

Research, Engineering and Development Advisory Committee (REDAC) MINUTES

Meeting Date and Time: 10/07/2020 – 9:30 AM **Meeting Location:** VIRTUAL SESSION

Purpose	REDAC Guidance on the Fiscal Year 2023 Research and Development Portfolio
Facilitator	Dr. John Hansman, <i>REDAC Chairperson, MIT</i> ; Ms. Shelley Yak, <i>FAA WJHTC Director and REDAC Designated Federal Official</i>
Note Taker	Monique Moore

Presentation: Welcome, Opening Remarks and FAA Strategic Research Impacts/COVID-19
Presenter(s): Ms. Shelley Yak and Dr. John Hansman

Ms. Shelley Yak, Director, FAA William J. Hughes Technical Center, announced the public meeting notice as required and provided an introduction and updates to the Research, Engineering and Development Advisory Committee (REDAC) members. Ms. Yak thanked attendees for their presence and commitment to the REDAC.

Ms. Yak spoke briefly about the Civil Aerospace Medical Institute (CAMI) being open, with the limited number of employees that are maintaining the lab.

She highlighted the three phases in relation to COVID-19; phase one, currently in and on site. Continue to look at gate criteria to allow more personnel on sight. Then, move into phase two. Lastly, past three, whatever the new normal operations will look like. There are about 3,000 federal and contract personnel at the Technical Center; however, at the present 200-300 to keep things going on. The personnel have adapted to the change, and she is pleased about the considerable progress in Research and Development. To date, produced were 90 technical reports documenting our research findings. Also, progress was made in many programs, such as: UAS-detection at airports work; the Fire Safety Team successfully completed projects under their purview- establishing standards for lithium batteries; Environment and Energy initiated over 30 proposals for projects and are progressing on the third phase of the CLEEN program procurement process. To illustrate the effect of the work that needs to be done in the lab environment the testing of our alternatives to FDS film foams, which resumed once the labs opened.

Ms. Yak thanked the Committee for the advice and assistance for last season in developing Fiscal Year (FY) 2023 plans. Discussions will be held today about how the research drivers that the committee assisted us in identifying and prioritizing, were used, and what will affect the Fiscal Year 2023 budget submission. Some of the highlights from the Fiscal Year 2023 submission are new technologies, such as electric aircraft, flight deck automation using AI, use of alternative sensors, weather data acquisitions, human factors, as well as emerging operations, UAS and Commercial Space. Additionally, the emerging technologies budget line previously, has been part of the budget and allows some flexibility to respond rapidly for emerging aviation challenges. A lot of this work

has been in conjunction with the advice and recommendations from the committee.

Dr. John Hansman (REDAC Chair) responded, it is good to hear about the tactical management related to COVID-19. Throughout the day, thought should be given in regard to the other strategic changes or needs that are driven by COVID-19.

Presentation: FAA Opening Remarks and NextGen Perspectives

Presenter(s): Pam Whitley, Acting Assistant Administrator - NextGen, ANG-1

Ms. Pam Whitley, FAA Acting Assistant Administrator for NextGen, thanked the Committee for their time and service.

Ms. Whitley stated the FAA remains fortunate while working in a remote posture. The agency made a quick transition to a remote status, which only took a couple of weeks to get into a normal practice. The Administrator emphasized the fact that employees' safety was a primary concern. The agency reached a normal state in terms of being able to respond and react. The recognition was that air traffic did fall down drastically, however, the FAA was able to keep the system going.

The FAA is yet tuned into the assistance that the government provides to the airlines. As indicated in the new media, airlines are in need of assistance, and it is also recognized through our work with the NextGen Advisory Committee (NAC) and within the community. There is a push to continue advancing the work with NextGen. Looking at the system today and where it is going is a huge undertaking. One of the areas of concern and resulting in a dynamic conversation with industry is equipage.

A performance-based navigation infrastructure, has some equipage requirements as identified through the NAC last year prior to COVID-19 activities, developed a minimum capability list. It was an opportunity for government and industry to look at aircraft equipage across Communications (COMNAV). If not just working in a framework of Automatic Data Surveillance – Broadcast (ADS-B) or DATACOMM but looking at the complete package to have the optimal suite of things on the aircraft to expand the NextGen capabilities, what would that look like? A document was signed/published in the early portion of year, and is available publically.

Consequently, industry's follow-on work was to address relevant issues moving forward. It did require a look at how they were investing in aircraft, and how the orders would appear. One of the elements identified was inconsistent communication. The group of people that order the aircraft and the group of people that understand the needs to be in the aircraft are not all in the conversation when orders are placed. The other thing learned is the agreements between the majors and regional carriers are all different. Some are owned and some are acquired through lease agreements. Often times, there is limited communication concerning equipage. Conversations with industry have increased and future work is anticipated. Looking at where the FAA and the system is today, what the opportunities are, and the continued required work to advance NextGen capabilities; the agency is looking at what is beyond NextGen.

The FAA has several on-going activities, such as partnership efforts with NASA, but really looking at the next big lead to a 4DT information environment. In doing that, an identification of future

requirements are being defined. Objectives and goals are starting to mature as it relates to enterprise information and cyber in a dynamic environment. There will be integration across the National Air Space (NAS) and various approaches supporting Unmanned Aircraft Systems (UAS), Urban Air Mobility (UAM), Advanced Air Mobility (AAM), Commercial Space and Air Traffic Management (ATM). Considering in those individual communities and the sharing of information; building the right information platforms will determine how advances occur in the NAS to ensure adequacy to service all users without having a negative impact on ATM. It will require several years of work to shape the concepts dynamics and the tasks that will be required in the performance of air traffic excellence. Working closely with NASA to shape that, as the agency will look beyond NextGen, and build that infrastructure. In simple terms, NextGen focused a lot on the CORE30, and in the future will focus on advanced capabilities, some NextGen-like capabilities, beyond CORE30. As a result, the airports and the system performance will be enhanced from a performance standpoint.

