REDAC Subcommittee on Human Factors WINTER/SPRING 2019 | MINUTES

Meeting date | *March 12-13, 2019*

Meeting location | *Boeing, Seal Beach, CA*

Purpose: Review Research, Engineering and Development (RE&D) accomplishments and expectations for fiscal year 2019 and proposed requirements for fiscal year 2021.
Facilitator: Dr. Bill Kaliardos, Designated Federal Official (DFO)
Note Taker: Dr. Bill Kaliardos; Evan Harvey

All releasable briefings can be found at: https://redacdb.faa.gov/browse.cfm.

Minutes from meeting:

Tuesday, March 12th, 2019

Welcome / Opening Comments / Introductions | Presenter:s: *Dr. Barbara Holder, HF Subcommittee Chair, Dr. Bill Kaliardos, DFO*

Drs. Bill Kaliardos and Barbara Holder welcomed the Subcommittee and gave introductions. The members introduced themselves. The Subcommittee reviewed the agenda and the meeting was called to order.

Introduction – Boeing Commercial Aircraft, Customer Support (BCA-CS) | Presenter:: *Cornelia Townsend, VP of BCA-CS*

Ms. Cornelia Townsend, Vice President of Boeing Commercial Aircraft, Customer Support, gave an introduction and welcomed the Subcommittee and attendees. She explained the functions of the facility (Boeing's Operations Center) and what to expect on the planned tours.

Update from Full Committee Meeting | Presenter:: *Dr. Barbara Holder, HF Subcommittee Chair*

Dr. Barbara Holder provided an update on the Full Committee Meeting. She reminded the audience of the purpose of the REDAC, emphasizing the benefit their input brings in terms understanding the broader R&D landscape. She listed various goals of the meetings (shown in briefing). She then moved to an overview of the Full Committee meeting. She explained that the FAA Research and Development (R&D) landscape was to be a major focus of this meeting, asking for feedback from the Subcommittees on the content and direction of the landscape. She also detailed the new process for Findings and Recommendations (F&Rs), highlighting there was a new mandate requiring the FAA to respond to the F&Rs within 60 days of the official release.

Dr. Holder moved on to a description of Finding and Recommendations (F&Rs) and the elements of a quality F&R, emphasizing especially that the recommendations must be actionable. Dr. Holder finished her briefing by giving an overview of the "Human Factors Emerging Issues List" that the HF Subcommittee has been developing over the last few meetings.

Aviation R&D Research Landscape (F&R #1) | Presenter:s: *Maureen Molz, Division Manager, NextGen R&D Management Division, ANG-E4*

Ms. Maureen Molz and her team briefed on the current state of the Aviation R&D Research Landscape and the tasking they are asking of each of the REDAC Subcommittees. She began by defining a landscape as a "collection of research drivers that provides information about their potential impacts to the industry", with a driver being any force that stimulates R&D investment. She explained that the tasking for the Subcommittee was to help the FAA understand the aviation industry's strategic focus and provide input on the progress of the R&D Research Landscape. Maureen asked the Subcommittee to review the list of drivers (25 in total) and identify missing items. The Subcommittee asked to review and define the list of drivers with Maureen and her team, as some members were unclear of the definition of certain drivers. Following the review of the drivers, the Subcommittee determined that the list must be refined, with clearer descriptions. The Subcommittee offered their list of Human Factors Emerging Issues, a list the Subcommittee has been developing over past meetings, as their response to the Research Landscape. The Subcommittee determined that the F&R in reference to the R&D Landscape would remain open, and requested for an update briefing at a future meeting, at which point the Subcommittee will provide their feedback for analysis.

