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

Session: *Summer/Fall 2023*
Dates: *August 22 – 23, 2023* (2 days)
Location: *Hybrid Meeting (In-Person & Zoom)*
FAA Building 10A, Orville Wright Building, Washington, D.C.
Conference Rooms 7B (8/22) and 5A (8/23)
Purpose: *Review of FY23-26 Proposed Portfolio; Provide Guidance and Recommendations; Informational Briefings or Updates*
Facilitator: *Phil Yeung, Designated Federal Officer (DFO)*
Chairperson: *Jim Kuchar*
Note Takers: *Monica Alcabin and Akbar Sultan*
Upcoming Meetings: *March 19 – 20, 2024 (Winter/Spring 2024)*
September 4 – 5, 2024 (Summer/Fall 2024)

Day 1 – August 22, 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. Phil Yeung reviewed prior action items and the agenda for the two-day meeting. Phil noted that the AI/ML framework is still open and that Steve Bradford will share it when available. Phil noted that the NAS Integration of Transiting Operations (NITRO) strategy has been completed and is in the process of being published. The document will be shared with the subcommittee when available. Jim Kuchar requested a response from the FAA to the subcommittee's Findings & Recommendations. Bruce Holmes asked if there was a way for the subcommittee to meet more often, due to the pace of change. Ms. Chinita Roundtree shared that other subcommittees have virtual working group meetings. The meetings are not as formal and the subcommittee members come prepared with homework assignments.

Presentation: 1. Director Remarks

Presenter: *Eric Neiderman (on behalf of Shelley Yak)*
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 FAA reauthorization expires at the end of September. Ms. Yak briefed Congress. Some of the key issues had to do with landing slots at Washington National Airport (DCA) and pilot issues. Mr. Neiderman noted differences between House and Senate language; however, the top number is consistent. The House and Senate will try to resolve differences when they come back from recess. Bruce Homes asked if there had been some discussion on asking the FAA to accelerate standards of third-party service providers related to Advanced Air Mobility (AAM). Mr. Neiderman was not sure but noted that the FAA is working to advance AAM. He noted that when they meet to work out final language, it can change.

Mr. Neiderman shared an update from the 1st AAM summit in Baltimore in August. It has implications for the FAA's research portfolio. The Summit was attended by 50% government & 50% industry. It was a whole of government approach, with all of the agencies working together to understand how they are going to make this work. There was a wide range of interest with

very extensive economic opportunities. The approach is to crawl, walk, run. How does the FAA integrate the NAS? Safety is foremost. There were discussions about leadership, piloted and unpiloted operations, varied use cases, sustainability, drone ports, noise, current infrastructure, urban, suburban, and rural operations, cyber security and infrastructure, security & access, equity, keeping costs down, and community engagement. Mr. Neiderman was struck by the pace of change and how rapidly things are evolving, public perception of this technology and how all these things will play together. There is a clear role for FAA's research to support this. The FAA is focused on thinking strategically – we want to make sure we are using our resources wisely as we develop our research roadmaps. The FAA will be unveiling those at the next Full REDAC Meeting in October. Mr. Neiderman asked the subcommittee members: are we communicating what we are doing and why? Are we focusing on the right things? Mr. Neiderman thanked the subcommittee for their time and guidance.

Presentation: 2. Budget Briefing
Presenter: *Tom Kelly*

Summary: Mr. Kelly provided the budget briefing, mainly focusing on the current events of the FY24 budget. The House believed that environment and facilities were duplicates of the IRA supplemental and therefore zeroed out the environmental BLIs. The two new BLIs are for Women in Aviation Pilot Shortage Studies and Aircraft Radio Altimeter Development, Testing, and Certification. $10M was added for counter UAS programs. Mr. Holmes asked if the subcommittee could get a briefing on the counter UAS activity. FAA is testing for qualification of these counter systems. The purpose of these demonstrations is to make sure that the mitigations are not harmful to civil aviation. Jim Patterson can brief on how they are conducting the research and the demos and trials. This topic will be briefed at the Airports REDAC on Sept 6-7. Mr. Holmes commented that it is more than just the airport – it is also airspace related. Mr. Bradford responded that airspace is not part of the airport research for this activity. Mr. Holmes asked if the budget for materials could be used for hypersonic vehicles. Yes, as long as there is no restriction in the bill language. Mr. Kelly commented that the FAA is going through OST passback for the FY25 budget, which is almost the same level as requested. The OMB submission will be in September.

Presentation: 3. Enterprise Concept Development
Presenter: *Steve Bradford*

Summary: Mr. Bradford provided updates on Enterprise Concept Development. This BLI is all Facilities & Equipment. For the Extensible Traffic Management (xTM) framework analysis, it is about having tailored rules for operations in lower altitude, middle altitude, etc. The structure will be the same but different in terms of performance. The goal is to get to a final Concept of Operations. For Responsible AI; need to look at the results in terms of biases that would disadvantage some users. We are working with NASA on this. The FAA has a draft Concept of Operations but have not completed it because those folks have moved over to work Innovate 28. The Responsible AI project is looking at small airports (airports without control towers) to see if there is opportunity for cooperative sharing of information to make them smarter.