Ms. Whitley reinforced the fact that, “This year we were challenged in terms of things we were able to accomplish. Some of our activities will sacrifice so we are in the process now for pulling together a plan for next year and how we bring some of those things back. We had demonstration activities planned, that didn’t happen. We did continue some our research but some was detained. We are in a recovery framework in terms of how we put the work back together. We are building priorities looking across all of things we have to do and really working to understand what things have the highest priority, how do get them back on track pretty quickly and then what sacrifice from there.

We have had pretty good conversations with the administrators on research early this year. We provided him a recommendation on his research priorities. They were all things you are familiar with. The idea was if he were to have a conversation outside of the FAA about research, it was the list of things that are in our portfolio today that have tangible outcomes that would support discussions at his level. He liked that because he didn’t have to memorize the entire NARP to talk about research. With the COVID-19 pandemic, we did not get to leverage that work as much as we thought we would but it’s something we will repeat next year as we begin to talk to him about research and those things that are on the horizon to change somethings. We looked at the things that were supporting a rulemaking or supporting an industry change and really built a conversation about this body of research is important right now. I chose to do that because a lot of our research has a long lifetime. I wanted a way to bubble up to the administrator just a sweet spot of things that are important to him in any given time so we will repeat it this year and continue that conversation.

In summary, the team is healthy, the team made the shift to a virtual environment, did it quickly, and did learn some lessons. John, to your point, I think in the 1st month we were very tactical because nobody went into this thinking this was going to be a long-term thing as we got into it, we had to take a look at how do we get the most important things done, understand our mission, understand what things related to our mission fall off.” Ms. Whitley asked the committee for questions and comments.

Questions and Comments

Dr. Hansman inquired about an opportunity or change in the assumption in the RNP, for example; has the equipage been reviewed or determined? Since people are parking airplanes, there may be an

assumption that this probably will increase the percentage of airplanes that are equipped, are RNP levels in with reduced traffic is there an opportunity to accelerate some of the NextGen things that were held up on mixed-equipage basis or it seems like something to look into.

Ms. Whitley believes there may be an opportunity as well. NextGen has reviewed the equipage data for all of the majors and regionals, and is tracking it, which led to the work that was performed on the minimum capability list. Then, following that, the work you described where the airlines are going from here post COVID-19, with some of the fleet coming out, some are looking to change the fleet, is actually a NAC tasking. Industry will work on this and provide the data to gain an understanding of the fleet, in order to map that to the work NextGen is doing from an airspace standpoint, and really see what those opportunities are.

Dr. Hansman suggested it would be interesting to have a survey of what the equipage profiles are, how they are changing and how they may have changed COVID-19.

Ian Redhead (Environment and Energy Subcommittee Chair) – Based on what Ms. Whitley mentioned, many airlines have taken out a lot of direct flights; moving through their major hubs so one will find a lot more of the smaller gauge planes being flown from those locations to the other location they may be using the higher-up gauge aircraft you get a lot more regional activities.

Dr. Hansman thinks that is the question. The airlines do not have money. It is really more which airlines are they decide to continue operating and which ones they will not. It is a very good dynamic environment, and would be good to monitor. It may change some of the assumptions of getting to the RNP level, another example, that you could expect for RNP procedures to be routine as opposed to exception.

Akbar – Just to chime in – So one of the elements that Mr. Redhead pointed out in terms of the hub and spoke operation. It is also due to the COVID-19 crew scheduling issues. The airlines find it difficult to overnight crews and keep them safe; so they are opting to have crews turn around and come home the same day. These long haul 5-hour legs are disappearing, it is easier to operate 2-3 hour legs and be able to overnight at their home base so that way they do not have to deal with lodging and associated health risks.

Dr. Hansman made mention, in terms of the current COVID-19 pandemic, aviation assets that are parked verses the ones that are operating. You see airlines opting to park 737 NGS, paring them in favor of the 8320. In this sense, every penny that can be captured out of an operating cost of a current asset has become a major issue.

Also noted, every airline has a different strategy as some are flying older airplanes because they will fly engines out and then park them. In a reflection point as far as COVID-19, both in terms of equipage, market strategy, root structure, etc., it is important for to understand particularly at the NAS level, where are the issues going to be in the future; in prior assumption in modeling equipment, etc., probably need to be looked at in general. This is the reason it is going to be very dynamic for the next year. We will not stabilize for a while. It is an opportunity to get on top of it. Start tracking the trends, equipage, rooting, etc., whatever the need is. The follow-on to NextGen or even the implementation of NextGen might be able to be accelerated or we might want to shift it to

address what the emerging issues are, because we are in a dynamic time.

Ms. Whitley agreed, the regular activity is to monitor what is flying in the system. NextGen has ways of understanding that data, and do not maintain airlines strategic plans around aircraft and equipment since it is proprietary information; the reason for a NAC tasking. To have the community work on how to match that story to the PBN work that NextGen is doing, and future plans of the system. Currently, there are many unknowns, and what recovery will look like. Some of the international discussions are centered around the posture from country to country, in terms of COVID-19 mitigation strategies so those things are having a connective negative impact on the industry coming back. There are some active conversations now. Lastly, the US put out a runway to recovery document, which was the message from government to the airline industry on recovery. It is available on the DOT website. The document is currently being updated based on some of the international discussions and discussions around the globe in relation to the items shared. Should there be mandatory quarantines, is that the right posture or the most productive posture to kind of help the industry come back.

