Research, Engineering, and Development Advisory Committee (REDAC)
National Airspace System (NAS) Operations Subcommittee | MINUTES

Date: *March 14 – 15, 2023*
Location: *Hybrid Meeting (In-Person & Zoom)*
FAA Building 10A, Orville Wright Building, Washington, D.C.
Conference Room 113
Purpose: *Review of FY23-25 Proposed Portfolio; Provide Guidance and Recommendations; Informational Briefings or Updates*
Facilitator: *Phil Yeung, Designated Federal Officer (DFO)*
Chairperson: *Jim Kuchar*
Note Taker: *Jim Kuchar*
Upcoming Meetings: *August 22 – 23, 2023*

Day 1 – March 15, 2023

Welcome / Review of Actions

Presenters: *Jim Kuchar / Phil Yeung*
Summary: Jim Kuchar welcomed the subcommittee members and thanked them and the FAA representatives for their time and commitment to supporting the REDAC, noting that this was the first in-person/hybrid meeting since Fall 2019. Phil Yeung reviewed prior action items and the agenda for the two-day meeting.

Presentation: 1. Director Remarks

Presenter: *Eric Neiderman*
Summary: Eric Neiderman, Deputy Director of the William J. Hughes Technical Center, presented a brief update on the FAA on behalf of Shelly Yak, thanking the subcommittee for their work. Mr. Neiderman noted that the Technical Center & Mike Monroney Aeronautical Center are open, in yellow status due to COVID, with a partial return to work but not yet back to pre-COVID numbers. Following the anticipated official end to pandemic in May 2023, the FAA plans on moving into their final future posture. Mr. Neiderman outlined four “Need to” areas for the FAA: (1) the FAA needs to be able to tell their story about the research portfolio and why it is important, (2) the FAA needs to know what industry is doing, (3) the FAA needs to develop an RE&D plan and roadmap, and (4) the FAA needs to incorporate strategic advice e.g. from REDAC. The FAA is developing a new Strategic Outlook for Research (SOR) framework that will aid in communicating the portfolio to senior management. The subcommittee noted their appreciation for the new strategy for communication as being very important and portrayed well. The subcommittee thanked Mr. Neiderman for his introductory comments.

Presentation: 2. Budget Briefing

Presenter: *Beth Delarosby*
Summary: Ms. Delarosby provided an update on the RE&D budget, which was enacted at $255M in December 2022. Funding lines in FY23 are relatively stable relative to FY22 levels. The subcommittee thanked Ms. Delarosby for her presentation.

Presentation: 3. Informational Briefing: Connected FMS Activities – EFB and FMS Integration
Presenter: *Collins Aerospace*

Summary: Mr. Kirk Kolek, Kevin Kronfeld, Andrew Onken, Paul Comitz, all from Collins Aerospace, provided a presentation on Connected Flight Management System (FMS) activities. They noted that exchanging trajectory information has significant value and outlined Collins' concept for a cloud-based Flight Management System (FMS) with the goal of improved collaborative decision-making. Jim Kuchar asked what is the state of standardization of capabilities and performance requirements and how will standardization be managed, and is there an RTCA subcommittee working on this? Mr. Kolek replied that there is no RTCA subcommittee on this topic yet, work is being done separately by different organizations. Monica Alcabin noted that it will be important to add connected FMS capabilities without requiring refit to aircraft systems. The subcommittee thanked the Collins Aerospace team for their presentation.

Presentation: 4. Informational Briefing: UAM Airspace Demo Project Status
Presenter: Nouri Ghazavi

Summary: Mr. Ghazavi provided an informational briefing on the FAA's UAM Airspace Demo Project Status. This will include a demonstration with multiple industry and NASA partners in Monterey Bay, CA. Initial use cases will involve piloted (or optionally-piloted) aircraft. Schedule details and specific test protocols have yet to be determined. The subcommittee thanked Mr. Ghazavi for his presentation.

