NASA Advisory Council (NAC) Aeronautics Committee

July 25, 2017
National Institute of Aeronautics, Hampton, Virginia

Summary of Meeting

Participants

First	Last	Organization	Role
Marion	Blakey	Rolls Royce, N.A. – NAC Member	Chair
Les	Lyles	Air Force, Retired	NAC Chair
John-Paul	Clarke	Georgia Tech – NAC Member	Member
Michael	Francis*	ITRC – NAC Member	Member
Karen	Thole	Penn State – NAC Member	Member
David	Vos	Tobogo, LLC – NAC Member	Member
Irma	Rodriguez	NASA ARMD	Exec. Secretary
Robert	Pearce	NASA ARMD	DAA/Strategy
John	Cavolowsky	NASA ARMD	Director, AOSP
Richard	Barhydt	NASA ARMD	AOSP
Ed	Waggoner	NASA ARMD	Director, IASP
Akbar	Sultan	NASA ARMD	Director, TACP
Brian	Baxley	NASA Langley	Public
Sherilyn	Brown	NASA Langley	Public
Dana	Gould	NASA Langley	Public
John	Gaine	NASA HQ	Public
John	Martin	NASA HQ	Public
Megan	Quigley	NASA Langley	Langley Admin.
Diane	Rausch	NASA HQ	Public
Rich	Wahls	NASA Langley	Public
Angela	Tvarozek	FedWriters	Minutes Recorder

*Attended remotely.

Welcome and Announcements

The meeting was called to order at 10:47 a.m.

This was Gen. Lyles' first Aero Committee meeting in person as NAC Chair. Mr. Bob Pearce thanked the NASA Langley team for hosting tours of the center, which celebrated its 100th anniversary this year. He also thanked the National Institute of Aeronautics for hosting the meeting, as well as Ms. Marion Blakely for her eight years of service as NAC Aero Committee Chair. Current Vice Chair John Borghese will be the new Chair.

ARMD FY18 Budget

Mr. Pearce discussed the NASA ARMD President's budget, noting it will be a challenge to achieve long term goals initially established under the significantly higher FY17 budget proposal, but otherwise the program is in relatively good shape, with $660 million approved by Congress for FY18. The transport sector remains a key focus of the budget as international competition in that area remains strong. Mr. Pearce described efforts to expand research in new areas under this budget, including the emerging urban air mobility market, UAS operations and autonomy and electric propulsion.

Mr. Pearce highlighted several accomplishments from FY16 and FY17. Topics included progress made on the Low Boom Flight Demonstrator (LBFD), first-ever ground wind tunnel tests of Boundary Layer Ingestion into an engine inlet, continued success in the Advanced Composites Project, and successful operation of a rotor test rig for multi-speed drives. Expansion of the envelope in which NASA and its partners are testing UAS Traffic Management Technology also was noted. (For more information about these topics and other examples of NASA ARMD's technical excellence, visit https://www.nasa.gov/aeroresearch/tech-excellence.)

For the FY18 budget request from the President, Mr. Pearce stated that NASA will be able to continue to fund a series of X-planes, although at a reduced tempo compared to the previous budget submission. Asked about NASA's focus on work related to autonomy, Mr. Pearce said it is possible that area may see increased funding through FY18 and FY19 as various programs consider how to leverage advances in autonomy.

The committee expressed concern and asked questions about how the current budget priorities would ensure NASA remain a world leader in research and technical innovation, especially in the area of UTM. Dr. David Vos stated that UTM work is NASA's most transformative project and wondered if 2021 is just the first time the agency is touching this, would it be late? He added that configuring new airplane designs is interesting and fun, but it's not moving the ball and maintaining NASA's status as a leader in research. Mr. Pearce replied by laying out NASA's roadmap, saying that NASA has the resources through 2018 and we are putting it toward the future described. He added that in 2018-2019, UTM research would test in higher altitudes under more complex scenarios, and then in 2020, NASA would complete its first urban-air mobility campaign. The research will help with the progress of the technical challenges.

The committee remained uncertain about the budget priorities in relation to the United States' standing as a leader in aviation research. Mr. Pearce noted that supporting this emerging market is key to keeping the United States at the forefront. NASA's roadmap for addressing this and other areas is well understood, but also is flexible in adapting to changes based on continuing input from its government and industry partners.

Mr. Pearce previewed key research areas for FY18 that include mitigating aircraft loss of control, moving forward with the Low Boom Flight Demonstrator (LBFD), and flying the X-57 distributed electric propulsion aircraft. Based on questions from the committee, Mr. Pearce

discussed how partnerships with various entities are involved with programs like the LBFD and the X-57, and how those partnerships may evolve in the future as research continues.

