NASA Advisory Council Aeronautics Committee Meeting
July 9, 2020
Virtual Meeting Originated at NASA's Mary W. Jackson HQ
Washington, D.C.

Welcome

Mr. John Borghese, committee chairman, called the meeting to order and offered some words of welcome. Ms. Irma Rodriguez provided the standard advisory committee guidance. Then Mr. Robert Pearce, NASA's associate administrator for aeronautics, provided some insight into what's been happening since the last meeting in March.

Mr. Pearce provided an update on NASA's current stance on COVID-19 in terms of workforce safety and operations. He also summarized the status of the fiscal year 2021 budget making its way through Congress, and then offered brief summaries of program and project status in areas such as an electric power flight demonstration, the X-59 Quiet SuperSonic Technology aircraft assembly, and the X-57 Maxwell electrified power research airplane.

Special Topic: COVID-19 Impacts and Industry Response

Committee members shared the impact of COVID-19 on each of their segments of the aviation community, while also acknowledging the condition of the industry was constantly changing and these reports amounted to a snapshot of the situation on that day. Here are some of the highlights of those reports:

Compared to last year, flight schedules domestically were down 56 percent, while internationally were down 86 percent. In terms of number of passengers flown, domestically they were down 71 percent and internationally they were down 93 percent. Bookings were down 76 percent and revenue was down 88 percent.

The airlines were burning through $6 billion a month during the second quarter, and through additional efforts to lower expenses reduce the monthly rate to $5 billion in the third quarter and $4 billion in the fourth quarter.

Mr. Andrew Cebula reminded the committee it took the airline industry three years to recover following 9/11. He suggested the recovery in this case could take longer, especially with international travel. Domestically it may take the return of more routine travel for business meetings and conferences.

Sales and deliveries of General Aviation aircraft has slowed, with $1.4 billion worth of aircraft waiting to be delivered internationally. Travel restrictions needed to close sales and bring pilots to the U.S. to fly their new aircraft overseas are a major problem.

Mr. Peter Bunce said General Aviation probably wasn't hurting as bad as the airlines in terms of traffic, which should make recovery a little easier. Private flight training and activity at Fixed Base Operators is gradually seeing improvements in numbers. He also noted, in response to a question from Mr. Pearce about research investments by industry as a result of the effects of COVID-19, there are positive signs industry continues to be interested and willing to invest in technologies NASA is closely involved with, including areas such as supersonic flight and Advanced Air Mobility (AAM).

Mr. Eric Fanning noted how fast both the International Civil Aviation Organization and the Federal Aviation Administration moved to determine steps that could be taken by the manufacturers, the airlines and the airports to put in place processes, protocols and equipment to reduce the health risk of flying.

In terms of vertical flight – helicopters (both civilian and military) and drones of all sizes – the COVID-19 impact has been felt but not in the same way or to the same degree as the other segments of the aviation community. For example, Mr. Michael Hirschberg noted the continued need for essential police and medical services. Also, Ms. Lisa Ellman noted the same situation is playing out in terms of drones. Demand for services has gone up for some use cases and overall interest in drones and their future operations remains robust.

<u>Discussion</u>

In elaborating on the immediate needs of the Unmanned Aircraft Systems (UAS) community when pandemic issues subside, Ms. Ellman talked about the need for more help with risk analysis for low altitude flights, especially in denser urban environments when radar data may not be available and there is concern about tracking non-cooperative air traffic. NASA representatives acknowledged the need and described some of the approaches being taken to address that concern.

Mr. Mike Hirschberg requested more information and discussion about the status and availability of NASA facilities that could help support the UAS ecosystem. Mr. Pearce suggested that a briefing from NASA's Mission Support Directorate could help the committee better understand the agency's research facilities in terms of their capabilities and challenges in maintaining.

