Research, Engineering and Development Advisory Committee (REDAC)

April 11, 2018
Federal Aviation Administration (FAA)
FAA Headquarters, 800 Independence Avenue, SW Washington, DC
10th Floor Round Room
Winter/Spring 2018

Meeting Minutes

Note Taker: Dennis Flath

09:30 – 09:45 am

Welcome Address and Opening Remarks

(John Hansman, *REDAC Chairperson*, and Shelley Yak, *FAA WJHTC Director and REDAC Executive Director*)

Dr. John Hansman called the meeting to order. Ms. Shelly Yak delivered the Public Notice and Rules, and referenced the Federal Register.

Ms. Yak thanked the members for their commitment and support to REDAC and the subcommittees. She acknowledged the REDAC subcommittees' involvement in the development of the redesigned National Aviation Research Plan (NARP), noting that it was currently in the process of being published, and she encouraged members to read it when released, and remarked that it represented great work from everyone.

The Cybersecurity Research and Development Plan was scheduled for June/July timeframe and an annual update was planned. Prioritization and continuing to set direction for cyber R&D. The team's next stage is how to link a planning document to the budget formulation process.

Ms. Yak acknowledged that the subcommittees had a challenging season, being a little different in that the focus was on '20 but had discussions on '19 at the behest of the REDAC Chair.

Shelley remarked, "As for the immediate future, the UAS Integration Research Plan had been developed and is an Official Use Only Document; but a tasking letter is being produced (in a week or so), requesting that you conduct a review as you did with Cybersecurity Plan, looking for gaps, overlaps or any adjustments in schedule or timing that you discover. Sabrina Saunders-Hodge will be briefing an overview later. We will deliver the plan early for your review cycle."

Shelley expressed a desire to hold a meeting with the Designated Federal Officials (DFOs) to discuss the next meetings (besides the scheduled UAS Integration Plan Review). She proceeded to ask, "Can you provide what research is being conducted by industry, for our better awareness?" Additionally, she stated, "We look to you as subject matter experts for a robust conversation on potential alignment with industry partners or to transition of research to industry." Shelley noted that it will be a broader discussion, but she wanted to prep the groups on the next "season".

Ms. Yak also noted that future discussions would be about the NARP next steps, but also focus on Annual Review. The meetings will include sharing what has been accomplished in the Annual Review redesign and alignment with NARP goals. She would also like a high-level reaction and feedback to the redesigned NARP: not necessarily a deeper dive, but mostly a first reaction would be helpful.

She indicated a desire for a discussion about the research portfolio, and research areas that are being

established, and how it affected the subcommittees and realignment. Shelley asked, "At the lower level, what type of research plans should we establish? Since there's so much on the plate, we need quality time together, so as soon as next week we'll schedule starts to conversations and roll it out and evolve research portfolio. Although it may sound like a lot, it is an extension of what we have been doing."

Dr. Hansman took a moment to introduce new personnel: Matt Griffin covering for Airports and Steve Alterman is covering Environment and Energy. Additionally, Chris Kmetz is new to covering Aircraft Safety.
John addressed that having asked for it for some time, the UAS Integration Research Plan is still not official, but the committee will be getting it in some restricted manner. In the handoff of industry and DOD research, that is in the REDAC charter, so it fits nicely in this manner.

09:45 – 10:00 am
NextGen Perspectives
(Pam Whitley**,** *Acting Assistant Administrator for NextGen, ANG-1***)**

Nextgen Updates were communicated by Ms. Whitley. On behalf of the agency, she thanked everyone for their willingness to serve. Ms. Whitley proceeded to provide an overview of NextGen. Stating that NextGen was doing pretty well, from an infrastructure standpoint, the FAA has modernized communications, navigation, surveillance and automation.

Pam stated:

> "We currently have new communications platforms and working on new voice communications infrastructure (although lagging a little bit), but that is because DataComm was the priority – we have completed the initial tower installations, and we have a little extra money to add additional sites.
>
> We are now moving into En Route Data Communications, providing capabilities that will launch FAA into opportunities to manage by trajectories. The long-term goal has always been trajectory-based operations, and having dynamic capabilities for rerouting, to respond to weather impacts on the system. Data Comm was a critical program to do that. It was important from a budget standpoint, Congress felt important enough to give more money than was asked for which demonstrated that to Congress and the entire community felt it was an important program to pursue.
>
> From an automation standpoint, the ERAM platform has been installed and enhanced (DataComm is dependent on ERAM, and Data Comms' capabilities reside on ERAM platform). We have completed our terminal and TRACON automation upgrades. The next big program out there is Terminal Flight Data Manager (TFDM), a surface capability to perform integrated arrival and departure. You will see that we have made substantial investments in every phase of flight.
>
> We see out there the big government/industry milestone out there…the Automatic Dependent Surveillance Broadcast (ADS-B) mandate. It is the opportunity for government and industry to demonstrate a joint effort, that we are committed to modernizing airspace system. We are working closely with airlines, our government partners and regional airlines where we understand where we will be on January 1, 2020.
> We have an open dialog with DOD because they have some special missions that we must understand from a government framework. We are working with them to understand their equipment problems and special needs and support their missions. General aviation (GA) is lagging a little bit and we are trying to understand. It may be where they intend to fly after 2020. We offered an incentive program, but it was not utilized fully. Consequently, we are working with