Presentation: 4. New Air Traffic Management Requirements
Presenter: *Steve Bradford*

Summary: Mr. Bradford provided the subcommittee with an update on new ATM requirements, developing requirements for the next 5 years by working with industry labs and NASA. With respect to the data distribution concept, how do we build an app store for internal consumption (not for EFB or WTIC). With respect to external apps, the FAA would do a tech transfer package with an industry partner. For FF-ICE1 (pre-departure), have done a series of table top exercises. The question for FF-ICE2 is how do you better manage flight information for trajectory development, 2 hours prior to departure? We are looking into the future of surveillance

that includes radars. Another project is how to qualify 3rd party weather, dispatch services for UAS, AAM, etc. Mr. Randy Bass added that right now we get weather information from sensors at the airport but that will not work for UAS. Mr. Bass has a meeting scheduled with Sabrina next week to discuss weather qualification for other providers. Some of the questions being asked are “What types of AI could I use for controller functions?” Time-Based Flow Management (TBFM) could provide better trajectories. Here it will provide better tools to help the controller. Post Departure Coordination and Airborne Coordination – there was a Boeing ecoDemonstrator flight where there were information exchanges across different ANSPs. For the Connected Aircraft project, there was a joint FAA/EASA/Boeing/Airbus paper on Hyperconnected ATM Systems. Ms. Monica Alcabin will share the paper with the rest of the REDAC subcommittee. The IP based command and control will be published soon. On the Emerging Focal Areas, it is making use of the cloud; architecture that supports trust, authorization, etc. For example, we need to stop having each program buy their own servers; solutions need to be ATC system agnostic. For example, we will only support B2 aircraft that do Internet Protocol Suite (IPS). We will add a translator so that they can support B2 aircraft. We cannot support Extended Projected Profile (EPP) but we can use connected aircraft to support EPP. Mr. Joe Bertapelle asked, with satellite costs coming down, will that reduce costs for any of this equipment? Mr. Steve Bradford responded that operators may be able to put Starlink on their aircraft. Mr. Jim Kuchar asked about the AI/ML framework. Mr. Steve Bradford can get us a copy. It is research with NASA strictly focused on ground and decision support tools. It is a plan for a plan and may not be done yet. Can we get a briefing on this in the spring? Mr. Akbar Sultan commented that there are two separate activities being worked – the use of AI/ML to provide services and the certification of AI/ML. Mr. Joe Bertapelle asked, “Is there anything in the 3-5 year timeframe that keeps you up at night?” Mr. Bradford responded “Trying to make sure that we agree to switch to enterprise solutions for our services; we do sustainment after sustainment; have to get away from owning your computer. With respect to research, UAS has to be equipped like other aircraft, have to have a transponder and talk to the controller. We are trying to work a task with our new FANS provider to get pilots on the party line. There are a few AAM operators that want to do that (Reliable, Xwing, Wisk). We are talking to Verizon to see if they can be on the party line. They will need to go ground to ground. That is the next big challenge.

Presentation: 5. Enterprise Human Factors
Presenter: *Tara Gibson*

Summary: Ms. Gibson shared that Trajectory Based Operations (TBO) is looking at the strategic planning of trajectories and balancing the flow across the NAS, trying to work it at the traffic management unit and the regional level. Tailored human readiness levels complement technology readiness levels – to assess if a technology is ready from a human factors (HF) point of view. The human readiness levels (HRLs) guidelines report is looking at a new standard and how that would fit in to the FAA. There is language in the FAA reauthorization bill talking about HRLs and the FAA wants to be ready when it becomes law. In general, it is looking way out in the future and what some of these concepts and visions might imply for the controller or air traffic manager. For example, there may be ATM work corresponding to the enterprise work and we have a new concept coming in. How will humans use that? Looking at the info-centric NAS with ubiquitous information. We will do a better job at collaborating among traffic management units (TMUs). In Phase 1, we looked at distributed teams, rapid decision making in other industries. This work is aimed at the FAA acquisition with respect to equipment, looking at ways to better support getting a traffic manager up to speed as quickly as possible and the HF effects on the TMU and regional team decision making. Mr. Joe Bertapelle asked in general if the automation was helping; do we need more people? Mr. Karl Kaufmann responded that, in general, this is focused on humans working in new processes and procedures. This is looking at the new capability coming along and how ATC will integrate into supporting the user with distributed teams and distributed decision making. Mr. Jim Kuchar asked about some of the recent incidents regarding runway incursions. Is there anything in the works? Some of that will

be pointed out in this next portfolio – it is not so much about staffing but rather training. On the flight deck side, there is work that has been done on the complexity of procedures but not on the controller side. Mr. Akbar Sultan asked if there were any specific outcomes or actions that came out of the recent FAA Aviation Safety Summit. The Office of Safety & Technical Training (AJI) probably participated. Ms. Gibson will take an action on that.

Presentation: 6. Air Traffic Control/Technical Operations Human Factors
Presenter: *Tara Gibson*

Summary: This BLI is about Air Traffic and Tech Ops (the maintainers that keep the system running behind the scene) and includes the Tech Center; Civil Aerospace Medical Institute (CAMI, OK City) and Volpe Labs. Human Machine Teaming research is looking at what does this mean. There was a question about an NTSB report. This one was an incident that happened at SFO with an arriving aircraft lined up with a taxiway instead of the runway. There were no crashes, no fatalities. The aircraft did a go-around. The research is around, what information to give to the air traffic controller to draw their attention to what is going on. This is looking at gaps in training. Mr. Bruce Holmes asked if any of this work is related to remote towers? Nothing directly. However, maybe visual scanning work on the previous slide could be applied but that is not what the focus is. That group would reach out to the folks at the lab at the Tech Center. In the past, this portfolio was involved in remote tower research, but this portfolio has constraints to anything that is operational. Mr. Jim Kuchar suggested that this group connect with Gary Pokodner who has been doing work with augmented reality for training. Ms. Emily Stelzer asked if this BLI covers onboarding new controllers and streamlining training. Yes, that research identifies those areas. ATO is the sponsor for this work
Mr. Bruce Holmes asked why windshear is being used as the use case for alarm research. Ms. Gibson was not sure – it could be just natural given the most obvious warning to use.