Presentation: 5. Runway Incursion Reduction (RIRP)
Presenter: *Rob Higginbotham / Scott Proudfoot*

Summary: Mr. Higginbotham provided a status update on the RIRP program. Currently being developed is a plan to evaluate a derivative of Runway Status Lights (RWSL) for lower-tier airports using a low-cost surface movement radar at San Antonio airport. They will be starting with the original RWSL safety logic and exploring how well it performs, with an operational evaluation planned for 2024. The subcommittee thanked Mr. Higginbotham for his presentation.

Presentation: 6. Enterprise Concept Development
Presenter: *Steve Bradford*

Summary: Mr. Bradford summarized the Enterprise Concept Development portfolio. This includes work concepts at a high level, with consideration of global harmonization and incorporating stakeholder feedback. Topics include the Extensible Traffic Management (xTM) framework and very long duration high altitude flights (e.g. over 24-hour duration). Bruce Holmes asked whether hypersonics will be included in the effort. Mr. Bradford answered that hypersonics will be treated as one-offs in the near term – using trajectory based operations, well planned and deconflicted in advance, and treated more like oceanic airspace. A new effort involves developing a responsible AI framework to ensure equitable integration of AI across stakeholders. The subcommittee thanked Mr. Bradford for his presentation.

Presentation: 7. New Air Traffic Management Requirements
Presenter: *Steve Bradford*

Summary: Mr. Bradford provided a presentation on the New Air Traffic Management Requirements portfolio. This includes early research into procedures, tools, and systems, with results transitioning to more formal F&E programs. There are a wide range of topics included in

this portfolio: Machine Learning (ML) / Artificial Intelligence (AI) in the NAS; Post-departure Coordination and Airborne Negotiation; Command and Control in a Cloud; Synchronization of Air/Ground SWIM (connected aircraft); Next Generation Input Devices; Surveillance Portfolio Analysis; IP Based Command and Control Data Links; an Automation Evolution Strategy; and Hyper-Connected ATM Concept. Bruce Holmes asked whether the portfolio included vehicle-to-vehicle communications, to which Mr. Bradford noted that that topic would be delegated to NASA to research. The subcommittee thanked Mr. Bradford for his presentation.

Presentation: 8. Enterprise Human Factors
Presenter: *Tara Gibson*

Summary: Ms. Gibson provided an overview of the Enterprise Human Factors portfolio. The scope remains relatively unchanged, with a focus on integrated systems and human performance requirements early in the process. Accomplishments include reports on trajectory based operations (TBO) impacts on traffic management units (TMU), a cognitive model method, TMU coordination and industry best practices, tailored human readiness levels guidelines, and a TBO training methods assessment human-in-the-loop (HITL) that was completed in January. Planned research includes TBO human factors effects on TMU, regional TMU decision-making and coordination, NAS mental model analysis, and human readiness levels phase 2. Products from decision-making and collaboration work will be provided to ATO for use in future concepts. Ms. Gibson also noted that data collection activities are picking up as COVID winds down. Joe Bertapelle asked whether there are any connections with this work and commercial space? Karl Kaufman answered, not to date. The subcommittee thanked Ms. Gibson for her presentation.

Presentation: 9. Air Traffic Control/Technical Operations Human Factors
Presenter: *Tara Gibson*

Summary: Ms. Gibson provided an overview of the Air Traffic Control/Technical Operations Human Factors portfolio. Some efforts were delayed due to COVID and an inability to bring in human subjects for experiments, but efforts are now spooling back up to catch up on the backlog. Accomplishments include literature review of human autonomy teaming, handbook for alarms, alerts, and warnings, structured interview for alarm design, and an update on requirements for displays, testing, maintenance, and training. Planned research includes developing operational guidance and training for workload, fatigue, and performance; ATC maintenance task guidance; and continued updates to Human Factors Design Standard. Emerging areas include stress and performance, skill degradation, alternative training delivery systems (AR/VR), impacts on automation on human performance, AI/ML in TRACON environment. The subcommittee thanked Ms. Gibson for her presentation.

