STATEMENT OF SHELLEY J. YAK, DIRECTOR, WILLIAM J. HUGHES TECHNICAL CENTER, BEFORE THE U.S. HOUSE OF REPRESENTATIVES COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE, SUBCOMMITTEE ON AVIATION, BUILDING A 21ST CENTURY INFRASTRUCTURE FOR AMERICA: ENABLING INNOVATION IN THE NATIONAL AIRSPACE, APRIL 4, 2017.

Chairman LoBiondo, Ranking Member Larsen, Members of the Subcommittee:

Thank you for the opportunity to speak with you today about the role of the William J. Hughes Technical Center in facilitating new entrants, new users, and new technologies in the National Airspace System (NAS). My name is Shelley Yak; I am the Director of the William J. Hughes Technical Center. I also serve as the FAA's Director of Research. In that capacity, I am responsible for managing the FAA's aviation research program.

Aviation is a vital resource for the United States because of its strategic, economic, and social importance. In order to maintain our position as a global leader in aviation, the FAA must respond quickly to changing and expanding transportation needs. The Technical Center supports the integration of new users into the NAS and the delivery of improvements to current NAS users through the introduction of new technologies and procedures, policies, and practices that accomplish this goal while promoting safety and sustainability. Today, I would like to highlight for you some examples of our work.

William J. Hughes Technical Center

The Technical Center has served as the core facility for sustaining and modernizing the air traffic management system, and for advancing programs to enhance aviation safety, efficiency, and capacity since 1958. It is the nation's premier air transportation system federal laboratory. The Technical Center's highly technical and diverse workforce carry out activities that support the full system/service development lifecycle – from conducting the research and

development, testing and evaluation, verification and validation, to operational sustainment and decommissioning. The Technical Center's staff develops scientific solutions to current and future air transportation safety, efficiency, and capacity challenges. Our engineers, scientists, mathematicians, and technical experts utilize a robust, one-of-a-kind, world-class laboratory environment to identify integrated system solutions for the modernization and sustainment of the NAS. Automatic Dependent Surveillance Broadcast (ADS-B), En Route Automation Modernization (ERAM) and Data Communications (Data Comm) were all developed, tested and began their nationwide deployment at the Technical Center through its engineering, testing, evaluation, and deployment platforms.

The Technical Center replicates the entire NAS, with the capability to support not only NextGen, but all aviation systems through their complete life cycle. The Technical Center's areas of focus include air traffic management, communications, navigation, surveillance, aeronautical information, weather, human factors, airports and aircraft safety. More recently, the Technical Center has been instrumental in the FAA's efforts to facilitate new entrants and users to the NAS; particularly, unmanned aircraft systems (UAS or drones) and commercial space operations.

The Technical Center has a number of unique laboratories engaged in research that contributes to aviation system development: air traffic management laboratories, simulation facilities, a human factors laboratory, the NextGen Integration and Evaluation Capability, a Cockpit Simulation Facility, a fleet of specially-instrumented in-flight test aircraft, the world's largest full-scale aviation fire test facility, a chemistry laboratory for analyzing the toxicity of materials involved in a fire, surveillance test laboratories, a full-scale aircraft structural test

evaluation and research facility, the National Airport Pavement Test Facility, and a UAS research and development simulation laboratory.

Much of the work performed at the Technical Center is in partnership with private industry, academic institutions, other agencies such as the National Aeronautics and Space Administration (NASA) and the Department of Defense, and international organizations. The Department of Homeland Security (DHS) and military entities also use facilities on the Technical Center campus. It is the home of the Federal Air Marshals Service training program and the DHS Transportation Security Laboratory, which includes specialized explosive storage and handling areas and a multi-laboratory infrastructure designed for applied research, and test evaluation. The U.S. Coast Guard Group Air Station Atlantic City, the U.S. Marshals Service, and the New Jersey Air National Guard 177th Fighter Wing are also based at the Technical Center. The Atlantic City International Airport is also on the Center's 5,000-acre campus. These other entities help to create a synergistic aviation-centered site that is without rival anywhere in the world.