Dr. Hansman thanked Ms. Whitley.

Presentation: FAA Aircraft Systems Information Security Protection (ASISP)

Presenter(s): *Isidore Venetos*

Mr. Isidore Venetos (Cyber R&D Manager) mentioned its branch has been working for a few years on trying to figure out how to do risk assessments on aircraft systems. R&D has been completed as of June 2020, is transitioning to industry slowly. A high-level overview is provided. How to assess risks on aircraft and figure out what is the appropriate mitigations going forward. The first briefing is broken out in two parts; 1) talks about the R&D and how to reach industry. Essentially talks about how to develop the cyber risk decision-making process, which is also one of the administrators past initiatives that was critical to the FAA; and 2) Industry's use of the methodology, then the third part on the last slide, one will see what is the future of the R&D, and the transition to something else beyond the risk-based decision-making approach. The original framework that the staff put together, was briefed to the Aircraft Safety Subcommittee in September 2015. Amazingly, it has held up in terms of the importance how the R&D was structured and the outputs of the R&D. The green box states what AVS does, which is safety risk management. There was an attempt to append it with the material. The idea was AVS was not familiar with thread analysis and identifying risk factors but once it was put into the risk assessment domain and options were given for mitigations, then it could be determined what is the appropriate mitigation to put into place. Not just from reducing vulnerabilities but also a cost-benefit analysis. What is the impact of actually putting in those mitigations?

Risk-based decision making with data also trying to put in place the importance of allowing consistent standard outputs from our analysis and pulling instruction methodologies is very important for collaboration. Which in the end, for a successful outcome, the collaborative element of this type of process is going to be the critical element to bring forward. By putting in the methodology, there are repeatable and validation processes, and it removes a lot of the biased assessment that sometimes are seen in risk assessments that are done without a structured approach. The other positive is that it is in compliance with FAA Order 8040.B. Currently, plans are to have a discussion with AVP about how to essentially append some of this material to the SMS and some of AVP risk-based decision processes. The key thing here, is again it supports a collaborative team

approach. From a collaborative perspective, it is a good place to start. It is not a good idea to start with pen testing, which is when people think about cyber, first thing comes to mind is pen testing, and see what the vulnerabilities are. Needed are subject matter experts from various parts of industry and government agencies, to figure out what are the real concerns and risks; that is more valuable than any pen test.

In terms of what was done, received were engineering principles from reputable organizations. Put together cyber system risk assessments, based on input and took best of breed from three entities. Essentially, a methodology was created, independently at first will all three companies. Then, needed to see what the commonalities were, what were the benefits of the approach, and try to combine it with one approach that could go forward. That is the status for the program.

With a final methodology that was published this June, 2020. What is the methodology based on? It turns out the researchers leveraged heavily on MIT process called “Theoretic Process Analysis”. It shows the commonalities between the two. The effort was create a methodology that has clear components for how to assess aviation risks and how to pull together the various entities to come out with these segments of analysis. So in particular, start out with a very high level scoping agreement, and again focus on the collaborative element.

Questions and Comments

Dr. Hansman asked if traditional definitions for the impact was used, and how to evaluate or is it considered a loss of service attacks?

Mr. Venetos mentioned, denial of service, and is that the reference? One method of attack.

Dr. Hansman asked about safety impacts? How is it assessed?

Mr. Venetos explained, as the attack tree is created and control structures, it will be understood through the attack scenarios what the safety impact is, part of the overall analysis.

Dr. Hansman presented a scenario. There is a denial of service attack, and Chicago is shut down, and there are no injuries. No safety impact?

Mr. Venetos indicated the branch maintains a chart that focuses on safety. In terms of not being safety risk, that is not something that would not currently be captured.

Dr. Hansman thought it should be. To mitigate some level of risk, would one be willing to shut down the NAS in order to get to a safe state?

Mr. Venetos said a change can be made to unacceptable loses to include efficiency or performance of a certain sector. That is all tailorable an entire analysis will take that into account.

Working AIA end to end environment. Analysis expected to be completed by the end of November or December. Also working with ICAO-IPS subcommittee group, using the methodology and have been very receptive of it. It also brings up a useful synergy. The Subcommittee group is aware of the use of this IPS use-case in the cyber security commercial aviation team.

Mr. Akbar inquired about SCAT. How to avoid it being a community of interest and making it more actionable in terms of agency representation like folks are participating. How to ensure that one is actually representing the agency positions?

Mr. Venetos mentioned if there are elements or entities that want to join the cyber safety CAT have been onboarding individuals.

Presentation: FAA R&D Landscape Update

Presenter: *Steve Summer*

Steve Summer presented a brief overview regarding the Aviation R&D Landscape. Mentioned, is the innovation that is going on within the industry; from supersonic aircraft, urban air mobility, new manufacturing techniques, new certification methods, etc. He suggested a tool is needed that will assist with helping to form the research portfolio to help ensure that we are adequately supporting and enabling these technologies. We need to look at what the challenges are so the technologies can be implemented into the system. The R&D landscape aims to be an effective tool to communicate the need for FAA research to support of industry objectives and direction, and for research planning to ensure research investments are in the right areas and identify gaps requiring new or additional research.

