NASA Advisory Council Aeronautics Committee Meeting
March 20, 2019
NASA Headquarters
Washington, DC

Welcome

Mr. John Borghese, committee chairman, called the meeting to order and welcomed everyone. He asked everyone present in the room to introduce themselves with name and affiliation. Several meeting housekeeping items were reviewed by Ms. Irma Rodriguez, the committee executive secretary. Dr. Jaiwon Shin, NASA associate administrator for the Aeronautics Research Mission Directorate (ARMD), added his welcome and immediately began a discussion of the first topic.

FY2020 ARMD Strategy and Budget Overview

Dr. Shin described the ARMD budget outlook for FY 2020 and beyond. He noted the drop in the budget from $725 million appropriated by Congress in FY 2019 to $667 million requested by the President in FY 2020. He explained the drop is due to a reshuffling of money within NASA related to a move of the Aeroscience Evaluation Test Capabilities (AETC) project from ARMD to become part of a new program under the Mission Support Directorate. This is due to centralizing management and funding of facilities used by all NASA mission directorates. Dr. Shin said the net effect is that ARMD didn't lose anything and that aeronautics will continue to be a major player in using and managing these national asset facilities.

Dr. Shin explained that in 2020 there will be four major projects ending: Air Traffic Management Technology Demonstration (ATD), Unmanned Aircraft Systems (UAS) Traffic Management (UTM), Advanced Composites, and UAS in the National Airspace System (NAS). These projects represent more than $150 million of budget. Therefore, moving ahead into 2021, ARMD is taking this opportunity to rebalance its research portfolio to support both traditional and emerging aviation markets. He then described some of the program changes that will be made to enable this next transformation of what ARMD will be working on and reviewed some of the new approaches in how these projects and programs will be managed. Dr. Shin cautioned several times throughout his presentation and the ensuing discussions that ARMD must be able to quickly adapt to changes in the marketplace and be able to address technical barriers, including some barriers which may not be considered as NASA's traditional responsibility.

Dr. Shin offered some program highlights with the X-59 and electrified propulsion and offered some comments about the ARMD budget going forward several years. He noted the trend seen since 2013 of how Congress has appropriated more money than the president has requested. He attributes this strong support from Congress to the work ARMD has done with its partners and stakeholders to lay out a strategic research plan that is answering the needs of the nation's aviation community, and the ability of the

agency to clearly tell its story. Dr. Shin also thanked committee members for their contributions and advice, which also has had a positive influence on the support NASA Aeronautics has received.

Dr. Shin concluded his remarks by calling attention to the management challenge he sees in ensuring the entire ARMD workforce will continue to rapidly accept change and embrace new possibilities and opportunities as they work together to transform aviation.

Discussion

Mr. Borghese expressed his concern that AETC facilities are critical to ARMD for future research projects; so, given the size of the other directorates, will ARMD be able to retain its ability to use those facilities in the name of continued advancements in aeronautics? Dr. Shin replied the short answer is "yes," but added that coordination and communication with the other directorates will need to continue to ensure that is the case.

Dr. Mike Francis asked if there was a process in place to ensure fair adjudication of priorities for who uses these facilities and when? Dr. Shin replied by explaining how a management structure is in place within AETC to make those decisions and that ARMD has a voice in that process. Related to this, Mr. Scott Drennan asked about facility utilization and if there was a backlog of requests. Mr. Jon Montgomery replied that facility use is high and where there is less than full-time occupancy the facilities are often upgraded or undergoing maintenance.

Dr. Francis sparked a lengthy discussion about an integrated transportation system in which travel by ground and air, using different vehicle modes at various altitudes, and travel within local, urban, state or national regions is all seamlessly connected. The idea involves more than just NASA, but as NASA works on its piece of such a system it should consider how that bigger, future architecture might drive its research now. Other committee members and NASA representatives chimed in with opinions and related considerations.

Dr. Francis offered his concern that ARMD's approach to managing missions such as the Low Boom Flight Demonstrator (LBFD) and Advanced Air Mobility is fragmenting engineers/technologists across several programs which will affect their self-identity within NASA and make it difficult to take advantage of each other's expertise and remain aware of what's happening in the larger research community. He urged that a management tool be found and employed to deal with that concern. Mr. Montgomery described some of the ways that ARMD is already doing this and acknowledged it is not a full solution but a step in the right direction.

