Q1**
Manual Flight Ops – Low Altitude Terminal Operations	Evaluate the current state of low-altitude manual flight operations (MFO) in the NAS, and how industry maintains/evaluates MFO skill proficiency. Examine the potential impact of flight guidance system and flight control system dependencies to baseline MFO tasks, and the potential impact of NextGen changes to MFO practice opportunities in future line operations.	**MITRE**	**FY22 Q2**

Ongoing and Anticipated Research in FY21+

Project	Description/Product	Vendor	Est. Completion
Cognitive Skill Degradation – Verification and Validation	Baseline the cognitive skills and knowledge required to complete flightpath management (FPM) tasks in current Part 121 operations, including the use of automated systems to complete FPM-related tasks.	Honeywell	FY22 Q2
EFVS Visual Advantage Operational Data Collection	Conduct a longitudinal study to validate visual advantage values established for existing EFVS models (Infrared-based sensors) – i.e. are current values adequate, too restrictive, or too lenient. Data will help implement the new EFVS rule, which broadly accommodates existing and future EFVS systems/sensors not yet evaluated.	CAMI	FY22 Q2
Low Visibility Operations Using Synthetic Vision Guidance System (SVGS) Information on HMDs	Evaluate the pilot performance considerations and viability of using SVGS-HMD for 150ft decision heights in 1400 runway visual range (RVR) conditions. Research builds on recent efforts that helped update AC 120-118 in July 2018 (SVGS-HDD).	CAMI	FY22 Q2
Flight Deck Information Management – Phase 1 Baseline Assessment *(Planned)*	Analyze the available data, displays/interfaces, display configurations, accessibility of information, and the resulting demands and challenges introduced by modern transport category across phases of flight to pilots. Examine current-day information management vulnerabilities and the mitigations successfully and/or unsuccessfully applied to address them	University of Michigan	FY22 Q4
Impact of Clearance Complexity and Flight Deck Procedures to Pilot Error in North Atlantic Flight Operations *(Planned)*	Analyze subjective and objective data related to Gross Navigational Errors (GNEs) attributed to complex clearances and clearance negotiation during NAT flight operations, including voice communications, Data Communications, and 3rd party voice communications	Volpe	FY22 Q4

Ongoing and Anticipated Research in FY21+

Techniques to Evaluate Monitoring Training and Monitoring Performance *(Planned)*	Identify a range of viable methods/techniques which could be used to evaluate flight deck monitoring training and to evaluate monitoring performance during flight operations, including a subset of methods potential methods for verification and validation.	**NASA AMES**	**FY22 Q4**
Human Factors Considerations for Multi-Modal Controls (Speech Controls) – Rotorcraft *(Planned)*	Conduct a HITL simulation to examine the human factors aspects of multi-function aircraft controls; specifically speech recognition controls and speech activated controls during single and dual pilot flight operations in a rotorcraft.	**Industry**	**FY22 Q4**
Combined Vision Systems (CVS)	Conduct a study to examine the contribution of CVS to pilot performance. This research will evaluate the potential use of CVS as a substitute for required airport infrastructure during low visibility takeoff operations. It will also examine the preliminary contributions of CVS to pilot performance during low visibility approach, landing, and rollout operations. This study will evaluate CVS on a head-up display and CVS on a head-down display.	**CAMI**	**FY23 Q1**