NASA Advisory Council Aeronautics Committee Meeting
November 21-22, 2019
National Institute of Aerospace
Hampton, Virginia

Welcome

Mr. John Borghese, committee chairman, called the two-day meeting to order and welcomed everyone. He introduced new committee member Mr. Peter Bunce and then offered Mr. David Throckmorton, vice president of research for the National Institute of Aerospace, an opportunity to say a few words as the host organization.

Mr. Throckmorton provided an overview of the Institute's operation, noting they are a non-profit research and graduate education organization originally created as a partner for NASA Langley Research Center employees to pursue graduate education opportunities, as well as being a research partner to Langley and providing educational public outreach.

Ms. Irma Rodriguez, NAC Aero Committee executive secretary, provided some opening housekeeping remarks, including reminding everyone of federal ethics regulations regarding special government employees as they apply to NAC Aero meeting activities.

Mr. Borghese recognized that Mr. Bob Pearce, NASA's associate administrator for aeronautics, was in attendance and invited him to say some words of welcome, which he did. The chairman then reviewed the committee's responsibilities in terms of providing findings and recommendations and what distinguishes the two.

A briefing on current research operations at Langley and some of the goals of that work followed, presented by Center Director Mr. Clayton Turner. During the briefing, committee members asked about the potential use of the Aircraft Landing Dynamics Facility in testing new electric vertical takeoff and landing vehicles built with composite materials, as well as NASA's ability to continue to attract top talent to work at Langley and provide continuing education and professional growth to existing employees. Mr. Turner responded with positive answers to the questions but cautioned that only will continue if NASA's work stays relevant to the nation's aeronautical needs.

NASA Aeronautics Transformation Planning

Mr. Jon Montgomery, NASA Aeronautics' deputy associate administrator for policy and planning, provided an overview and update of the mission of NASA's Aeronautics Research Mission Directorate (ARMD). His focus was not on describing specific technical goals, but rather on answering the general question the committee posed during its July meeting that asked, "how do you actually accomplish what you are doing?"

Mr. Montgomery reviewed the history of how the ARMD Strategic Implementation Plan came about and what were the influences that inspired that strategy in the first place. He also described some changes in aviation that have resulted during the past few years as new trends and industry players have emerged. He said that while the global drivers the plan is based on have not changed, these new trends have prompted a somewhat small re-evaluation of the plan's six strategic thrusts. (To download a copy of the 2019 edition of the plan, please visit https://www.nasa.gov/aeroresearch/strategy.) A larger course correction in NASA Aeronautics' strategic plan is anticipated in the 2021 timeframe.

Mr. Montgomery described how ARMD's programs and projects support the six strategic thrusts, how they manage specific research in short- and long-term bites, and how they work from an organizational management perspective with NASA's four aeronautics research centers, each of which has its own aeronautics research director (ARD) to interface with ARMD at NASA Headquarters.

Dr. Eric Allison asked how funding is distributed down through the field centers and how research is managed given this operational paradigm. Mr. Montgomery explained how the answer is different depending on the center, the program or project, the scope of the work, and other variables. He stressed that success is dependent on the program managers at NASA Headquarters working as a team with the four center ARD's.

Mr. Montgomery also explained the relatively new idea to ARMD of managing large-scale efforts by designating them as missions and employing a mission manager to coordinate activities across multiple projects, programs, and centers. Dr. Allison noted this is what is known in management theory as a "three-dimensional matrix organization." The first of these is the Low Boom Flight Demonstration mission with Mr. Peter Coen as mission manager.

Mr. Borghese asked if collaboration tools are in place to support managing a mission in this way and if measures are in place to ensure everyone who is working remotely from others feel like they are part of the team. Mr. Montgomery and other NASA representatives assured the committee during the discussion that followed that such tools and measures were in place and effective.

