

FEDERAL AVIATION ADMINISTRATION
REDAC Subcommittee on Aircraft Safety (SAS)
Spring Meeting 2016
March 23 – 24
Meeting Minutes

Chairman: Ken Hylander, FSF

DFO: Eric Neiderman

Note-Taker: Erin DeBarth, CSRA.

Day One

Wednesday, March 23rd

Meeting commenced at 8:30a.m.

INTRODUCTIONS

Meeting formally started at 8:35 a.m. with opening remarks by Mr. Kenneth Hylander, Subcommittee Chairperson. Mr. Hylander welcomed everyone and thanked them for attending. He addressed the full agenda stating there is a lot to talk about. Introductions were made by Subcommittee Members and meeting attendees both present (Appendix II) and via phone.

Mr. Hylander continued reviewing the meeting goals listed on the agenda. He added that there is also a need for a deep dive into UAS Safety. Mr. Hylander informed the Subcommittee of a meeting that was held in Washington, D.C., which some of the committee members attended, and he added he would like to discuss further and have something to take to the final REDAC.

Mr. Hylander explained the second objective is to provide guidance for the FY18 portfolio.

Mr. Hylander stated based on a meeting he attended with Peggy Gilligan that it would be helpful to address the FY19 portfolio as well. Mr. Hylander informed the Subcommittee he has a meeting schedule with Ms. Gilligan at the end of April and he would like to be able to present what the Subcommittee has been doing. He stated for the next two days he would like the Subcommittee to put their thoughts together in regards to UAS research, have input for the meeting with Ms. Gilligan on research portfolios FY18 and FY19, and get the FY18 portfolio approved. He expressed gratitude to Mr. Eric Neiderman, SAS DFO, and Mr. Mark Orr and their teams for the dedication they show. Mr. Hylander explained this process is ongoing and the preparations for this meeting started right after the last meeting.

Mr. Hylander informed the Subcommittee he would like to see the big picture. He expressed the FAA SAS Team has done a great job, but would like to see more.

Mr. Eric Neiderman, FAA SAS DFO, welcomed everyone and thanked them for attending. He thanked Mr. Hylander for his comments about acknowledging the work that goes into preparation for this meeting. Mr. Neiderman stated the comments from the last meeting that the

Subcommittee needs to see the “loaf of bread” instead of slices, resonated with the SAS Staff. Mr. Neiderman explained and agreed to tell the holistic, simple, and consistent story. He agreed that is easy to say but not always easy to do. Mr. Neiderman explained the discussions regarding how to guide the research portfolio and commented to the many meetings that brought philosophical discussions and debates. He informed the Subcommittee they do not have all the answers but hopefully the Subcommittee will start to see the “whole loaf” and it will help in guiding the portfolio and gain a better understanding of the work. Mr. Neiderman introduced Shelley Yak, WJHTC Director, informing them Shelley has made a commitment to attend every REDAC Subcommittee Meeting so she can understand the dynamics and questions of each meeting to help her in developing her role.

Ms. Shelley Yak, WJHTC Director, welcomed everyone. She stated research stays relevant and conducive to the AVS requirements. Ms. Yak explained one consistent thing she sees throughout all the REDAC Subcommittees’ meetings so far is the questions about what we are doing, how are we doing it. What are our priorities, what is the outcome we are trying to achieve? Ms. Yak noted that every REDAC meeting operates a little differently and has a different perspective. She expressed what she would like from the Subcommittee is ideas, views on progress, and input on what needs to be done. Ms. Yak stated she feels encouraged by the relationship with Ms. Gilligan and believe there needs to a strong relationship between the Executive Level and the Subcommittee.

Mr. Hylander asked the Subcommittee whether there were any issues with the minutes from the last meeting and made a motion to formally accept them. The Subcommittee agreed to formally accept the meeting minutes. He continued by explaining a change in process from last meeting, stating at the last meeting the Quad Charts were tackled all at one time and he would like to tackle any questions on the quad charts when they are discussed during the presentations. He asked the FAA to make sure appropriate people were in attendance to help with answering the questions. Mr. Hylander proceeded with a review of the agenda. He asked the Subcommittee if there were any comments or questions to the change in process or the agenda. No questions or comments.

MIKE GALLIVAN, *Budget Update*, Mr. Gallivan began his presentation by reviewing the FY16 budget of \$166 million that was approved on December 18, 2015 and stated Safety was awarded \$95.9 million. Mr. Gallivan explained the request for FY17 is \$167.5 million. Mr. Gallivan stated the FY 2016 House and Senate Report included Conference Language explaining the allocation for UAS Research and Environmental Sustainability Research. He explained there is an increase of \$8 million dollars above the budget request allocating \$17.635 million for UAS Research and \$5 million for the Center of Excellence Research.

Mr. Gallivan also explained the allocation towards Environmental Research includes an increase of \$3 million above the budget request with allocations for the CLEEN Program and the Center of Excellence for alternative jet fuels and environment. Mr. Gallivan explained the increases aren’t true increases because the funds are being taken from other line items. The Subcommittee discussed the impact that reallocations have on other research projects, and a particular concern is the Human Factors. He explained the presentation on UAS would have a better explanation of details regarding the budget uses.

Mr. Gallivan continued by reviewing the FY17 overall budget request and explaining the breakdown. He explained the plus up for the NextGen Research is substantial and he would prefer to see the funding back in to the Fire Safety and Human Factors Research. Mr. Gallivan proceeded informing the Subcommittee of the Congressional Issues for FY17 explaining the sequestration should not be an issue for the FY17 budget request. Mr. Gallivan explained FY17 will most likely start under a CR and the potential issues with operating under a CR are only 80% of the money can be spent, and no new work can begin so things are slowed down.

Mr. Gallivan continued with giving an overview of the FY18 budget timeline stating it would be submitted to R, E&D in early June 2016, submitted to OMB in early September 2016, and would go to Congress on February 6, 2017. He informed the Subcommittee that a new president could impact the budget due to transition process. Mr. Gallivan reviewed the Out Year Targets, noting to expect them to change due to the uncertainty this year. The Subcommittee asked if the budget numbers included inflation adjustment. Mr. Gallivan responded yes it is about two percent. Mr. Gallivan informed the Subcommittee the House and Senate passed current authorizations until the end of July 2016 and he is expecting another extension to extend past July 31, 2016, stating the FAA prefers the long term extensions. Mr. Gallivan reiterated the budget future is uncertain with a new president elect to bring up questions with FY18 and sequestration. He commented that there will not be a better understanding until after the election.

KEN HYLANDER, Strategic Framework from Fall 2014, Mr. Hylander began by reminding the Subcommittee on their roles and where things were since last meeting in 2015. He reviewed the process of looking at the portfolio, discussion of quad charts, and how research finding and strategies led to early input of FY18 plan.

Mr. Hylander reviewed four findings from last meeting stating the first one was not linked to a specific research area.

SAS Fall 2015-1: Improved Clearer Link between Research Activities and Overarching Safety Objectives and Goals – the Subcommittee discussed the possibility of improved management tools for research areas and how they are not seeing the big picture. The Subcommittee agreed this requires further discussion and internal collaboration.

SAS Fall 2015-2: Enhanced International Collaboration on Safety Research – the Subcommittee agreed they would like to make sure the FAA is engaged.

SAS Fall 2015-3: Immediate Needs for Additive Manufacturing Certification Support – the Subcommittee agreed this has been a big topic for the past couple meetings and there is a lot of concern that there is not that much activity on this.

SAS Fall 2015-4: Research to Mitigate the Impact of Cockpit Laser Strikes – the Subcommittee stated the concern that the FAA work has been more focused on the perpetrator and law enforcement over research about minimizing impact in cockpit.

The Subcommittee agreed to talk about FAA responses.

Mr. Hylander informed the Subcommittee the Full REDAC was in October 2015 and the report was reviewed and requested changes were made. He explained most of the revisions requested were geared toward clarity and wording changes. Mr. Hylander informed the Subcommittee the

discussion for all tasks in some way involved UAS and a full meeting was held D.C. in February 2016. He stated some REDAC meetings devote an entire day to UAS and considerations to Air Traffic and Safety. Mr. Hylander commented there are a lot of issues regarding UAS research and strategy across the agency. He stated the REDAC feels this meeting objective should have UAS as top priority.