Presentation: 7. Runway Incursion Reduction Program (RIRP)
Presenter: *Rob Higginbotham / Scott Proudfoot*

Summary: Mr. Higginbotham shared the information from the project in San Antonio. 1st system produced by Saab in Syracuse with runway entry lights, surveillance tower and shelter. However, the FAA will need to take the system out in FY26 because the system will not have been certified, it was only used for the study. Mr. Jim Kuchar asked if there is a longer-term roadmap other than this demo evaluation. There are other initiatives within AJI. Mr. Jaime Figueroa commented that after the demos, the FAA will have high level requirements information and cost information and will be able to do a cost benefits analysis. This would then go to the business case side of things. The project is about proving if the technology works – is this acceptable and is it affordable. Ms. Emily Stelzer asked if this is helping industry efforts find solutions at four sites. Mr. Higginbotham responded that this could but that the FAA is looking at a new system from Saab that is smaller and has been certified. In this system, the lights are the same as have been used in other systems. The FAA is only putting lights at the intersections where there have been problems, not putting them all over the runway. Mr. Bruce Holmes asked about surveillance technology options and the potential for a direct pilot enunciation system. The FAA responded that this new radar was the only solution investigated. The question asked was, what about passive radars? The FAA is hoping that the market surveys that the PMO is doing will help solve the problem. Mr. Jim Kuchar asked if the FAA is looking at some of the primary airports. Yes, but one of the problems at these large airports is that these large airports are already equipped with the high-level surveillance systems like Airport Surface Detection System – Model X (ASDE-X), etc. We are not sure if one of the reasons that the industry is seeing this could be the higher level of traffic post-COVID. Mr. Jim Kuchar asked if there was a longer-term plan. There may be some other activities in AJI, but not for this project.

Presentation: 8. Informational Briefing: Innovate 28 Overview
Presenter: *Mitchell Bernstein*

Summary: This project is about AAM and electric vertical take-off and landing (eVTOL) and the whole of government approach, hoping to use existing infrastructure as much as possible. The plan is to go from piloted to autonomous, trying to track the whole spectrum of operations. We are trying to get the regulatory framework in place for these new aircraft including the ground infrastructure, charging, vertiports, and airspace structure. EIS operations may be one operator in one location. Was initially targeting LA Olympics, working closely with LA but also working with operators at key sites where they see the business case. We are not trying to shoe horn the Olympics. The AAM Interagency Working Group is looking at cyber security, power, energy, standards for charging infrastructure, vertiports, spectrum allocation, community impacts & engagement, supply chain. Mr. Joe Bertapelle asked if we have the same plug for charging (e.g., do we need standardized charging?). Mr. Bruce Holmes asked if the FAA is taking a systems engineering approach to this project? Yes. The UAM Concept of Operations got published in May and in July, the AAM Implementation Plan came out focused on workstreams. Within DOD, there is the Agility Prime program to push the industry forward – identify military use cases, doing flight testing. The FAA is partnering with them and NASA. The FAA is trying to develop the policy based on performance and leverage all of the flight testing to understand air traffic, approach and departure profiles. Mr. Bruce Holmes asked if the scope includes electric cargo short take-off and landing (CSTOL)? Yes, the FAA is talking with Reliable Robotics. Is the FAA doing wake modeling? Does the FAA have the simulation capability for wake modeling? Yes, but will take the FAA some time to get there. Innovate 28 is not a demo. The FAA wants to create a leave behind project – looking to create the ecosystem and leave it in place using simulations to look at the impact on commercial operations. The FAA wants to identify everything that the FAA needs to do and what needs to be done by all the other stakeholders; focal role providing programmatic support; Paul Fontaine is in the weekly meetings; they brief the Administrator on a bi-weekly basis. Mr. Akbar Sultan asked if we have an established strategy for heliports for the role of government? Yes, probably there will be some public and private vertiports; for private ones, the FAA will not have much say. Mr. Bruce Holmes suggested making CNS visible in a plan like this. Mr. Joe Bertapelle asked if Airport AIP is available for this? Not specifically for vertiports. This implementation schedule will get tailored for each of the individual sites. Mr. Joe Bertapelle asked if a vertiport needs to be a fixed location and there was some discussion. Mr. Bruce Holmes referred to a NASA program called SATS that was aimed at the ability to go from x-urbs to the local airport. One aspect of those operations was that we were operating small very light jets. We avoided taking pax to Orlando or Miami because we didn't have the ability to get the pax out of the aircraft into the secure part of the airport. So we lost many of the time savings and lost the business case. Right now, the rule is that 12 pax or more need to go through security. Mr. Bernstein commented that there is a group within the IWG that is focusing on security. Mr. Akbar Sultan talked about the issue of energy reserves, departing, and arriving to the north may not be possible because of Traffic Alert and Collision Avoidance System (TCAS) rules. Mr. Joe Bertapelle asked why a Joby eVTOL can operate more economically than a helicopter. Mr. Akbar Sultan said that going from a turbo to electric motor, production and maintenance is a lot cheaper. Mr. Bruce Holmes added that if you have an aircraft that can take advantage of the wing lift and rotor lift, you have large gains. Mr. Joe Bertapelle asked if there is something up there keeping Mr. Bernstein up at night. Understanding each of the operations and what their initial operations look like. Mr. Akbar Sultan commented that we need to answer a fundamental question – do you need to treat this vehicle different from the traditional? If the answer is no, no problem. But if the answer is yes, you need to treat them differently, then "what?". I don't believe we have answered that first fundamental question (at least for air traffic). In some cases, yes and in some cases, no. Mr. Jim Kuchar asked about funding. The NextGen Office is the lead. There is also work on I-Teams. The FAA is taking a portfolio approach. Funding is low, don't have a line item, just started in October, don't have a multi-year funding program. The power of this project is both Innovate and Integrate – multi office effort, trying to understand the interdependencies. The goal is trying