Leveraging Partnerships

The Technical Center leverages the nation's significant investment in basic and applied research and helps to cultivate the next generation of aerospace engineers, managers, and operators through the Center of Excellence (COE) program. Authorized in 1990, COEs promote collaboration between government, academia and industry to advance aviation technologies and expand FAA's research investment through required non-federal matching contributions.

The FAA established 12 COEs in critical topic areas focusing on: unmanned aircraft systems, alternative jet fuels and environment, general aviation safety, commercial space transportation, airliner cabin environment, aircraft noise and aviation emissions mitigation,

advanced materials, general aviation research, airworthiness assurance, operations research, airport pavement and technology, and computational modeling of aircraft structures., Through the COE program, the FAA has made a major commitment to support multi-year and multi-million dollar research efforts, ensuring coordination and innovation across the university teams that make up the various COEs. This investment has resulted in significant advancements in aviation science, technologies, and technology transfer. The COE program has included over 70 institutions of higher learning and over 200 industry and government affiliates. Through their collaborative efforts, they have conducted research in areas which are critical to the FAA and the flying public.

Research Areas

Cyber security

FAA recognizes that cyber security is one of our greatest challenges because threats change continuously. We know that the agency must be vigilant, particularly as we add new technologies and procedures into the NAS. It is important to incorporate cyber protection into everything that we do and to test and validate the effectiveness of those protections.

The FAA's Cyber security Test Facility at the Technical Center serves as a research and development lab for finding new ways to protect the NAS from cyber risks and threats. This facility provides an open test bed for customers with security testing and prototyping needs. It also provides a way to test cyber scenarios without interfering with continuous operations of our actual air transportation system.

FAA also is working with its national security partners to protect aircraft from cyber risks and threats. The Technical Center plays a vital role in the Aviation Cyber Initiative Research and Development (ACI R&D) program, which is utilizing a Boeing 757 aircraft at the Technical

Center as a test vehicle. The Technical Center is also supporting the Aircraft Systems Information Security Protection program to conduct research into vulnerabilities of information systems on aircraft.

UAS Integration

FAA is working with NASA and industry to develop a UAS Traffic Management (UTM) System. NASA's research concept specifically considers small UAS operations below 400 feet, in airspace that contains low-density manned aircraft operations. NASA developed a phased approach for its UTM concept, building from rural to urban and from low to high-density airspace. In April 2016, NASA coordinated with the six FAA-selected test sites to perform phase one testing of the UTM research platform. A Research Transition Team (RTT) has been established between the FAA and NASA to coordinate the UTM initiative, as the concept introduces policy, regulatory, and infrastructure implications that must be addressed as this technology moves forward. Additionally, the UTM work with NASA will inform our efforts with respect to UAS operating in proximity to airports. The UTM initiative focuses on operations in low altitude airspace. A second RTT has also been established with NASA to focus on UAS operating in higher altitude and controlled airspace.

FAA is also working closely with its partners in government and industry to evaluate UAS-detection technologies. As directed in Section 2206 of the 2016 FAA Extension, the FAA has established a pilot program to evaluate some of these technologies, which have been tested in airport environments at New York's JFK Airport, Atlantic City International Airport, and Denver International Airport. Further testing will take place at Dallas-Fort Worth Airport later this year.

Commercial Space

Space transportation is no longer the exclusive domain of the government. A number of history-making achievements occurred in the last year, including the launch and landing of reusable rockets and progress toward the first commercial human orbital launches to ferry astronauts to and from the International Space Station.

As the number of commercial space launches increases, FAA is focused on how we integrate these operations into the NAS. Currently, we accommodate these launches by blocking off a significant amount of airspace. We know this is not sustainable or affordable in the long term. The Technical Center is conducting research to develop approaches that will safely reduce the amount of airspace that must be closed to other stakeholders for launch and reentry operations; develop timely response capabilities to launch scenarios that do not proceed according to plan; and quickly release to other users airspace that is no longer affected. Part of this research includes prototyping a tool called the Space Data Integrator (SDI). The SDI receives time-accurate data directly from the launch or reentry vehicle, formats it, and routes it to the FAA's air traffic systems for use by air traffic controllers. FAA tested the SDI at a launch in December 2016 and plans to conduct tests at all of the upcoming launches at Cape Canaveral, Florida.