Committee members raised awareness about the pandemic's effect on the current aerospace workforce, as well as the future aerospace workforce in the form of today's college students – especially those pursuing engineering disciplines. Mr. Pearce acknowledged those concerns and emphasized NASA's vision for the aviation community of the future provides inspiration and opportunities for tomorrow's workforce.

Discussion that took place regarding passenger safety in the cabin and other concerns related to the current pandemic and future health scares is summarized in this overall committee finding.

Finding

The COVID-19 pandemic has devastated the aviation community in every measurable way. Lack of demand due to concern about virus transmission within an aircraft cabin and many other factors, and an erosion in trust due to conflicting sources of information all hinder recovery. History shows this will not be the last such health crisis. The Committee recognizes NASA's public stature as a trusted government entity and suggests the agency consider what types of technology research and development can be done to minimize the effects of COVID-19 as well as a future health crises on the aviation industry.

Future Flight Demos

Dr. Ed Waggoner, Dr. Jimmy Kenyon, and Mr. Lee Noble briefed the committee on NASA's research plans related to technology that might someday be incorporated and flown on a full-scale subsonic technology demonstrator aircraft. Dr. Waggoner noted that the market data, plans and potential timelines did not reflect any possible effects from the COVID-19 pandemic.

Dr. Waggoner presented the case for the need of a new single-aisle subsonic airliner in the future, both in terms of maintaining U.S. technological leadership and a healthy economy, as well as ensuring the aerospace industry's positive contribution to the balance of trade. He noted the importance that the U.S. industry consistently come to the market first with the most innovative technologies and efficient production systems. Continuing to introduce ever-more-efficient technologies in terms of their physical and sociological impact on the environment also is a major driver.

Dr. Waggoner briefly reviewed previous research that helped set the stage for the current efforts in this area. He noted the important contributions of the Environmentally Responsible Aviation project, which concluded in 2015 and resulted in eight successful integrated technology demonstrations. Another example was the Advanced Composites Project, which recently concluded. These "game changers" are the baseline for moving forward.

Dr. Kenyon briefed the committee on plans for the Advanced Air Transport Technology project and described four major research initiatives underway that will serve as the technical foundation for what might be brought together in the future as a subsonic X-plane. These technologies include electrified aircraft propulsion, small core gas turbine engine, transonic truss-braced wing, and high rate composites. (For a general summary of these initiatives, go to https://www.nasa.gov/aero/nextgen-aircraft-design-is-key-to-aviation-sustainability.)

Mr. Noble expanded on the idea of electrified aircraft propulsion by describing the immediate research steps being taken in the form of the Electrified Powertrain Flight

Demonstrator project. The idea here is to transition the theoretical into an actual system that is transformational in terms of using electric propulsion on larger aircraft. This means demonstrating the safe operation of megawatt-class electric propulsion and the full integration of that system within a single-aisle subsonic transport. Depending on the size of the aircraft and its power needs, such a system may be fully electric or employ a hybrid electric scheme. The ultimate goal of this project is to integrate a system into an existing aircraft and demonstrate its capabilities in flight. This would precede its integration into a purpose-built X-plane demonstrator.

Discussion

Committee members asked the NASA representatives several detailed questions regarding each of the four technical areas, and in doing so generated conversation that resulted in the following recommendation.

Recommendation

The Committee requests that NASA better define and more tightly articulate its research goals and key performance indicators with respect to technologies that could be flown on a future subsonic single-aisle transport technology demonstrator, or X-plane. These technologies include high rate composite manufacturing, small core gas turbine, electrified propulsion, and a high-aspect ratio transonic truss-braced wing. Stated goals for improved efficiencies in areas such as fuel burn, emissions and noise should use as a baseline the Boeing 737 MAX and Airbus A320neo.

Urban Air Mobility Plans

Mr. Davis Hackenberg provided the committee with an update on NASA's research plans for what is now called Advanced Air Mobility (AAM), noting it has been two years since the committee was briefed on the subject. He also reviewed current thinking behind the plans for the National Campaign, which previously was known as the Grand Challenge.

