NASA Advisory Council Aeronautics Committee Meeting
December 15, 2021
Virtual Meeting Originated at NASA's Mary W. Jackson Headquarters Building
Washington, DC

Welcome

Mr. John Borghese, committee chair, called the meeting to order. Introductions were made and new members of the Committee were welcomed. Information regarding the purpose and scope of the Committee's discussions, findings, and recommendations were described. Once again, due to the restricted travel rules necessitated by the COVID-19 pandemic, this meeting was conducted online.

Sustainable Aviation in NASA's Aeronautics Portfolio

Mr. Robert Pearce, NASA's associate administrator for Aeronautics, began with a broad overview of the missions, programs, and projects included in NASA's Aeronautics portfolio, including those related to sustainable aviation, Advanced Air Mobility, commercial supersonic aircraft, and air traffic management. Mr. Pearce noted the appropriations to NASA Aeronautics in the President's Budget request and the actual budget enacted by Congress have increased in recent years, especially to Aeronautics programs working on sustainability in aviation.

Mr. Borghese commended NASA's productive research in these areas and affirmed the value in an increased Aeronautics budget. He asked about the effect of being in an ongoing continuing resolution (CR) before the FY 2022 budget is enacted—particularly on NASA's ability to start new programs. Mr. Pearce elaborated the current CR had yet to be detrimental to NASA Aeronautics' priority procurements, facilities, and workforce. He added that a full-year CR, should it transpire, may have an impact on certain projects and demonstrations.

Mr. Pearce continued his overview of NASA Aeronautics with organizational charts and details, introducing the directors of each Aeronautics program and specific projects such as the X-59 Quiet SuperSonic Technology aircraft, the University Leadership Initiative, and the Aerosciences Evaluation and Test Capabilities portfolio. He also showed the Committee the distribution of budget increases to Aeronautics programs under the budget request for FY 2022.

Mr. Borghese asked for details on how the increases to each program were determined and noted each program received increases as opposed to fewer high-cost or high-priority activities. Mr. Pearce explained, despite the "peanut butter spread" appearance of the increases, the bulk of the funds are distributed to components of the Sustainable Flight National Partnership (SFNP) existing within each program.

Mr. Pearce continued the overview with more in-depth coverage of the SFNP and elaborated the focus of the increases is to eventually work toward a zero emissions, zero impact future for aviation whose outcomes can extend far beyond the next generation. He added that there are further opportunities for this type of innovative future-thinking research to occur in other areas as well, such as the University Leadership Initiative.

Ms. Lisa Ellman asked Mr. Pearce about the way budget requests and the overall budgeting process affects NASA's work on automation, including for small and large Unmanned Aircraft Systems (UAS) and air mobility. Mr. Pearce responded that, although most of the increases have gone to sustainability operations, the budget adds some more "breathing room" for UAS-related projects, noting the budget can get tight in the areas of autonomy and automation.

Ms. Ellman replied with a follow-up question on NASA's awareness of electrically powered UAS as an emerging clean transportation solution, and whether NASA has an understanding of this perspective at a political level. Mr. Pearce responded that the language received from Capitol Hill offers tremendous support for NASA's activities in electrically powered aviation and SFNP. He stipulated NASA's work in electric power has been mostly in the megawatt class because it has applications at the transport scale and with regional-class type aircraft, which are both larger than what a small UAS may need. Mr. Pearce explained NASA's role also includes helping future industry be sustainable from day one and how electric aviation and systems are a large part of that mindset. NASA is focusing on questions such as what it takes broadly to move toward electrified aviation.

Mr. Pearce continued his overview of NASA Aeronautics, explaining the four main Aeronautics centers across the country and their roles. Afterwards, he explained the type of future aircraft NASA is exploring, including UAS, electric vertical takeoff and landing vehicles, ultra-efficient subsonic aircraft, and commercial supersonic aircraft, emphasizing safety as a priority at all levels.

Mr. Michael Dumais questioned whether the high-speed effort, namely supersonic aircraft, are compatible with sustainability in the long run, though he also pointed out that these areas of aviation are complementary. He asked if there may come a point in the future where high-speed aircraft are deemphasized in the budget to invest in more sustainable aviation.