Mr. Hylander reiterated Ms. Gilligan's need to see the big picture. He explained in preparation for his meeting with her in April, he would like to be able to discuss more than UAS. Mr. Hylander continued stating Emerging and Future issues is something he continues to believe has value from a Safety perspective and the Subcommittee needs to review and ask if the eight they came up are the right ones. The emerging issues are:

1. *Real-Time System-Wide Safety Assurance;*
2. *Dependability of Increasingly Complex Systems;*
3. *Certification of Advanced Materials and Structural Technologies;*
4. *High-Energy Density Storage, Management, and Use;*
5. *Commercial Space Integration into the NAS;*
6. *General Aviation's Role in Safety Systems Development;*
7. *Effects of Breakthrough Medical Technologies on FAA Medical Certification Standards;*
8. *Identification and Segregation of Strategic R & D Needs.*

Mr. Hylander explained he wants the Subcommittee to look at these current to future to be sure these are the correct ones. He explained as input is given for the FY19 budget the key thing focus on is anything missing. Mr. Hylander expressed this is the appropriate time to be able to influence. He stated the SAS approach is consistent from meeting to meeting and there is a need to build on future and emerging concerns. Mr. Hylander explained there has been CSTA and FAA expert participation. He expressed the necessity for the deep dives and the need to understand where the money being spent.

Mr. Hylander stated the Subcommittee needs to determine the priority items and the agenda should be built around those priorities. He reiterated some of the emerging issue topics stating should they be brought into the agenda. Mr. Hylander stated at some point the Subcommittee should start seeing success in projects so they can start to diminish and the Subcommittee can start looking at other projects. He expressed the importance of knowing where the Safety money is being spent. Mr. Hylander stated what is challenging as an agenda is being built is what to discuss, and where to fit it in. He explained the R & D bucket doesn't change and if the need to tackle something new arises, then something has to end. Mr. Hylander suggested looking at what research is being performed and finding the gaps related to emerging issues, answer what needs to be spent and possibly refine emerging issues if needed. He stated the Subcommittee has spent a lot of time on the issues and believes it is the job of the Subcommittee to keep them in the forefront and sway research towards those issues.

Mr. Hylander stated to look in a year or two at whether the time spent discussing the Emerging issues is seen as an investment. He stated he feels the Subcommittee should review the FY19 budget before it goes out and see if the Subcommittee has made an impact. Mr. Hylander informed the Subcommittee a copy of Emerging Issues will be distributed to everyone during the A.M. break.

Xiaogong Lee, Open Findings, Recommendations, and Actions, Mr. Lee began his presentation with a review of the Action Items from Spring 2014 and 2015.

Spring 2014 Action Item 8: Eric Neiderman will provide information regarding the NASA Ames tool to track safety cases (Action - John Cavalowsky, CLOSED) – John will present and discuss it on 2nd day of the meeting as scheduled.

Spring 2015 Action Item 4: Provide human factor presentation on operator fatigue issues (Action- Mark Orr) – the Subcommittee discussed the need to summarize where the FAA is with this research and to start FY16 research plan. The Subcommittee was informed the ground work to collect data is there and the FAA is working on collecting data amidst the rule change 1.17. The Subcommittee suggested the recommendation be to analyze data and make changes to the rule. It is expected to be funded this year. The Subcommittee agrees there is an operational need for this research. It was explained to the Subcommittee that funding keeps going back and forth and while it is back for now, it is less than before, but doable for data collection. The Subcommittee asked if the FAA was preparing to ask for more funding for this research and the FAA responded that it is included in the FY17 budget. The Subcommittee commented they are surprised this research is not active in the portfolio. The FAA responded stating that just because there is no R, E & D money on this research does not mean things are not getting done, explaining part of the issue is some of this is operational responsibility and part of this is R & D responsibility, and it is not the first time the FAA has looked at fatigue. The Subcommittee suggested since this is ongoing, to close this out and revisit and reopen if necessary. Mr. Hylander asked are we looking at the right emerging issue because this looks like it could be one. The Subcommittee commented is there a funding requirement to do this work.

Conclusion – CLOSE. The Subcommittee agreed to close this, but watch.

Spring 2015 Action Item5: Provide requirements list with Mendoza Line and items below in advance of future Spring Meetings (Action- Mark Orr) – this was sent to the Subcommittee. The FAA explained FY18 is broken down by TCRG and control numbers and the greyed out items are below the Mendoza Line and the white items are above the Mendoza Line and will be presented for approval on April 28, 2016. The Subcommittee agreed the homework was to review the grey items and agreed this gives a broader context. The FAA explained there is a three phase process for portfolio items.

1. Technical Prioritization
2. Cost of the research relative to the Mendoza Line
3. Review and Approval

It was further explained that this list is Phase 1 of the process and doesn't show funding. Phase II, all items on list are judged by same criteria. Only most promising ones give cost estimate. The Subcommittee discussed concerns of how many issues were projects and how many were strategic and agreed that some in grey might not be able to be used.

Conclusion – CLOSE. The Subcommittee agreed to take this off Action Item list and put on homework list and if anyone has any issues or an item for the agenda to let Mr. Hylander know. Mr. Hylander asked that members don't wait until the next meeting. The time frame for selection of information starts right after the meeting. The FAA agreed to continue to provide the list prior to future SAS meetings.

Findings and Recommendations:

SAS Spring 2015-1: *UAS Portfolio Flexibility*

Conclusion – CLOSE and develop a set of new ones based on UAS discussions. The Subcommittee reviewed the FAA response and was not satisfied. The Subcommittee agreed to hold discussion for UAS presentation.

SAS Spring 2015-2: *Research Roadmap Development*

Conclusion – CLOSE. The Subcommittee agreed to take actions to develop specifics asking what types of roadmap can be expected.

SAS Spring 2015-3: *Additive Manufacturing Research Acceleration* - the Subcommittee agreed this didn't make the FY18 budget. The FAA explained they are waiting for OMB pass back. The FAA also stated for FY18 there are some places for additions and developing a plan. The Subcommittee agreed the little bit of money that has been set aside for this has been applied.

Conclusion – CLOSE. The Subcommittee accepted the FAA's response.

SAS Fall 2015-1: *Clearer Link between Research and Safety Goals*

Conclusion – CLOSE. This was determined to be a finding and FAA responses to the recommendations will be discussed throughout the two days meeting.

SAS Fall 2015-2: *Enhanced International Collaboration on Safety Research* – the FAA agreed with this recommendation. The Subcommittee agrees the FAA is doing everything they can to the best of their ability.

Conclusion – CLOSE. The Subcommittee agrees to close this recommendation

SAS Fall 2015-3: *Immediate Needs for Additive Manufacturing Certification Support* – the Subcommittee asked for a status on the policy memo. The Subcommittee stated the concern is it does not seem like it is a pressing issue. The FAA explained they will have to speak to the National Team. The Subcommittee asked if questions regarding the Research Roadmap will be able to be answered.

Conclusion – CLOSE and new F&R will be developed based on the outcomes of the two-day meeting. The Subcommittee agrees to close this recommendation

SAS Fall 2015-3: *Research to Mitigate the Impact of Cockpit Laser Strikes* – the Subcommittee questioned if any research has been done. The Subcommittee suggests focusing on what research will be done and developing relationship with civil authorities to gather information when these events occur. The Subcommittee discussed looking into what are the health and safety issues relative to this. The Subcommittee suggested the FAA look into potential consequences if these issues aren't mitigated. The Subcommittee also stated incidents with helicopters are on the rise and some injuries have occurred. The Subcommittee agrees this area warrants further consideration.

Conclusion – CLOSE. The Subcommittee agrees to turn this recommendation into an Action and will make it an agenda item with a deep dive for the next meeting.

A.M. Break – 10:50a.m. - 11:05a.m.

Presentations Commenced 11:05a.m.

Mark Orr, Discussion – Holistic View of the Research Portfolio – Mr. Orr began his presentation referring to the Action Item from the Subcommittee stating the information previous received didn't include everything. He gave an overview of the AVS R & D Life-cycle Model and AVS R & D Process Definitions. He explained the quad charts he presents to the Subcommittee are not as detailed as the quad charts submitted to the Executive Board.

