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"*Aviation Noise: Measuring Progress in Addressing Community Concerns"*

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Introduction

Chairman Larsen, Ranking Member Graves, and members of the subcommittee, thank you for inviting me to appear today. My name is David Silver, and I serve as Vice President of Civil Aviation for the Aerospace Industries Association (AIA). For over 100 years, AIA has advocated for America's aerospace and defense (A&D) companies and the more than two million men and women who are the backbone of our industry.

Our Industry's Role in Reducing Noise

Aircraft manufacturers have been investing in ways to reduce aircraft noise for many years. To date there have been many successful initiatives that have reduced the exposure of the general public to aircraft noise, while still allowing the industry to grow and deliver huge mobility benefits to our society.

Illustrating this trend, aircraft produced after 2010 generate approximately half the noise of aircraft made between 1980 and 2007. This significant change came from newer, quieter engines as well as airframe and design improvements developed after 2010 which are significantly quieter.

According to the Federal Aviation Administration (FAA), the number of people exposed daily to significant aviation noise in the U.S.[1] declined from roughly 7 million in 1975 to just over 454,000 today. Over the same time period, the number of enplanements[2] increased from 202 million in 1975 to 890 million today and the U. S. population grew by more than fifty percent.

[1] Defined as noise of 65 DNL or greater, a metric which measures cumulative noise exposure over an average 24 hours.
[2] An enplanement equals one person flying on a single commercial flight.

AIA appreciates this committee's past leadership in supporting research and development (R&D) that greatly contributed to the improvements seen to date. The longstanding partnership between government and industry has resulted in significant improvements in both noise and emissions, as noted above, and we believe that continued cooperation is critical to future success. Examples of these improvements include higher bypass ratio engines, more aerodynamic airframes, and improved engine nacelle treatments, all developed cooperatively with industry, and all improving the noise environment.

Despite these improvements, our industry realizes the work is not done. AIA's members continue to make significant investments in technology that will further reduce the aviation-related noise occurring near our nation's airports.

Working with Government to Reduce Environmental Footprint

Noise is one category comprising the environmental footprint of aviation. The aviation industry has long been involved with efforts to reduce the entire environmental footprint, including emissions, noise, and efforts to reduce climate change. For example, AIA and our members have committed to achieving net-zero carbon emissions from the U.S. aviation sector by 2050. Internationally, many of these improvements are supported by governments, industry, and non-governmental organizations working together at the International Civil Aviation Organization (ICAO), a specialist branch of the United Nations. Due to the global interconnectivity of aviation, ICAO provides the necessary framework to ensure environmental standards and regulatory practices are attainable and coordinated globally to ensure success.

Domestically, we continue to work with the FAA and the U. S. Department of Transportation (DOT). AIA commends the FAA's work to better understand, reduce, and mitigate the impact of noise on communities, and its wider actions to increase community outreach to those affected by aircraft noise through community roundtables and other measures. AIA strongly supports the data-driven approach the FAA is taking to ensure that aircraft noise policy continues to reflect the latest science on this matter. AIA also appreciates that the FAA recognizes the importance of stakeholder engagement in decisions related to aircraft noise policy and we are committed to continuing our input on all aspects of aviation noise.

We were pleased to receive the most recent update of the U.S. Aviation Climate Action Plan, which set out the U. S. government's plan to achieve net-zero greenhouse gas emissions for the U.S. aviation sector by 2050, a goal in line with our own efforts. The plan builds on our industry's commitment to net-zero and highlights specific actions and policy measures to foster innovation and drive change across the entire sector. Though focused primarily on emissions, we believe this plan will have a positive effect on aircraft noise because many of the pathways to emissions reduction have the secondary effect of reducing aircraft noise. These improvements will come about largely through: (1) development of new, more efficient aircraft and engine technologies; (2) improvements in aircraft operations throughout the National Airspace System; (3) electrification, and potentially hydrogen, as solutions for short-haul aviation; and (4) advancements in airport operations across the United States.

We see much of this progress accomplished under the framework of the Sustainable Flight National Partnership, a cooperative effort by NASA, the FAA, and industry to accelerate the development of more efficient aircraft and engine technologies targeting up to a 30 percent improvement in fuel savings compared to today's planes, while also delivering substantial reductions in noise and emissions.

The potential for improvement is not limited to technology, but also includes opportunities in aircraft operational efficiency. While the U.S. National Airspace System is significantly more efficient than in the past,[3] opportunities remain to reduce fuel burn and noise in all phases of flight. These include boosting efficiency during taxi, takeoff, and landing, as well as flying optimized trajectories.