Mr. Pearce affirmed the validity of the question and its associated challenges but added even though supersonic aircraft may always be less efficient than subsonic, stakeholder support remains for supersonic aircraft and sustainable aviation fuels are a possible solution to the question of sustainability at supersonic speeds. He elaborated on the challenge industry faces in scaling-up sustainable technology and fuels to meet the needs of aviation by the middle of the century.

Mr. Pearce continued to cover NASA's role in sustainable aviation, explaining how the

goal of net-zero aviation emissions by 2050, and NASA's role of pushing the efficiency of aviation operations to new levels, applies mainly at the technological, operational, and infrastructure levels. He stipulated the key point that truly sustainable zero-carbon emissions aviation can only be reached with sustainable aviation fuels—a research area where NASA has a supporting, rather than primary, role.

Mr. Pearce moved on to subsonic transports, describing subjects such as the Transonic Truss-Braced Wing design and other more efficient practices in commercial aviation that could come to be used in the 2030s. Mr. Pearce concluded his remarks with the idea that the goal of enabling sustainable aviation is twofold – not just net-zero emissions in aviation, but also U.S. leadership in sustainable aviation technologies.

Dr. James Kenyon, director of the Advanced Air Vehicles Program, described in-depth the technological and methodological details of SFNP's work in four key, transformative areas of technology being explored: high aspect ratio wings, small-core gas turbines, electrified aircraft propulsion, and high-rate composite manufacturing.

Dr. Kenyon noted the FY 2022 budget from Capitol Hill includes funds to develop combustion technology for small-core engines to burn up to 100 percent sustainable aviation fuel blends. He also explained NASA's approach of addressing each of the four key technologies individually, providing the opportunity to work with a broader range of the aviation industry in a more focused manner. Dr. Kenyon concluded his remarks with a discussion of safety and procedures related to NASA's work with electrified aviation technology.

Discussion

Dr. Helen Reed expressed the increases to the Aeronautics budget in recent years is heartening, recalling a time when it was not as substantial, comparatively. Mr. Borghese echoed the sentiment and reckoned industry, the public, and Congress see the value of the work being done by NASA Aeronautics.

Mr. Dumais added as the current administration and future administrations continue to focus on sustainability and commercial air travel as a contributor to the carbon footprint, there may be opportunities for NASA to advocate to secure even more funding for some of its related initiatives. Mr. Borghese concurred.

Ms. Ellman suggested part of NASA's budget could be devoted to quantifying the environmental benefits of electric vehicles, including small and large UAS. She noted other parts of the federal government are focused on this topic, and that she hasn't seen any of NASA's budget devoted to this specific context. Ms. Ellman also clarified some places in the federal government have the misconception that UAS integration is complete, which, she stated, is far from true.

Mr. Jay Dryer commented that in terms of moving towards sustainable aviation and the goal of zero emissions by 2050, systems analysis showing where the benefits are and

how NASA could get there would be useful—also taking it to a level in which NASA says “we’re going to be the long pole.” He stated the timeline is critical to understanding where NASA can have an impact, as well as venturing into some areas not traditionally in NASA’s lane. Mr. Dryer commended the goal of high-rate composite manufacturing as a good example of this mindset.

Regarding the electrified aviation effort, Mr. Dumais stated NASA should not underestimate the importance of safety when faced with the challenges of dealing with higher voltages and what is needed to manage them. Mr. Borghese concurred.

Mr. Dryer pointed out how creating international participation in NASA’s commercial supersonic transportation and high-speed aircraft is critical, and NASA has an opportunity to help set international standards, which in turn become an important part of US leadership in aviation from a broad perspective, including from the standpoint of NASA’s renewed focus on sustainability.