The Research Landscape for the National Airspace System, a draft document, was developed through input from the REDAC membership in addition to FAA subject matter experts. Information was collected, and continue to be update as needed, as the industry evolves. Captured within this document are 33 research drivers; things that motivate or create a need for investment in research. They are categorized in four categories: 1) Advances in New Vehicles and New Missions; Advances in Technology and Materials; 3) Advances in Data and Processing Power; and 4) System Wide Advancements and Improvements. The first three were geared to industry objectives and advancements. In the fourth category, speaks to the ongoing FAA needs in terms of support that needs to be provided as a regulatory agency. For each of the drivers, information was solicited to identity the various research challenges associated with each and grouped them into three areas. Also, provided maturity data, and identified a timeframe.

As part of the Fiscal Year 2022 prioritization effort, we started to look at how we can leverage this information to evaluate the portfolio. The researchers will supply information related to each of their research projects to identify the connection points to the landscape drivers.

He shared the lessons learned which are: need better socialization with researchers regarding landscape drivers, and a tool for input that should allow for multiple driver to be selected.

Will continue to work with the researchers to further refine the mapping and ensure it is an accurate reflection of the portfolio. This is first look at the data, which is listed on the REDAC website. As we dig into this more, we will likely find either mis-mapped or mapped to multiple drivers, part of the reason why you will notice some disparity in terms of the linkages of the projects.

Dr. Hansman responded that he noticed there is nothing in electric or hybrid electric propulsion.

Mr. Summer indicated that there are projects related to electric propulsion. This goes back to improve the data collection process and improve our process with the researchers to refine this data. Next iteration, one will see some changes in the numbers.

Dr. Hansman thinks this is valuable; however, what is presented is not accurate.

Mr. Summer – In large part it is the lack of, in the existing tool, to identify multiple drivers related to a single project.

Dr. Hansman asked if dependent on tools? A human can do that.

Mr. Summer indicated there needs to be some improvements to the process.

Presentation: Subcommittee Report: Airports

Presenter: *Chris Oswald, Subcommittee Chair*

Chris Oswald gave an update regarding the Airport subcommittee's meeting. During the August 2020 meeting the subcommittee focused on some specific projects and initiatives. One topic of discussion included the review of the current Airport Technology Research and Development portfolio and complementary Airport Cooperative Research Program research. Additionally, information was provided in relation to unmanned aircraft system research, aircraft braking friction research and aircraft fire fighting agent testing program.

There were consequential impacts on several research projects due to COVID-19. Some testing was delayed, and will be re-sequenced, as there will be a need for an extension. The subcommittee recommends that the FAA reassess research timelines in light of COVID-19 delays and prioritize the activities associated with Congressional deadlines. Also, recommended is that the FAA provide early indications of research activities that may not be completed in time to inform FAA actions regarding Congressional mandates. These evaluations should take into consideration time necessary for cross-agency collaboration and coordination.

The next finding, the Subcommittee supports the research into emerging pavement additives. While the subcommittee realizes the useful potential of these additives, we note that consideration needs to be given to how additives may affect full-scale pavement construction. It is recommended that the FAA consider evaluating emerging pavement additives in the National Airport Pavement Testing Facility test facility during future construction cycles. Additionally, the Subcommittee recommends that construction of these test sections be monitored to determine any impact on the full-scale production of concrete placing, consolidating, and finishing using standard construction practices.

The final finding the Subcommittee remains interested in the Airport Technology Research Program's involvement in unmanned aircraft system and urban/advanced air mobility system research-both from the perspective of their beneficial use at and near airports and from the perspective of managing the safety and security risks associated with authorized use of these and near airports. The subcommittee recommends that Airport Technologies Research Program utilize the Subcommittee to provide airport stakeholder input and insight into its UAS and AAM research activities, as well as in crosscutting research undertaken elsewhere in the FAA.

Presentation: Subcommittee Report: NAS Operations

Presenter: *James Kuchar, Subcommittee Chair*

James Kuchar provided, during the meeting over the summer, the subcommittee was briefed on various topics and deep dives. One, to receive more details on the Aviation Weather Research Program's research requirements new process that was implemented to prioritize research needs and allocated to programs. Also had a briefing on the FAA's progress in building a NAS 2035 vision and NASA's 2045 vision. Both are currently in process of being developed; the FAA's vision is relatively mature and will be coming out very soon. Additionally, there was a discussion on Cyber R&D. Had a briefing on International Aviation Trust Framework, which is helping coordinate cyber requirements across national boundaries, and a briefing on Aircraft Systems Information Security/Protection.

Mr. Kuchar mentioned the subcommittee's findings and recommendations. The first describes the FAA's progress in developing and exploiting its Research Landscape for the National Airspace System. The subcommittee appreciates the utility of defining research Drivers and mapping them to the various RE&D activities within the FAA.

The organization of the Landscape into four major Driver categories (Advances in New Vehicles / New Missions; Advances in Technology and Materials; Advances in Data and Processing Power; System Wide Advancements / Improvements) is helpful toward understanding how the broad range of RE&D programs span the space of work required to progress beyond NextGen.

Some challenges in the roll-out of this process were identified, including the need to better socialize the various drivers so that program managers understood where their programs would fit within the Landscape, and some practical matters such as requiring the ability to allow program managers to map their work to more than one driver. It is anticipated that those challenges will be easily addressed in the near future.

At this time, however, the connection between the Research Landscape and the FAA's research planning process has not been clearly articulated. The subcommittee identified an opportunity to more explicitly connect the Research Landscape to the FAA's RE&D planning and prioritization efforts.

The subcommittee recommends that the FAA clearly define how the results of the Landscape effort will inform RE&D prioritization, and subsequently report out periodically to the REDAC subcommittees on the prioritization process.

By making a connection between drivers and priorities, it is anticipated there will be more utility extracted from the Landscape process beyond its current value in communicating driver-to-research mappings. Ideally, the subcommittees would be provided with regular updates on the connections between drivers, RE&D programs, and its priorities, to build a more holistic understanding of the FAA's research portfolio.