Regarding the X-59, Dr. Francis cautioned that NASA considers the budgetary requirements for software and/or hardware changes that may be required after the aircraft is built and flown. He said that is hard money to chase at the end of a program and that a contingency plan should be developed. Dr. Shin acknowledged there is no

money currently budgeted for those kinds of major modifications late in the program and that some program-level discussion of that topic would be appropriate.

Following discussion of this topic, the committee took a lunch break, during which an audible demonstration of the expected low-level sonic boom produced by the LBFD was presented.

Recommendation to NASA (Update June 2019 - During the NASA Advisory Council (NAC) Meeting – the Council decided to hold this recommendation to a later time until a formal Human Capital briefing is provided to the Council in order to understand recent developments in this topic.)

The Committee is excited about the budget and the direction of NASA Aeronautics. The Committee recognizes the need to find a mechanism for NASA to hire engineers and technologists from non-traditional disciplines that are shaping the next generations of aeronautical systems. The Committee recommends that NASA Aeronautics, working with the agency's Human Capital Management Strategy, actively engage in bringing on-board innovators to work on the difficult problems that the industry and academia are facing through a new, more flexible hiring and retention process.

Major Reasons for the Recommendation

Twenty-first-century aerospace is being rapidly shaped by the digital revolution. In aeronautical systems, new platforms ranging from those enabling urban air mobility to unmanned aircraft are garnering economic momentum, while the relationship between the pilot and airplane is being redefined for even traditional manned systems. The engineering and other technical disciplines required to address digitization are different from those that dominate the current workforce. Moreover, NASA can fulfill an important national leadership role in shaping this future by implementing research and development activities that integrate the complexities of traditional aeronautics with these advanced, emerging technologies to maximize capabilities, assure safety and help the nation gain a competitive edge in an array of these new markets.
Universities have highlighted the pull by companies for students in STEM fields, particularly in the areas of data analytics, machine learning, deep learning and autonomous systems. Graduates in these fields are in significant demand with correspondingly high salaries. These engineers expect to work on challenging, market-defining problems, while these new disciplines are themselves evolving rapidly. NASA is currently in competition with Silicon Valley to attract these individuals. To recruit and retain this talent, NASA needs flexibility beyond the standard government process for hiring and promotion. DARPA has addressed this challenge by implementing a new hiring process called 1101, adding considerable flexibility to the acquisition of its technical talent pool. NASA needs to think broadly and address this hiring and retention difficulty with their own dynamic hiring process. Perhaps establishing a new category such as Fellow, similar to what companies have done, is an example of recognizing and retaining specialized engineering talent.

Consequences of No Action on the Recommendation

The emerging global urban, inter-urban air mobility, and other emerging markets are moving fast, and the U.S. is facing global competition. In order for the U.S. to stay competitive and a leader in this industry, NASA needs to address the STEM issues that it and the country are facing.

Finding

While very optimistic regarding the 2020 proposed budget, the Committee expressed concern about the transfer of the Aeroscience Evaluation and Test Capabilities Project (AETC) from Aeronautics to the Mission Support Directorate. The main concern is ARMD's utilization of these facilities in terms of the agency priorities in the future. Given the focus by NASA to establish a presence on the Moon, the Committee has concerns over ARMD's future ability to resolve scheduling and related resource conflicts when it comes to wind tunnel facilities.

Airspace Research Vision Beyond NextGen

Mr. Akbar Sultan, NASA's director of the Airspace Operations Safety Program, provided an update on a vision for what airspace management systems research will be required after the current vision for a Next Generation Air Transportation System is fully implemented.

Mr. Sultan began by reviewing the four primary research areas NASA has worked on to enable the FAA's initial vision for NextGen implementation by 2025. The first involved precision arrivals at busy airports, which NASA developed two technologies for and turned over to the FAA. The FAA plans to rollout these capabilities in Denver during 2020. The second involved integrated arrival/surface/departure management of aircraft at airports, providing technology that allows an aircraft to push back from its gate, taxi directly to the runway for takeoff and insertion into a slot in the overhead stream. This is being tested at Charlotte and will be expanded to Dallas next year. The FAA plans to deploy this technology at 21 airports in 2021. The third area relates to weather and providing flight planners tools to adapt airliner trajectories in real time to avoid weather issues. The fourth area is UAS Traffic Management or UTM, which has been demonstrated in four Technical Capability Levels. Three of the four levels already have been demonstrated, each showcasing more sophisticated and complex UAS traffic management. The final level is to be demonstrated later this year in Reno, Nevada and Corpus Christi, Texas. Mr. Sultan concluded this review by saying, "These are the four huge impacts we've had upon NextGen."