Morning Break

AVS Core Submitted Research Requirements | Presenter:: *Dr. Michelle Yeh, Human Factors Specialist/Aircraft Certification RED Team Lead*

Dr. Michelle Yeh briefed the Subcommittee on the FAA Office of Aviation Safety (AVS) Core Research Requirements that have been submitted. She stepped through each proposed requirement and provided an overview, which can be found in the online REDAC repository linked above. Dr. Katrina Avers assisted in the briefing of these requirements. The AVS Core submitted research requirements are:

1. Emerging Flight Deck Technologies
    - Research will address new display concepts and advanced control interfaces (e.g., touch, speech, gaze), and will provide data to support the certification of these technologies
2. Advanced Vision Systems (Enhanced Flight Vision Systems (EFVS), Enhanced Vision Systems (EVS), Synthetic Vision System (SVS), Combined Vision System (CVS), Head-Up Displays (HUD), and Head Mounted Displays (HMD): Operational Standards & Approval Criteria
    - Research will inform development of operational requirements, standards, conditions, limitations, mitigations, and authorizations for the use of Advanced Vision Systems, HUD, and HMD
3. Fatigue Mitigation in Flight Operations
    - Continue to evaluate pilot fatigue data and the effectiveness of fatigue risk management approaches utilized by 121 and 117 certificate holders
4. Maintenance Human Factors to Support Risk-Based Decision Making and Maintenance Safety Culture
    - The importance of this project is emphasized by the Office of Secretary of Transportation/FAA/Industry meeting in July 2018 that highlights the importance of integration of human factors into required maintenance safety management systems. This research program is designed to provide AFS-300, industry, and the administrator the information needed for appropriate action.

5. Pilot Training, Qualification, Procedures and Flight Operations
    - Research is needed to provide data-driven guidance to inspectors and operators on training methodologies (especially concerning use of technologies in training, such as distance learning and virtual reality), qualification and operational procedures. Research is also needed to provide recommendations for data to support the potential emerging risks, including that of the upcoming pilot workforce, and address and mitigate those risks.
6. Human Factors Considerations and Emerging Trends Associated with Helicopter Air Ambulance Operations
    - This research will provide information that can be used to enhance the FAA's understanding of current industry risks and emerging issues and trends, and will inform policy, operational requirements, standards, procedures, limitations, mitigations, and guidance materials pertaining to helicopter air ambulance operations.

AVS NextGen Research Requirements | Presenter:: *Dr. Kathy Abbott, Chief Scientific and Technical Advisor for Flight Deck Human Factors*

Dr. Kathy Abbott briefed the Subcommittee on the AVS NextGen Research Requirements. She provided an overview of each requirement:

1. Human Factors Guidelines for Advanced Instrument Procedure Design and Use
    - Research is needed to anticipate, mitigate, and reduce potential pilot performance issues related to flying advanced NextGen instrument procedures, including Trajectory-based Operations
2. Procedures, Tasks, Skills and Training for NextGen Air Carrier Pilots
    - Research is needed to evaluate procedures and training and checking requirements for pilots as their jobs change in NextGen operations, including Trajectory Based Operations. This will inform NextGen procedures and training guidance.
3. Advanced Vision Systems (EFVS, EVS, SVS, CVS), Sensor-Based Technologies, Head Mounted/Head Worn Displays (HMD), and Other Flight Deck Systems
    - Research will inform development of operational requirements, standards, conditions, limitations, mitigations, and authorizations for the use of Advanced Vision Systems, Advanced Vision System sensor technologies, and HMD/HWD
4. Human Error and Complex Systems
    - This research will inform development of guidance for NextGen operational and equipment approvals, training programs and flight crew procedure development for NextGen operations, such as trajectory-based operations.
    - Dr. Abbott noted different aspects of this requirement, particularly its emphasis on Information Management. The Subcommittee acknowledged the effort to fund research in the area of Information Management, and considered the associated F&R closed (F&R #2). The Subcommittee planned to draft an Action Item to follow up on the status of this effort.