AOPO and other organizations. We are looking at additional educational and outreach on GA. Going forward, there are many things related to the work on research portfolio. Cybersecurity is one of those areas that we need to address across platforms…dynamic structures across systems. We need to develop an understanding of layers of cybersecurity, exchange of data - particularly with outside entities. The NextGen organization ended up with a name – NextGen – that does not, in some cases articulate all the things for which we are responsible. We drive modernization for the entire National Air Space (NAS). We put some stuff in a bucket called NextGen but there are other things in the agency - like Commercial Space. How do we integrate those concepts? How does the work in CS impact investments made from an automation standpoint. The growth of drones and unmanned aircraft systems (UAS) involves a continuous effort of current activity. It lays out a learn need for a future vision and goal. Work with entire agency to understand what we have on the plate today, how do we shape tomorrow, and how do we formulate our research portfolio and investments to form that?"

Pam continued:

There is a term we use internally that I would like to talk about a bit, that is Strategic Research and Development. For many years, we have effectively managed a research portfolio that has answered questions that are more near term. This administration is challenging us to have a wider strategic view of research - not limit government responsibility to the work we do. As Shelley mentioned earlier, we need to get a better view of research in industry, how to leverage and share results thereby moving aviation forward in a way that we are not solely dependent on federal budget. Do we have the right relationships with the academic community? Do we have opportunities to better leverage our assets such as our Centers of Excellence? Advance and alignment our research portfolio, more comprehensive view of the research needs and from government perspective of facilitating and sharing. This group can help us shape how we advance in those areas by looking at the existing portfolio and get wider, bigger picture, strategic view. UAS is an area where we have been moving out with a series of activities with partners with concepts and opportunities.

"Pam mentioned that they expected that they will get help and directives when they get a reauthorization. . Acting Administrator for Nextgen, Dan Elwell, would say that the move to get FAA out of the government was not a reflection that NextGen was not doing what it was supposed to do. In his opinion, Nextgen was limited by budget process, stops and starts through continuing resolutions, short-term investments. Many of these were million-dollar programs that could not be stopped and started without an impact on schedules and performance. The goal is to maintain a stable environment for Nextgen in the government.

Pam continued:

"The NextGen effort continues to have dynamic dialog and discussions with our Advisory Committee. We do not always agree and sometimes find that the effort to get to common ground is not as easy as one would think. We have multiple carriers, with multiple business plans with different drivers for their decisions. The forum is made up to help us make the right investments for the system. The work we do now was championed by the current Chair, the CO of FedEx, has us working on the Northeast corridor – challenging us to see if the NextGen stuff can work in a complex environment. The challenge was to take the NextGen successes and put them in the Northeast corridor. You will see in the next joint implementation plan what that will look like. Obviously, it is not the first time we tried to fix New York or the Northeast corridor. However, we are looking at the challenges differently - not just looking at the tools but also getting a better understanding of the human factors element. For instance, how do we change the concept of for the way a tower, TRACON, or center operates? It will be a challenge, but the technology pieces are pretty well proven. The operational pieces are a learning opportunity for the air traffic

community because we now have to think about how these facilities will operate together. We need to do that while understanding the user needs and gaining efficiencies.

We are at the beginning of that process and beginning two versions of that plan. I think initially this is not an advanced plan, perhaps some clean up and maintenance work, but behind that you will start to see capabilities. It will lead to NextGen and trajectory-based operations rolling out across the country."

Steve Alterman expressed concern:

"This cuts across many government agencies, and I'm just curious as to how FAA on cyber interacts with DHS, TSA, DOD and other parties with the same interest of keeping us safe. We don't want to see it stove-piped and I'm assuming there's some coordination with other agencies."

Pam Whitley responded:

"There is coordination and exercises that we do annually that includes different government parties. We all learn from that to as what we need to implement changes."

Shelley Yak added that the R&D plan revealed partnerships with other agencies, the scope of the work and how the FAA was leveraging those partnerships.

10:00 – 10:35 am

UAS Perspectives

(Bill Crozier**,** *FAA - Deputy Director, UAS Integration Office***,** Sabrina Saunders-Hodge, *FAA - Manager, UAS Research Division, Office of UAS Integration*)

Mr. Crozier informed members that he would be providing a high-level briefing and some updates from the meeting in October. Ms. Saunders-Hodge would be covering details.

Referring to his PowerPoint slides:

Slide 2: The first slide showed the metrics monitored to see how the integration was going. As of that date, there were just over one million drone registrations with over 160,000 registered under Part 107, or commercial operations. FAA has certified over 86,000 new remote pilots, over 18,000 airspace authorizations and 355 emergency authorizations for hurricane response. Several rules on the horizon that would include one for remote identification, operations at night and over people, and to protect critical infrastructure.

Slide 3. Bill mentioned that subcommittee members have seen this slide before. It represented management of low risk, up to full integration. FAA has been in the process of making visible progress for airspace management working with NextGen airspace management, honing in on autonomy that UAS provides to the system, and how to accommodate.