Finding

The Committee is pleased to see NASA’s Aeronautics Research Mission Directorate (ARMD) receiving a higher budget during recent years in both the President’s Budget request and in the official budget appropriated by Congress. While pleased with the increase in funding, the Committee also sees an opportunity for NASA Aeronautics to advocate for more funding to its programs and projects investigating and implementing sustainable aviation technology and practices, sensing high potential for Congress and the public to see the benefit of these activities. One such area is the use of Unmanned Air Vehicles and Advanced Air Mobility that have the potential to substantially reduce emission by replacing automobiles and delivery vans with electric powered air vehicles.

Successful Transfer of Airspace Technology Demonstration 2

Mr. Akbar Sultan, director of the Airspace Operations and Safety Program, discussed NASA’s work in airspace operations and air traffic management. He explained how, alongside partners in the FAA, NASA sees the vision of a collaborative environment for aviation by 2035 progressing towards even further goals and more diverse capabilities; as airspace operations diversify and increase in number, safety and automation become a greater challenge due to the limiting factors of a human-centric system.

Mr. Sultan discussed specific activities in furthering this research, such as a set of five demonstrations beginning in 2022 and continuing into 2023. These demonstrations, building off integrated trajectories and gate-to-gate trajectories, will be a set of capabilities for efficient takeoff scheduling. Mr. Sultan stated 2024 as when NASA would like to move towards demonstrations in a more complex, highly dense environment together with the FAA—and expanding into oceanic, global flight trajectories in 2025. Mr. Sultan stipulated the work and its vision includes not only commercial aviation, but also Advanced Air Mobility (AAM) and other ideas in the mix for the future of aviation.

Mr. Sultan gave the achievements of Airspace Technology Demonstration 2 (ATD-2) as an example of using NASA technology to improve airspace operations, and explained how work already done at just three airports (Charlotte Douglas, Dallas/Fort Worth, and Dallas Love Field) with three airlines (American, Southwest, and Envoy) on gate pushback times, nonstop taxiing to the runway, and continuous climbs in available slots already made significant improvements in reducing fuel usage and passenger delays. He made clear this technology is not just "sitting in the lab," but has been transferred to the FAA and industry. Mr. Sultan expressed the research doesn't end there, and future technology such as new flight demonstrators, electrified aviation, AAM, and high-speed vehicles will be operationalized into this kind of system.

Ms. Susan Pfingstler asked about the effect of weather conditions and environmental factors. She pointed out how systems currently used for these tasks are outdated and that time spent making decisions on weather costs emissions. She noted that start/stop conditions for operations could be looked at more closely by NASA. Mr. Sultan affirmed the importance of different configurations for air traffic management and the specific question of weather conditions are planned to be covered in demonstrations planned for 2025 and 2026 involving disruption management recovery. He noted there are even more areas to consider, such as reducing the number of repositioning flights made by airlines with no passengers or cargo aboard, and NASA intends to address these cases.

Mr. Borghese noted the program's In-Time System-Wide Safety Assurance research has seemingly evolved out of just safety in the terminal area to now using new methods of trajectory management with different types of aircraft and added focus on sustainability. Mr. Sultan added to Mr. Borghese's observation with the nuance that as NASA looks to the future of air traffic management, follow-on ideas to NASA's previous work with In-Time System-Wide Safety Assurance lead into the highly automated environments of AAM, electrified systems, and even the high-speed environment.

Discussion

Ms. Pfingstler congratulated NASA's ATD-2 team for their successes. She suggested that, with sustainability in mind and future integration of other emerging technologies, now is not the time to "let the foot off the gas" when it comes to bridging the gap between concept development and the actual implementation of the technology in real-time operations. She noted without the work done by ATD-2, it may not have been possible to capitalize on other integration investments already made in the industry. Ms. Pfingstler noted apprehension with the idea of a budget line item going down instead of up, stated her support for the continuation of the good work done by the ATD-2 team and encouraged even more work if possible. Mr. Borghese agreed with Ms. Pfingstler's points on keeping the proverbial foot on the accelerator.

Dr. John-Paul Clarke commented on the door-to-door, curb-to-curb aspects of airport terminals and airport operations and pointed out the possibility for some areas of the system to become efficient while having a bottleneck elsewhere.