Mr. Pearce talked about NASA's acoustical research with regard to UAS community noise, noted that the University Leadership Initiative had made its first five award this past year, and concluded his presentation discussing NASA Aeronautics collaboration with DoD on hypersonic research.

Following discussion, the Committee approved the following finding related to this topic:

> *The Committee believes that aeronautics is and will continue to be a dominant factor for the U.S. economy, critical for our national defense and our transportation infrastructure. The Committee finds that NASA provided an excellent overview of the Aeronautics portfolio and is appropriately supporting the spectrum of what is needed by both the traditional and emerging aviation communities. NASA is making excellent progress on its Low Boom Flight Demonstrator X-plane and the committee endorses NASA's work in the New Aviation Horizons X-planes initiative and sees concrete benefits to the U.S. industry. The Committee continues to urge NASA to be aggressive in addressing the airspace integration, autonomy and other key needs for emerging aviation users.*

New Aviation Horizons Planning and Management Status

Dr. Ed Waggoner, Director of the Integrated Aviation Systems Program (IASP), explained the New Aviation Horizons planning process and recent activities, including funding industry studies for five possible subsonic X-plane designs. He explained that NASA is evaluating the study results and considering a second round of research solicitations.

Work on the Low Boom Flight Demonstrator (LBFD) project continues, with bids for the request for proposal (RFP) to build the LBFD X-plane to be submitted in October. NASA expects the first LBFD X-plane flight test to take place in 2021, followed by an acoustic evaluation and community response testing from 2023 through 2025. The committee shared concerns about public tolerance for perceived noise levels, considering that based on data and field trials any sound level higher than 75db is unacceptable. Noise could become proxy to how the public will really feel about supersonic flight. The committee emphasized that pushing supersonic flight and testing must be from the angle of technological advancements and giving the United States a global advantage. Dr. Vos noted that it's important to make the argument that the value is greater than the concern. In discussing supersonic technology research, the committee noted its importance to U.S. leadership around the world. Dr. Karen Thole suggested that the first application of the low boom technology could be military.

Dr. Waggoner noted the importance of market forces in driving NASA's research goals in terms of selecting X-plane designs to develop. Changes in regulations also will be required to enable commercial supersonic flight, which Congress is enthusiastic about. The virtual Systems Project Office (vSPO) has been stood up to oversee the LBFD project. The goal of NASA research is to generate test data using accepted testing methodologies that will provide

accurate data about the level of annoyance of a sonic boom to a representative non-biased, diverse population.

The committee asked about the market viability for an actualized LBFD aircraft and if there will be a positive return on investment. Dr. Waggoner noted NASA will have more specific data on those questions toward the end of FY18. The committee inquired about the use of current technology in building an LBFD, noting the tradeoffs between a clean sheet design and one that employs many Off the Shelf (OTS) systems. Mr. Pearce explained that several off the shelf components are proposed to be used in the LBFD, since the aircraft shape is what needs to change to generate the quieter noise profile.

Following discussion, the Committee approved the following finding related to this topic:

> *The Committee strongly supports the Aeronautics budget for X-planes and recognizes that NASA has worked very hard for the current budget levels. The Committee recognizes that NASA should consider exploring opportunities to integrate autonomous operations into the New Aviation Horizons initiative. The Committee also finds that NASA should be careful not to sacrifice other investments in emerging market areas (UAS, Urban Air Mobility, etc.) in the event of X-plane cost escalation.*

University Leadership Initiative

Mr. Richard Barhydt, Deputy Director, Transformative Aeronautics Concepts Program (TACP), gave a presentation about NASA's new university partnership program, named the University Leadership Initiative. Under this program, universities are to assemble and lead teams in conducting research that will address one of NASA Aeronautics strategic research thrusts. The initiative aims to promote Science, Technology, Engineering and Mathematics education among the next generation of undergraduate, and graduate students. Dr. David Vos of the committee noted that ULI is a pragmatic way to provide opportunities at the undergraduate level to enable and inspire students of all backgrounds and identities. Five teams were selected for first round awards this year. Based on the projects that won this solicitation period, the total was exactly 2 million dollars every year per awardee for up to five years.

The committee asked if the objective of ULI was to inspire more people to get into science and technology. Mr. Barhydt agreed, and added that it was a main point in the solicitation. The schools are working on important efforts that encourage students to be interested. Some schools are developing teaching modules and reaching out to be even more productive.

Dr. Vos provided an anecdote about adding to the diversity of STEM. He judged an engineering competition and 80 percent of the winners were high school girls. When Dr. Vos asked the committee to guess how many of those girls said they planned to go into STEM careers, the committee replied between 10 and 15 percent. Dr. Vos said that, in fact, none of them wanted to, and the girls said that going into a STEM career would be arduous and not as lucrative as other fields. Dr. Vos noted that this initiative would do well to add diversity to the brightest engineers as these universities are working on relevant and exciting projects. Dr.