"We need to think critically about pilot certification now that the machine can make decisions that are traditionally expected of pilots, so how do we incorporate that into our rules and what relief is given to our pilot. We need to consider what to transfer from human decision making to the machine." said Bill.

. Portion of the chart showed working with security partners about rules. The Administration has moved forward with legislative proposals that were addressing counter UAS authority. The FAA supported this effort and the members have been briefed on the Hill and in industry. This is a crucial piece for rulemaking and expanding operations such as over people and remote identification. Bill addressed that those who attended the expo may be familiar with what the ID concept may look like. "

Slide 4. Bill explained, "This slide captures our work. It's a bucket of activities by the goals they support."Bill called particular attention to what NASA versus FAA is doing on Unmanned Aircraft System Traffic Management or UTM. NASA is conducting research program and not building system. FAA will consider that research as we move forward. Part is identifying roles and responsibilities of the air traffic

system via the air navigation provider (FAA), industry suppliers and individual operators. NASA geared toward industry's responsibility. FAA is deploying several aspects of the air traffic management system – UAS registration, Low Altitude Authorization and Notification Capability (LAANC), and remote identification is next. An ATM network needs to provide support of where you are at and where you are going. I wish to draw your attention to "Enabling Expanded Operations". The Integration Pilot Program (IPP), which is driven by the Presidential memorandum to the Secretary, is a big linchpin and we're very excited by lots of opportunities for partnership. The IPP will be conducted under the current construct of authorities we have…the memorandum didn't provide any additional authorities for those."

Dr. Hansman asked for a clarification on Part 135 certifications and non-107 compliant, such as higher mass vehicles.

Bill stated that consider that might be one industries demands for package delivery and FAA will flesh it out with the Integration Pilot Program under Part 135 using what is already established, will not include passengers, and they will identify barriers to make adjustments to accommodate UAS.
As for 107, I assume you're asking about vehicles that weight more than 55 lbs. and wouldn't fit under 107. They would get a type certification (TC) for those aircraft, the higher the complexity, then higher the oversight and more safety mitigations required. As for that middle area (process for small, process for big), the bottom line is that we may learn from the new industry of UAS and their highly autonomous systems where issues may present themselves that we haven't encountered before. Our plan is that we'll use our current process.

Slide 5. UAS Integration Pilot Program timeline.
The Secretary will select participants, and according to Presidential memorandum, MOAs will be signed with selected participant the first week of May. We are pressing along to that timeline. There are a few overarching goals: the basic is to enable more advanced operations, and gathering operational data that supports rulemaking efforts. Getting good operational data has challenging, and this program will help. Another is getting feedback to permit federal preemption; good mechanisms for balancing federal, state and local jurisdictions. We have found that with UAS there are authorities that are challenged that aren't normally.

Chris Kmetz asked if Bill could discuss the process the operational requirements.

Applicants propose what operations they would do in their applications as defined in the listing in the Federal Register. The posted SIR laid out the categories, spelled out what they needed to include in their application. What and how.

Sabrina Saunders Hodge proceeded with her portion of the UAS presentation.
Sabrina started the discussion concerning the long awaited release of UAS Integration Research Plan (2017-2022). Sabrina acknowledged her appreciation of Shelley Yak's participation in the development of the plan. Sabrina clarified the release stating that the Plan is fully vetted for "For Official Use Only".

Sabrina mentioned, "This is the first coordinated UAS Plan, with consideration for every operational, what is needed for certification, what does Flight Standards need for certification, what does Air Traffic need to be doing, what does everyone need to be doing to meet the operational capability and what research is conducive to helping with that.
As with all FAA plans, this a five-year look ahead plan from 2017 to 2022.
Research needs to remain agile and fluid, so we are trying to update to 2018. Everything in UAS is moving at lightning speed so your input, comments are crucial. Moving to the slides…"

Slide 3: UAS Integration Landscape. The Plan covers the entire landscape from the lower to higher

altitudes.

Slide 4: We have aligned this plan to FAA's Strategic Priorities and informs the NARP

Slide 5: UAS Integration Research Functional Framework. It takes policy, security, air traffic management, airspace, capabilities and systems – all the key FAA mission functions in the chart to succeed with safe integration of UAS. The Plan lays out unpinning of research to move those forward as well as what modifications to certification procedure we need to consider UAS.

Slide 6. The Plan does pivot off Operational Capabilities. As Bill laid out previously, FAA is not starting from scratch. We've learned a lot, with a lot more to learn, using our knowledge to expand operations. We start from lower complexity up to the higher complex areas such as operations over people (you will notice we have enabling capabilities). Identification is key. Beyond visual line of sight is still a key enabler that we are working towards. As we learn more, it will expand operations over people, and inform the next step on up to package delivery. When we get to non-segregated operations, that is where our air traffic organization lies and involves controlled airspace, routine of scheduled operations, cargo and passenger transport.

Slide 7. UAS Research Collaboration and Partnerships.
We can't do it alone and we don't try. We have so many partnerships that we leverage…you will see in the plan the research that government partners, industry, COE, test sites, and standards groups. Sabrina reached out to the REDAC for their expertise in reviewing the plan and identifying opportunities or priorities that the FAA may not have addressed…ongoing or planned.