to catch everything up front so that you don't have a type certified aircraft that needs a 3 year process to operate. Mr. Bruce Holmes suggested commercial demonstrations for hydrogen fuel cells – keep it visible as one of the infrastructure challenges.

Presentation: 9. NextGen – Wake Turbulence
Presenter: *Jillian Cheng*

Summary: This project is about data collection, databases, modeling and analysis for new aircraft to maintain acceptable level of wake safety, increase airport arrival and departure rates. The goal is to make wake separation recommendations to ATO. For the Absolute Wake Encounter Metric, you will see this for a couple of years. This office is looking at wake risk encounter for new entrants for the vehicle (as a generating and an encounter) – collecting data from the various manufacturers and using that to model the wakes. We are also looking at wake vortex impact for new Ground Based Augmentation System (GBAS) Landing System (GLS) procedure at SFO for update to 7110.308 (pending). Mr. Jim Kuchar asked if the modeling for new entrants is from a generator or an encounter? Both.
There could be an 8 to 9 degree glideslope for some of these new entrants. How does that affect the vertiport? We are taking that into account. We are looking at this from a mid-term point of view – what will this look like in 10 years? Mr. Jim Kuchar asked if the FAA is using new sensors to develop new measurements for new entrants? New LIDARS? There is a background noise issue. The FAA is involved with NASA and DOD on a project to collect gust data. The modeling will be more of a LIDAR issue. Mr. Bruce Holmes asked if there is a role that doppler technology can play in combination or to replace LIDAR? The presenter's understanding is no, but is willing to have a more detailed conversation. Mr. Bruce Holmes commented that is it nice to see that en route effects are being considered. It is a small change that has been pushed harder in the past couple of years.

Presentation: 10. Wake Turbulence Re-Categorization
Presenter: *Jillian Cheng*

Summary: Mr. Jim Kuchar commented that zeroing the project out is not satisfying and a longer-term research roadmap is needed to justify and organize research to address remaining and future needs. The rest of the subcommittee agreed.

Presentation: 11. NextGen – Flight Deck Data Exchange Requirements
Presenter: *Nouri Ghazavi*

Summary: Mr. Ghazavi commented that any data provided to the aircraft will need to go through a zero-trust framework. For this phase of the project the focus is on how can we mitigate any security concerns associated with the hyper connected ATM system. This is about exchanging safety critical information with the aircraft. Hyperconnected ATM is focusing on one direction information flow (not bi-directional). Mr. Bruce Holmes asked if the FAA is looking at 6G? Mr. Akbar Sultan asked if the project is looking at bi-directional flow? Not yet. Mr. Bruce Holmes commented that there is some work going on in cloud-based FMS services - how would those show up? They would not. Those would be in an aircraft control domain and those requirements will come from AFR/AIS domain. Mr. Joe Bertapelle asked about what is currently available. All of it. If you put a blanket around the AID, then you are protecting the aircraft. What additional security links do we need to consider? Not everything goes through AID. Sometimes the pilot enters something directly into the aircraft. Mr. Joe Bertapelle asked if the EFB is dedicated to the airplane? It's not part of the aircraft but it's part of aircraft operations. In this project, we are agnostic to the EFB. Today's usage continues. A description of the hyperconnected aircraft tool assessment was provided in spreadsheet form. It provides an assessment of the security controls for the message set and the means of compliance for meeting the security requirements. These are aimed at 3rd party developed apps that would go into AID, EFB, etc. This project is finished; no additional funding proposed.