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Mr. Barhydt outlined the outreach process and assignment structure. The ULI team has worked with the academic community to provide greater awareness and guidance in proposal construction, and feedback on how to improve the initiative. ULI hopes to improve communications with minority schools to notify universities of this opportunity. Mr. Barhydt then opened the floor to the committee to provide other ideas to get in touch with STEM educators. Some of the options included: visiting high schools, contacting other government agencies, science and engineering conferences for students and educators and venturing out to contact students and educators in nontraditional disciplines.

The committee suggested that NASA should determine the success of ULI at each school based on how well the partners work together, noting that while transitioning technology is important, this may not be the strength of a university. The committee also added that communicating a minimum and maximum size of awards might be beneficial, so schools can decide whether it benefits them to solicit a smaller award. Additionally, the committee suggested using a phased approach to manage the financial aspect over a period of time, and asked to reevaluate the ULI program after its first year is complete.

Following discussion, the Committee approved the following finding related to this topic:

> *The Committee commends NASA for the effort to successfully launch the University Leadership Initiative (ULI). The Committee was very impressed with the objective and approach to the initiative, including the competitive award process used by NASA. There was expressed concern about the ability of the U.S. educational system to motivate students to pursue STEM careers. The Committee believes that ULI is a great example of an initiative that can address this issue with a diverse group of students and institutions. NASA has a great reputation worldwide and ULI should be amplified so that more students can take advantage of the opportunities offered.*

Airspace Technology Demo Overview

Mr. Akbar Sultan, Deputy Director, Airspace Operations and Systems Program, presented NASA's progress in the Airspace Technology Demonstration program and the expected outcomes of each phase.

Mr. Sultan began with an update on ATD-1, including a new, NASA-derived flight interval management system that improves the efficiency of flights arriving at a major airport. ATD-1 was demonstrated during two weeks of flight tests in February 2017 and provided insight about the use of technology and generated lessons learned about application in a flight environment as well as necessary software and operational improvements for the future. The committee discussed the impact on the ATD-1 system of aircraft not equipped with ADS-B, and deliberated whether there were real benefits to spacing, fuel efficiency and burn once an aircraft is equipped. Overall, the committee suggested that time segregation would be more

efficient for spacing and Mr. Sultan said his will team will consider adding that to one of the ATD projects.

Mr. Sultan continued with presentations on ATD-2 and ATD-3. ATD-2 introduces an integrated arrival and departure system that ties together air traffic management facilities so they share information and can more efficiently manage traffic from the gate to the overhead stream and back down again. ATD-3's focus is on improving the ability for aircraft and air traffic managers to react in real time to changing conditions en route and minimize delays.

The committee asked if success for ATD-2 depends on success for ATD-1. Mr. Sultan noted the two are independent until the conclusion of ATD-3, which will tie all of the concepts into one technology demonstration. The committee noted the apparent lack of pressure from Congress to produce ATD technology, considering the potential for real value. Mr. Sultan agreed, but noted other companies and the airline industry have been fascinated by ATD and want to participate. The committee asked if there was a way to accelerate the combination of the three ATDs. Ms. Blakey noted greater expectations are not reasonable because the timeline is already set

Mr. Sultan noted the ATD work has helped solidify a tight, productive relationship with the FAA and its industry partners. He also presented information about NASA's work on Technologies for Airplane State Awareness (TASA), which is part of the overall ATD program. TASA is a system for improving the overall safety of flight deck management training models, data, and tools. Some of the tools TASA looks to add include synthetic visual enhancements, visual cues, and address the challenge of spatial disorientation. NASA is responsible for delivering six of the Commercial Aviation Safety Team (CAST) outcomes, which include safety enhancements resulting from accidents because of loss-of-control incidents. Accidents, like the loss-of-control accident to an Air France aircraft, occur mainly because simulators do not appropriately simulate a stall. Reverse command input can't be used by a simulator. So most pilots have not ever experienced loss-of-control because many simulators don't capture it. For instance, a fall can appear to be a climb, which is what happened in the Air France incident. The committee was surprised to hear that there have not been previous measures to prevent these types of accidents. Mr. Pearce noted that usually the idea during flight training is to focus on prevention to avoid a stall situation. Mr. Sultan concluded his presentation, adding that TASA is a big portion of the ATD project.

Following discussion, the Committee approved the following finding related to this topic:

> *The Committee finds that NASA should further highlight to the public the contributions it is making to NextGen. The Airspace Transportation Demonstrations (ATD's) are providing tangible benefits to the airlines and flying public that are not widely recognized, but critical to fulfilling the NextGen vision. The Committee encourages NASA to push toward demonstrating higher levels of automation and autonomy to increase the benefits further.*

MEEETING ADJOURNED at 5:27 p.m.