Lithium Batteries

FAA continues to be actively engaged in research and testing to develop technologies and procedures to improve the safe transportation of lithium batteries. In addition to their presence onboard aircraft as both cargo and in personal electronic devices carried by passengers, lithium batteries are increasingly installed in aircraft equipment.

The Technical Center's Fire Safety Branch conducted extensive testing to document the hazards from a variety of lithium battery types and sizes as well as the ability of existing aircraft fire protection features to mitigate or control fires involving lithium batteries. These tests demonstrated that the current fire suppression systems in passenger airplane cargo compartments cannot protect against a fire involving a bulk shipment of lithium batteries. Largely because of the FAA's test findings, a large number of airlines throughout the world voluntarily ceased shipping lithium batteries on passenger carrying aircraft, and Boeing, Airbus, and ICAO have recommended that airlines cease shipping lithium batteries until safer shipping methods are developed and implemented.

New Aviation Fuels

Avgas is the only remaining lead-containing transportation fuel. Lead in Avgas prevents damaging engine knock, or detonation that can result in a sudden engine failure. However, it is a toxic substance that can be inhaled or absorbed in the bloodstream. To help "get the lead out," the FAA is supporting the research of general aviation alternate fuels at the Technical Center. The Technical Center is working with the general aviation aircraft and engine manufacturers, fuel producers, the U.S. Environmental Protection Agency, and industry associations to overcome technical and logistical challenges in developing and deploying a new, unleaded fuel through the Piston Aviation Fuels Initiative (PAFI).

In March 2016, FAA selected two unleaded fuels for Phase 2 engine and aircraft testing. In the near term, this effort will continue with the ground testing of 19 different engine models on proposed replacement unleaded fuels. Within months, the research will continue with the initiation of flight test activities. Testing will culminate at the end of 2018 subsequent to the

operational flight test activities of 10 unique aircraft models under the full range of atmospheric conditions (e.g., hot and cold weather) on proposed replacement unleaded fuels.

Airport Pavement

With the implementation of new procedures from NextGen research, the role of airports will be to accommodate increased traffic safely. This is especially critical during aircraft operations in inclement weather. Increased traffic will necessitate efficient inspection and maintenance of our runways and taxiways. This will require development of technologies to heat airport pavements, reliable methods to assess the braking performance of aircraft, development of lighting and marking materials providing higher visibility, and development of new lighting technologies.

In 2015, the Technical Center opened the National Airport Pavement and Materials Research Center (NAPMRC), which allows us to research environmentally-friendly pavement technologies that are more durable and locally available. This will help airport operators to save money by lowering the costs of initial construction, maintenance, and repairs, as well as by providing a longer pavement life. The NAPMRC is also capable of supporting the testing of materials other than pavement, such as marking paint technologies and rumble strips for preventing runway incursions.

NextGen

The Technical Center supports the advancement of NextGen by providing the gateway for NAS system upgrades, improvements, and delivering of new operational capabilities. A number of NextGen technologies were tested, validated, and began their nationwide deployment at the Technical Center. One example of the Technical Center's many contributions to modernizing our air traffic control system is Data Comm. Data Comm has changed the way that

air traffic controllers and pilots communicate. It supplements voice communications between air traffic controllers and pilots with digital text-based messages.

Voice communications can be time consuming and labor intensive. For example, when planes are awaiting takeoff, controllers must use a two-way radio to issue new routes to pilots to help them avoid bad weather. This process can take 30 minutes or more, depending on how many aircraft are in line for departure. It also introduces the potential for miscommunication known as "readback/hearback" error. Data Comm dramatically reduces communications time, which results in faster taxi outs and reduced delays. Data Comm also enhances safety by virtually eliminating the chance of the flight crew misunderstanding the message from air traffic control. Data Comm is now operational at 56 air traffic control towers nationwide and is installed in 31 different types of aircraft. Expanded Data Comm services at all FAA en route air traffic control centers are planned beginning in 2019.

Conclusion

Aviation is marked by constant evolution. There will always be a need for research and evolving technology to meet new aviation needs. The Technical Center will continue to play a critical role in supporting the FAA's commitment to ensure that the United States continues to lead the world in the development of aviation technology while operating the safest and most efficient aviation system in the world.

This concludes my statement. I will be happy to answer your questions at this time.