Slide 8: FAA Requesting Your Research Expertise.
The FAA requests that REDAC provide final recommendations by November 1, 2018. It will be used internally, and will be reflected into our external facing companion document - the UAS Roadmap that we submit to Congress. The input will be reflected in the 2018 version of the UAS Integration Research Plan. We plan to be updating at calendar year end going forward. We will also be asking the Drone Advisory Committee (DRAC) for very a similar review effort. In conjunction with their operator's point-of-view, and your research perspective will provide us the material to make this the most robust and high fidelity plan it can be.

Steve Alterman raised a question:
"The word 'security' keeps popping up relative to UAS, and I'm making the assumption that DHS/TSA is likewise doing research." Steve inquired as to how does that work mesh. Given the shortage of government funds, he wanted to ensure there is not a duplication of efforts - particularly with DHS/TSA.

Sabrina responded that FAA has collaborated with DHS, most recently in airport detection, blending work conducted by the Center of Excellence (COE), and the FAA Technical Center. DHS has evolved, having their own research plan and budget. Nick Lento (FAA Mgr. COE ASSURE) provided information about the COE efforts, working closely with Timothy Bennett at DHS (program manager in the department's Science and Technology Directorate (S&T), issuing grants and modifying interagency agreements.

Sabrina directed the groups' attention to the prior slide (Collaboration and Partnerships) and the specific block, "UAS EXCOM" or UAS Executive Committee, explaining that it is specifically run by AVS-1, comprised of a refocused group of government agencies with high stakes in UAS to make sure of collaboration and not duplication. Under that is a Senior Steering Group (SSG) led by Earl Lawrence, our Director of the Integration Office, and at the mid-level, we talk about what everyone is doing. We're so connected to our other government agencies on UAS integration journey. Under that is the Science Advisory Research Panel (SARP), the research TIGER team to take on some of those quick look research questions such as the "Well Clear" definition, which was later adopted by the RTCA. We have

a multi-level structure to tie those elements together and those investments.

Dr. Hansman followed up the discussion by exploring the method for REDAC to respond to request, as to whether to farm out to subcommittees in their domain or develop a special group. He proposed a discussion with Shelley Yak to determine which may be the correct approach.

10:35 – 10:55 am

Subcommittee Report – Human Factors

(Barbara Holder, *Chair, Crew Interface Technology/Human Performance and Cognition, Honeywell Aerospace*)

Slides 2-3:

The Winter/Spring meeting objectives were to review the proposed 2020 R&D portfolio based on strategic guidance, provide recommendations, define human factors emerging issues and consider deep dives into significant areas.

In summary, the group met at the Honeywell Aerospace Deer Valley site in Phoenix, Arizona on February 27-28. The subcommittee reviewed the 2020 FAA proposed research portfolio, had extensive discussions concerning the impact of the planned reductions in budget on critical priorities (and that's reflected in our Findings and Recommendations…there are concerns that critical priorities may not be met). Prior to the meeting, the committee members were invited to identify the emerging issues in the human factors area and to submit those and we discussed the issues presented. We developed a consolidated list that is included in the package. We used the list to identify the R&D gaps and mismatched priorities in the portfolios. Some of the areas the committee needs to better understand in the future include: human factors activities that are happening in adjacent industries, such as Uber and Google, and we'll be looking for subject matter experts to invite to future meetings. Dr. Kathy Abbott (CSTA) suggested a better understanding the European commission R&D areas and priorities for HF as well.

The subcommittee took tours of the Honeywell labs; speech, immersion, and advanced flight deck lab.

Slides 4-5: Findings and Recommendations

Finding 1: Important areas for continued research and development.

In general, the first identifies the areas that need support; the second identifies gaps, and the third is an expansion on a prior *Recommendation*.

There is considerable concern over the limited funding, and how resources are going to be balanced to meet critical priorities.

The subcommittee is pleased that the human factors Core and NextGen research includes areas the committee believes are critical. Review the list, but these include certification criteria for advanced avionics tech and vision systems; evaluation of fatigue mitigation, training effectiveness, validation of pilot training and procedures for NextGen and human factors guidelines for advanced instrument procedure design.

Chairperson Hansman asked:

Are there new procedures that are being talked about? Is this about a TERPS (Terminal Instrument Approach Procedures) known problem, a charting issue, or is there a new class of procedures you are anticipating?

Barbara responded that there was a discussion of the integration of new procedures NextGen into current environment. Dr. Hansman suggested more specifics or enhanced in the findings and recommendations. The recommendation is to fund consistently these areas; they are currently identified in the report. Since there isn't a '20 budget plan set, merely a suggestion of what may be, we looked at proposals with a

budget reduction target in mind.

The **Chair** provided suggested guidance:
It would be better to identify what are safety risks. As an Advisory Committee, we don't normally discuss money since everyone always asks for more. As experts, we can discuss safety risks or restrictive measures. Those type of arguments are useful because we can look for commonality of subcommittee issues and include them in the report to the Administrator.