Mr. Sultan then presented an overview of what the next airspace vision looks like. Now, instead of a concentration on managing high-altitude commercial transports, all levels of the sky will be filled with all manner of sized-vehicles, each with very specific

capabilities and mission profiles. All told, the number of daily operations could number in the millions. That's significantly more than the 50,000 to 60,000 operations currently managed in the NAS today. Mr. Sultan noted that, to grow the system to handle that volume, you can't just scale up the current system by making it a little better and faster. Instead, a complete transformation of the NAS is required.

Mr. Sultan explained that some of the keys to creating such a system are to instill flexibility, be far more collaborative, resilient to uncertainty and increase use of third-party services. In order to do this safely for all users, vehicle types, and potential missions, the current strategy is to anchor such a system around a service-oriented architecture. As an example, Mr. Sultan offered that if you're a package delivery person and you're operating at the low altitude, you will need a certain set of information services that will be completely different from an ultra-high-altitude operator, or from an urban air mobility type operator.

Mr. Sultan offered that part of the future research strategy is to be sure the research stays ahead of the need. There must be sufficient time allowed to develop, mature and demonstrate capabilities, so when the need is economically viable the validated technology will be available. In this spirit, much of the research legwork must be identified and completed if the Urban Air Mobility (UAM) Grand Challenge is to be successful and lead to systems entering the market.

Mr. Sultan and other NASA representatives engaged with the committee in a discussion and exchange of information about very specific technical details related to the UAM Grand Challenge, as well as UAM, UAS, and UTM operations, and what are some of the potential research goals and plans that will enable those operations and certify systems as safe to fly. The availability of ever more sophisticated levels of autonomy and how they will be a factor also was touched on in the conversation.

Discussion

Discussion of this topic was brief. Comments made by Dr. Karen Thole and Mr. Anil Nanduri are directly reflected in the Finding listed here.

Findings/Recommendations

The Committee suggests that NASA show a return on investment on the airspace technology demonstrations (ATD) within the Airspace Operations and Safety Program (AOSP) and what they collectively mean for the future and benefit of the nation. If the AOSP program is not successful, we may not have a competitive urban air mobility (UAM) industry. The advancements in the air traffic control system are necessary for achieving a safe and reliable national air transportation capability. The Committee encourages NASA to continue demonstrating the technologies long-term to obtain more data on the impacts of the UAM integration into the airspace.

The Committee also noted the reduction of the NASA ARMD budget starting in 2023 and suggested that the success by NASA in these new markets for autonomous vehicles and supersonic flight could justify a higher budget.

Progress on University Leadership Initiative

Dr. Koushik Datta, NASA's manager of the University Leadership Initiative (ULI) presented an update on this project. He immediately solicited advice from the committee covering three areas: increasing participation from non-aeronautics faculty; improving the effectiveness of the peer-review process used in selection; and involving industry more in the ULI, especially in the research transition.

Dr. Datta reviewed the history of the project and its desire of inviting university research teams to make a more direct contribution in helping NASA achieve its strategic research goals. The first round of selected universities resulted in awards to five teams, each receiving $1 million to $2 million a year for three to five years. A second round of selections were made and solicitations for a third round is expected soon.

Dr. Datta discussed results to date in terms of technical, organizational and entrepreneurial categories. He said NASA is receiving high-quality technical proposals that reflect high system-level thinking, partner engagement, and multidisciplinary research areas. From an organizational standpoint, the teams also are doing well and Dr. Datta noted his pleasure in seeing university teams include undergraduates. There is also good involvement of the teams with industry, both to take advantage of their resources and expertise but also to lay groundwork for transitioning the research results to industry. Dr. Datta noted one case where Boeing is involved with a team and is interested enough in the potential value of the research that the company is planning to fly the concept on its ecoDemonstrator aircraft.