Mr. Orr presented R & D Documentation and explained the document elements. He reiterated the suggestion by the Subcommittee to align research projects with emerging issues. He explained not all research performed uses R, E & D funding. Mr. Orr stated selecting research has a process and the most important part of that is outcome. He explained the outcome can be advancing state of the art system to address issues or impact of safety measure. Mr. Orr stated they find particular hazards, presenting potential risk and we want to prevent the risk. Mr. Orr stated the explanation for the documentation presentation is in response to the Subcommittee asking to see one document that tells everything. Mr. Orr stated there is not one document that tells everything. Mr. Neiderman interjected and suggested the FAA needs to brainstorm and come up with a way to customize the output. Mr. Orr proceeded to give an overview of Future Research. The future research included working towards a single source for baseline information to alleviate document recreation, loss of continuity, improve tracking, and better change management documentation, as well as give a more holistic view across time and project domains. Mr. Orr cited the five year plan as an example of how the holistic view influences the budget. He explained the holistic view is to be able to see where funding and efforts are actually going and help make choices. Mr. Orr reminded the Subcommittee the FAA always has to look at the budget cycle with Congress, but this should make everything more understandable.

Mr. Orr continued his presentation with AVS R & D Drill-down. Mr. Orr began explaining the process for the organization of research for SAS. He presented FY18 outcomes listed by TCRG stating TCRGs are a group of Subject Matter Experts that the FAA has chosen. Mr. Orr proceeded by explaining the outcomes by TCRG and how the outcome is achieved. Mr. Neiderman commented this is a key part of the presentation and hopes it is helpful to someone who doesn't see this every day.

Ms. Yak interjected asking the Subcommittee if they had the work breakdown by TCRG would that help them understand and find the emerging issue. Ms. Yak suggested looking at the outcomes with the Emerging Issues to find the gaps. She asked the Subcommittee if technology issues are looked at. Ms. Yak stated there is a distinction in research and looking at the R & D Budget because it does change. Mr. Neiderman interjected stating that TCRGs are consistent over time and the ones included in the presentation are the ones above the Mendoza Line.

Mr. Orr proceeded reviewing a recommendation from 2015 for FAA to try to map FY18 budget to Emerging Issues. Mr. Orr explained the chart he is presenting is the result. The Subcommittee commented one of these projects could have a small piece that applies to emerging issues and asked if that has been looked at. Mr. Orr responded no. The Subcommittee responded it goes back to the discussion do we believe you are doing the work you are saying you are doing and it is the correct research. The Subcommittee commented that the list was helpful.

Homework – the Subcommittee homework is to look at the Quad Charts in terms of Emerging Issues and look at the TCRG outcomes and then go back and try to find the gaps.

The Subcommittee suggested finding a better way to organize the Quad Charts based on outcomes instead of BLI. The Subcommittee stated that the context is lost using the bottom up approach to develop requirements to line them up to BLI. The Subcommittee stated that looking at quad charts by outcomes and Emerging Issues would provide bigger picture and then deeper dives can be taken from there. The Subcommittee suggested having the sponsor tag projects by Emerging Issues, Operational, and Financial.

The FAA questioned who owns the Emerging Issues and the response was the Subcommittee. The Subcommittee stated that FAA/AVS doesn't necessarily agree that they are emerging issues and how things fit together. The Subcommittee stated the one thing that has been asked for is a roadmap for a more comprehensive look at the project. The Subcommittee agreed Emerging Issues are hard for the FAA. Emerging Issues in the five year, ten year plan receive push back because it is not dealing with today, it is not our issue, or it is not deemed important.

The FAA asked for input on Quad Charts with Emerging Issues. The Subcommittee responded looking at Quad Charts as Emerging Issues is difficult. The Subcommittee agreed to look at Quad Charts, look at Alignment Charts and see from there. The FAA explained that was the reason for the TCRG/Emerging Issues Chart, to show all TCRGs are aligned with priorities. The FAA there may be a thing or two below the Mendoza Line to look over and review. Mr. Orr continued by reviewing the FY18 budget, commenting that there is an increase in requirements from FY17, but the budget is lower than both FY16 and FY17.

The Subcommittee asked if any work was performed using in-house budget and Mr. Orr responded yes. The Subcommittee asked if all research projects are performed by Sub Contractors. Mr. Orr explained not all research is contractor work.

The Subcommittee discussed taking money for UAS from other places and what can be done for FY18. Mr. Orr explained FY18 can change and informed the Subcommittee the FAA is expecting big changes for FY17. He continued by stating the money will be spent and added, but it is not one year money, it is three year money meaning FY15 money doesn't have to be spent until FY18. The Subcommittee commented UAS was awarded six million dollars and the plan is to spend that all by the end of this year. The Subcommittee discussed the struggle with getting the big picture and there needs to be a focus on building structure and aligning projects with Emerging Issues. The Subcommittee applauds the SAS Team efforts.

Lunch Break - 12:30p.m – 1:15p.m.

Presentations Commenced at 1:15p.m.

UAS Forum Discussion, UAS Safety R & D Considerations, UAS Quad Chart Review,

Mr. Hylander began by stating this is meant to be a meaningful discussion about UAS.

Mr. Hylander stated this is a requirement of the full REDAC Committee. He informed the Subcommittee of a meeting in February 2016 in Washington D. C. solely for UAS that was extremely informative. Mr. Hylander stated some Subcommittee members attended and he would like input and thoughts from those members. He stated the objective of this discussion is to give thoughts and new perspective on the approach to Safety.

Mr. Hylander informed the Subcommittee that the FAA could not provide a roadmap or CONOPS documents and it has been requested for a long time. The Subcommittee agreed in order to have an integrated portfolio it makes sense to have those documents. The Subcommittee commented that there is no clarity on who is in charge. The Subcommittee spoke on the six million dollars awarded to the Center of Excellence and commented that there is no clarity with that program as well, stating there are six areas with five being funded and that money is trying to be spent by the end of the year. The Subcommittee stated the concern is that is not clear which research areas are being addressed with that money. The Subcommittee expressed concern with the FAA(HQ) having line item titled UAS and then having other pockets under other projects for UAS. The Subcommittee discussed the issue of data collection and the different programs the FAA has for UAS research. The Subcommittee commented that the schedules were pretty far out, and there was no talk on how problems were being solved.

The Subcommittee expressed the concern that the work being done and the information that comes out of the work may not be shared. The Subcommittee informed attendees of a Congressional Mandate that DHS and the military are looking at Defense Mitigation. The Subcommittee explained it is looking at someone with ill intent or hostile concerns operating a UAS and what to do. The Subcommittee agreed this is not just an FAA issue.

The Subcommittee proceeded by stating there isn't much data out there regarding UAS and there are a lot of issues surrounding this topic for example; military, operations, airports, and added that most UAS research teams are struggling with what they are doing. The Subcommittee agrees you have to look at mitigation, potential damage, and whether the damage would catastrophic or not. The Subcommittee suggests looking at risk factors and there needs to be real data to support FAA decisions. The Subcommittee agreed UAS are not going away and there needs to be a way to integrate them into the system. The Subcommittee agreed there is pressure industry wide and initiations for research are being driven by different things.

The Subcommittee stated there needs to have a coherent plan and what is being done by COE, FAA, and Pathfinders and COE and R & D activities must be coordinated to meet predetermined high-level goals and objectives. The Subcommittee stated there needs to be more discussion how to integrate and possibly all other work will flow down. The Subcommittee agrees that the FAA needs to have a more clearly stated vision and a plan. The Subcommittee stated that it could be too late to look at this for FY18 as the research requirements had been finalized and approved. The FAA responded stating because of extra money from FY15 and FY16 a lot of tasks have been moved up and can start earlier such as, collecting data, collision avoidance, and detect and avoid.

The Subcommittee stated it is hard to strategize because the requests for research are coming from the bottom up, not the top down and because of that the strategy seems to disconnect with funding. The Subcommittee stated there should be a list of what is important. The Subcommittee asked that there be a review of the highlights from the February meeting and they will discuss more on Day Two.

Mr. Mark Orr, FY18 Research Portfolio – Quad Chart Review,

Propulsion and Fuel Systems, the presentation began with a review of the research requirement and sponsor outcomes. FY16- FY18 budget was discussed and it was explained the quad chart

from the prior year was reviewed to respond with target research and this project made the Mendoza stack. It was discussed that Congress is stating funding for UAS is too low and the FAA has a concern on protecting the work that they feel needs to be done. The Subcommittee suggested putting this work into a concise recommendation due to UAS money being directed to come out of what has already been proposed. The Subcommittee stated they will review each project's Quad Chart and discuss any issues.