Lunch

UAS Human Factors Research: Past, Present, & Future (Action Item #2) | Presenter:s: *Dr. Bill Kaliardos, NextGen Human Factors Integration Lead and Dr. Michelle Yeh, Human Factors Specialist/Aircraft Certification RED Team Lead*

Dr. Bill Kaliardos and Dr. Michelle Yeh briefed the Subcommittee on UAS Human Factors Research. Dr. Kaliardos reviewed past projects in UAS Human Factors for both Pilots and ATC:

Pilot Human Factors

1. Maintenance Human Factors Considerations
2. Control Station - Pilot sensing/information deficiency effects
3. Visual Observer and visual detection/estimation
4. Review of UAS pilot interfaces
5. Human Factors Review of UAS Accidents and Incidents
6. UAS control latencies
7. Review of Pilot Training for manned aircraft and UAS
8. DAA display minimum information (3 total)

ATC Human Factors

1. Exploration of lost link definition, lost link behavior, lost link codes/interfaces
2. Multiple demos and operational assessments/impacts
3. Joint Test with DoD – contingency ops
4. Terminal Contingency Ops – Technology and Procedure requirements
5. Enroute Contingency Ops – Technology and Procedure requirements

Dr. Yeh briefed a summary of the current UAS Human Factors Research Requirements. These include:

1. Air Carrier Operational Considerations for Unmanned Aircraft Systems
    - This research addresses safety concerns specific to Air Carrier Operations for UAS to include air carrier staffing, training, testing, duty and rest requirements.
2. UAS Automation and Intelligent Systems
    - This research will develop a long-term automation strategy to work towards approval of intelligent systems. This program proposes a phased approach beginning with UAS and moving toward cargo and passenger carrying aircraft. The intent is to identify considerations for certification, including general human factors.
3. High Visual Contrast for UAS
    - This research will identify ways to increase the visibility of UAS by examining different colors, paint schemes, and lighting as well as the noticeability of UAS operations in a particular area for pilots of manned aircraft as well as for the visual observer on the ground.
4. Minimum Detect and Avoid (DAA) Display and Flight Path Information
    - This research is intended to support the development of the DAA Phase 2 MOPS by providing human factors considerations for the design and evaluation of DAA symbology.

A member of the Subcommittee noted that future requirements may need to address airport surface operations for large UAS. The Subcommittee agreed that this information had satisfied Action Item #2 that called for a review of ongoing and planned FAA UAS Human Factors activities.

Afternoon Break

Urban Air Mobility | Presenter:: *Dr. Tom Prevot, Director of Engineering, Airspace Systems, Uber*

Dr. Tom Prevot briefed the Subcommittee on the topic of Urban Air Mobility from the perspective of his positon as the Director of Engineering of Uber – Airspace Systems. He began by outlining the current issues surrounding the growth of cities and transportation congestion, and how these problems will only become more prevalent in the future. With the emergence of these issues, the need for more efficient modes of transportation will be higher than ever, and Uber's answer to this is a multi-modal transportation that involves the use of air-taxis, ridesharing services, electric bikes and scooters, as well as other modes, to get one to their final destination. Dr. Prevot briefed about the initial concepts, foreseeing a Dynamic Skylane network that might utilize roofs of parking garages or skyports over highways as terminals for operations. Uber is also actively testing their Uber Eats drone delivery service and the testing will expand in 2019. Dr. Prevot acknowledged the issues of urban air mobility (safety regulations, noise concerns, training a pilot workforce that they eventually plan to replace with automation, etc.), but he stressed the inevitability of different modes of transportation emerging as our cities continue to grow. Dr. Prevot answered questions from the attendees regarding affordability for the consumer, contingencies around weather, among others, and thanked everyone for their time. This briefing will not be available for distribution.

F&R Discussion, Wrap-up, and Homework Assignments | Presenter: *All*

There was discussion about the status of F&R #1 (Research and Development Landscape). The Subcommittee came to the consensus, as noted above, that rather than respond to the handbook, the Subcommittee would provide its list of Human Factors Emerging Issues as its response to the FAA. The Subcommittee then agreed to close this F&R and draft an Action Item requesting an update on the R&D Landscape. The Subcommittee reviewed other assignments and concluded the day's meeting.