Ms. Yak suggested that it be beneficial if it were a two-way dialogue. One of the important aspects of the landscapes and research drivers is getting a sense from the subcommittee members what

industry is working on and what the priorities are.

Dr. Hansman inquired about if the subcommittee discussed what the landscape or drivers or the post COVID-19 implications would be.

Mr. Kuchar responded with no.

Mr. Kuchar shared the second finding. The FAA 2035 Vision and NASA 2045 Vision invoke a significantly higher degree of autonomy than today's NAS, with machine learning (ML) and artificial intelligence (AI) supporting a dense operations environment comprised of diverse vehicles and operating entities. These visions allude to the need for operations-recovery constructs and infrastructure resiliency when off-nominal conditions occur.

The Subcommittee notes, however, that responding to novel, or previously unobserved situations (and recognizing precursors to these) is particularly challenging for ML/AI technology.

The Subcommittee recommends the development of strategies for effectively responding-to and recovering-from significant, off-nominal scenarios should be a priority in these future NAS visions. The off-nominal scenarios encompass both unplanned operational events as well as system failures. In system failures, the likelihood that significantly-more-intense operational responsibilities will need to shift back temporarily to the human work force in a graceful manner (airline, air-traffic control and flow-management) during off-nominal situations should be considered.

In addition, historical data on these autonomous systems performance and behavior does not exist, and thus a prognostic analytical approach is needed to determine the system health as well as assist in standards development and certification processes. Furthermore, the autonomous systems will need to coexist and be integrated into the traditional human centric systems.

The Subcommittee recommends that future versions of these FAA and NASA visions, and its related RE&D efforts, explicitly address strategies for off-nominal event management, recovery, and graceful system degradation, and that these be briefed to the subcommittee when appropriate.

Dr. Hansman asked how to operationally integrate and how to get approval for non-deterministic software systems.

Mr. Kuchar indicated that it can be modified and try to introduce the language.

Dr. Hansman suggested to do that or go for a meta-recommendation.

The last finding relates to A11.r Flight Deck Data Exchange Requirements and Aircraft Systems Information Security Protection (ASISP). The research is targeted at identifying and mitigating potential cyber vulnerabilities in aircraft systems. An important part of the cyber analysis process is developing a methodology that is both effective and vetted across multiple stakeholders including the FAA and other government agencies, and industry spanning airframe manufacturers, avionics, ground systems, and data communications systems.

The ASISP program has built a strong cyber Safety Risk Assessment (SRA) methodology that has been closely coordinated with industry and government stakeholders including the Cyber Safety Commercial Aviation Team (CS CAT) and broader constituencies such as the tri-agency Aviation Cyber Initiative (ACI) and the international Aviation Information Sharing and Analysis Center (A-ISAC).

ASISP has successfully conducted several cyber system analyses on critical components such as the Flight Management System. In contrast, the cyber analysis process currently being used in A11.r was not explained directly, and it was apparent that this effort is not closely coordinated with or leveraging the methodologies and accomplishments of the ASISP program. Some efforts, such as analysis of Aircraft Information Displays and Flight Management Systems, appear to be duplicative or overlapping with ASISP.

The Subcommittee recommends the FAA should ensure that the A11.r Flight Deck Data Exchange Requirements research effort is making full use of and closely coordinating with the ASISP program.

Findings and methods used in ASISP should be informing the methods used in A11.r, and likewise results from A11.r should be coordinated with ASISP and the broader ACI and A-ISAC communities.

Dr. Hansman suggested to put on the agenda to monitor and what is going on in the COVID-19 side; does it change the assumptions, or what is thought to be the critical points are, or what the RNP equipage levels are.

Presentation: Subcommittee on Human Factors

Presenter: *Dr. Barbara Holder, Subcommittee Chair*

The Human Factors (HF) Subcommittee conducted a virtual meeting on August 18 – 19, 2020. Dr. Holder shared the outcomes with the parent REDAC committee. The group reviewed the past year accomplishments and proposed sound advice in support of the FAA Research and Development (R&D) portfolio as applicable for HF initiatives and objectives. Various deep-dive presentations were provided on critical topics that created opportunities for important discussions. There was a briefing on the HF research that spans across other BLIs. This was immensely helpful as it enabled individuals to see the all of the HF research currently in process, where the research is aligned and directed and to better identify the gaps. Also, they were given a presentation by a subject matter expert researcher from MIT, concerning future autonomous vehicles. The Subcommittee addressed issues from the standpoint of agencies, and areas where HF and aviation is impacting and not impacting, as well as how to can learn from other domains. Lastly, input was provided from the Subcommittee members on what the latest emerging issues are, and the resultant priorities. The emerging list is being updated.

There was an important discussion related to Data Analytics for Operational Personnel. The implementation of many NextGen initiatives across the FAA facilities, such as Trajectory Based Operations, drives a tighter coupling of the tasks performed by different FAA facilities. In order to improve interfacility coordination in such cases, improved data analytics support for operator feedback is required. Visibility is essential to ensure operational performance issues are addressed. It is vital to know the requirements at each facility. Causal analyses remains a critical component in

this process. The Subcommittee expressed that the FAA should conduct research to identify those TBO initiatives where an effective learning feedback loop is needed to coordinate process improvements across facilities. Without improved data analytics for operator learning and training, the FAA will not be able to identify NextGen initiatives that may result in inter-facility inefficiencies and their associated causes.