Finding 2: Research gaps that are not well represented in the current funded portfolio.
These are the identified gaps based on our emerging issues list and review of the portfolio.
The three areas culled out were human factors issues related to the integration of UAS into the NAS; managing the complexity in airspace operations – old and new vehicles into the operations, and supporting effective information management.
In addition, two other very important human factors research focus areas requiring attention were identified:

- The increased introduction of automation and autonomous systems and subsystems, and
- Transition to Trajectory Based Operations (TBO) and Performance Based Navigation.

The *Recommendation* is that FAA review the areas identified for inclusion in its research portfolio to ensure that these areas will be addressed in a timely and sufficient manner. Additionally, the Subcommittee requests that the rationale for the resultant decisions be presented at the next Subcommittee meeting.

Finding 3: Flight Crew Information Management
The concern is that the flight crew understand the accuracy, integrity, and timeliness of all information presented (certified systems), especially from a safety aspect. The unease is with understanding how the FAA can effectively evaluate appropriate means to ensure flight crew understanding of the various pieces of information on the flight deck. Traditional methods of workload assessments may be insufficient in evaluating ways information is being presented and integrated into todays and tomorrows' flight deck.
The *Recommendation* is that FAA have standards specifically for evaluating the criteria that information presented to the crew across the devices doesn't impact their understanding, accuracy, integrity or timeliness of information – and managing across the devices. Also evaluating the presentation of that information is consistent.
This was a follow-on from our prior *Recommendation*, but we felt that it was important to present and raise awareness intended to provide more specificity since it was somewhat broad previously. For clarification, these are issues associated with apps, say on an iPad or Surface Tablet, that are not certified.

Chairperson John Hansman noted that is a good issue for concern, whether air carrier or general aviation. It's worrying in that there's too many sources in todays' environment. It is better to focus on what are things we need to understand that could distraction hazard – FAA can't manage everything that goes through the flight deck door needing approval - more and more integration, potentially mixing certified and non-certified.
It is more of a risk management approach.

11:00 – 11:30 am

Subcommittee Report – Aircraft Safety

(Chris Kmetz, *VP, Engineering, Module Centers at Pratt & Whitney*)

Slides: Spring 2018 SAS Meeting Objectives.

The Subcommittee wanted to provide continued input to the research portfolio, continue to identify emerging issues and trends that were affecting safety research. In particularly, UAS, GA, additive manufacturing, fatigue management and electric propulsion. We also wanted to continue learning from industry, NASA, Boeing, National Academy of Sciences, COE PEGASAS and GAMA. We had presentations and rotated through committee members to get different perspectives on industry as it relates to emerging issues.

We also took the action from the Chair to look at a reduction of FAA R&D funding to the extent possible. Our approach is to keep emerging issues in the forefront our ongoing reviews about research and opportunities and to couple them to stay ahead of emerging issues. We had excellent conversations with AVS management team. We've been bringing CSTAS, and outside industry for deep dives and discussions, specifically on items identified by REDAC, and emerging issues identified by committee members. We've made improvements over time and provided guidance.

Chris provided the Agenda, but skipped ahead to the Summary of Findings and Recommendations.

Summary of Findings and Recommendations.

We thought it was important to start with the impact of 2019 budget reductions and related research. This was not a planned agenda topic, so I give credit to Mark Orr and Eric Neiderman and the team to pull together their assessment of planned research - thinking about 19-20 and beyond. This was done in a very short time.

It gave us a more reasonable view of the thinking of '19, '20 and beyond.

If we look at '18's level of funding, it takes the funding level of $170-180 million down to $74…bout a 50% reduction. A significant reduction. This was carried through '20 to '24 as a planning cycle. We need more information for the SAS to assess the funding approach. We see that there's a greater emphasis on continuing research that's in place and funding it at a reduced level…although making progress by "moving the ball down the field", but not being impactful and ignoring what we see as emerging issues in favor of those programs.

In particular, a few areas such as safety assessment of electric aircraft, at the pace those developments are moving forward – again was not recommended for funding. Safety oversight of management systems (consistent with our emerging issue of real-time, or in-time safety management), needs focus there.

With respect to UAS, there's a $73 million spend, however only $3.4 million is directed towards R, E and D. We expressed concern as to whether that is adequate for research to keep up with the pace or progress being made in other areas. Now that we can get a look at the Plan, we may be able to get more specifics.

Another area is the reduction of 50% in aeromedical research. That will have long lasting implication as to CAMI's (Civil Aeronautical Medical Institute) ability to provide any kind of support. Finally, Commercial Space was left uncovered for '19 and beyond.

Our ***Recommendation*** was to reassess planned research and consider cancelling ongoing work in favor of funding research and shifting or pivoting to emerging issues.

Our other ***Recommendation***, although not reflected on the slide, is to partner with NASA and DOD, to take advantage of ongoing research.

As a general comment, although called "deferred research" in 2019, it is effectively cancelled. This will result in a loss of talent with unique capabilities, difficult to replace and is most likely to occur at CAMI with a significant potential reduction of staff. CAMI and Technical Center personnel are recognized as international experts and leaders, and this could potentially effect international policy in the national interest.