ICAO's Balanced Approach -- A Holistic Approach for Tackling Aircraft Noise

Despite previous improvements in aircraft technology and airport operations, AIA is committed to working with international bodies, FAA, and the Congress to identify ways to further reduce and mitigate the impacts of aviation noise.

[3] See for example, FAA's NextGen Annual Report for FY20, p. 19, at https://www.faa.gov/nextgen/media/NextGenAnnualReport-FiscalYear2020.pdf.

This must be accomplished in a holistic manner and consistent with the global nature of aviation. We believe the ICAO Balanced Approach[4] offers a global baseline for addressing noise issues. The Balanced Approach consists of identifying the noise problem at specific airports and identifying which of four available elements can reasonably address the issue. The four elements of the Balanced Approach are: (1) Reduction of Noise at the Source (Technology Standards); (2) Land Use Planning and Management; (3) Noise Abatement Operational Procedures; and (4) Operating Restrictions.

1. Reduction of Noise at Source (Technology Standards)

Today we look to the certification of new products to ensure the latest available noise reduction technology is incorporated into aircraft. For example, the application of the new ICAO Chapter 14 international noise standard is expected to greatly reduce the number of people affected by significant aircraft noise (defined as an average sound level throughout the day of 55 decibels). Between 2020 and 2036, average noise levels will reduce to below 55 decibels for more than one million people. Industry is continuously looking at three particular areas to contribute to these improvements: engine technology, aerodynamics, and new materials.

Engine Technology

The increase in fan size allows the industry to increase the amount of air, while also reducing the speed of the air as it moves around the nozzle, thereby achieving high- or ultra-high bypass ratios. Historically the nozzle was the noisiest part of the engine. The shift to higher bypass ratios reduces the noise. Today fan noise remains the dominant source.

With the introduction of ultra-high bypass ratio engines employing geared turbofan technology (GTF), one manufacturer further reduces fan speed. This technology allows additional slowing of the fan, preventing the tips of the fans from potentially becoming supersonic. This feature can further reduce a major noise source, reducing the noise footprint by over 75 percent.

Reshaping the nozzles changes the air flow coming out of them to specifically reduce noise, leading to the 'chevron nozzle' design. This technology, combined with the use of new materials

[4] *Aircraft Noise*. International Civil Aviation Organization. Retrieved April 14, 2021, https://www.icao.int/environmental-protection/pages/noise.aspx

such as acoustic lining around the sides and underneath the engine shroud (cowl), has also significantly reduced engine noise.

We have reached a point when it comes to noise that we can no longer concentrate on one area. Every part of the engine plays a role—the fan, booster, compressor, combustor, turbine section and exhaust area. Through public-private partnerships between NASA, the FAA (CLEEN Program), industry, and universities, we expect to see continuous improvements in these areas with each generation of engine.

Aerodynamics

The landing gear, landing gear doors, extended flaps, and the simple fact of moving a large object through the air no matter how streamlined, creates noise. Better aerodynamics means less air resistance, which means less noise. A more aerodynamically 'slippery' commercial aircraft gives us an opportunity to affect take-off noise characteristics. On takeoff, this allows the operator to either reduce the required take-off thrust due to less air resistance or maintain the same amount of thrust but climb more quickly, meaning that the aircraft is higher above a community at the end of the runway. By using the ICAO balanced approach either of these could be used based upon the needs of a specific airport.

However, there is a tradeoff in the landing phase of flight. The more aerodynamic an aircraft, the more effort that may be required to slow it down. In some cases, the pilot needs to deploy spoilers and landing flaps earlier, which has the potential to generate additional noise on approach to the runway.

Over the last few years, a series of NASA flight tests successfully demonstrated technologies that achieve significant reductions in the noise generated by aircraft and heard by communities near airports. The Acoustic Research Measurement (ARM) flights conducted at NASA's Armstrong Flight Research Center in California tested technology to address airframe noise, or noise that is produced by non-propulsive parts of the aircraft, during landing. The flights successfully combined several technologies to achieve a greater than 70 percent reduction in airframe noise. NASA also evaluated options to modify the landing gears and flaps to reduce noise during take-off and landing, directly focusing their R&D efforts on the major cause of noise complaints around

airports. The goal of NASA and its industry research partners is to substantially improve the quality of life for communities that experience aircraft noise today.

New Materials

A lighter airplane is quieter because it requires less thrust to keep the aircraft in the air. Aircraft designers are continuously looking to increased composite use and advanced manufacturing techniques to further reduce the weight of an aircraft, while maintaining the high safety requirements.

2. Land Use Planning and Management

The second pillar of ICAO's Balanced Approach is land use planning and management. This is an effective means to ensure that activities near airports are compatible with aviation. The goal is to minimize the population affected by aircraft noise by effective land use zoning around airports. Compatible land use planning, and management is a vital instrument in ensuring that the gains achieved by the reduced noise of the latest generation of aircraft are not offset by further residential development around airports.