The Subcommittee also stated the significance of workforce proficiency training requirements. It is critical to know that there are always the potential risks for skill degradation. As a result of the impact of the COVID-19 pandemic, the operational workforce (e.g. air traffic controllers, maintainers, and pilots) have experienced intense difficulties in the workplace. Examples of setbacks included backlogs in training, extended periods of work inactivity, increased time periods since training or requirements for retraining. To ensure continuity of operations, there have been temporary extensions of personnel certifications, and new-personnel certification in the current low-traffic environment. However, it is unknown how these disruptions affect and exacerbate the issues associated with workforce proficiency. To understand the effectiveness of existing training/proficiency requirements and programs, the FAA needs scientific human performance data to determine how long workforce (e.g. operators and maintainers) skills and knowledge are retained. There is awareness that the FAA should consider research that will result in viable scientific data generating answers that will remedy and sustain training programs through informed guidance and implementation. This data must assess proficiency retention to enable the FAA to generate informed decisions in the development of training protocols and when addressing unanticipated challenges.

Dr. Holder discussed potential actions that were of concern to the Subcommittee. The first action was the need for enhanced Human Factors inclusion in the Landscape Drivers tool. The Subcommittee received a presentation update on the research drivers for the Landscape and noted that Human Factors was not specifically identified. The discussion concluded that “Human Factors” should be identified as one of the “challenges” considered for each of the drivers, due to its cross-cutting nature. Also identified was the need for the Landscape to be responsive to emerging issues and represent such responsiveness to emerging issues appropriately. The Subcommittee requested that “Human Factors” be added to the list of challenges for each of the drivers, and the FAA develop a plan to address responsiveness to emerging issues. The Subcommittee requested an update on this action at the Winter/Spring 2021 meeting.

The second action was for the Subcommittee to receive a series of “deep-dives” on several research topics and plans. Recognizing the impact of COVID-19 on the execution of research plans relative to the uncertainty of timelines and budgets, the FAA was asked to identify mitigation strategies at the Winter/Spring 2021 season, as well. Lessons learned from the COVID-19 pandemic has introduced an opportunity to capture experiences, challenges, and successes associated with a major global disruption to the aviation sector. The Subcommittee applauds the FAA for their participation in the global response to ensure a smooth transition back to full operations. The Subcommittee encourages the FAA to be resilient and proactive in the face of uncertainty. Data on these experiences can enable the FAA to identify and mitigate HF-related risks associated with adapting to and recovering from global disruptions such as the COVID-19 pandemic.

As a general observation, the Subcommittee appreciates the work the FAA is doing to manage the situation. As mentioned, there was the belief by these industry experts that there is a gain from

tracking experiences in an effort to establish and maintain sound practices to mitigate future issues that may occur.

Questions and Comments

Dr. Hansman commented that in relation to COVID-19, it did not appear that enough was thought about from a HF standpoint and the perceptions of confidence in the system on the part of passengers. It seemed that at least in the media, a lot discussions centered on air quality. The FAA had a Center of Excellence in air quality. Although, it has not been active in a while; he assumed there was no conversation regarding this group. Dr. Holder replied that it was a good point, and that it had not come up.

Dr. Hansman also shared a general comment relevant to short term versus long range research and development. He asked, "...Should the FAA get back in looking at and is there research that needs to be done on air quality, propagation, risk mitigation, etc., or is it the opinion of the community that it is understood and there is not a research need? With respect to including Human Factors in the Landscape, thought should be given about the specific Human Factors drivers. If a strategy like a Landscape will be used, think about how Human Factors manifests itself as a driver in the system."

Ms. Holder responded with, "Yes, exactly. In the discussion, the challenges were identified as the way, in terms of a process, the way they identify these cross cutting issues like safety."

Mr. Chris Oswald also relayed his perspective on the COVID-19 discussion. He acknowledged that, "There is a lot of cross-cutting that goes on in that front. If one can roll some of those pieces in both from the flight operators and the airport operators, and maybe the NAS Ops side as well."

Mr. Jaime Figueroa commented on the first two recommendations on maintaining skillsets and ensuring that there is no degradation, and giving the operator analytic input. He noted that there is a common thread between that and the recommendation in Dr. James Kuchar's report on studying that transition to a failure mode or an anomalous system state.

Presentation: Subcommittee Report: Aircraft Safety

Presenter: *Terry McVenes, Subcommittee Chair*

The Subcommittee met for the Summer/Fall 2020 session on August 11 – 12, 2020. One of the meeting objectives included the provision of strategic input for the Fiscal Year 2023 FAA Research and Development (R&D) Portfolio. Additional focal areas included presentations and discussions about the Fiscal Year 2020 Portfolio and research accomplishments, Aircraft Safety Assurance Portfolio, Environmental & Weather Impact Mitigation (Aircraft Icing), Human Performance & Aeromedical Factors, Aviation Performance and Planning Portfolio and the COVID-19 Impact on R&D Programs at Civil Aeromedical Institute (CAMI). Additionally, there were briefings provided by the following: John Kolling, Misty Davies, Lance Prinzell (NASA), Akbar Sultan (NASA), In-Time Aviation Safety Management System (IASMS); Ken Davidian, Commercial Space Research; Bill Oehlschlager, UAS Research, and Katrina Avers, General Aviation 2030.

As a key observation during Subcommittee discussions and communicated to the parent Committee, was the significance of recognizing the value of enhancing R&D efforts by working collaboratively with various aviation industry professionals to obtain insight into future programs. This is especially critical regarding new entrants that are entering the aviation system. Many have an expansive international scope. The Subcommittee expressed that the FAA and industry knowledge-sharing will be important to establish and communicate a common set of requirements and promote sound compliance.