A lot of the research capability is unique to the FAA and, in some cases, there might not be a viable alternative as this work is not being sponsored by industry. This work could stop in its entirety.

We talked a bit about cyber this morning. We noted that there is $10 million planned in the Office of the Secretary; the Subcommittee would like to understand if any of that funding is intended to research any

safety related threats in particular.

From a UAS perspective, we did get a status of the Integrated Research Plan. The Subcommittee is looking forward to the release, as there has been a lack of overall clarity so it's been difficult to understand the spend versus the plan and what is actually needed. We did get a good status on '17 and '18, and we see areas identified of gaps in the required research and funding. With more visibility in the Plan, we should be able to develop more concrete plans and findings.
The SAS also received a good update on manufacturing activities. The technical experts briefed us on the challenges they see and FAA's management role. We know that additive manufacturing research or roadmap is coming, and they will share that with us in the future. SAS saw with some level of clarity the details of ongoing tasks and policy changes. They appear to have a good handle on the additive piece, and they are making progress. We look forward to providing additional feedback.
SAS was also provided a briefing and given a path to electric and hybrid-electric regulation. We expect future briefings and discussions relative to electric aircraft systems. We see FAA involvement in a number of industry committees and, most noteworthy, is active participation to shape what is going on.
Overall, we see the level of aircraft and system integration is just increasing as well look at electric/hybrid-electric systems – including where the propulsion system is providing primary flight controls, transition from vertical to horizontal flight. We think there's a need for alternate V&V (Validation and Verification), and certification compliance methods. FAA should get out ahead and build national plan now because there will be a significant amount of research required for electric aircraft safety going forward.

Final thoughts: SAS appreciates the interaction with AVS, and we like the innovations centers seeing it as an enabler for future product development. SAS is continuing our focus of GA and its' role in aviation safety – and in particular, advancements in electric propulsion. COE PEGASAS provided a briefing on GA2030 Vision. We will continue our technology status briefings and uncovering common themes. We're seeing increasing complexity of systems within systems.

11:30 – 12:00 pm
Subcommittee Report – NAS Operations
(Leo Prusak*, Chair & VP, Air Traffic Management Products and Strategy, PASSUR Aerospace*)

You've heard the phrase *"It's not rocket science."* In this case, some of it is.
During our 2018 Spring NAS Subcommittee meeting, we were briefed by the Office of Commercial Space Transportation. The program places an emphasis on safety to the public through effective airspace integration and spaceport interoperability with the use of models and predictive capabilities, mission planning tools, regulations, and safety analysis. The research area assumes and integration of space traffic within NAS through automation, and control.
Our ***Finding 1*** is that today's commercial space traffic (CST) is based primarily on airspace segregation and has a significant impact to airspace use by other NAS users.
Our ***Recommendation*** is that scheduling a causal factor analysis to all NAS ops be included in the R&D portfolio. There's a rise in the number of space ports under the certification process and it is forecasted that the number of launches will increase. Therefore, analysis is needed before an assumption of Trajectory Based Operation (TBO) will mitigate CST on the NAS.

Our ***Finding 2*** concerns ATDP - Ops Concept Development and Infrastructure.
We were briefed on ATDP project on the March meeting. The Subcommittee has been extremely interested in FAA work in this area, and we view the work as critical. We believe that insufficient work significantly increases the risk of operational problems. Since the budget work was moved from the NextGen office to the ATO, the focus has been on concepts closer to implementation. When this shift occurred, we were told that prior R&D would be managed by ANG-E portfolio managers. The presentation did not address how FAA decides, with a limited budget, which concepts will be studied or what criteria is used to select and prioritize.
Our ***Recommendation*** is the development of clear criteria for selection and prioritization for concept

evaluation. The FAA should identify potential implementation risks for concepts that are not selected for study or concepts that are subjected to only limited validation.

Finding 3 concerns Human Factors and NextGen Air Traffic Control/TechOps
This program addresses the R&D needs in five focus areas:

- human factors standards
- workforce optimization
- improved safety
- human factors in NAS technology integration, and
- human performance enhancement

Maintaining an effective air traffic controller workforce is critical to ensuring the safety of the NAS and enabling increased efficiencies. It is noted that in addition to tactical air traffic control functions, strategic traffic flow management is critical to NAS efficiencies. The skill needed for effective traffic flow management (TFM) is different from that typically needed for tactical control. The Subcommittee found that the current portfolio and proposed R&D roadmap focuses solely on tactical air traffic control and technical ops personnel. Absent R&D investment, the TFM workforce will have significant challenges in today's environment and when transitioning to TBO. This will jeopardize the expected benefits of new technologies and procedures.

Therefore, our *Recommendation* is that TFM workforce human factors considerations be directly included in future R&D portfolio planning. TFM stakeholder community representatives should be included in the ATO R&D Requirements Roundtable. Specific research requirements should be identified and included in the process.

The NAS Ops Subcommittee received a separate briefing on Uber technologies, which was a good engagement for the committee. To Shelley's point of identifying research areas that are outside and interesting…this seem to be one that fit our group. For our next meeting, we're planning to identify someone to speak on identifying cellular signal surveillance issues and how that will effect industry. I think to follow Shelley's suggestion, we're trying align to the future vision and we'll invite a guest to each meeting that might be 'off agenda' for us, but relevant to the work that we're doing and the recommendations and guidance that we're providing back to the agency.