Dr. Mike Francis asked some questions that prompted a brief sidebar discussion on autonomy and how that can be more aggressively addressed within the organizational structure, especially from the perspective of managing programs and projects across multiple centers. Mr. Montgomery noted that discussion continues, and autonomy will be a focus of the new Advanced Air Mobility project.

Dr. Francis later reiterated his strong desire for the NAC Aero committee to receive a briefing on the subject of autonomy, especially from the perspective of machine intelligence, specifically "how NASA's going to take on the leadership role connecting this important area to aeronautics."

Mr. Montgomery talked about ARMD's communications strategy and the importance of informing stakeholders and the public about NASA's accomplishments in aeronautics. Key goals are to make sure audiences understand what NASA Aeronautics is doing, that the work is valuable, and that it can be transitioned to industry to benefit the public. He noted that current key themes revolved around major research areas such as enabling commercial supersonic air travel, Urban Air Mobility (UAM) and success in demonstrating airspace management systems for Unmanned Aircraft Systems (drones), and ongoing work to support the Federal Aviation Administration (FAA) in contributing technology and systems to the Next Generation Air Transportation System.

Finally, Mr. Montgomery discussed NASA Aeronautics' strategy to engage its government, industry, and academic partners to make sure ARMD is focused on the right work, to support the transition of NASA research to its partners, and to make sure the work remains relevant.

Discussion

This topic prompted a significant discussion with the committee regarding NASA's involvement with its partners in helping to determine industry requirements and/or standards, and then passing that data along to the FAA to use in the certification of new hardware, systems, and/or procedures – especially in areas such as UAM.

During the deliberations portion of the meeting, as it relates to carrying out the strategic plan with its six thrusts, significant discussion centered around NASA's research facilities, who is using them, how are they being maintained, who is paying for what maintenance and services, what is the distribution of facility time between NASA and external entities, etc. The result is a list of topics desired for a future NAC Aero meeting, as noted later in these minutes.

System-Wide Safety Assurance

Mr. John Koelling, NASA's System-Wide Safety (SWS) project manager, and Dr. Misty Davies, SWS deputy project manager, briefed the committee on this topic. Chairman Borghese noted this would be the committee's third briefing on the subject, the most recent one having taken place more than two years ago. Since then, a study of NASA's work on SWS by the National Academy of Sciences was published. It can be accessed at https://www.nap.edu/download/24962.

The presentation focused on four technical challenges (TCs) the project has committed to working:

TC-1 Integrated Terminal Risk Area – Will require the ability to take in a large amount of data, process that in near real time so any safety issues can be identified and

addressed in time before something happens — summarized for this challenge and all others as monitor, assess, and mitigate.

TC-2 In-flight Safety Predictions for Emerging Operations – Will attempt to determine recommendations for minimum data requirements and standards of the architecture necessary to mitigate risks.

TC-3 Validation and Verification for Commercial Operations – This challenge deals with the software tools industry can use to help them meet certification requirements. NASA is attempting to determine the dollar value of these tools to industry while also being more proactive in sharing these tools and being responsive to change requests as appropriate.

TC-4 Complex Autonomous Systems Assurance – Will develop a preliminary certification process for autonomous systems that include machine learning or artificial intelligence components.

Discussion

Discussion within the presentation and during the formal period of discussion for this topic prompted comments and questions from the committee, not all of which could be immediately answered as they are part of the research being conducted.

Committee members wanted to know what does “in-time” mean? How soon, how last-minute will the algorithms be designed to assess and mitigate potential trouble? Answers will depend on what is considered acceptable risk, acknowledging that targeted levels of safety could be different based on use cases.

For example, you could say we don’t care about situations in which low-end, inexpensive drones are lost due to a technical failure because they are cheap and can easily be replaced. But when that inexpensive drone crashes into a kindergarten playground or it was carrying an expensive cargo of diamonds, then the way you value the level of risk and investment in the complexity of the autonomous safety system gets more complicated.