Mr. McVenes continued to relay the important dialogue that occurred at the meeting. COVID-19 impacted the FAA research world but during the briefings many were made aware of the resiliency of the various technical teams throughout the Agency. Many program and project leads created and implemented work plans that permitted continuous workflow. The Subcommittee was impressed by the tremendous progress that had been made. There will be a focus on the long term progress so that Agency and industry goals are met. The focus on the FAA R&D program remains imperative. Disruptive items were also identified. One of the items briefed was the suspension of all the human-subjects research. There was a concern for potential budgetary and program disruptions. Also, in addition to the COVID-19 situations, both the aviation industry and the FAA had the additional burden of dealing with the outcomes of 737MAX re-certification. These issues may lead to new priorities within the R&D program.

The Subcommittee on Aircraft Safety offered suggestions to address the identified priorities in the Safety environments. As an initial consideration for FAA R&D programs, the Subcommittee encouraged the continued focus on funded programs. They requested regular status updates for any R&D programs that may be negatively impacted by the COVID-19 crisis, including re-planning of milestones. The second recommendation asked for technical information and parameters regarding the completed progress towards the recertification of the 737MAX. At the appropriate time the Subcommittee stated that they will request lessons learned deep-dive briefings to include the impacts on the FAA's R&D portfolio, and subsequent necessary changes to its priorities.

Dr. Hansman expressed that the COVID -19 impact analyses would provide critical insights to support research program evaluations. The first step is to understand what the FAA thinks.

The suggestion, again, would be to clearly share with the Committee the lessons learned, new research needs, requirements and objectives to enable clearer comprehension of the various technical program implementation.

Dr. Hansman asked about a previous slide, for reiteration purposes. This was replanning of milestones that existed. Questions included, "Is there research that is no longer as critical as it was because, for example, the drop in demand (in facilities) or the fact it will not be as congested? What are the new things coming in? He stated that Ms. Holder's comment on the loss of skills was a really good one. It is likely to go into a period retrenchment, and when things are resolved, then there will be an effort to spin up the industry, which may not be the same air carriers in the past. On the international side, it is the same thing.

The second Finding was related to the Fatigue Risk Management R&D Portfolio. The Subcommittee was impressed with the dedication of researchers, including rotary-wing operations. There was no

appearance of any planned research aimed at assessing Fatigue Risk Management Program/Fatigue Risk Management System (FRMP/FRMS) in long-haul commercial operations. Budgetary information is a concern, and shows several research requirements are unfunded in Fiscal Year 2022. The Subcommittee requests additional information on the FAA's fatigue-related projects to enable a better understanding of funded research objectives and deliverables and allow the FAA to identify shortfalls and potential enhancements to the current flight time/duty time regulations. They requested an update at the Spring 2021 meeting on the progress and continued funding of this research.

The third Finding is in relation to Aircrew Stress Biomarker Research. The objective markers for degraded aircrew performance are urgently needed. Ground-breaking research into gene expression and genetic-based biological indicators at CAMI is unique and aims to deliver tools that can identify pre-accident aircrew stress states. These techniques, when validated, can serve as fitness-for-work assessments, giving safety and management personnel tools for real-time risk assessment decision-making.

The Subcommittee requests that the FAA consider the potential short-and long-term benefits of objective genetic-based biomarkers for aircrew stress and impaired performance and evaluate possible stable funding strategies to support this important and unique forward-looking research program.

The group also addressed Ice Crystal Icing on High Altitude Icing on Turbine Engine Damage and Power loss. This project is currently funded through Fiscal Year 2020. Considerations should include the development and testing of a large-scale model rotating rig to investigate engine geometric scaling effects. Further research will aid rulemaking efforts. Additional funding is needed for consultants on flight campaigns and additional testing for modeling for ice accretion behind the fan.

The Subcommittee recommended that the FAA should also consider further funding for ice crystal icing research for fiscal years 2021 and 2022, and beyond, as this problem has not been adequately addressed in certification and rulemaking. The FAA should consider additional research in the following fields, such as aerosol testing to determine how the water droplet adheres to the pollutant, and new engine entrants and components (e.g. wide chord fans, composites, etc.).

Questions and Comments

Dr. Hansman asked for clarification on the research needs that the Committee needs to understand better.

Mr. McVenes mentioned that some of these new entrants are really looking at a broader look at things, and the Subcommittee would like to ensure the requirements are organized.

Dr. Hansman inquired about the part 23 safety requirements based approach. It was developed to address the program. Also, questions regarding bio-marker research concepts usage were presented. Discussions stated that the future implementation will review a Concept of Operations and create a sustainable implementation plan.

Presenter: *Ian Redhead, Subcommittee Chair*

The Subcommittee on Environment and Energy (AEE) met on September 16 – 17, 2020. This group and meeting participants including observers had a very successful meeting where critical aspects of the AEE portfolio were highlighted. Key topics included but were not limited to COVID – 19 Impacts, Leadership in International Organizations, Partnerships, Industry Perspectives, Alternative Jet Fuels, Emissions, and Noise Research.

Subcommittee Chair Mr. Ian Redhead acknowledged the Environment and Energy workforce for the exemplary accomplishments that they continued to excel in completing regardless of obstacles or delays. The professionalism and innovative character of the executive management, chief scientist and technical subject matter experts remained critical for the sound execution of the Environment and Energy Research and Development (R&D) Portfolio.