3. Noise Abatement Operational Procedures

The way aircraft are operated during day-to-day operations may also present noise impacts that reach the ground. ICAO assists in the development and standardization of operational procedures that reduce noise while maintaining safety. These measures include noise preferential runways and routes and noise abatement procedures for takeoff and landing. The appropriateness of any of these measures depends on the physical layout of the airport, its surroundings, and the expected air traffic and air traffic management system, but in all cases the procedure must give priority to safety considerations. With the support of air navigation service providers and airport operators, airlines and pilots can implement noise reduction procedures such as reduced thrust takeoffs, displaced landing thresholds and continuous descent operations to further reduce noise.

Controlling where planes fly during takeoff and landing has important impacts on community noise. The placement and use of runways is fundamental. For example, the routing of aircraft over bodies of water often reduces the impact of community noise. One goal of air traffic management (ATM) is to map out flight tracks that avoid the most densely populated areas wherever possible. Recent

developments in navigation performance mean that aircraft can now follow more precise tracks. This reduces the overall area exposed to noise, but often results in some communities being subjected to a higher number of flyovers. ATM planning must be undertaken in close consultation with community leaders to effectively consider the tradeoffs between flight track concentration and flight track dispersion.

4. Operating Restrictions

The final element of the ICAO Balanced Approach involves operating restrictions -- banning certain aircraft at noise-sensitive airports or limiting their hours of operation. However, operating restrictions of this kind can present significant economic implications for the airlines.

AIA believes that continued application of the Balanced Approach allows the global aviation industry to continue making progress on noise while effectively involving all layers of government, local communities, and stakeholders. We believe the first three elements (technology standards, land use planning and management and noise abatement operational procedures) will often provide the greatest contribution to resolving community noise issues.

Current Standards and Future Changes

In 2013, ICAO introduced Chapter 14 in the ICAO Annex, establishing a new standard in noise reduction. It stipulated that new aircraft models must be at least seven decibels quieter than those built to the previous Chapter 4 standard. That means that all new aircraft certified to this standard will have half the noise footprint of aircraft that are one generation older. It is up to individual regulatory bodies, particularly states of design like the United States, to either adopt the ICAO standard or (as the U. S. does) codify it in their individual national regulations. U.S. industry appreciates the framework established by "Stage 5" within 14 CFR Part 36, in which the FAA adopted the more stringent noise certification standards for new aircraft in line with ICAO Annex 16 Volume I Chapter 14.

AIA member companies are currently working with ICAO's Committee for Aviation Environmental Protection (CAEP) to update the Chapter 14 limits to encourage even quieter aircraft in the future. These may include more stringent limits for existing aircraft and the first noise standard designed for the next generation of supersonic aircraft. AIA member companies are also

working closely with ICAO to begin exploration of future noise standards for emerging technology such as advanced air mobility (AAM) aircraft. We believe the speedy adoption of ICAO standards in areas such as noise and emissions is critically important, not only to improve the noise environment but also to ensure that U.S. manufacturers stay competitive in both established and emerging global aviation markets.

Future Aircraft Types

New aircraft under current development will have a major impact on future aviation operations around the globe. These include supersonic aircraft and advanced air mobility aircraft.

Supersonic Aircraft

Supersonic flight began famously in 1947 when U. S. pilot Chuck Yeager broke the sound barrier. Commercial airlines began flying oceanic routes in 1973, most famously the Concorde. Due to a wide array of challenges, including untenably high operating costs, extensive maintenance requirements for an aging fleet, and overland supersonic flight restrictions instituted by the United States and other countries, British Airways announced the retirement of the Concorde in April 2003. There has not been commercial supersonic flight into or out of the United States for nearly 20 years.

Several of our industry partners are currently working on new aircraft designs and improved engines that would enable the U. S. to lead the reintroduction of civil supersonic flight.
Our industry understands the environmental and economic challenges associated with these aircraft and are working to solve them. While overland routes remain unavailable due to the sonic boom generated when the aircraft breaks the sound barrier, industry efforts are focused on design requirements to be successful in transoceanic flight (avoiding sonic booms over land) as well as research and development of low boom technologies, which allow an aircraft to break the sound barrier with a quieter “thump” rather than triggering an unacceptable sonic boom. These companies are committed to design supersonic aircraft to meet the current subsonic Stage 5 noise levels using innovative advanced procedures.