Mr. Pearce noted that NASA Aeronautics has a long-term commitment to this topic as evidenced by its inclusion as a strategic thrust. So, as these individual TCs are met, research will continue as it will take a long time to achieve the ultimate vison in this area.

When it comes to UAM, NASA must be able to merge both design and operations in certifying autonomous systems. Research in these areas cannot be done separately; at some point, they must be considered together. To demonstrate this, ARMD is beginning to consider a series of Safety and Resiliency Capability Level activities.

During the presentation, the subject of partnerships through the Small Business Innovation Research program was discussed. While most frequently associated with NASA's space programs, ARMD has some experience with this means for partnering with industry. The discussion prompted an outcome to include this as a topic for a future briefing with NAC Aero.

Dr. Karen Thole asked about sharing data and tools and noted differences in what NASA and industry is able to do in terms of keeping some information available only to U.S. entities, whether that be within industry or the public or internationally. Mr. Montgomery provided information about NASA's role in this and described some of the limitations imposed upon the agency either by contractual language dealing with proprietary information or by law.

Dr. Francis expressed his desire that NASA Aeronautics provide more information on autonomy directly from the researchers it considers to be leading this effort with ARMD. Mr. Scott Drennan then asked about who NASA is working with externally. Ms. Davies mentioned that DARPA and AFRL were the two largest ones.

Mr. Borghese commented that while the committee has received briefings on the topic of autonomy in the past, those briefings may have been too top level and what the committee needs is a briefing that describes with more detail what NASA is "really" doing.

Additional discussion on tools used to verify and validate autonomous systems – both for UAM in particular and SWS in general and their accessibility to external-to-NASA users – followed and resulted in the finding listed below.

Although not included in the wording of the finding, Mr. Borghese suggested the committee wants a presentation on software tools, including their use in simulations and test capabilities, as well as specifically what tools are available and how are they accessed.

Mr. Bunce asked that NASA develop a graphic for UAM that showed how many pieces of NASA (facilities, programs, projects, etc.) are working on it, what companies are working on it, how are they distributed throughout the nation – something similar to what Mr. Coen showed during his briefing on supersonics.

Finding

The Committee finds that NASA ARMD has made significant progress with the System Wide Safety project enjoying early success with regard to strategic thrust #5: In-time System-Wide Safety Assurance. More specifically, the Committee suggests that as NASA continues to build and use new software tools to develop a safe and robust system in support of Urban Air Mobility, the agency ensures it is purposefully making

those tools as widely known and available online and other venues as possible consistent with maintaining U.S. competitiveness.

Supersonic Market Developments and Low Boom Flight Demonstration Status

Mr. Coen provided an overview of the Low Boom Flight Demonstration mission, including its history, strategic rationale, organizational structure, and current status of the mission in terms of recent work on practicing community response methods in Texas and construction of the X-59 Quiet SuperSonic Technology aircraft in California.

During the presentation, questions generally covered two themes.

First, how can NASA be sure it will be able to gather community response data that is statistically valid and unbiased? Many different potential influences on the data were suggested and discussed. Mr. Coen noted that ensuring the data is valid and useful to the FAA and the International Civil Aviation Organization (ICAO) to consider rule changes is the top priority and every effort is being made to be confident in success.

Second, several committee members expressed concern that by focusing on the sonic boom noise issue, other significant concerns related to supersonic flight – emissions at altitude, landing and takeoff noise, operational affordability – are not getting the same levels of attention.

NASA representatives and other committee members answered by discussing the strategy – namely that a commercial supersonic air travel market cannot happen unless the sonic boom noise rules are changed. It is a single, binary barrier for the rest. NASA's limited resources to tackle all the issues simultaneously also was an influence.

Committee members expressed their concerns about the impact of schedule delays on the mission, noting that unexpected issues are common with a one-of-a-kind supersonic aircraft like the X-59, and the need to be sure data availability is in alignment with the Committee of Aviation Environmental Protection's every-three-year's schedule. Mr. Coen noted that such issues are anticipated, and plans are in place to mitigate those "known unknowns" as best as possible.