An important change since the last briefing was in the adoption of Advanced Air Mobility as the overall descriptor of the mission, replacing Urban Air Mobility. This was the result of expanded thinking and awareness that drones would be flying in areas urban, rural, and in between.

The high-level goal of AAM is now safe, sustainable, affordable, and accessible aviation for transformational local and intraregional missions. In this statement, local missions are less than 75 nautical miles and intraregional are no farther than about 300 nautical miles. Enabled by electrification and automation, AAM does not include supersonic or faster transports, nor existing hub-and-spoke air service with larger transport aircraft.

Important components include vehicle development and operations, airspace design and operations inspired by results from the UAS Traffic Management (UTM) project, and a robust community integration strategy that catalyzes public acceptance and adoption of appropriate new local regulations and infrastructure.

Mr. Hackenberg laid out the definitions of various system maturity levels by which AAM employs increasing more complex technology and operations, all of which will factor into the execution of a series of industry events NASA will manage called the National Campaign.

The purpose of the National Campaign is to assure AAM safety and accelerate scalability through the integrated demonstration of candidate operational concepts and scenarios. More specifically, the objectives include accelerate certification and approvals; develop flight procedure guidelines; evaluate the communications, navigation, and surveillance trade-space; demonstrate an airspace operations management architecture; and characterize community concerns.

Mr. Hackenberg wrapped up his presentation with a description of the industry and government partners NASA is working with on AAM, and a survey of existing AAM-related research facilities and tools available to the agency and industry.

<u>Discussion</u>

Mr. Borghese asked if the various UAM Maturity Levels included an air traffic control system component. Mr. Hackenberg said there was and explained how as the number and complexity of the types of flights described increases, the associated demand on an air traffic management technical capability also increases. Lessons learned and operational capabilities demonstrated by the UTM project will provide key contributions.

Mr. Cebula asked if NASA envisioned there being an evolving certification process as the maturity levels in research and operations expanded, and Mr. Hackenberg responded he expected that would be the case. While certification is a role for the FAA, the build up to and execution of the National Campaign by NASA working with industry will help provide data, both technical and operational, that can help.

Mr. Anil Nanduri prompted a short discussion among committee members about the feasibility of taking advantage of reduced air traffic as a result of the economic effects of COVID-19 to perform or accelerate additional testing at a time when, at least statistically, there would be less overall risk to the public in certain scenarios. A component of this discussion turned on whether any vehicles were close enough to being ready for certification such that this kind of accelerated testing would be helpful. The need for additional low altitude safety analysis also was raised.

UAS in the NAS and UTM Projects Close Out

Mr. Lee Noble and Mr. Akbar Sultan briefed the committee on the UAS in the National Airspace System (NAS) and UTM projects, respectively. Both projects are closing out this year after a five-year run.

UAS in the NAS

Mr. Noble began with the UAS in the NAS summary and describing the overall goal of providing research findings to reduce technical barriers associated with integrating UAS into the NAS utilizing integrated system level tests in relevant environments. These environments include altitudes higher than Class G airspace and involve operational considerations related to instrument and visual flight rules (IFR and VFR), as well as cooperative and non-cooperative aircraft.

Developments in two key technical areas provided the foundation for the project's success, which included defining Minimal Operational Performance Standards. These technologies were Detect and Avoid, and Command and Control. Demonstrated advances in these areas led to defining operational concepts and technologies in support of standards related to communication, navigation, and surveillance capabilities consistent with IFR flight.

These technical challenges were and are being demonstrated in two phases, each featuring their own capstone events. Phase 1 involved large UAS and resulted in a remotely piloted aircraft being allowed to fly within the NAS without an accompanying safety chase aircraft, which is normally required. Phase 2 involved mid-size UAS with its capstone event being a series of Systems Integration and Operationalization flights performed by three industry partners under NASA contracts. (At the time of the meeting one of three had been flown, with the remaining scheduled before the end of 2020.)