Noon – 12:20 pm
Subcommittee Report – Environment and Energy
(Steve Alterman)

The Environment and Energy Subcommittee met on March 7 and 8, 2018.
We received a complete briefing on all the ongoing Environmental projects and the effect that the '19 budget would have on them. Steven acknowledged the cooperation of the AEE staff in providing the information and being candid in what they could and could not do, and where they are going. That comment also applies to NASA. In the past, the relationship between FAA and NASA was much different than today. The work being done in collaboration now on the environment is striking. On behalf of the Subcommittee, Steve extended his 'thanks' to all the government people who participated in the meeting and explained all the ramifications that the budget would have.
Steve stated that although the Subcommittee has five recommendations, in his opinion, there are actually three and two of them will flow into them.
Finding 1 concerns Alternative Jet Fuels
This project started years ago when one thought it was a viable way of fueling aircraft. Industry and the government got together – not just the FAA – but it's the Department of Agriculture and a whole host of agencies got together to see if an alternative fuels program would work and help the environment. It has, and its' produced an entirely new industry in this country. It is, however, still in its' infancy and the '19 budget, as we know it, would zero out all research work, and we feel it is not appropriate at all. We think there's a function of the U.S. government that steers the industry and without the governments

participation the industry would 'die on the vine'. The U.S. government, the FAA and all the other government agencies have led to the certification and use of the fuels.
Our strong ***Recommendation*** is that funding remain for this program. The alternative jet fuel program will major environmental benefits to the public, it helps create a new industry that benefits the United States and rural American and would benefit the aviation industry.
Steve added a personal comment and observation: Once a program is eliminated, it is much more difficult to start it again versus even cutting it drastically. It should be kept at some level. The fear that surfaced at the meeting is that if the alt fuels program is eliminated, it will never get started again. The Subcommittee feels extremely strong about that. We have not set what that funding level should be, but we think eliminating is not the right way to go. Across the board, if programs worthwhile and good, they should continue at some level so that they are more easily ramped up.
A short discussion among members ensued concerning the current ability to buy alternative fuels, and that airlines have committed to buying it. Questions arose that if funding were cut, what R&D would not be done, and its impact.

Dr. John Hansman contributed that there are multiple pathways and processes with various risks and they have to go through the certification process. One thing that is being done is to speed up the process if given different processes or sources.
Steve inquired of Jim Hileman about how much is being produced now.
Jim reported that one to three million gallons per year are being produced now at a single facility near Los Angeles. FAA's efforts are to streamline the approval process, to bring in more fuels, to ensure they are safe for use, and to bring on additional technologies – as well as the regulatory side whether domestic or international. There is a large interest internationally to include alternative fuels within the global marketplace.
The second ***Recommendation*** relates to public and private partnerships – but it is intimately related to alternative fuels, because that is a public/private partnership between the government and industry.
In public/private partnerships, where money can be leveraged between the two segments, have historically turned out to be very good. We think that the staff of FAA and AEE have done well in figuring out how best to use taxpayer money in conjunction with industry money to get the best possible "bang for buck". You have programs like the CAAFI (Commercial Aviation Alternative Fuels Initiative) and the CLEEN (Continuous Lower Energy, Emissions, and Noise) Program, which is at least a one-for-one – which has actually turned out more industry then government money. It is required to be at least a one-for-one with the government in developing new technologies inserted into aircraft to help with noise and emissions. The products developed resulting from the CLEEN program are now making their way into production. In these type of programs, where industry has 'skin' in the game, they are capable – and do – go up to the Hill and get more money for programs such as CLEEN, because they can do X,Y,Z where the government can't. They have traditionally done that.
Therefore, the Subcommittee ***recommends*** continuing the endorsement of public/private partnerships like CAAFI, CLEEN and Centers of Excellence to leverage resources, and FAA prioritize robust funding for these programs.
The third ***Recommendation*** addresses the noise issues that you're no doubt aware; noise issues have been raised around the country. The bottom line is that planes make noise and the only way we can stop noise issues is to stop flying planes and that's not something anyone of us wants to do.
Consequently, we have to figure out what we are doing with noise. As we move forward with NextGen, there are new, more concentrated routes and there are more complaints coming from different areas. FAA has embarked on noise research program to figure out the real effects on people. This issue is not going away, it is not just in the communities, or just FAA, but is now in the court systems. The Subcommittee strongly supports continuing and prioritizing noise research so we know better how to manage noise to the extent possible, and how to design NextGen programs to minimize and mitigate noise.