These environmental challenges include not only noise, but also carbon dioxide (CO2) and nitrogen oxide (NOx) emissions. Importantly, ICAO is also looking to address these issues through harmonized international rules, spurred on in part by FAA’s leadership in proposing a noise rule for

supersonic aircraft pursuant to Section 181 of the FAA Reauthorization Act of 2018. This work by the FAA on an updated noise rule for supersonic aircraft paved the way for development of a harmonized international rule through ICAO. At the most recent Committee on Aviation Environmental Protection conference (CAEP 12), a new work item was added to set stringencies (limits) for both landing and takeoff noise and emissions for new supersonic aircraft.

Setting noise and emissions limits before an aircraft is produced is a groundbreaking step strongly supported by the aviation industry. It will allow aircraft and engine manufacturers to work on designs that meet or exceed these standards, making future supersonic aircraft both economically and environmentally positive.

Advanced Air Mobility Aircraft

Advanced Air Mobility (AAM) is the emergence of transformative airborne technology to transport people and goods in both rural and urban environments. AAM technologies promise to transform how people and cargo are moved, with significant benefits to the U. S. economy. In the United States alone, the AAM market is estimated to reach $115 billion annually and employ more than 280,000 people by the year 2035.

AAM involves a new type of aircraft known as electric vertical takeoff and landing, or eVTOL. These types of aircraft can take off and land vertically like a helicopter and then shift to flight like a fixed-wing airplane. Additionally, eVTOLs are community friendly, with measured noise levels 100 times quieter than a helicopter. This will allow them to integrate into a city without the noise footprint of other aircraft.

Over time, changes to FAA's regulatory process may be needed to enable higher volumes of AAM operations and autonomous operations. In addition, AIA applauds Chairman Larsen and Ranking Member Graves for introducing bipartisan legislation in support of state and local planning for AAM systems (the "Advanced Aviation Infrastructure Modernization Act"). This legislation would authorize a new grant program that would lay the groundwork for communities to plan their development and deployment of AAM technology. In doing so, it would provide assistance for local governments to specifically assess the siting of public use vertiports and any potential environmental effects of AAM operations. We believe this legislation is a strong step forward to

ensure any noise impacts from this emerging technology are understood local communities.

How to Get There Faster and Quieter

A critical factor for increased improvement in the noise characteristics of aircraft is continuing the effective partnership between the FAA, the National Aeronautics and Space Administration (NASA), and the aviation industry. We believe collaborative support for aviation research and development is vital for aviation's future, and the opportunity exists today to double down on these public-private partnerships and accelerate the next generation of aircraft and engines.

AIA member companies are exploring a range of technologies for next-generation aircraft for introduction in the 2030s, offering improvements in fuel efficiency of 15 to 25 percent compared to current aircraft. To realize these benefits, U. S. manufacturers will require support to remain competitive, given the impact of Covid-19 and the billions of dollars in investment being made by European governments in support of similar efforts overseas. Congress can help in these efforts by:

- Continuing to support increased funding for the FAA's Continuous Lower Emissions, Energy and Noise (CLEEN) Program to accelerate reductions in noise and other emissions in conjunction with fuel efficiency improvements;

- Supporting and expanding the Alternate Fuel and Low Emission Aviation Technology grant program in the House-passed Build Back Better legislation and introduced in the Senate as S. 3125 ("Aviation Emissions Reduction Opportunity" or AERO Act);

- Passing H. R. 6270, the "Advanced Aviation Infrastructure Modernization (AAIM) Act", to establish a pilot program to provide grants related to Advanced Air Mobility infrastructure;

- Helping to drive the development of a comprehensive, long-term research agenda that supports transformational aviation technologies, leveraging partnerships between industry and government agencies including NASA and the Departments of Transportation, Defense, and Energy; and

- Continuing to support NASA's work in the development of enabling technologies for next generation aircraft, such as new airframes and engines that reduce noise and emissions while improving efficiency. This should include accelerating the timetable for a NASA subsonic demonstrator 'X-plane' incorporating airframe innovations, to ensure U. S. companies can bring these technologies to maturity ahead of European competitors.

On air traffic management improvements, the FAA continues to make significant progress in delivering enhancements to the National Airspace System (NAS) and reducing noise through its NextGen efforts. Congress should continue to invest in and prioritize these improvements, which are expected to further reduce noise through 2030. The FAA should also ensure performance-based navigation (PBN) routes are complemented by efforts to promote community involvement in changes to airspace structure, delivering positive outcomes for community noise.

Conclusion

AIA applauds the Committee for this opportunity to discuss the important topic of community noise and allowing industry to provide our views on ongoing research and our significant efforts to reduce both noise and emissions impacts. We appreciate the support of Congress in authorizing and appropriating funds for vital FAA and NASA research that will lessen aircraft noise, and your support for emerging technologies like supersonic and AAM aircraft systems. We look forward to working with this Committee as you consider important policy changes related to aviation noise this year and in the next FAA reauthorization bill.