Unmanned Aircraft Systems Traffic Management (UTM)

Mr. Sultan summarized the research and results of the past five years regarding UTM by describing its origins, key technical challenges, operational demonstrations, and ways in which this work is already informing plans for expanding the concept and technology into other areas of air traffic management.

Mr. Sultan defined UTM as an air traffic management ecosystem for small UAS in low-altitude airspace, generally thought of as being below 400 feet above ground. The intention of the system was to supply services under the FAA's regulatory authority in places where those services do not exist.

Through UTM, NASA and its industry partners worked with the FAA to define roles and responsibilities, all technical parameters related to data exchange, and recommended performance requirements. These goals ultimately were showcased in a series of increasingly more complex demonstrations of technical capabilities that began with a few drones flying within line of sight in a rural area, and ended with many drones flying beyond line of sight close together over a dense urban area – in this case both Reno, Nevada and Corpus Christi, Texas.

Discussion

Several committee members asked about the communication links that enable UTM to operate in terms of quality of service, security, and the implications of more widespread deployment and use of 5G networks as more and more UAS enter the market and UTM becomes operational. Mr. Sultan acknowledged all of these areas are important considerations as work on UTM and its contributions to other NASA projects is expanded.

Committee members also asked if NASA had the appropriate facilities and modeling tools to examine small vertical lift aircraft from a crashworthiness standpoint. The more general topic of NASA aeronautics research facilities and tools, and their availability to industry, was discussed. NASA representatives responded that an in-depth briefing could take place at a future meeting.

Finding

The Committee congratulates NASA's aeronautics innovators associated with the Unmanned Aircraft Systems Traffic Management project as it wraps up its impressive research, writes its final reports and closes out a pioneering prologue in the history of advanced air mobility. The new technology, procedures and industry relationships NASA has forged during the project will have a lasting and positive impact on the flying public for many years to come.

Public Comments

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

List of Webex Attendees

Committee Members

Mr. Andrew Cebula
Mr. Anil Nanduri
Mr. Darin DiTommaso
Dr. Eric Allison
Mr. Eric Fanning
Mr. John Borghese
Dr. Karen Thole
Ms. Lisa Ellman
Mr. Michael Hirschberg
Mr. Peter Bunce
Dr. Tom Shih

NASA

Alicia Wesley
Abigail Casas
Akbar Sultan
Andrew Carnell
Anthony Washburn
Barbara Esker
Carl Russell
Cheryl Quinn
Daniel Williams
David Thipphavong
Davis Hackenberg
Edgar Waggoner
Eric Cooper
Gary Kellogg
Heather Arneson
Irma Rodriguez
Jaewood Jung
James Kenyon
Jim Banke
Jennifer Kibler
John Cavolowsky
John Koudelka
Jon Montgomery
Joshua Moody
Ken Goodrich
Kyle Yunaska
Lee Noble
Lexie Brown
Marc Birckbichler
Maria Consiglio
Mary Stringer
Michael Guminsky
Michael Rogers
Naseem Saiyed
Nateri Madavan
Parimal Kopardekar
Patricia D. Rausch
Paul Krasa
Paul Nelson
Richard Wahls
Robert Pearce
Ronald Johnson
S Melissa Rivers
Shawn Engelland
Sridhar Reddy
Starr Ginn
Steven Clarke
Steven Velotas
Susan Gorton
William Johnson

External (Affiliation identified if provided)

Adam Grasch (Aurora Flight Siences)
Pat Hofacker (Aerospace America)
Daniel Morgan (Congressional Research Service)
David Hyde (AIA)
Ferne Friedman-Berg (FAA))
James Lochner (USRA)
John Tylko (Aurora Flight Sciences)
Lee Olson (FAA)
Matthew Parstensen (Aurora Flight Siences)
Max Fenkell (AIA)
Oliver Pape (German Aerospace Center)
Richard Fisher
Tom Rubino (FAA)
Steve Moran (Spire Global)