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

Summary: Mr. Akbar Sultan did not see the application of human factors with respect to automation (degradation, etc). He would have liked to see a better treatment of that.
Mr. Joe Bertapelle commented that this BLI seems to be crossing several topics whereas in the past it was more focused, like remote towers.
Mr. Bruce Holmes commented that he does not understand the structure across the different lines of business; it's related to organizational efficiency – why have HF distributed vs focused; why distribute it; are there efficiencies gained technically and resource wise?
Mr. Jim Kuchar commented that there is a whole HF subcommittee; in the past we were more focused on training for ATC; if the automation is not in what we heard, where is that work happening? How is the work in HF distributed across the different lines of business? It would be good to see a holistic view of where the HF work is being done.
Ms. Chinita Roundtree commented that if the subcommittee can get more specific on what we are looking for, then we won't get a generic briefing. Would recommend rephrasing the question so that it is specific.
Mr. Akbar Sultan will do some data mining to better phrase the question. Has to do with automation. The comment is based on what the airlines and industry want to see out of the NextGen Advisory Committee (NAC), is there any convergence from what we saw from Steve and what the NAC wants?
Mr. Joe Bertapelle commented that both sides are frustrated.
Mr. Bruce Holmes commented that there is a long list of reports, but does not understand what is going on. Perhaps we need to ask every briefer to provide a risk assessment about what is really going on. We don't hear much of a description of program risk; we do not hear anything about the content of their products. I am feeling left in the dark about the content of the work. Maybe having in-between meetings where we go into detail about some of the topics.
Ms. Chinita Roundtree mentioned that the Aircraft Safety Subcommittee will have working group meetings; they get specific questions and get specific briefings; will provide contact info to the co-chair of that subcommittee to Mr. Jim Kuchar.
Ms. Monica Alcabin suggested to schedule a zoon call where we can talk with him and get an idea of the briefings that they are getting.
Ms. Emily Stelzer asked, what's the objective and what do you intend to get out of it?
The Full REDAC Meeting is Oct 4, 2023.
The Spring FAA REDAC NAS Ops Subcommittee Meeting is March 19-20, 2024.
Mr. Joe Bertapelle asked, would it be useful to get a presentation from Aireon on their future satellites and other capabilities?
Mr. Phil Yeung suggested that for runway incursion, we should probably get a report from AJI.
Mr. Joe Bertapelle asked, what are the lessons learned from the ecoD MRTBO live flight?
Mr. Akbar Sultan responded, the first one was procedures; how do you do more active traffic management and better prediction? Is it surveillance, TBFM, navigation?
Mr. Bill Kaliardos was in the room and provided more insight into the HF research. He stated that the FAA does manage some of the HF research, but it is fragmented throughout the agency. He understands that REDAC is looking for gaps in research, but it is the internal application of research. If the fragmentation results in a research gap, that would be good to identify.
Mr. Akbar Sultan commented that a long time ago, there was a Congressional Act for the FAA to develop a HF Action Plan. HF created an integrated plan and there were periodic integrated portfolio reviews. AVS has recently tried to do an AVS HF Research Plan (not just ANG but is in all the AVS divisions). That is probably the best integrated plan we have right now. Shows what are the funded projects right now but is still in draft form.
Mr. Bill Kaliardos responded that in the FAA REDAC NAS Ops Subcommittee, you only see two of the HF line items; the other two go through the HF Subcommittee.

Mr. Bruce Holmes asked, how does the application of HF research apply to some of the automation going on with some of the AAM aircraft? Where does the HF research to enable those operations? Mr. Bill Kaliardos responded that it would go through the UAS office through the center of excellence, ASSURE. If it does not go through the Tech Center or CAMI, it will go through ASSURE.
Mr. Bruce Holmes commented that what we are looking for is an operation of a fleet of aircraft and the prospect that there would be alternative means for providing communications between the aircraft and the third service providers. Is there strategic advantage to having centralized research activity, including HF, maybe the economy of it? Would there be a benefit to having an integrated strategy for HF research?
Mr. Bill Kaliardos shared that the HF subcommittee is next week. They will be getting briefings on HF issues from 2 AAM Original Equipment Manufacturers (OEMs) – Joby and Supernal.

Day 2 – August 23, 2023

Presentation: 12. Informational Briefing: AAM Vision
Presenter: *Greg Bowles / Joby Aviation*

Summary: We have been through the drone world – this is very different from that. These aircraft will be piloted, will integrate in and fit in the system like other aircraft. We are filling lots of gaps as a young company – we are building all of our own parts, CNS and displays are from Garmin. The intent is to build the whole thing in-house. We have 1500 in-house employees.

We are targeting 2024 EIS. We will test aircraft at Edwards AFB shortly. The Air Force will be flying the aircraft in 2024. The aircraft is 5200 lbs., 5 pax with the pilot up front, all electric. All the military flights have been remotely piloted. Greg showed battery, interconnected wiring, each with a control station, each of the batteries are temperature controlled. We build our own motors. Greg has been at Joby for 5 years now. Battery developers came from Tesla. We use a pouch for the lithium-ion batteries and have built a titanium plate. We are monitoring all of the batteries. We have designed the system for rapid charging; nominal flights are 15-20 mins; can recharge a flight for 5 min; aircraft can fly for 30 mins. The certification path is on track with FAA; starting to do flight testing; will be doing full scale flight tests later this year. The SFAR deals with powered lift; existing commercial and helicopter pilots can get type rated in the aircraft. The aircraft has very traditional equipage – that is the beginning, day/night VFR flights. For the US to succeed, we need to solve this – high density IFR; needs to happen in the 2030s. We have more pressure for the US to succeed. Showed a graphic of the number of aircraft in the system: 8500 airliners; 10,500 helicopters; 143,000 private, 22,500 business. Consider a vertiport a quiet heliport. We have been doing a lot of work with the military; this is the electric era of aviation. This is an outgrowth of F-35B program, unified flight control; pilot controls speed and direction.
What is coming next? High density IFR; Hydrogen – will enable longer range; Bigger, faster, farther. What are the main cost advantages? Our motor has only 1 bearing; maintenance costs drop, cost of electricity is very low, energy cost is low, pilot traditionally will be one of the big costs, but ultimately will fly autonomous; noise opens up a way to integrate flight in a new way. VIP helicopter flight can be attainable; UPS truck drives down the street to deliver my Amazon package – same kind of transition; energy can be clean; battery electric is 30 times less dense than traditional fuel; aircraft is very efficient; Cessna buns 11.1 gallons, we burn 1.1. We are competing with bicycle travel and electric car travel. What about bird strikes? We are doing bird strike tests on different parts of the airplane. The FAA is doing each applicant separately. Currently there is no bird strike requirement. We are the first leading edge applicant. We are finding resistance to hydrogen fuel. We think hydrogen is compelling – 3-5% more efficient batteries per year; however, everyone wants to blend electric propulsion and control. We need a better fuel source for aviation; hydrogen is the way to go; this will be what happens in the next decade. Department of Energy has put billions of dollars into hydrogen hubs. Hydrogen will