Rotorcraft, the FAA explained this research is looking at bird strikes and how it relates to PAR 27/29- Pilot Protection. The FAA stated altitude birds are more prevalent and they are looking at flying at different altitudes. It was explained that other work is being performed outside of bird strikes. The Subcommittee asked why there is no milestone for FY18. The response is there is uncertainty regarding funding. The FAA explained there was funding in FY16 and no funding for FY17. The Subcommittee asked if these were requests that didn't make it past the Mendoza line, the FAA confirmed. The Subcommittee asked if Bird Strike was a big problem the FAA replied yes, the bird strike canopy is so severe explaining the plan is to change PAR 27 and PAR 29. The FAA explained they are doing work with funding they have. The Subcommittee agreed the research seems coherent.

MMPDS Support and Design Values for Emerging Materials, the Subcommittee asked for a general overview explaining why a large number of requests fell below the Mendoza Line and what is driving this. Mr. Orr responded stating the branch asked for a proactive Safety approach and other people from other organizations made pushes for requests for research. The Subcommittee agreed this project was the closest to addressing an emerging issue.

Transport Airplane Ditching, the Subcommittee asked what the value of this is due to ditching being a pretty rare event. The FAA responded agreeing that ditching is rare but water landings are not rare and they are looking at rerouting, ways to end up, and reviewing the rule, and protecting the aircraft. The FAA explained this was a Congressional Action brought forth by a NTSB request to upgrade the rules. The Subcommittee explained with dollars and timing this plays out as a pretty low priority, adding Peggy and the team ultimately make the decision on what gets funded. The Subcommittee agreed they are not looking at this as high priority but added that crash worthiness seems to be a bigger priority with the issue of funding being shared between two projects.

Aircraft Fire Safety, the Subcommittee commented that just looking at the Quad Chart makes it hard to see what is being done. Subcommittee felt the work looked useful but more detail was needed. SAS subcommittee asked how much work was related to halon replacement. FAA responded that the second task as listed in the Quad Chart on an integrated gas generation system was driven by halon replacement. The Subcommittee pointed out that two of the items (fire suppression/inerting systems (halon replacement), lithium battery hazard mitigation) appeared to be important work. Subcommittee also asked how much work was related to new test methods for hidden materials. FAA responded that currently new tests were under development for wiring and ducting, and that work was beginning to examine lightweight magnesium alloys for ducting. FAA also pointed out that the last milestone on the Quad Chart was on the adequacy of existing tests for new materials. FAA also emphasized that the portion of the research on material flammability tests in FY-18 would depend on the status and response to the planned FAA NPRM to completely revamp the material flammability regulations, and could become more significant.

P.M Break – 3:55p.m. – 4:10p.m.

Presentations Commenced 4:10p.m.

Dr. Estrella Forster, Aerospace Medial Research - Emerging Aviation Safety Medical Issues. Dr. Forster presented the three aeromedical (AM) TRCG Requirements supported by the FAA Civil Aerospace Medical Institute (CAMI) in Oklahoma. She explained that the research focus of the CAMI Aerospace Medical Research Division is on the health and safety of the human in the NAS (e.g., the pilot, cabin crew, passengers). Dr. Forster also presented a summary of the emerging medical issues that will play a role in human safety in aerospace operations. Her presentation included a listing of the resources supporting each requirement (personnel and facilities). Dr. Forster presented the research activities concerning (1) the Aerospace Medical Systems Analysis requirement that aims to support risk-based decision making by analysis of aeromedical information such as autopsy findings and airmen medical records; (2) the Accident Prevention & Investigation requirement, which concerns research activities that enable the detection and measurement of drugs, alcohol, toxic gases, and other substances in victims of fatal aircraft accidents; and (3) the Human Protection & Survival requirement, which concerns research activities that address the numerous advances in materials, aircraft configuration, devices, and emergency procedures that affect aircrew, cabin crew, and passenger safety, particularly as it relates to crashworthiness and survival issues.

The Subcommittee asked for an example objective for this type of research. Dr. Forster replied that an aim of such research is to reduce the risk of the pilot losing consciousness during flight. The Subcommittee stated this is definitely linked to an emerging issue and is a top priority task.

Mr. Ken Hylander, Mr. Eric Neiderman, Discussion/Summary/Actions, Mr. Hylander began with a ***homework action***: Tab D, go through and try to find gaps.

Recommendations: review the UAS paper Tab F, condense to key points, review propulsion and bring key points, concerns, and concerns driving UAS internal funds away from other projects

Specific Actions(for day two): more of a detect and avoid story, check Quad Chart- understand what has been done- refer to FY16 Quad Chart, coordinate and have someone explain, Navigation Performance and Reliability – origin of requirement

Longer Term Action Items (future meeting): what are other roadmaps we might want to see?

Additive Manufacturing – status – the Subcommittee discussed why it didn't make it above the Mendoza Line. The FAA responded it was something that cannot be answered in this venue. The FAA agreed it was an outstanding recommendation. The Subcommittee stated it was a high level one year ago, very targeted, and there is nothing planned and it is below the Mendoza Line. The FAA stated they are in the process of developing a roadmap and it was included for FY16 research. The Subcommittee stated there is the potential for improvement will possibly have a third recommendation after the discussion on day two.

Pilot-Laser Strikes - the Subcommittee agreed to have a longer discussion on day two.

The Subcommittee also stated the response to UAS Portfolio Flexibility was not satisfactory and will be discussed on day two. the Subcommittee agreed it is larger than UAS, could include passenger aircraft.

Meeting Adjourned at 5:05p.m.

Day Two

Thursday, March 24th

Meeting commenced at 8:30a.m.

Mr. Hylander began by welcoming everyone back. He stated the first thing he would like to address is the next meeting. Mr. Hylander explained he discussed it with Mr. Neiderman and it looks like September 14th-15th 2016 (Wednesday and Thursday), same location. He also stated he would like to be able to plan the next spring meeting for the month of March 2017, and it will be held in Oklahoma City, OK. Mr. Hylander explained the rationale behind that is there is a lot of research going on there and it is an opportunity to meet some researchers and tour facilities. He asked the Subcommittee members to look over their calendars and let him know availability.

Review of homework:

UAS Meeting Key Points, the Subcommittee stated the concerns are as follows: who has the authority- not clear who has ultimate responsibility, there is no set plan, and there is a need for more data, need for CONOPS, need more information on pathfinder projects, and concerned about ASSURE presentations.

The Subcommittee discussed the need for a comprehensive plan explaining that UAS touches all line of business and in order to have integrated research need to have enterprise wide plan. The Subcommittee stated the FAA (HQ) might have a plan but it was not presented. The Subcommittee agreed they were unable to identify a comprehensive plan for UAS integration and agreed the plan needs to be distributed widely and has to include an organizational component. The Subcommittee agreed there is a lot of energy spent on this, but it is not coherent. The Subcommittee explained the coherent strategy is needed in order to make judgements to R &D. They explained is harder to evaluate if appropriate research is been done because there is no coherent strategy.

The Subcommittee spoke on the data issue stating there needs to be a clearer direction is what data is needed. The Subcommittee stated there needs to be a focus on clarifications of data, type of UAS, and early data is needed to see where the data focus should be. The Subcommittee commented there should be a strategy in regards to the data to state type, where to get the data, which should collect the data, where the data should go. Overall data should have a criteria developed. The Subcommittee stated the FAA also needs a plan and to execute that plan to be sure projects like ASSURE are being consistent with the research.

The Subcommittee agreed that the “major buckets’ for this program are: research plans to include data collection, connection between ASSURE and research plan. The Subcommittee continued by discussing the Pathfinder issue stating they would like to see them in more complex situations, pushing forward. The Subcommittee would like to know how the result will propagate out to guide the plan. They also stated it’s important for the Pathfinder results to be available to the community and be clear on how it will move forward. Mr. Hylander commented he would like to take another shot at this outside the meeting and get a deadline and have it submitted. He stated to make a clear actionable statement for the FAA to responds to giving a timeframe for plan. Mr. Hylander stated the response has been good but the faster we move to a top down strategy the better for everyone.

