

FAA arranged a one-day session (Monday, Feb 22, 2016) to highlight their UAS R&D for the REDAC. They also organized a set of poster sessions to show the work of the new UAS Center of Excellence – Alliance for System Safety of UAS through Research Excellence (ASSURE). The Monday morning session was open to all but the afternoon session was arranged especially for the REDAC subcommittee members who were able to attend.

Ed Bolten (FAA Assistant Administrator for NextGen), Earl Lawrence (FAA Director, UAS Integration Office), and Mark “Hoot” Gibson (Senior UAS Advisor to the FAA Deputy Administrator) opened the session. Lawrence, who reports to Peggy Gilligan (AVS-1) is the UAS “insider” – he runs the agencies UAS efforts. Gibson is responsible for interface to the “outside” world. They obviously work very closely together and both are committed to having UAS “fly sooner rather than later, but safely”. They told us that FAA senior management is totally committed to this that the way forward represents a fundamental shift and they are focused on improving integration. Earl and Hoot stated that research is critical, but its success depends on having industry identify “gaps”.

Earl described that critical milestones have been developed at the “-1” level and can be captured on 1-2 pages. “The roadmap is out there. Plans are out there.” But none of this information was available to provide a foundation for how the research across many areas will be integrated toward achieving the roadmap objectives or the milestones for this year. It would be good to see how the objectives are being flowed out to assure alignment of the research and to help the REDAC identify gaps

It is not clear though who actually has the ultimate authority and responsibility to “make it happen” within the agency. Is it Earl, Peggy Gilligan (AVS-1), to whom Earl reports, or Ed Bolten (NextGen program) who seems omni-present on the issue. Despite direct questions to the effect we were unable to determine the level of the FAA research budget for UAS.

The second session was devoted to ASSURE, highlighting the capabilities and providing an overview of the research activities in the six research areas that are “necessary to integrate UAS into the NAS” (airworthiness, air traffic integration, UAS crew training and certification, control and communication and spectrum management, human factors, and detect and avoid). The COE was established last summer and \$6M in tasks were awarded last September, with an ambitious 12-month schedule for deliverables. The COE is led by Jim Poss, a retired Air Force Major General, now at Mississippi State University. He has a good grip on the COE, its mission, and its work program. ASSURE has 22 university members (15 in the core) who have been working informally as a UAS research team for six years and more formally for the past three years. The ASSURE criteria for team members is an ability to do practical applied research and practical experience with rulemaking.

- The ASSURE panel was asked about engaging non-affiliated Universities but it wasn't clear that there would be widespread engagement with unaffiliated Universities. This is a serious shortcoming of the FAA approach to put all UAS R&D into ASSURE since there is very significant capability outside the ASSURE coalition that could benefit FAA.

- The ASSURE focus is clearly on FAA/AVS safety and certification interests. The only area that relates to air traffic management (“air traffic integration”) is still unfunded.

- In most of the presentations it was not clear what the research question/issue being addressed was and how it related to FAA research priorities. Each of the ASSURE panelists discussed research in one form or another but we did not get a comprehensive picture of the research being performed or the gaps in research needs in the eyes of the FAA team. Without knowledge of the comprehensive picture it is hard to assist in identifying gaps.

The third session provided the FAA UAS research stakeholder perspective. The lack of data on UAS use and performance was highlighted by Nan Shellabarger (director of the FAA Policy shop) and also by Jim Hileman (chief scientist for energy and environment). Nan's office develops the FAA aviation forecasts but, because the traditional econometric models they use don't work for UAS, they don't have good forecasts for UAS. Without forecasts and better data, the office will not be able to make fact based UAS policy decisions. The environment office is interested in finding the UAS noise impact, but without data is falling short. Chris Swider, the R&D lead in Earl Lawrence's organization, is looking to ASSURE for a flexible framework for risk based UAS decision making and performance based rulemaking. The theme of using a risk based approach to certification that will bring new technology into use was reinforced by Wes Ryan from the small aircraft directorate. This directorate is interested in making sure that risk based requirements are scalable and that industry based standards are "mature enough". The latter worked well for light sport aircraft, but is problematic for UAS because of a lack of experience with UAS in civil airspace. The airport office is the sponsor for all research related to UAS use at and around airports. Their primary interests are in detection and mitigation of UAS around airports and in integrating UAS on the airport surface.