probably not be used for cars, but the lightweight nature of hydrogen is compelling for aviation – there will be huge pressure to get there. What about weather? Weather will be important; the issue will be density. We can get very accurate microweather. Most of the flights will be 20 miles away. We will know the weather and location information out of their locations. How can you route around weather systems? From an R&D perspective, we have enough information, it is not that challenging. High density integration, spectrum, controller workload, letters of agreements (LOAs). The Dallas region into DFW would be good to have LOAs for that route. It is an initial step but will not solve the density question. We need to pull the industry together, but the problem is that everyone has their special interest. We need an arbiter.

Autonomous system will get you to zero zero. We have not focused on a non-skilled pilot. What about wake vortex? We have been working with the wake vortex office. The wake we generate and our susceptibility to wake. We are better than an aircraft and fixed wing. The generation of wake is very small. We would like to come in and land perpendicular to the active runway. That is our biggest challenge – we need to be able to quantify when the wake is/is not there. Mr. Bruce Holmes gave the example from previous work where they avoided flying into larger airports because they lost time dealing with airport security and asked about pax issues. Greg said that they are working with Delta and working through those issues.

For traffic awareness and collision avoidance are equipping with ADS-B and Terrain Awareness and Warning System (TAWS). We have been talking with ACAS-X office. We need to figure out the details of the technology and certify it. We have a 15-20 mins flight duration, what about integrating with GA? Outside of controlled airspace, we are very traditional GA ops with traditional equipage. In controlled airspace, that's where the LOAs come in. The drone community has been pushing state of the art. We will be able to integrate those things on board when they are ready. We have gone down a very traditional path, standardization and community engagement is key

RTCA tried 10 years ago. Jens thinks there should be a Task Force 6, that the industry needs to get together and do that. In the DAC everyone is yelling at each other and thinks that the industry is finally ready for that. One of the FAA staff at the meeting thinks the industry has finally getting to the point where some of these technologies are coming together. Jens commented that the agency cannot pick winners and losers. These companies are fiercely competitive – there are areas where we collaborate, but the drone industry is not yet ready to do that. The AAM space is in the middle. What about human factors? Have you briefed the HF REDAC with respect to controller workload? No, I believe we have not. We are participating in Innovate 28 out of LAX. We will have lots of learnings between 2025 and 2028 to get ready for the LA Olympics.

Presentation: 13. Informational Briefing: Industry Positions on AAM R&D Needs
Presenter: *Jens Hennig / GAMA*

Summary: There are three dozen companies in the AAM space. GAMA has been working this space since 2015. Historically we have not worked with pre-revenue companies. We need a very good definition description of AAM. Jens referenced the AIA paper with three use cases and reviewed the CNS equipage Typical Capabilities List paper. We do not have a mature helicopter infrastructure system in place today – helicopter community has been spending the last 20 years developing the standards; now we have to spend the resources developing the procedures.

Early introduction will be VFR. Helicopters and GA typically stay away from dense areas. The difference is these vehicles want to go into dense areas. Today we do that but it's highly instrumented and equipped. In no time, corridors will be saturated. What do we do then? Jens shared example from two heliports in Manhattan. The same thing in Las Vegas with Maverick – we do not need new regulations, we are doing it today with high density operations using LOAs

Helicopters – new ones are 1000/year; thinks that these new aircraft will be 4000/year. What does dense operation mean? What is the retirement rate of helicopters? Not sure, these aircraft fly around 20, 30, 40 yrs. Detect & avoid, C2 link – RTCA is working on DAA and getting TSOs. We need DAA to be operational. How to certify the ground station? We need higher air to ground surveillance capability, higher update rate, higher accuracy on the aircraft.

Can we use data comm for tactical? Is FAA's research portfolio working for you? We are happy to see FAA statements on DAA. We need help on high-rate surveillance. V2V – what is it? We need to define it – is it a spacing or separation application?

Mr. Akbar Sultan thanked Mr. Jens Hennig for his briefing – you got through the noise; you say exactly what is needed from a CNS perspective, getting to the next layer. Mr. Jens Hennig responded that this is going to turn into something, some of the next steps are really boring but it's those steps that will help us get there.

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

Summary: Mr. Gary Pokodner mentioned that he took recommendations from REDAC to go look at seaplanes. He showed a video of Digital Copilot to provide wind and runway, using ADS-B to tell the pilot the favored runway – this is being developed by MITRE. Mr. Bruce Holmes asked if this could be used by a vertiport to tell the pilot the landing direction and spacing? MITRE is developing this. There is the potential for each transfer with other suppliers like Foreflight. Ms. Emily Stelzer commented that this is mostly geared towards GA, but could be applied to AAM. Mr. Bruce Holmes asked if cross wind limits for fixed wing aircraft had been included? Yes. Mr. Bruce Holmes indicated that we teach traffic patterns at airports and that we have handbooks for that and that could be included here. Digital Copilot was internally funded by MITRE. Some other pieces were funded by different offices of FAA. This could be used as a training application for weather. Digital co-pilot terminology needs HF maturation. In addition to benefits, the requirements are also being defined. The data being fed into the system is to be determined by MITRE. MITRE believes that by end of 2024 it can be ready for tech transfer. Is it integrated with NOTAMS? Not sure, believe so, but not sure. This is a platform that could be used for variety of uses, especially on fusion or availability of different tiers of weather information. We would want to know about other traffic – can sequencing be integrated into this? No this is not providing sequencing capability. When the Weather HITL is done, perhaps additional requests for other services would come. This is only weather function and cannot be providing piloting functions. For AAM pilot training they would need to go through similar training in simulation environment.