End of Day 1

Wednesday, March 13th, 2019

Budget Update | Presenter:: *Mike Gallivan, RE&D Financial Manager*

Mr. Mike Gallivan updated the Subcommittee on the current state of the FAA budget (this briefing was not planned, but coordinated after the meeting started on Tuesday). He noted that the FY 2019 R,E&D budget was funded at $191.1M, and that Congress was pleased with the current research. He went on to explain that the FY 2020 budget was submitted the week of March 11th, 2019. He noted that out-year targets are consistent at $120M for the next five years, but these are expected to change. Mike Gallivan concluded his briefing thanking the Subcommittee and providing contact information for any future questions.

ATO Strategic Vision (Action Item #1) | Presenter:: *Lara Schmidt, ATO Roundtable Liaison*

Ms. Lara Schmidt briefed the Subcommittee on the ATO Strategic Vision, specifically the ATO "Roundtable" process, in response to an Action Item from the previous meeting. She began giving an overview of the ATO Human Factors Roundtable – a forum intended for Human Factors research conversations across ATO. This forum has evolved over the years resulting in a defined process to prioritize research. A major benefit is that this process brings together different organizations, as every service unit is invited. The Subcommittee agreed that Action Item #1 could be closed, and they requested updates as the process evolves.

FY21 ATC Core Research Requirements | Presenter: *Dan Herschler, Scientific & Technical Advisor for Human Factors and Lara Schmidt, ATO Roundtable Liaison*

Dan Herschler and Lara Schmidt briefed on the FY 2021 ATC Core Research Requirements. The briefing began with an overview of the Air Traffic Control / Technical Operations Human Factors Budget Line Item (BLI) and the Core Program Team that carries out and supports this work. It was explained that the program addresses R&D needs within five focus areas:

1. Human Factors Standards
2. Workforce Optimization – Human Factors Efforts
3. Improved Safety – Human Factors Efforts
4. Human Factors in NAS Technology Integration
5. Human Performance Enhancement

Dan then provided an overview of the FY 2019 requirements, a list of anticipated research in FY 2020, and the emerging research needs for FY 2021. The Subcommittee provided feedback noting that the FY 2021 emerging needs could be better emphasized by elaborating on the impact of the report. Dan and Lara explained that this would be more clearly addressed in the year of execution. This briefing can be accessed using the online REDAC repository.

Morning Break

FY21 NextGen Enterprise ATC Research Requirements | Presenter: *Dr. Bill Kaliardos, NextGen Human Factors Integration Lead*

Dr. Bill Kaliardos briefed on the FY21 NextGen Enterprise ATC Research Requirements. He provided an overview of the program and the program managers and stakeholders. Dr. Kaliardos reviewed the accomplishments made in FY 2019, and the anticipated research in FY 2020-2021. A Subcommittee member commended the list of anticipated research that was proposed, and the Subcommittee agreed to draft an F&R highlighting the necessity of this work. This briefing can be accessed using the online REDAC repository.

Review of Recommendations and Action Items and Wrap-up | Presenter: *All*

The Subcommittee reviewed the proposed list of F&Rs and Action Items. They discussed drafting assignments and agreed that the Human Factors Emerging Issues list was to be reviewed and updated at the next meeting. The F&Rs and Action Items developed from this meeting are listed below.

Lunch

Boeing Facility Tour | Presenter: *All*

- Boeing Operations Center
- Virtual Reality Lab

End of Day 2

Actions from Winter/Spring Meeting March 12-13, 2019

Findings and recommendations have been extracted from this version of the minutes

New Actions:

Action 1: The FAA should be commended for its efforts to provide strategic research guidance through development of landscapes and drivers. The Subcommittee recognizes the importance of providing this guidance in a manner that enables prioritization of research activities based on critical aviation needs and FAA's unique ability to address those needs. While the Subcommittee appreciates FAA's efforts to incorporate industry feedback, it is currently unclear how FAA plans to consolidate a growing list of drivers into succinct guidance to inform research planning. FAA should provide an update on this approach at the Summer/Fall 2019 meeting.