Finding

The Committee commends ARMD for establishing the value of the research done by ATD-2 and for transferring the technology to the FAA. Stemming from this success, the Committee encourages NASA to keep the ball rolling with continued, subsequent successes in more air traffic management and sustainability-related activities. Committee members note there is still much work to be done in the areas of increasing capacity and requirements to meet the net zero by 2050 goal, and steps like the ATD-2 completion and transfer could be just one of many more to come.

Achievements of the University Leadership Initiative

Dr. John Cavolowsky, director of the Transformative Aeronautics Concepts Program, covered the program's research projects and activities. He described how the driver of the three projects included in the program is to address bigger-picture future challenges and needs, as well as invigorate and inspire the workforce internally.

Dr. Cavolowsky explained how this concept takes form in the University Innovation project and its University Leadership Initiative (ULI). He acknowledged how the participation of some members of the Committee in this initiative did not necessitate a deep discussion, though he still detailed the number of universities that have participated in the initiative and the dollar amount of grants they have received.

Dr. Cavolowsky mentioned the 300+ students who have participated in the initiative, and how invigoration and diversity of the workforce are critical to the future of the entire aviation industry. Dr. Cavolowsky also linked ULI to the furthering of NASA's goals in sustainable aviation and explained the intention of NASA to have ULI "cast a wide net," helping to get a variety of ideas and work with other NASA Aeronautics programs.

Discussion

Mr. Naveed Hussain commended ULI, having been involved in several of them and having interacted with participating students. He noted he and his group had learned from students in some cases and expressed hope the students benefitted from the activity, along with their university and all involved.

Finding

The Committee applauds NASA for the ULI activity and its benefits to aviation in the United States. ULI brings the best academic minds together to work on solutions to aeronautical challenges – enabling collaboration across universities and promoting aeronautics programs for students to enter. The Committee sees ULI bringing new innovative ideas for the electrification of aircraft, material development, and sustainability to industry.

(Editor's Note: more information on the University Leadership Initiative can be found at this link: https://www.nasa.gov/aeroresearch/programs/tacp/ui-uli)

Public Comments

A public comments period was offered as required. No public comments were received.

Conclusion

The meeting of the Committee was concluded with discussions on the timeline and plans for future meetings. As this meeting was Mr. Borghese's last with the Committee, Mr. Pearce thanked Mr. Borghese for his years of service to the NASA Advisory Council Aeronautics Committee and extended invitations to remain part of the extended NASA family and return to the table any time. Mr. Borghese returned the thanks to Mr. Pearce for his presence on the Committee and noted that the future of Aeronautics is bright.

MEETING ADJOURNED

List of Webex Attendees

Committee Members

1. Mr. John Borghese
2. Mr. Peter Bunce
3. Dr. John-Paul Clarke
4. Mr. Jay Dryer
5. Mr. Michael Dumais
6. Ms. Lisa Ellman
7. Dr. Naveed Hussain
8. Dr. Nicole Key
9. Mr. Natesh Manikoth
10. Ms. Susan Pfingstler
11. Dr. Helen Reed
12. Dr. Hassan Shahidi
13. Mr. David Silver

NASA

14. Akbar Sultan
15. Alicia Wesley
16. Barbara Esker
17. Robert Pearce
18. Cheryl Quinn
19. Edgar Waggoner
20. Eric Miller
21. Gelsomina Cappuccio
22. Huy Tran
23. Irma Rodriguez
24. James Kenyon
25. Janet Ross
26. John Cavolowsky
27. Jon Montgomery
28. Kate McMurtry
29. Lee Noble
30. Marcia Guignard
31. Michael Rogers
32. Nateri Madavan
33. Parimal Kopardekar
34. Ron Colantonio
35. Rich Wahls
36. Steven Clarke
37. Steve Hirshorn
38. Vanessa Aubuchon
39. William Johnson

External (affiliation identified)

40. Denis Feerick (USRA)
41. Christine Joseph (House Science Committee)
42. James Lochner (USRA)
43. Darrell Pennington (ALPA)
44. Mark Reed (ALPA)
45. Chanchan Song (Mississippi State University)

FedWriters (NAC meeting support)

46. John Gould