Presentation: 10. Informational Update: AST R&D Portfolio and Post-COE Update
Presenter: *Brian Rushforth / AST*

Summary: Mr. Rushforth provided an informational update on the FAA Office of Commercial Space Transportation (AST) R&D portfolio. This portfolio is undergoing changes due to the completion of the AST Center of Excellence, compounded with some attrition in staffing. A new Research Alliance is planned in the future pending hiring more staff. The focus of AST research is now on liquid oxygen (LOX)/Methane explosive testing, human spaceflight, and STEM outreach. Joe Bertapelle asked what does space launch demand look like in the next 5 years? Mr. Rushforth noted that demand is increasing exponentially, with more than 70 operations last year and estimating there will be more than 500 per year in 5 years. 75% of launches occur at federal ranges, with most of those out of Florida, some at Wallops, and the rest at Vandenburg AFB or Kodiak, AK.

Bruce Holmes noted that it will be important to have a third party help coordinate and administer the Research Alliance government / private partnership and that the FAA should also seek industry cost-share in research. The subcommittee thanked Mr. Rushforth for his presentation.

Presentation: Findings and Recommendations Discussion
Presenter: *Jim Kuchar / Subcommittee*

Summary: The subcommittee reviewed the day's presentations and began discussing potential findings and recommendations. Discussions were then adjourned until the following day.

Day 2 – March 16, 2023

Presentation: Review Findings and Recommendations
Presenter: *Jim Kuchar / Subcommittee*

Summary: Jim Kuchar and Phil Yeung welcomed the subcommittee members and engaged in a brief discussion of potential findings and recommendations based on the prior day's presentations.

Presentation: 11. Informational Briefing: Industry Perspectives on General Aviation and AAM in a Future CNS perspective
Presenter: *Virginia Stouffer / AURA Network Systems*

Summary: Ms. Virginia Stouffer provided a requested informational briefing on Industry Perspectives on General Aviation and AAM in a Future Communications, Navigation & Surveillance (CNS) perspective. Bruce Holmes introduced Ms. Stouffer and noted that this presentation has been briefed across NASA HQ and ARMD offices, and was brought to the NAS Operations subcommittee to begin connecting to FAA. The presentation emphasized the need to focus on building a strong CNS foundation at UAM Maturity Level (UML) levels 2 and 3 before getting to level 4 operations. Early operations are likely to occur at low altitude (2000 or 3000 ft AGL), where there will be additional challenges for CNS. As one example, plans for Very High Frequency Omni-Directional Range (VOR) decommissioning may negatively impact navigation information availability for AAM.
Joe Bertapelle asked what part of this development is the responsibility of FAA vs. industry? Ms. Stouffer noted that the FAA should consider AAM as a test environment for the future info-centric NAS, and so the FAA should be interested in participating. Additionally, some FAA roadmaps like VOR decommissioning have not taken AAM into account. Ms. Stouffer reviewed a set of R&D topic areas that need to be addressed (e.g. communications infrastructure development, detect and avoid, precision navigation and timing) and provided a set of recommendations for NASA and FAA roles in supporting a range of research topics, including engaging in standards development, testing infrastructure, simulation support, collaboration in cloud architecture and cyber security, and greater engagement with NASA centers. Monica Alcabin noted that there will also be a global harmonization issue for future CNS systems. The subcommittee thanked Ms. Stouffer for her presentation.

Presentation: 12. NextGen – Wake Turbulence
Presenter: *Jillian Cheng*

Summary: Ms. Cheng provided an update on the NexGen Wake Turbulence portfolio. This RE&D program covers initial concept development, then transitions to F&E program. Accomplishments include assessing wake risk to develop risk mitigations and estimating wake

generation from new aircraft types. Wake data collection occurs at SFO and JFK airports. The portfolio is starting to look into AAM vehicle characteristics with respect to wake separation standards.
Ms. Cheng noted that the Light Detection and Ranging (LIDAR) technology being used for data collection are aging, and so they are looking to perform a sensor assessment to identify and procure the next set of sensor hardware. Jim Kuchar asked whether there is a clear wake mitigation business case, for example for time-based separation and/or dynamic separation? Ms. Cheng stated that this is being worked through Wake Re-Categorization program. Dr. Kuchar also asked whether the wake program is connected to AJV-S in terms of defining future requirements and operational constraints, to which Ms. Cheng replied no, there has not yet been such a connection. The subcommittee thanked Ms. Cheng for her presentation.