Propulsion, the Subcommittee discussed how the re-appropriation of funds for UAS impacts the FAA ability to plan and continue research in other areas. The Subcommittee suggested a recommendation that the FAA should develop and alternate and holistic approach to incremental funding so UAS does not result in significant deduction in research budgets for other BLI's. The FAA explained Congress decides where funding gets allocated. They look at the budget projects as a whole. There is a need to bring impact assessments to the forefront to show what is being impacted due to the reallocation of funding. Congress does not see the research that takes the hit; they see the BLI's taking the hit. The Subcommittee stated the FAA needs to state what is important, be specific on funding and wrap it around research that has been cut or delayed. The Subcommittee reiterated this is the result of not having a plan. They agreed everything is stemming from not having cohesiveness. The Subcommittee stated Congress needs to understand the impact of their decisions.

Hot Corrosion, the Subcommittee reviewed Quad Charts from the past. The Subcommittee agreed the findings aren't present and this research has not been on the list.

Turbine Engine, the Subcommittee agrees there has been a lot of work done. The Subcommittee stated there is no funding and agrees this needs support and funding needs to be re-established.

Titanium, the Subcommittee agreed FAA has done a lot of work but was concerned because this is an industry wide problem and the FAA is the only one performing the work. They agree the research seems to be reliability driven, but the Subcommittee does know if the events continue to happen it is significant statistical damage.

Advanced Computational Materials, the Subcommittee agrees there has been a lot of research industry wide and suggests the FAA work with the AF due to the AF working on similar research. The Subcommittee recommends continuing this research and there is appropriate funding this could be applied to Emerging issues and discussed how to align this research with the Emerging Issues.

Presentations

Dr. Kathy Abbott, Lessons Learned about Operational Use of Automated Systems, when Dr. Abbot was completed with her presentation the Subcommittee commented in regards of non-certified resources on aircraft the Subcommittee asked if the research was including non-certified risk area. Dr. Abbott responded stating the research is looking a non- standards and non-certified information as well as PAR 91 operations, but at this time it is not being looked at as a potential risk. The Subcommittee suggested research tracking this to see if it is a problem. Dr. Abbott responded that is difficult because it is not a regulatory responsibility, that is only is some aspects of Operations. She added the issue can be reassessed but the challenge with research is budget and prioritization. Dr. Abbott informed the Subcommittee an accident analysis is performed every few years to see if issues arise. Dr. Abbott explained in FY16 the request was for one million and they received 300,000 and she is waiting for FY17 and has several projects being requested.

A.M. Break – 10:35a.m. – 10:45a.m.

Presentations Commenced at 10:45a.m.

Mr. Peter Skaves, Safety Risk Management Proposals for Airborne Electronic Hardware, Software, Systems and Information Security, the Subcommittee discussed the SDS Quad Charts commenting they cannot tell what research is going on and it is a critical area. The Subcommittee stated in regards to Emerging issues, what is going on to support that. There were discussions on the FAA ASISP research approach/projects. The Subcommittee agreed on an Action Item for the FAA is to provide more detailed information on SDS and ASISP cybersecurity research activities. The FAA referred to last fall's presentation having more detail from an avionics perspective. The Subcommittee stated that more information was needed on these research programs. The Subcommittee stated that although a deep dive was done on Software piece and it was hard to connect the dots. The Subcommittee asked why there is no money planned to FY17. The FAA explained that was a late change from OMB over Christmas. The Subcommittee noted that interruption of funding and restart in follow-on fiscal years must make it difficult to effectively and efficiently complete RED tasks. The Subcommittee agreed this goes back to the collateral impact of reallocating funds and a Finding and Recommendation was proposed.

Mr. Mark Orr, Quad Chart Review,

Tab K – SIC12- The Subcommittee stated this is a critical issue and the issue is the test methodologies used are outdated. The Subcommittee asked for more detailed information from future meeting.

Metallics – Additive Manufacturing, the Subcommittee stated the FAA's response to this recommendation would be a written policy memo. The Subcommittee also stated they need a broader roadmap. The FAA responded stating a draft has been created and will go through the approval chain. The Subcommittee asked if funding was sufficient. The FAA responded that the money is not solely for metallic. The Subcommittee stated they don't believe the FAA is getting behind this commenting that it was raised as a key finding last year and now it is below the Mendoza Line. The FAA explained that what is shown is not the entire picture of what is being done. The Subcommittee stated they asked for a research plan before August and made recommendations and have received no substance. The Subcommittee stated they need the bigger picture. The Subcommittee wants to push forward but is seeing no output and output is critical. The Subcommittee agreed to write up an action pressing for documentation due in August and a deep dive for the September meeting. The Subcommittee also requested verbal updates and would like a two-three page summary snapshot within by March 31, 2016.

Tire Failure Characteristics, the Subcommittee stated in general they would like to see more of what is being done. The Subcommittee asked if retreats were included and the FAA confirmed. The Subcommittee would like to see more in way of modeling.

Transfer of UAS Technology for Enhancement of GA Study, the FAA stated this is new for FY18 and based from a REDAC Recommendation. The Subcommittee stated it looks straight

forward, but does lack high level strategy. The Subcommittee discussed and agreed there are criteria for lists of work and there is an interest in keeping Emerging Issues visible.

Alternative Fuel for GA Aviation, the FAA informed the Subcommittee Phase I deliverables were met and things are progressing and moving to Phase II. The FAA explained Phase II will be engine aircraft testing and issues found are mitigatable. The Subcommittee asked when fuels would be approved. The FAA stated they are not sure. The FAA stated funding is needed to fit continue testing and hoping to get approval for FY18 and beyond. The FAA stating this is a safety focus project and all data collected will go to fuels office.

Lunch Break -2:15 a.m. – 1:00 p.m.

Andy Lecher, Emerging Issue/Aviation Safety Topic – Autonomy and Automation, the Subcommittee asked whether the FAA is the right agency to regulate this. The Subcommittee commented these types of vehicles need to be characterized according to risk level. The Subcommittee agreed they believe the FAA is accepting the risk based approach. The Subcommittee stated in there are low altitude vehicles and high altitude and now there is middle ground and how do they get integrated into NAS. The Subcommittee agreed data is important and this is not going away. The Subcommittee suggested Integrated Operations with Amazon and Google moving forward and what the definition of airspace will be. The Subcommittee agreed there needs to be someone involved in the research that has an IT perspective and FAA needs to collaborate with the other players in the community.

Dr. John Cavalowsky, Update on NASA Safety Portfolio, Autonomy and Automation, the Subcommittee asked if FAA has adopted the standards that NASA has developed and where does it show in a FAA UAS portfolio. The Subcommittee asked where the FAA strategy is leveraging NASA. The Subcommittee asked for a big picture and acknowledges this warrants observation. Dr. Cavalowsky inform tied the Subcommittee that FAA had been unwilling to engage UTM and in the last three months the Senior Leaders were able to get together to look at UAS in NAS. Dr. Cavalowsky stated this is a thirty million dollar per year citing and it is 10% of the current budget. The Subcommittee commented that the FAA and NASA need to work together on this issue.

Mr. Tom Bond, Aircraft Icing Quad Chart Review, the Subcommittee questioned the codes, asking what they are and who is suing them. The Subcommittee also asked what the plan is to get sufficient validation. Mr. Bond responded stating validation is planned for the end of FY18, explain the testing will be late 2016 and at that time will have a better handle on it. Mr. Bond explained Aircraft R & D Support Certification Requirements came out in 2015. The Subcommittee was pleased about the collaborative work with NASA and Industry and understands the biggest difficulty is funding, particularly for the BLI A11.d to support Icing engine test and analysis tasks. The subcommittee also noted significantly differing allocations between the BLIs (in this case A11.d and A11.k (weather)).

The Subcommittee agreed the funding within the safety portfolio and between BLIs is not matching the research priorities, and an F&R was proposed

Mr. Mark Orr, FY19 Research Portfolio Planning – Strategic Guidance, Mr. Orr stated the FY19 and asked the Subcommittee to review and have any comments returned to him by Friday. He explained the areas research is emphasizing are safety, risk, hazard issues. The Subcommittee had a concern because Emerging issues weren't included. Mr. Orr explained the guidance approval process to the Subcommittee and explained the direction he receives on what the research should be focused on. The Subcommittee suggested Mr. Orr to include the Emerging Issues in the Strategic Guidance letter and submit for approval. The Subcommittee explained this is the opportunity to write something up for considerations. The Subcommittee stated submitting the document as a list of concerns from the REDAC Safety Subcommittee will hopefully open the door to more strategic conversation.