Presentation: 15. Weather Program

Presenter: *Randy Bass*

Summary: Mr. Randy Bass shared that starting in FY24, Weather Program (WP) and WTIC will be merged under one program once the federal budget is passed. If there is a continuing resolution, they will continue as two separate programs. Weather Information Modernization & Transition (WIMAT) – there are about 20-30 convective weather products out there. Many of them are 20-30 years old. This is doing an assessment of the ones out there.

Mr. Bass shared that they are meeting next week with AUS-300 to look at weather standards. Mr. Akbar Sultan asked if the community is making better inroads to advance that? On F&E side, they are qualifying 3rd party weather providers. They are taking the non-traditional weather information that is out there, that provides good weather information, and certifying it for use by AAM (e.g., a sensor on a roadway that is closer to where the AAM wants to operate. We've never done forecasting at 400 ft – that is a huge change.

Mr. Akbar Sultan commented that these vehicles are energy constrained, so, even being able to forecast the winds, these vehicles are going to be using their motors – higher consumption, if you have to deal with turbulence or micro weather, you may have to use more of your reserves. This information is important. The UAS Office under their Community of Interest is looking at the gaps in wind information for UAS, Special Weather Action Team (SWAT). Sustainment vs enhancement. Climate change impacts on turbulence

Terminal Area Icing Weather Information for NextGen (TAIWIN) and High Ice Water Content (HIWC) will be funded by the Aircraft Icing Program. Funding appropriation concern, as the two programs are merged, and the combined effort is tracking at $3M reduction for FY24
Weather below 400 feet is still a gap. Turbulent tailwind which could be viewed as good can still eat up consumption, example provided of 40-minute power going down to nearly half. Visibility and ceiling information critical for AAM and innovate 28. Space weather focused on legacy aviation operations. TAIWIN and HIWC are going to aircraft icing in the future. Current sensors did not properly reflect the actual visibility due to smoke with the recent fires (e.g., sensor may say 7 miles and GA would report 2 miles actual visibility). They will be looking at the issue.

Presentation: 16. Operations Concept Validation & Infrastructure Evolution (ATDP)
Presenter: *Jorge Rodriguez Cifuentes*
Summary: There was discussion about the Impact assessment of space launch operations. AST is more the licensing side; this group is more the operations side. Mr. Bruce Holmes commented that Kansas & North Dakota are working supersonics & hypersonics. There are companies that are developing these vehicles in Nevada and parts of California. Mr. Holmes asked if Mr. Cifuentes had had any interaction with any of these states or companies? Probably more downstream with getting operational approvals.

Presentation: 17. Informational Update: NASA ATM-X
Presenter: *Akbar Sultan*
Summary: Mr. Akbar Sultan presented the slides. The focus is 20-30 years out and tech transfer is 5 years before deployment. The FAA's Info-Centric NAS – a highly automated environment. NASA's "Sky for All" vision – monitor, alert and mitigate for safety. Air Mobility Pathfinders – Critical Commitments (CC26) – fully integrated ConOps. There is no fully integrated ConOps for UAM. System Wide Safety – in time safety risk management. Need for a more prognostic environment. Are proposing to use ML/AI to look for safety risks. They are doing an op eval with American Airlines at their ops center.

Mr. Jim Kuchar asked, what is the mitigation? Runway incursions are in the news. What to do about it seems to be stalled. Would you identify the mitigations?
Mr. Akbar Sultan responded saying that NASA originally called it "real time safety". The National Academies report said, it does not have to be real time, could be before, after, etc., Therefore, we renamed it in-time. Advanced Capabilities for Emergency Response Operations, Wildfire airspace management, Air traffic management transformation. ICN is the step to get to Sky for All. There will be joint demos for BVLOS below 400' (partnering with NASA and industry).

Mr. Jim Kuchar asked if there are specific plans between NASA and FAA? Mr. Akbar Sultan responded that it depends on the maturity of the project. The completed ones have been crossed out. For those that have been closed out, there was a NASA milestone listed on the FAA roadmap.

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

Summary:
The subcommittee reviewed its findings and draft recommendations and discussed logistics for the next meeting.

- Spring 2024 Meeting – March 19-20, 2024
- Fall 2024 – date set for Sept 4-5, 2024
- A document was requested to be provided to the subcommittee: the latest UAS/AAM Integrated Research Plan
- Monica Alcabin will provide the subcommittee with the Future Connectivity for Aviation White Paper
- It was noted that the Human Factors and weather research areas would benefit from an integrated strategic plan. In particular, for human factors, how is automation and autonomy – and the addition of new entrants – reflected in their research plans

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

Summary: The subcommittee discussed potential findings and recommendations as well as identified documents and briefings to be included for the next meeting in Spring 2024. The date for the Fall 2024 meeting was set for September 4-5, 2024.