Presentation: 13. Wake Turbulence Re-Categorization
Presenter: *Jillian Cheng*

Summary: Ms. Cheng summarized the Wake Turbulence Re-Categorization portfolio. This involves an assessment of the dynamic wake separation concept. The FAA is currently completing a final report, after which this program will be closed down with no future funding. The subcommittee discussed concerns about the need to perform and communicate a solid business case cost/benefit analysis to inform future research investments in this area, and that those findings need to be communicated with the ATO and AJV-S. The subcommittee thanked Ms. Cheng for her presentation.

Presentation: 14. NextGen – Weather Technology in the Cockpit (WTIC)
Presenter: *Gary Pokodner*

Summary: Gary Pokodner reviewed the WTIC portfolio. Accomplishments included approval of a project plan to incorporate weather information into the MITRE digital copilot, and completion of a report and briefing on ADS-B vertical rate turbulence technology, which is now ready for live online and offline demonstrations. WTIC also completed PEGASUS reports on augmented weather interfaces and helicopter operations.
WTIC is being moved under weather programs instead of having its own BLI. Mr. Pokodner noted that FY 25 work will focus on standards, data fusion, AI/ML, training, human factors and effects of automation.
Bruce Holmes asked what support WTIC gets for technology transfer (market research, targeting industry, etc.)? Mr. Pokodner replied that the FAA hosts a technology transfer conference to bring stakeholders together, and attends events like Sun N Fun, plus the PEGASUS Center of Excellence includes industry partners. Mr. Holmes suggested that WTIC also connect with startup companies, though they require more effort than established industry and so having a technology transfer center could be helpful. Emily Stelzer also noted that MITRE is helping through their own technology transfer office. Mr. Holmes also suggested that WTIC contact the Cessna Citation owner's group, or similar parties. The subcommittee thanked Mr. Pokodner for his presentation.

Presentation: 15. Weather Program

Presenter: *Randy Bass*

Summary: Mr. Bass provided updates on the Weather Program including work on visibility estimation through image analytics and its extension into cloud estimation; formalizing the research to operations collaboration process with national weather service; exploring transitioning research directly to industry; space weather aviation, to improve NAS resilience during space weather events (including NAS software vulnerabilities); and volcanic ash

detection including a feasibility of use of airborne radar. Mr. Bass noted that AUS has canceled a set of programs related to UAS weather research that had been briefed to the NAS Ops subcommittee at its previous fall meeting. Mr. Bass also provided a brief review of status and future places for research in convective storms, inflight icing, model development and enhancement, turbulence, ceiling and visibility, quality assessment, aviation weather demonstration and evaluation, terminal area icing weather information for NextGen, high ice water content, UAS weather (including urban wind effects at low altitude), and weather observations. Mr. Bass noted that starting in FY25, Terminal Area Icing Weather Information for NextGen (TAIWIN) and High Ice Water Content (HIWC) are moving out of the Weather Program BLI to the Aircraft Icing BLI. The subcommittee thanked Mr. Bass for his presentation.

Presentation: 16. Informational Briefing: Remote Tower Development Status

Presenter: *Matthew Richardson / ANG*

Summary: Mr. Richardson provided a status update on the FAA's Remote Tower Pilot Program, which was established in 2018. Mr. Richardson provided an overview of the remote tower installation at Leesburg, VA and Fort Collins, CO airports. Work includes operational approval and technical certification approval (System Design Approval). The Leesburg system will be removed since the vendor has now moved on to a more advanced system that leapfrogs the system installed at Leesburg and no longer wishes to pursue technical certification on the original system.

Matthias Steiner asked whether data were collected during inclement weather. Mr. Richardson answered yes, and the evaluation showed the systems did perform well, with some lessons learned (e.g. some camera window obscuration by weather).