Action 2: Previously, the Human Factors Subcommittee made findings and recommendations about the need to develop guidance for flight deck information management practices, challenges/threats, procedures, and training. The Subcommittee was pleased to learn that research requirements were proposed for future work that would address this growing need. The Subcommittee views this as a research priority, and would like an update at the next meeting to review status and progress of the proposed work. (Ref. Aug 2018, F&R 2b)

Agenda:

DAY 1 – Tuesday, March 12, 2019

Time	Topic	Presenter
8:30-9:00	Check in at Boeing's Building 80	
9:00-9:15	Welcome / Opening Comments / Introductions	**Dr. Barbara Holder**, HF Subcommittee Chair; **Dr. Bill Kaliardos**, Designated Federal Official (DFO)
9:15-9:30	Introduction – Boeing Commercial Aircraft, Customer Support (BCA-CS)	**Cornelia Townsend**, VP of BCA-CS; **Dr. Maggie Ma**, BCA-CS Maintenance HF
9:30-9:45	Update from the Full Committee Meeting and New F&R Process	**Dr. Barbara Holder**, HF Subcommittee Chair
9:45-10:30	F&R #1 (Research Landscape)	**Maureen Molz**, Division Manager, NextGen R&D Management Division, ANG-E4
10:30-11:00	Morning Break	
11:00-11:30	AVS "Core" Research Requirements Submitted	**Dr. Michelle Yeh,** Human Factors Specialist/Aircraft Certification RED Team Lead
11:30-12:00	AVS NextGen Research Requirements	**Dr. Kathy Abbott,** Chief Scientific and Technical Advisor for Flight Deck Human Factors
12:00-13:00	Lunch	
13:00- 13:30	Action Item #2 (UAS Human Factors Research: Past, Present, & Future)	**Dr. Bill Kaliardos**, NextGen Human Factors Integration Lead and **Dr. Michelle Yeh,** Human Factors Specialist/Aircraft Certification RED Team Lead
13:30-14:30	Gap Analysis - What is Missing from Research Landscape and Research Requirements. Note: Includes Action Item #3 (Human Factors Emerging Issues)	**All**
14:30-14:45	Afternoon Break	
14:45-15:45	Urban Air Mobility	**Dr. Tom Prevot,** Director of Engineering, Airspace Systems, Uber
15:45-16:00	F&R #2 (Flight Crew Information Management)	**Dr. Kathy Abbott,** Chief Scientific & Technical Advisor, Flight Deck Human Factors
16:00-17:00	F&R Discussion Day 1 #2 and Wrap-up	**All**
EVENING	Group Dinner	

DAY 2 – Wednesday, March 13, 2019

Time	Topic	Presenter
8:30-9:00	Check in at Boeing's Building 80	
9:00-9:30	Action Item #1 (ATO Strategic Vision)	**Lara Schmidt**, ATO Round Table Liaison
9:30-10:00	FY21 ATC Core Research Requirements	**Lara Schmidt**, ATO Round Table Liaison
10:00-10:15	Morning Break	
10:15-10:45	FY21 NextGen Enterprise ATC Research Requirements	**Dr. Bill Kaliardos**, NextGen Human Factors Integration Lead
10:45-11:30	Review of Recommendations and Action Items	**All**
11:30-12:00	Wrap-up	**All**
12:00-13:00	Lunch	
13:00-14:30	Boeing Facility Tour – 13:15-13:45 IC.IDO (Virtual Reality) Lab – 13:50-14:20 Boeing Ops Center	**All**