REDAC / NAS Operations Subcommittee Meeting Agenda

Purpose: Review the R&D portfolio developed based on the subcommittee's strategic guidance from the Spring Meeting. The FAA briefs the proposed R&D FY+3 years.

Day 1: Tuesday, August 22nd

Conference Room:

Building 10A, Orville Wright Building, 800 Independence Ave SW, Washington, DC 20024
7th Floor, Conference Room 7B (see page 4 for room location)
Zoom/Dial-in: See Page 3 for phone and video conferencing details

9:00am	Welcome / Review of Actions	Jim Kuchar / Phil Yeung
9:10am	1. Director Remarks	Shelley Yak
9:15am	2. Budget Briefing	Tom Kelly
9:30am	3. Enterprise Concept Development	Steve Bradford
10:00am	4. New Air Traffic Management Requirements	Steve Bradford
10:30am	Break	
10:45am	5. Enterprise Human Factors	Tara Gibson
11:15am	6. Air Traffic Control/Technical Operations Human Factors	Tara Gibson
11:45am	7. Runway Incursion Reduction Program (RIRP)	Rob Higginbotham / Scott Proudfoot
12:15pm	Lunch	
1:00pm	8. Informational Briefing: Innovate 28 Overview	Mitchell Bernstein
2:00pm	9. NextGen – Wake Turbulence	Jillian Cheng
2:30pm	10. Wake Turbulence Re-Categorization	Jillian Cheng
3:00pm	Break	
3:15pm	11. NextGen – Flight Deck Data Exchange Requirements	Nouri Ghazavi
3:45pm	Findings and Recommendations Discussion	Subcommittee

Day 2: Wednesday, August 23rd

Conference Room:

Building 10A, Orville Wright Building, 800 Independence Ave SW, Washington, DC 20024
5th Floor, Conference Room 5A (see page 5 for room location)
Zoom/Dial-in: See Page 3 for phone and video conferencing details

9:00am	12. Informational Briefing: AAM Vision	Greg Bowles / Joby Aviation
10:00am	13. Informational Briefing: Industry Positions on AAM R&D Needs	Jens Hennig / GAMA
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	
1:00pm	16. Operations Concept Validation & Infrastructure Evolution (ATDP)	Jorge Rodriguez Cifuentes
1:30pm	17. Informational Update: NASA ATM-X	Akbar Sultan / NASA
2:30pm	Findings and Recommendations Discussion	Subcommittee
3:30pm	Recap and Closing	Jim Kuchar / Phil Yeung

Legend Key:

	Informational Briefing or Update

Day 1 Attendee List:

Adam O'Hara	SAIC
Alexandra Papantoniou	FAA
Akbar Sultan	NASA
Andrea Stevenson	FAA
Anthony Pocchio	FAA
Beth Arnz	FAA
Bill Kaliardos	FAA
Bob Humbertson	FAA
Bria Johnson	FAA
Brian Powers	FAA
Bruce Holmes	Holmes Consulting LLC
Caitlin O'Kelly	FAA
Chinita Roundtree-Coleman	FAA
Chris Lawler	Cavan Solutions
Deborah Shaibe	FAA
Eddie Sierra	FAA
Emily Stelzer	MITRE
Eric Neiderman	FAA
Jim Kuchar	MIT Lincoln Laboratory
Joe Bertapelle	Joe Bertapelle LLC
Jon Schleifer	FAA
Karl Kaufmann	FAA
Kristina Carr	FAA
Mark Hale	Diakon Solutions LLC
Marlo Allen	Quasars, Inc.
MaryAnn Bernacki	Diakon Solutions LLC
Matthias Steiner	NCAR
Mitchell Bernstein	FAA
Miwa Hayashi	NASA
Monica Alcabin	Boeing
Nouri Ghazavi	FAA
Okoineme Giwa-Agbomeirele	FAA
Phil Yeung	FAA
Rob Higginbotham	FAA
Robert Humbertson	MBO Partners
Sabreena Azam	FAA
Steve Bradford	FAA
Tammy Flowe	FAA
Tara Gibson	FAA
Tennille Blackwell	FAA
Tom Gunnarson	Wisk
Tom Kelly	FAA
Vaughn Yates	FAA
Zachary Dassault	FAA

Day 2 Attendee List:

Adam O'Hara	SAIC
Alexandra Papantoniou	FAA
Akbar Sultan	NASA
Bill Kaliardos	FAA
Brian Powers	FAA
Bruce Holmes	Holmes Consulting LLC
Chinita Roundtree-Coleman	FAA
Chuck Romano	FAA
Deborah Shaibe	FAA
Emily Stelzer	MITRE
Gary Pokodner	FAA
Greg Bowles	Joby Aviation
Jaime Figueroa	MIT Lincoln Laboratory
Jens Hennig	GAMA
Jim Kuchar	MIT Lincoln Laboratory
Joe Bertapelle	Joe Bertapelle LLC
Jorge Rodriguez Cifuentes	FAA
Mark Hale	Diakon Solutions LLC
Matthias Steiner	NCAR
Mitchell Bernstein	FAA
Miwa Hayashi	NASA
Monica Alcabin	Boeing
Okoineme Giwa-Agbomeirele	FAA
Phil Yeung	FAA
Randy Bass	FAA
Robert Humbertson	MBO Partners
Tara Gibson	FAA
Tennille Blackwell	FAA
Tom Gunnarson	Wisk
Zachary Dassault	FAA