Mr. Richardson then noted that the FAA is now developing a new centralized testing facility at the National Research and Technology Park near the FAA Technical Center. This approach provides several benefits over single-vendor testing at single airports. The specific technical requirements are being developed, with version 4 expected to be delivered by end of March 2023. Two business cases have been developed for remote towers.

Bruce Holmes asked how many vendors are needed to satisfy demand for remote tower services? Mr. Richardson replied that there are currently five vendors, and a significant number of towers will need to be replaced, plus there is an option for installing remote towers at airports currently without a tower, so it is expected the market is substantial.

Joe Bertapelle asked how the FAA's program compares to what is being used in Europe? Mr. Richardson replied that Europe efforts are at airports with a more limited traffic and radar environment than the U.S. and are generally not as complex an environment as in the U.S.

Bruce Holmes asked if there are international standards for harmonization? Mr. Richardson responded that yes, IASA, ICAO, CANSO, and EUROCAE have active standards development and the FAA is involved. The subcommittee thanked Mr. Richardson for his presentation.

Presentation: 17. Operations Concept Validation & Infrastructure Evolution (ATDP)

Presenter: *Jorge Rodriguez Cifuentes / AJV-S*

Summary: Mr. Rodriguez Cifuentes filled in for Guillermo Sotelo to provide an overview of the Operations Concept Validation and Infrastructure Evolution program. This program ensures potential enhancements are operationally sound and captured in architecture planning. The portfolio includes NAS Integration of Transiting Operations (NITRO), UAM operational picture, and UTM strategic roadmap. FY24 plans include working on operational requirements for space launch/re-entry operations improved situational awareness.

Joe Bertapelle asked if the AJV-S work was connected to Innovate 28? Mr. Rodriguez Cifuentes replied that these efforts are not directly connected at this time. The subcommittee thanked Mr. Rodriguez Cifuentes for his presentation.

Presentation: Findings and Recommendations Discussion
Presenter: *Jim Kuchar / Subcommittee*

Summary: The subcommittee discussed findings and recommendations as well as identified documents and briefings to be included for the next meeting in Fall 2023. Subcommittee members were assigned to develop text for the findings and recommendations.

Presentation: Recap and Closing
Presenter: *Jim Kuchar / Phil Yeung*

Summary: The date for the Spring 2024 meeting was set for March 19-20, 2024. Jim Kuchar and Phil Yeung thanked the subcommittee members for their work and the FAA and guest presenters for their time developing and delivering their briefings.

Requested documents prior to next meeting:

- xTM Conops 1.0 – Steve Bradford
- AJV-S NITRO Strategy and Roadmap document – Guillermo Sotelo

Requested informational topics requested for the next meeting:

- Briefing(s) on NASA status and updates on their xTM and AAM projects – Akbar Sultan or designee
- “Innovate 28” program – Steve Bradford or Paul Fontaine
- UAM Demonstration status update – Steve Bradford or Nouri Ghazavi

REDAC / NAS Operations Subcommittee Meeting Agenda

Date: March 14-15, 2023

Location: Building 10A, Orville Wright Building, Washington, D.C.
1st Floor, Conference Room 113 (located inside the Customer Service Center)
Dial-in: See last page for phone and video conferencing details

Purpose: Review the R&D portfolio developed based on the subcommittee's strategic guidance from the Fall Meeting. The FAA briefs the proposed R&D FY+2 years.

Tuesday, March 14th

9:00am	Welcome / Review of Actions	Jim Kuchar / Phil Yeung
9:10am	1. Director Remarks	Eric Neiderman
9:15am	2. Budget Briefing	Beth Delarosby
9:30am	3. Informational Briefing: Connected FMS Activities – EFB and FMS Integration	Collins Aerospace
10:30am	Break	
10:45am	4. Informational Briefing: UAM Airspace Demo Project Status	Nouri Ghazavi
11:45am	5. Runway Incursion Reduction (RIRP)	Rob Higginbotham / Scott Proudfoot
12:15pm	Lunch	
1:15pm	6. Enterprise Concept Development	Steve Bradford
1:45pm	7. New Air Traffic Management Requirements	Steve Bradford
2:15pm	Break	
2:30pm	8. Enterprise Human Factors	Tara Gibson
3:00pm	9. Air Traffic Control/Technical Operations Human Factors	Tara Gibson
3:30pm	10. Informational Update: AST R&D Portfolio and Post-COE Update	Brian Rushforth / AST
4:30pm	Findings and Recommendations Discussion	Subcommittee