Discussion

During deliberations there was discussion about the X-59's external vision system (XVS) with regard to the FAA's involvement in certification (NASA is self-certifying its use on X-59) and its potential availability to industry to use in commercial operations. Mr. Borghese offered that an update to the Low Boom Flight Demonstration mission take place during the fall NAC Aero meeting and that it includes a focus on the XVS.

Finding

The Committee finds that NASA's focus on using the X-59 Quiet SuperSonic aircraft to gather public response data that will aid regulators in changing the current rule that bans supersonic flight over land is the correct one. The Committee suggests NASA seek additional expertise from other trades in developing the methodology by which objective public response to the X-59 community overflights will be gathered and analyzed.

Although the X-59's propulsion system is not part of the data gathering, the Committee also urges NASA to be ready to respond to public queries regarding environmental effects of jet engines used for supersonic flight and how NASA research may help industry mitigate those effects.

Topics for the Work Plan

1. NASA Aeronautics Facilities – The committee would like to better understand the spectrum of physical and virtual capabilities available for aeronautical research. Among the committee questions:

    a. How does industry learn about what facilities are available?
    b. What is required to gain access to these facilities?
    c. How much lead time is necessary to arrange use of the facilities?
    d. Of those programs now using the facilities, what is the distribution of internally and externally funded programs?
    e. How is research related to Urban Air Mobility using existing facilities and what other types of facilities are still needed?
    f. With these new types of vehicles planned to be operated in the thousands within the next decade, is there a need for a new effort on crashworthiness to update existing tools?

2. Small Business Innovation Research – How does NASA Aeronautics benefit from this program? What is the return on investment?
3. NASA Developed Software – How are software research tools made available for others to use, including topics of access awareness, distribution restrictions, licensing, and any other controls or issues that impede their widest possible use? How is NASA working to overcome any of these barriers?

List of Attendees

Committee Members
Dr. Eric Allison
Mr. John Borghese
Mr. Pete Bunce
Mr. Scott Drennan
Ms. Lisa Ellman (remotely)
Dr. Mike Francis (remotely)
Mr. Michael Hirschberg
Mr. Anil Nanduri (remotely)
Dr. Tom Shih
Dr. Karen Thole

NASA
Ms. Vanessa Aubuchon (remotely)
Ms. Sharilyn Brown
Ms. Melissa Carter (remotely)
Dr. John Cavolowsky
Mr. Brent Cobleigh
Mr. Peter Coen
Dr. Misty Davies
Ms. Mary DiJoseph
Mr. Jay Dryer
Ms. Mijahla (Jae) Eadon
Mr. Shawn Engelland (remotely)
Ms. Michelle Ferebee
Ms. Dana Gould (remotely)
Dr. James Kenyon
Mr. John Koelling
Mr. John Koudelka (remotely)
Mr. Paul Krasa
Mr. Clayton Meyers (remotely)
Mr. Jon Montgomery
Mr. Lee Noble (remotely)
Ms. Lori Ozoroski
Mr. Bob Pearce
Ms. Cheryl Quinn (remotely)
Mr. D. R. Reddy (remotely)
Mr. David Richwine
Ms. Irma Rodriguez
Mr. Patrick Shay (remotely)
Mr. Akbar Sultan
Mr. Clayton Turner
Mr. Steven Velotas
Dr. Ed Waggoner
Dr. Richard Wahls

Other
Ms. Asha Balakrishnan (remotely - Health Science Committee)
Mr. Brian Harvey (remotely - B&A Associated)
Ms. Cat Hofacker (remotely - AeroSpace)
Mr. Mitchell Lee (remotely - Committee on Science, Space & Technology)
Mr. James Lockner (remotely - USRA)
Mr. David Throckmorton (NIA)
Dr. Ray Young (NY VAS Test Site)

FedWriters (Meeting Support)
Mr. Jim Banke (remotely)
Ms. Abigail Casas