Discussion

Mr. Anil Nanduri asked if there was a metric of involvement of women and diversity with the teams. Dr. Datta said he didn't have that metric, but it could be easily obtained as he is familiar with all of the team's members. Mr. Nanduri then suggested that it would be interesting to see the trend in those numbers and that goals related to that should be considered. Dr. Thole suggested that encouragement to include underrepresented groups should be part of the call for proposals. Committee members then elaborated on this theme of diversity and inclusion.

In response to a question from Dr. Francis, Dr. Shin explained why in ULI the "L" stands for leadership. In summary it's because these universities represent an "engineering powerhouse" within the United States and around the world. This gives them an opportunity to become leaders in conducting research, a role that can include partnering with underrepresented colleges, mentoring them, and providing them with an opportunity to expand their research capabilities.

Another theme of the discussion touched on the problem of attracting non-aviation-oriented universities to respond to proposals from NASA because they do not see the relevance to their work. Dr. Francis offered autonomy as an example of a technology that is going to drive the future of aviation, yet universities who excel in that area are not showing an interest in ULI. Dr. Francis suggested that ULI may be a somewhat vague name and that it needs a tagline that will attract non-aeronautics-focused schools to participate in ULI.

Dr. Datta asked the committee for ideas on how to attract these schools that are not traditionally focused or even interested in aeronautics. This led to a lengthy discussion with many suggestions regarding branding and marketing ULI, managing the peer review process that is the foundation for how proposals are selected, and addressing the challenge of recruiting needed talent who may be swayed by Silicon Valley and Wall Street. No specific consensus for proceeding with any particular idea was reached except to include the finding as noted here.

Findings/Recommendations

The Committee applauds NASA on its flexibility on trying to find the optimal mechanism on the University Leadership Initiative. The Committee emphasized the need to assure diversity when selecting proposals from the universities and to track and show statistics. DoD agencies require Historically Black Colleges and Universities (HBCU) participation in certain research solicitations to insure diversity. ARMD may want to consider an approach along these lines. The Committee also found that there is a need to drive the message that aeronautics is not only relevant, but serves as a pioneering application for 21st century technology innovation. NASA needs to be more proactive when engaging with and advertising these opportunities to the university community.

List of Attendees

Committee Members

Mr. John Borghese
Mr. J. Scott Drennan
Dr. Mike Francis
Mr. Anil Nanduri
Dr. Tom Shih
Dr. Karen Thole

NASA
Dr. John Cavolowsky
Dr. Koushik Datta
Mr. Jay Dryer
Ms. Jennifer Dure
Ms. Barbara Esker
Mr. George Finnelli
Ms. Laurie Grindle
Mr. Jon Montgomery
Mr. Robert Pearce
Ms. Cheryl Quinn
Ms. Irma Rodriguez
Mr. Justin Tilman
Dr. Jaiwon Shin
Mr. Akbar Sultan
Dr. Ed Waggoner
Ms. Alicia Wesley

Other Attendees (Affiliation Indicated if Provided)

Mr. Michael Hirschberg (Vertical Flight Society)
Ms. Lee Olson (FAA)

FedWriters (Meeting support)

Ms. Abigail Casas

Remote Participants by Webex and Telecon

NASA
Ms. Vanessa Aubuchon
Mr. Gregory Dees
Ms. Michele Dodson
Mr. Shawn Engelland
Mr. James Harrington
Mr. Susni Idris
Mr. Paul Krasa
Mr. Nateri Madavan
Mr. Michael Rogers
Ms. Angela Surgenor
Mr. Christopher Teubert

Other Remote Participants

Mr. James Banke (FedWriters)
Mr. Joe Bertapelle (JetBlue)
Mr. Jeffrey Darnell (SW Airlines)
Mr. Josh Griffith (SW Airlines)
Mr. Mark Hopkins (Delta Airlines)
Mr. James Lockner (USRA)
Ms. June Mackie
Mr. Jon Merritt
Mr. Ronald Renk (United Airlines)
Mr. Henry Smith (Las Vegas McCarran Airport)
Mr. Chuck Stewart (United Airlines)
Mr. Rocky Stone (United Airlines)