To ensure continued program effectiveness, the Subcommittee provided advice related to Private – Public Partnerships. This group was commended for the outstanding U.S. representation that they provided through collaborative work done with the International Civil Aviation Organization / Committee on Aviation Environmental Protection (ICAO/CAEP). The program work completed in conjunction with the Alternative Jet Fuels (AJF) / Sustainable Aviation Fuels (SAF) Programs was reviewed, as well. This included the Aviation Sustainability Center of Excellence (ASCENT), Commercial Aviation Alternative Fuels Initiative (CAAFI), and Continuous Low Energy Emissions and Noise (CLEEN). The FAA/AEE will continue to leverage these affiliations.

Essential to the critical initiatives contained in the AEE R&D portfolio was discussions that addressed Noise Research. This was very important as awareness addresses emerging technologies and new entrant vehicles into the NAS. All of these future entrants will have a profound impact on Noise related issues. The Subcommittee in support of the FAA initiatives have paid close attention to the work being completed in this arena.

Mr. Redhead also shared the interests of the Subcommittee as it pertained to the impact of the COVID-19 pandemic. As with most FAA research programs, all of the technical work efforts that could be accomplished from remote locations were done without fail. Contingency plans to address delayed program tasks were created for future execution. As a whole, the AEE Program continued to perform at optimum levels when possible.

Presentation: Committee Closing Discussion, Future Actions

Presenter(s): *Dr. John Hansman, REDAC Members*

The Research, Engineering, and Development Advisory Committee (REDAC) was appreciative of the scope of information shared by the presenters on a full range of programmatic topics. Areas of continued dialogue included the needs to:

- Understand the broader impact and changes driven by COVID-19, As short term tactical, operational efforts were necessary to minimize work flow disruptions, there is a need to understand the FAA’s longer range strategic R&D plans,

- Address the potential decrease in Trust fund receipts,
- Continue to accelerate observations relating to new entrants research (AAM, UAS,UAM)
- Develop a more efficient mechanism to forecast air traffic projections,
- Create implementation strategies for the inclusion of accelerated technologies, diverse operations, increased volumes and future demands, complexity and enhanced future aviation planning (What is the view of the NAS in 2025-2035-2045?)
- Design training strategies that will develop resource skillsets to complement future technologies like artificial intelligence (AI) and machine learning (ML), address graceful degradation and human performance requirements,
- Project the evolution path beyond NextGen. (How will this impact the NASA – FAA Research and Development interface?)
- Develop sound processes for innovative thinking and implementation.
- Ensure viable communication strategies and platforms to adequately inform the public about future protocols to foster public confidence in air travel.

Dr. RJ Hansman will complete the meta-recommendations for review by the Committee upon development. These items will be communicated to the FAA Administrator in the Strategic Guidance Report FY 2020.

**Research, Engineering and Development Advisory Committee
Federal Aviation Administration (FAA)**

VIRTUAL SESSION

October 7, 2020

Agenda

Time	Topic	Presenter(s)
9:30 am	Welcome Address FAA Strategic Research Impacts/COVID -19	John Hansman Shelley Yak
9:45 am	FAA Address/NextGen Perspectives	Pamela Whitley
10:00 am	FAA Aircraft Systems Information Security Protection (ASISP)	Isidore Venetos
10:30 am	FAA Research Landscapes	Steve Summer
11:00 am	<i>Lunch</i>	
12:15 pm	Subcommittee Report - Airports	Chris Oswald
12:45 pm	Subcommittee Report – Human Factors	Barbara Holder
1:15 pm	Subcommittee Report – Aircraft Safety	Terry McVenes
1:45 pm	<i>Break</i>	
2:00 pm	Subcommittee Report – Environment and Energy	Ian Redhead
2:30 pm	Subcommittee Report – NAS Operations	James Kuchar
3:00 pm	Committee Discussions	
3:30 pm	- Findings and Recommendations - Future Actions	Committee Members
4:00 pm	Chairman’s Closing Remarks	
4:30 pm	Adjournment	John Hansman

2020 Summer/Fall - Full REDAC
Attendance List

1. CA Roundtree-Coleman
2. Nancy Clarke
3. Pam Whitley
4. R. John Hansman
5. Akbar Sultan
6. Alanna Randazzo
7. Al Pollard
8. Al Sipe
9. Anna Dietrich
10. Anthony Tvaryanas
11. Barbara Holder
12. Bill Kaliardos
13. B. Meineke
14. Brandon Suarez
15. Brian
16. Caitin Matulenas
17. Caprice Brown
18. Carla Hackworth
19. Chanda Sanders
20. Chip Meserole
21. Chris Oswald
22. Christopher Loring
23. Colleen Donovan
24. Craig Updyke
25. Dan Brock
26. Dan Diessner
27. Dave Atwood
28. Diana Liang
29. Doneilya Deneva
30. Doug Rodzon
31. Eric Neiderman
32. Fabio Grandi
33. Gabriel Elkin
34. Giovanni Diperro
35. Hossein Eghbali
36. Ian Redhead
37. Isidore Venetos
38. Jaime Figueroa
39. James Kuchar
40. Jean Cook
41. Jennifer Myers
42. Jenny Hoff
43. Jim Hileman
44. John Dermody
45. John Peace
46. Kathy Abbott
47. Kevin Walsh
48. Lee Olson
49. Mark Orr
50. Michel Hovan
51. Mike Paglione
52. Molly Laster
53. Monique Moore
54. Murphy Flynn
55. Paul Aussendorf
56. Peter White
57. Phil Yeung
58. Philip Hays
59. Rany Azzi
60. Rich Golden
61. Rick Garceau
62. Robert Ochs
63. Sadam Alam
64. Shelley Yak
65. Sherry Yang
66. Steve Summer
67. Tara Holmes
68. Terry King
69. Terry McVenes
70. Tom Flournoy
71. Warren Randolph
72. Wes Ryan
73. 1-206-287-4797
74. 1-206-914-5800