Wednesday, March 15th

9:00am	Review Findings and Recommendations	Subcommittee
9:10am	11. Informational Briefing: Industry Perspectives on General Aviation and AAM in a Future CNS perspective	Virginia Stouffer / AURA Network Systems
10:00am	12. NextGen – Wake Turbulence	Jillian Cheng
10:30am	13. Wake Turbulence Re-Categorization	Jillian Cheng
11:00am	Break	
11:15am	14. NextGen – Weather Technology in the Cockpit (WTIC)	Gary Pokodner
11:45am	15. Weather Program	Randy Bass
12:15pm	Lunch	
1:15pm	16. Informational Briefing: Remote Tower Development Status	Matthew Richardson / ANG
2:15pm	17. Operations Concept Validation & Infrastructure Evolution (ATDP)	Jorge Rodriguez Cifuentes / AJV-S
2:45pm	Findings and Recommendations Discussion	Subcommittee
3:15pm	Recap and Closing	Jim Kuchar / Phil Yeung

Legend Key:

	Informational Briefing or Update

Day 1 Attendee List:

Adam O'Hara	SAIC
Alexandra Papantoniou	FAA
Andrew Onken	Collins Aerospace
Akbar Sultan	NASA
Beth Delarosby	FAA
Bill Kaliardos	FAA
Bob Humbertson	FAA
Brian Powers	FAA
Brian Rushforth	FAA
Bruce Holmes	Holmes Consulting LLC
Chinita Roundtree-Coleman	FAA
Emily Stelzer	MITRE
Eric Neiderman	FAA
Jim Kuchar	MIT Lincoln Laboratory
Joe Bertapelle	Joe Bertapelle LLC
Jon Schleifer	FAA
Karl Kaufmann	FAA
Ken Hailston	Booz Allen Hamilton
Kevin Kronfeld	Collins Aerospace
Kirk Kolek	Collins Aerospace
Lisa Smith	FAA
Mark Hale	Diakon Solutions LLC
Marlo Allen	Quasars, Inc.
Matthias Steiner	NCAR
Michael Reininger	FAA
Monica Alcabin	Boeing
Monique Moore	FAA
Okoineme Giwa-Agbomeirele	FAA
Paul Comitz	Collins Aerospace?
Phil Yeung	FAA
Rob Higginbotham	FAA
Robert Humbertson	MBO Partners
Steve Bradford	FAA
Steve Collision	FAA
Tara Gibson	FAA
Vaughn Yates	FAA
Victor Quach	FAA
Wyatt Element	FAA

Day 2 Attendee List:

Adam O'Hara	SAIC
Alexandra Papantoniou	FAA
Bill Kaliardos	FAA
Bruce Holmes	Holmes Consulting LLC
Chinita Roundtree-Coleman	FAA
Emily Stelzer	MITRE
Jim Kuchar	MIT Lincoln Laboratory
Joe Bertapelle	Joe Bertapelle LLC
Jorge Rodriguez Cifuentes	FAA
Ken Hailston	Booz Allen Hamilton
Lisa Smith	FAA
Mark Hale	Diakon Solutions LLC
Marlo Allen	Quasars, Inc.
Matthew Richardson	FAA
Matthias Steiner	NCAR
Michelle Whitcher	FAA
Monica Alcabin	Boeing
Monique Moore	FAA
Natee Wongsangpaiboon	FAA
Okoineme Giwa-Agbomeirele	FAA
Phil Yeung	FAA
Robert Humbertson	MBO Partners
Steve Collision	FAA
Victor Quach	FAA
Virginia Stouffer	AURA Network Systems
Wyatt Element	FAA