The last two ***Findings and Recommendations*** are intimately related. The *fourth* speaks to global leadership. The environment staff at the FAA has been instrumental in establishing a relationship with the international community – ICAO (International Civil Aviation Organization). It is not an

understatement to say that the U.S. has led the charge on all environmental issues in ICAO. There is now a standard and scheme for reducing emissions and it is a result of U.S. leadership. In order to do that, there has to be an FAA staff dedicated to do it.
Chairperson Hansman advised that it might there might be a better argument. Whether you like it or not, the world has decided, this is important and our carriers operate in the world. The U.S. would be at a disadvantage as ICAO could impose standards on U.S.
Steve continued:
The committee felt strongly that the work in ICAO continue and to do that you need people which goes to the *fifth recommendation*. If the staff of 80 is cut 50% as contemplated by the 2019 budget, it becomes impossible to do all these things. A 50% cut cannot be absorbed and still do all the things needed to do in the environmental area.

12:20 – 12:35 pm
Subcommittee Report – Airports
(Matt Griffin)

The Airports Subcommittee held the meeting on March 20. Due to a significant snowstorm, we had an abbreviated meeting moving a traditional day and a half meeting into a single day.
Referring to his presentation, and specifically slide 3, Matt displayed the Airport Technology Research Programs at a Glance. The Subcommittee was generally pleased with the spectrum of programs and the progress being made. We moved quickly through safety and planning, and we had a good update by the work being conducted by the takeoff and landing performance group, the braking action team, and a good update on cybersecurity.
As with all the other committees, we had the same key concerns with the R&D funding. We were alarmed to have that update but were happy to see, for the more recent programs have been funded in the short term. We would appreciate and push for a more stable funding source, and a longer-term R&D funding via multi-year authorization legislation.
Finding 1:
We were pleased that safety and design standards for commercial spaceports has begun. We are hoping to get an update on the work being conducted under the Spaceport Categorization ARC (Aviation Rulemaking Committee).
Recommendation:
There are a number of rulemaking committees involved in commercial spaceports. We will be asking for updates and request that the DFO (Designated Federal Official) ensure the ARC is briefed and possibly provide input into the spaceport standards research project.

Finding 2: As was the case during our Fall 2017 meeting, the Subcommittee continues to place high value on research and facilities – specifically research on UAS and commercial space vehicles, and facilities noted in our finding.
Recommendation:
The Subcommittee continues to recommend that the FAA Office of Airports place a high priority on research and facilities as identified in our findings.

Finding 3:
The Subcommittee is pleased with working group and subject matter experts to reassess aircraft braking research.
Recommendation:
Given the Working Group's efforts span multiple subcommittees' areas of expertise; we would like to see future braking research presented to other subcommittees (Human Factors, Aircraft Safety and NAS Ops) and recommendations across the industry and proud of ongoing progress.

Finding 4:
This is an ongoing Finding - trapezoidal runway grooving. The Subcommittee recognizes that there are

safety, technical and operational issues precluding effective testing at the Atlantic City International Airport and the Tech Center's B727 test bed.
Recommendation:
The Subcommittee recommends that program staff and the FAA Office of Safety & Standards consider evaluation elsewhere. Since performance of work trapezoidal grooves in terms of drainage and effects on aircraft braking are international, perhaps cooperation with ICAO be considered (i.e. Singapore).

Finding 5:
The National Airport Pavement Test Facility (NAPTF) at the Technical Center (a national asset) requires a roof replacement to ensure continued functionality.
Recommendation:
The Subcommittee recommends moving forward with the roof replacement as soon as practicable.

The Subcommittee had a good briefing on the Cybersecurity Plan and good commentary about how airports are adopting cybersecurity. There are probably not direct linkages between airport Wi-Fi and airport network systems. You may have noted recently that Atlanta shut down their public facing Wi-Fi, so there are concerns. The Subcommittee is will to provide some airport CIOs (Chief Information Officer) names to interface with should they wish to reach out.
There is the ongoing noise survey, which both the Airport Subcommittee and airport communities are really looking forward to the survey results. The Subcommittee is looking to how they can build on that research.

12:35 – 12:40 PM
Committee Closing Discussion

Dr. Hansman referred to items in two categories to mention in REDAC's letter– that of integration of new entrants of UAS and commercial space, and urban air mobility vehicles; and criteria for certification of advanced avionics in automation of flight control technologies.
REDAC members conversed about other issues for consideration such as human factors (with respect to autonomous systems), and concern about talent, skill, expertise and capability in the agency with uncertainties of budget or cuts.

1:15pm
Adjourn

Research, Engineering and Development Advisory Committee
Federal Aviation Administration (FAA)
FAA Headquarters, 800 Independence Avenue, SW
Washington, DC – 10th Floor Round Room
April 11, 2018

Agenda

9:30 am	Welcome Address and Opening Remarks	John Hansman Shelley Yak
9:45 am	NextGen Perspectives	Pam Whitley
10:00 am	UAS Perspectives	Bill Crozier Sabrina Saunders Hodge
10:35 am	Subcommittee Report – Human Factors	Barbara Holder
10:55 am	Break	
11:00 am	Subcommittee Report – Aircraft Safety	Chris Kmetz
11:20 am	Subcommittee Report – Environment and Energy	Steve Alterman
11:40 am	Subcommittee Report – NAS Operations	Leo Prusak
Noon	Break	
12:15 pm	Subcommittee Report – Airports	Matt Griffin
12:35 pm	Committee Closing Discussion - FY 2019 Budget - Recommendations - Future Actions	John Hansman
1:15pm	Adjourn	