Wrap Up

Mr. Hylander asked for a debrief meeting/telecon next week with Mark and Eric.

The Subcommittee discussed the Emerging Issues and the possibility of doing one or two deep dives vertically and then discuss at the end of the meeting. The Subcommittee agreed they still feel like they are missing the big picture. The Subcommittee explained when asked to evaluate research it helps to have the big picture. The Subcommittee stated they are trying to give the best guidance and need think it through. The Subcommittee commented they will work on trying to come up with a helpful way to get the correct information to them. The Subcommittee agreed the same question applied every year to every project and that is what the outcome is. The FAA stating they agree with the Subcommittee and the input they give is extremely valuable.

Mr. Hylander created an Action Item for himself, Mr. Orr, and Mr. Neiderman – figure out a way forward and then they will distribute to the rest of the Subcommittee

The Subcommittee discussed the next full REDAC is April 28, 2016

Draft SAS findings and recommendations (F&R) by SAS members assigned for the “homework” are due to Xiangong and copy Eric Neiderman by March 31, 2016

Mr. Hylander informed the Subcommittee he will send out the finished product to everyone for review and needs a quick return. If a call is needed, then one will be scheduled. If no call is needed then it will be finalized via email.

Mr. Hylander reminded everyone the next meeting is September 14th -15th 2016 and the Spring Meeting is March 8th and 9th 2017 in Oklahoma City.

Meeting Adjourned at 5:05p.m.

Appendix I: SAS Spring 2016 Meeting Agenda (as held)

FEDERAL AVIATION ADMINISTRATION
REDAC Subcommittee on Aircraft Safety (SAS)
William J. Hughes Technical Center
 March 23-24
 Director's Conference Room
Dial in Access: (609) 916-1975, passcode 630437
Wednesday, March 23, 2016

Meeting Goals:

- **Deep dive on UAS safety considerations.**
- **Review of the FY18 portfolio with consideration of emerging issues.**
- **Guidance and identification of gaps in the FY19 portfolio.**

Time	Topic	Presenter(s)
8:00 – 8:30	Security Operation Center (SOC) check in	ANG-E2 (TBD)
8:30 – 8:50	Welcome/Opening comments <ul style="list-style-type: none"> • Introductions (all) • Opening remarks/comments (Chair & DFO) 	Kenneth Hylander (Chair) Eric Neiderman (SAS DFO)
8:50 – 9:00	Welcome	Shelley Yak (REDAC DFO & WJHTC Director)
9:00 – 9:15	Budget Update	Mike Gallivan
9:15 – 10:00	Strategic Framework from Fall 2014	Ken Hylander
10:00 – 10:30	Open Finding & Recommendation and Actions	Xiaogong Lee
10:30 – 10:45	Break	
10:45 – 12:00	Discussion – Holistic View of the Research Portfolio	Mark Orr Kerin Olson
12:00 – 1:00	Lunch	Cafeteria
1:00 – 3:00	UAS Forum Discussion UAS Safety R&D Considerations <i>UAS Quad Chart Review</i>	Subcommittee Perspectives: Andy, Ken, Chris, Chris, & Dres
3:00 – 3:45	FY18 Research Portfolio – Quad Chart Review PS, RS, SSM, F&CS, TAS, & Wx Quads	Mark Orr
3:45 – 4:00	Break	
4:00 – 4:45	Emerging Issue - Aviation Safety Medical Issues <i>AM Quad Chart Review</i>	Star Forster
4:45 – 5:00	Discussion/Summary/Actions	Kenneth Hylander/ Eric Neiderman
6:30	Reception – hors d'oeuvres 101 South Suffolk Ave., Ventnor, NJ 08406	Eric's Shore House

PS – Propulsion Systems; RS – Rotorcraft Systems; SSM – System Safety Management; F&CS – Fire and Cabin Safety; TAS – Terminal Area Safety; Wx – weather in the cockpit

Director's Conference Room
Dial in Access: (609) 916-1975, passcode 630437
Thursday, March 24, 2016

Time	Topic	Presenter(s)
8:00 – 8:30	Security Operation Center (SOC) check in	ANG-E2 (TBD)
8:30 – 9:45	Review of Homework Assignments from Previous Day – Findings and Recommendations Discussions	Subcommittee
9:45 – 10:30	Chief Scientist and Technical Advisor (CSTA) Perspective – Lessons Learned about Operational Use of Automated Systems <i>HF Quad Chart Review</i>	Kathy Abbott
10:30 – 10:45	Break	
10:45 – 11:30	Chief Scientist and Technical Advisor (CSTA) – Safety Risk Management Proposals for Airborne Electronic Hardware, Software, Systems and Information Security <i>SDS Quad Charts Review</i>	Peter Skaves
11:30 – 12:15	FY18 Research Portfolio - Quad Chart Review SIC, SIM, FCMS, ES, & GA Fuels	Mark Orr
12:15 – 1:00	Lunch	Cafeteria
1:00 – 1:30	Emerging Issue/Aviation Safety Topic – Autonomy and Automation	Andy Lacher
1:30 – 2:00	Update on NASA Safety Portfolio – Autonomy and Automation	John Cavalowsky (invited)
2:00 – 2:15	Q&A – Autonomy & Automation emerging challenges	Andy Lacher/John Cavalowsky
2:15 – 2:30	Break	
2:30 – 2:45	Chief Scientist and Technical Advisor (CSTA) - Higher Level Aircraft Icing Research Perspective <i>Aircraft Icing Quad Chart Review</i>	Tom Bond
2:45 – 3:30	FY19 Research Portfolio Planning – Strategic Guidance	Mark Orr
3:30 – 5:00	Wrap up – Homework Assignments, Action Items, etc.	Subcommittee
6:30	Group Dinner: <i>Knife and Fork Inn</i>	

SIC – Structural Integrity - Composite; SIM – Structural Integrity - Metallic; FCMS – Flight Controls & Mechanical Systems; ES – Electrical Systems; GA Fuels – General Aviation Fuels

WebEx Login, FAA SAS Spring Meeting

Every day, from Wednesday, March 23, 2016, to Thursday, March 24, 2016

Join WebEx meeting

Meeting number: 992 271 791 , Meeting password: spring

Appendix: II List of Attendees/Participants

Name	Company
Shelley Yak, REDAC DFO	FAA
Eric Neiderman, SAS DFO	FAA
John Hansman, REDAC Chair	MIT
Ken Hylander, SAS Chair	Flight Safety Foundation
Mark Orr, AVS R&D	FAA
Chris Benich, via telecon	Honeywell
John A. Cavolowsky	NASA Aeronautics
John Crowley	US Army Res Lab
Patricia Culler	Boeing
Chris Kmetz	Pratt and Whitney
Andrew Lacher	MITRE
Jim Mangie	Delta Airlines
John White	ALPA
Dres Zellweger	Consultant
Allan Abramowitz	FAA
Andrew Cheng	FAA
Angela Campbell	FAA
Chinita Roundtree-Coleman	FAA
Cliff Johnson	FAA
Daniel Brock	FAA
David Chen	FAA
Erin DeBarth	CSRA
Fred Snyder	FAA
Garrison Canter	CSRA
Gus Sarkos	FAA
Heather Hemdal	FAA
Hossein Eghbali	FAA
Isidore Venetos	FAA
Jaime Figueroa	FAA
Jimmy Bruno	FAA
John Lapointe	FAA
John Peace	FAA
John Reinhardt	FAA
John Zvanya	FAA
Jorge Fernandez	FAA
Kathy Abbott	FAA
Katrina Avers	FAA
Ken Hutcherson	FAA
Ken Knopp	FAA
Maria Paine	FAA

Michel Hovan	FAA
Michelle Yeh	FAA
Paul Tan	FAA
Peter Sparacino	FAA
Robert McGuire	FAA
Steve Edgar	FAA
Steve Ramdeen	FAA
Tim Smith	FAA
Tom Fournoy	FAA
Vasu Kolli	FAA
Xiaogong Lee	FAA

Appendix III: Action Items

Action Item 1: Research to Mitigate the Impact of Cockpit Laser Strikes (**SAS Fall 2015-4**) – the subcommittee questioned the work and would like to know the details. The Subcommittee agreed to close the F&R and take an action to determine what the specifics are required to mitigate potential safety risks due to cockpit laser strikes. (Action assigned to SAS)

Action Item 2: SDS – the Subcommittee requests that the FAA provides deep dives of SDS research programs to understand how the FAA research programs support the AVS needs as presented by the FAA Chief Scientific and Technical Advisor for Advanced Avionics on Airborne Electronic Hardware, Software, Systems and Information Security. (Action assigned to Eric Neiderman)

Action Item 3: The Subcommittee discussed the need to have some presentations at a higher level and more deep dives into others. The Subcommittee discussed how to find a way to get the appropriate information to them. (Actions assigned to Ken, Eric, and Mark for next SAS meeting).