In the discussion at the end of the morning, it was evident that there is not a clear method for developing UAS research requirements nor agreement on who has primary responsibility for this. There was recognition that there are huge cultural differences among the UAS stakeholders, especially between the traditional aerospace companies and the new UAS users like Amazon. The FAA does not appear to have an answer for dealing with this.

The afternoon session for the REDAC started with a presentation by ATO's Rob Williams (AJV-7) about their work on UAS Conops and requirements development. They developed a Conops for UAS ATM operations several years ago. They allocated "operational requirements" derived from this to FAA and to UAS operators and then identified research requirements for the FAA portion. This is less than satisfactory because: the assumptions on which this work is based were made 3-5 years ago and many are no longer valid; none of this work was ever vetted outside the FAA; and the research requirements, as a result of this approach, address only a small portion of what is needed to achieve seamless operation of UAS in the NAS.

The second afternoon session was a presentation of the three AVS UAS "pathfinder" projects (operation over people; operation in extended visual line of sight; and operation beyond visual line of sight). Limited demonstration projects are being conducted with industry partners. Use cases will be developed to help identify risk and get to a required target level of safety. I was encouraged to see this approach of partnering with stakeholders who stand to benefit from these operations, but, as in much of FAA's approach to UAS, it is "too little too late". Mark Weber was more positive on the Pathfinder activity

than I was. For operations outside Part 107 rule making, FAA will have to develop rigorous, defensible authorization processes and he thinks the industry-FAA partnership is a good approach. He agreed that it is too small in scale and should be expanded to broach many additional Conops.

Next, a new “pathfinder” to develop means for detection UAS near an airport and taking appropriate “defensive” action (mitigation). The FAA is dealing with the former and DHS is dealing with latter. The FAA project consists of limited evaluations of one possible detection methodology. The FAA project is in its infancy, it was not clear that the project would result in airport specific detection requirements. During the discussion a concern was raised that the potential UAS threat around airports was unlikely to warrant (costly) implementation of a detection system.

The pathfinder projects are starting to collect a small amount of data to understand UAS risk, but, there is no serious FAA initiative to get sufficient data to really understand the risk of UAS operation. There is no attempt to project what future UAS operations will look like and what potential safety issues might emerge. With nearly 400,000 registered sUAV, 3700 section 333 exemptions, 4 pathfinder programs and who knows how many other UAVs operating in the airspace we saw nothing that told us what data exists to quantify safety issues that exist today. While there may be no formal data and incident reporting criteria in place today FAA needs to start somewhere even if it is only qualitative data. It would be nice to know is: 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? What is the "going forward" data set that should be put in place now to help us assess the safety of UAVs in the airspace? This may be an area where research is required.

The final session was a Q&A with FAA UAS leadership and research stakeholders. It was clear from the Q&A that the FAA UAS focus is on AVS safety issues and that there is little interest in seriously moving toward UAS operational integration into the NAS.

ASSURE poster sessions for each of the six research areas were open to the REDAC on Tuesday. Five of the projects (**airworthiness, human factors, training, detect and avoid, low altitude safety, control and communications**) are funded, each with near \$1M for the initial year. Much of the budget is going to be spent on extensive simulations and on flight tests. The sixth (**air traffic integration**) is not funded. 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. From the discussions with the ASSURE people at the poster session and the project description on the posters, I did not get the impression that most of the projects were on a clear path to develop the flexible framework for risk based UAS decision making and performance based rulemaking for which the FAA UAS office R&D people are looking. Mark agreed with my skepticism that ASSURE will be able to answer key integration questions at the level of fidelity needed by FAA. A recommendation might be to flesh out a process for engaging non-university partners such as Government laboratories, industry, FFRDC's etc. to translate ASSURE research products into data needed by FAA to validate new operating concepts.