Action Item 4: Big Picture - the Subcommittee explained that they still feel they are missing the Big Picture and believe that getting the Big Picture is critical for evaluating and advising the FAA safety research. The Subcommittee discussed ways to get the proper information. Ken Hylander, Mark Orr, Eric Neiderman were tasked with figuring out a way forward and distributing the final piece to the rest of the Subcommittee. (Action assigned to Ken, Eric, and Mark)

Appendix IV: 2016 Spring Meeting Findings and Recommendations

Meeting Summary:

The sub-committee for Aircraft Safety met on March 23 and 24, 2016 in Atlantic City, NJ, for its routine spring meeting. This meeting had three specific deliverables on its agenda:

1. Be responsive to the REDAC's request, from the fall 2015 meeting, for study and comment on the FAA's Unmanned Aerial Systems (UAS) research
2. Review and provide comment on the FAA's 2018 safety research plan
3. Consider what input, if any, should be included in the agencies internal strategic guidance document for developing the FY 2019 aviation safety research plan

Regarding the first objective, seven members of the SAS attended the FAA sponsored UAS seminar on Feb 20, 2016. This seminar was scheduled to assist all the REDAC sub-committees in gaining a complete understanding of the status of FAA sponsored UAS research. Those SAS members in attendance pooled their thoughts into a single document, which informed the discussions at the full SAS meeting. The findings and recommendations attached to this report are the results of those discussions.

To assess the 2018 research plan, 45 research "quad" charts were reviewed by the SAS in advance of the meeting. SAS also had insight into a proposed five-year contract dollar spending plan (2016 through 2020) for the areas of research noted. Of note is that this planned expenditure totals more than \$210 million. This insight was helpful in our deliberations regarding the actual dollar priority research focus areas. SAS continued its practice of engaging both sub-committee members and agency expertise to inform the discussions. Four FAA Chief Scientists and Technical Advisors directly supported the meeting. Findings and Recommendations related to Additive Manufacturing and Advanced Materials Research are attached to this report.

As previously reported the SAS believes that there is value in considering the existing and planned research against a set of emerging and future issues, which may have an impact on aviation safety. SAS continues to keep these previously developed issues in mind in our reviews. We also continue to explore better ways to evaluate the proposed research against these issues to determine any gaps that may exist. We are pleased to see that in some areas emerging issues are being considered in the future research plans. Plans related to Aeromedical research and General Aviation technology impact on safety are examples. With these future issues in mind the SAS has made a general recommendation that our emerging issues get a broader audience within the AVS community by including them in the FY 2019 strategic guidance document.

Respectfully Submitted,

Ken Hylander

Chair, REDAC sub-committee for Aviation Safety

2016 Spring Meeting Findings and Recommendations

Related to UAS

Findings: UAS Leadership and Strategic Planning. FAA still has not released to the SAS a high-level strategy and single, overarching, plan with clear objectives and milestones for dealing with UAS in an integrated manner. We believe that a roadmap is in development this information is not readily available for review. The lack of an articulated strategy makes it very difficult for the SAS, and others, to evaluate UAS R&D plan and identify potential gaps.

The UAS safety requirements come from the UAS office in AVS; the research is carried out by the NextGen office; and the UAS CONOPS development lies in the ATO organization. The integration and connection between these elements is not apparent. It is not clear who has the ultimate UAS authority and responsibility within the agency. To outside reviewers there is neither a method for developing comprehensive and integrated UAS research requirements, nor agreement on who has primary responsibility for this.

Recommendations: SAS recommends that the FAA:

- Distribute a coherent strategy for achieving safe and efficient UAS integration into the NAS. This should be the basis for a holistic approach to prioritized planning of UAS activities, responsibilities, and associated funding. A companion document should be developed to show how the objectives are being flowed out to ensure alignment of the research and to help identify gaps. These need to be shared with all UAS stakeholders.
- Implement a cohesive organizational structure for all of its UAS activities and place overall responsibility for the activities with a single person or organization.

Finding: UAS CONOPS and Concept Maturation Plan. The FAA should be commended for developing a CONOPS for integrating UAS operations into the NAS, associated “operational requirements”, and a concept maturation plan for identifying research required to carry out the maturation plan. SAS found that the CONOPS was developed several years ago, based upon assumptions developed at that time, and has not been vetted with stakeholders outside FAA. Since the UAS situation is rapidly changing (e.g., increased emphasis on small UAS flying at low altitudes), and lacks broad community stakeholder input, the concept is likely incomplete.

Recommendation: SAS recommends that this CONOPS, the “operational requirements”, the concept maturation plan, and the prioritized research requirements be vetted with all stakeholders and updated accordingly.

Finding: UAS Data. SAS supports the risk-based approach for UAS requirements, certification, concepts, and policy – but all of these require data. FAA panelists identified the need for more data, for a variety of purposes (environmental assessment, UAS forecasts, UAS policy decisions, FAA adoption of industry based standards, risk based UAS requirements, etc.). The lack of data and the lack of a serious FAA initiative to collect data is a shortcoming. Beyond certain incident and accident data from COA operations, there does not appear to be an attempt to get comprehensive data to understand the risk of UAS operation, and what potential safety issues might emerge. With over 400,000 registered small UAS, 3700 section 333 exemptions, several Pathfinder programs, and

many other UAS operating in the airspace there is an opportunity to expand the operational and safety data routinely collected and analyzed. This existing data can be used to inform what data collection initiatives may be required in the future.

Recommendation: SAS recommends that FAA begin a comprehensive effort to collect UAS operational and safety data. Data beyond just accidents and incidents is needed. Routine operational data will help establish baselines of operational use, norms, best practices, and serve as the dominator when considering mishaps rates. FAA should use this data to answer a series of questions: What sort of safety incidents are we aware of today? How many of them are occurring? Can these events be dealt with by existing policy or rules or will research be required to develop a solution?

Resulting from the rapid and often unpredictable UAS growth a research project should be initiated to determine what UAS safety data is needed 5-10 years from now and to lay the groundwork for its creation, collection, and analysis.

SAS further recommends that the Safety Oversight Management System (SOMS) project (A11H.SSM.11) be expanded to include UAS data.

Finding: UAS Pathfinder Projects. SAS commends FAA for the novel industry partnership in the three Pathfinder projects. This will lead to faster implementation of UAS procedures in the three areas of UAS application. With the exception of the participants, there is limited availability of the details of the pathfinder program initiatives outside of the FAA. The SAS remains concerned that the scope of the Pathfinder effort is limited when considered against the current UAS expected operational demands.

Recommendation: SAS recommends that the FAA consider accelerating the Pathfinder program to include more complex types of operation with more accelerated schedules. Additionally, a process should be developed for the results from the Pathfinder projects to be made widely available.

Findings: UAS Center of Excellence (ASSURE). In most of the ASSURE presentations and the poster sessions at FAA-sponsored UAS seminar in February it was not clear what the research question/issue being addressed was and how it related to FAA research priorities. SAS was unable to get a comprehensive picture of the research being performed by ASSURE or the gaps in research needs in the eyes of the FAA team. This finding is another reflection of the lack of a disseminated overarching UAS strategy. Without knowledge of the comprehensive picture it is hard to evaluate the ASSURE research and identify gaps.

ASSURE projects have received approximately \$6m for this fiscal year but one of the six ASSURE project areas, "Air Traffic Integration", remains unfunded. The "Airworthiness" project was impressive – the team is building on years of work in developing a finite element model of a Boeing commercial aircraft and will have this ready to begin simulations of the impact of UAS collisions on different parts of the aircraft. It was not clear that the rest of the on-going projects were on a clear path to develop a flexible framework for risk-based UAS decision making and performance-based rulemaking. It seems unlikely that ASSURE will be able to answer key integration questions at the level of fidelity needed by FAA.

It is not clear that there can be widespread engagement between ASSURE and universities unaffiliated with the COE. This is a potential shortcoming of the FAA COE approach as there may be significant capability outside the ASSURE coalition that could likely benefit FAA.

Recommendations: SAS recommends that:

- Future ASSURE projects should be consistent with FAA research needs and priorities based on the overarching FAA plan for UAS integration into the NAS. The projects should include funding for UAS integration into the NAS.
- FAA develop and implement a process for engaging capable universities and other research organizations not affiliated with ASSURE in UAS research

2016 Spring Meeting Findings and Recommendations

Related to FY 2018 Research Plan

Finding: UAS Funding Impact on Other Safety Research Portfolio Items. Contract funding for UAS is contained in Budget Line Item, A11.1, under AVS. SAS observed that funding for UAS has been significantly increased over the requested amount in the final congressional appropriation for the past two years. In 2015 the amount increased from a contract request of \$7210k to \$13210k. In 2016 the enacted amount increased from \$8150k to \$16022k. Overall this resulted in an average of 33% reductions in funding for other safety related BLIs. Contract requests for UAS in 2017 and 2018 are \$8400k and \$7400k, respectively. SAS is concerned that a similar congressionally directed re-allocation may occur in FY17 and FY18. We also note that this re-allocation of funds within the AVS scope impacts the FAA's ability to plan and conduct research in other areas considered critical to aircraft safety including human factors (\$5.1M reduction in FY16), Aeromedical (\$1.5M reduction in FY16) and Weather (\$1.6M reduction in FY16).

Recommendation: SAS recommends that the FAA conduct a review that assesses the collateral impact of congressional re-allocations of budget on existing and proposed RE&D and Aviation Safety research portfolio to understand the funding changes required, and the impacts of those changes, on other aviation safety RE&D priorities. Specifically, those BLIs or RE&D tasks that are provided funding in a one year, then halted in interim year(s), and restarted may make it difficult to efficiently utilize resources and effectively complete RE&D activities. The subcommittee recommends re-reviewing prioritization within and between BLIs for consideration of balancing funds and ensuring the most significant aviation safety priorities are addressed, particularly in light of the RE&D restrictions during Continued Resolution operations.

The FAA should also consider developing an alternate approach to incrementally funding UAS that does not result in significant reductions in research budgets for other BLIs.

Finding: Additive Manufacturing. SAS has been previously expressed concern that the FAA may be falling behind in evaluating technologies and certification criteria related to Additive Manufacturing and its expected increasing presence in industry. This has been a finding in the past two SAS meeting reports and was identified as one of the emerging issues. The FAA has responded

to our concerns by noting that Certification Policy Memos and an Additive Manufacturing Research Roadmap are in development. There is also a tactical project plan, which is working the issue. The committee applauds these efforts and encourages their continuation on an expedited pace although we remain concerned that the pace of change is too slow to support industry. Additionally, it is noted that Additive Manufacturing research continues to fall below the funding cutoff levels in the 2017 and 2018 research plans.

Recommendation: Expedite efforts to provide the Additive Manufacturing Research Roadmap and Certification Policy Memos and reconsider required funding in future year plans to accomplish the required tasks in the tactical plan and Roadmap.

Findings: Advanced Materials Research – Supportive of SAS Emerging Issue. SAS published its Emerging Issues and Future Opportunities Tasking Report in the fall of 2014. The report included a description of an emerging issue related to the Certification of Advanced Materials and Structural Technologies. Specifically, “as aircraft and engine designs drive towards advanced performance, new material systems and structural concepts will continue to be introduced that are significantly different from the current ways of designing, building, and maintaining airframes and engines. The FAA needs to stay abreast of these changes to make certification decisions and build its knowledge to support regulations, standards, guidance materials, and training that maintain safety.”

Four specific areas are recommended for additional propulsion system research in alignment with this emerging issue, Hot Corrosion in Nickel Alloys, Advanced Inspection Technology, Cold Dwell Fatigue in Titanium and Advanced Computational Materials Methods for Microstructure Changes.

- The effect of hot corrosion on engine rotor life is an important element that needs to be matured, especially the influence of operations in severe environments. Initial results of a program to predict the formation and growth of corrosion pits during service is being incorporated into the FAA rotor life prediction design code known as DARWIN (Design Assessment of Reliability With Inspection) to quantify the degrading effects of hot corrosion on rotor life. This work should be continued.
- The engine industry continues to rely on the Fluorescent Penetrant Inspection (FPI) process whose reliability is highly dependent on human performance. With innovative NDE methods, it is becoming increasingly possible to more reliably detect cracks and to also characterize microstructure for anomalies prior to crack formation and as a means to measure material properties to determine remaining life. In addition, methods to nondestructively determine grain size and bond joint integrity can be used as tools to both validate manufacturing processes and to provide finished part quality assurance. Lastly, advanced NDE used during on-line process monitoring of manufacturing processes has the ability to virtually eliminate manufacturing induced anomalies. The Subcommittee notes with concern the lack of FAA resources currently allocated for the NDE of Critical Engine Components requirement. This requirement is currently programmed for zero funding in FY16, FY17, and FY18.
- The sub-committee notes that the FAA has also made significant progress in studying Dwell-Fatigue in Titanium (Ti6242). This work established some of the fundamental, physics-based reasons for the occurrence of the cold dwell phenomenon, which can lead to fatigue failures and uncontained rotor failures. The research identified titanium features that are required for the activation of the cold dwell phenomenon. Quantitative characterization of these

microstructural features was initiated during this project in both metallographic and ultrasonic methods, but specific, standardized characterization tools and methods were not established or proposed. There are follow-on efforts that would be useful in establishing an industry-wide adoption of tool/methods to mitigate the incidence of cracks and fractures due to cold dwell fatigue.

- Recent and anticipated progress in computational materials science has shown that fundamental theoretical research and modeling can be used to develop an understanding of the critical physical phenomena that occur during metal processing. With this understanding microstructural changes can be anticipated and accounted for in the process. Computer experiments can be used to aid in rotor alloy designs and manufacturing process development.

Recommendations:

1. The FAA should continue to prioritize funds within the Improve Aviation Safety R&D portfolio to allow further development and validation of hot corrosion models and their incorporation into the DARWIN code.
2. The FAA should reinstate previous funding levels to continue the study of innovative NDE research for engine materials characterization and to assist with the transition of the most promising methods to OEM production and field overhaul facilities. Efforts should also be focused on advanced NDE to replace and improve upon Fluorescent Penetrant Inspection
3. The FAA should continue to work collaboratively with industry and AFRL through the RISC and JETQC initiatives to fully understand texturing in Titanium and identify billet and forging practices needed to prevent cold dwell failures including standard definitions for characterization and certification of titanium material.
4. The FAA should continue to work collaboratively with the USAF and other agencies to develop and incorporate similar computational methods into the DARWIN code to better enhance its life prediction accuracy.

Finding: Research to Mitigate the effects of Ice Crystal Icing – engine test and analysis capabilities. In the spring 2016 SAS meeting, the subcommittee was presented a comprehensive review of the icing-related RE&D portfolios (A11.D (Icing), A11.K (Weather)), with a focus on proposed funding and research in FY18. Significantly differing allocations between the BLIs (in this case A11.D and K) were noted.

Recommendation: The near-term need for ice-crystal-icing (ICI) test and analysis tools for engines has been noted in the engine harmonization working group (EHWG) and acknowledged by the Technical Community Representative Group (TCRG). While further weather research may be advantageous to assist in operations to avoid ICI conditions, it would not be practical to expect all operations to be able to avoid ICI. Therefore a means for engines must to be designed, analyzed, and-or lab tested to predict and reduce susceptibility is crucial. The need for near-term solutions for predicting effects of ICI on specific engine design, and to allow for methods of compliance other than extensive and complex flight testing is recommended. The subcommittee recommends that RE&D funding for A11.D be prioritized at a higher level for FY18 and forward.
