WRITTEN STATEMENT OF

AIR LINE PILOTS ASSOCIATION, INTERNATIONAL (ALPA)

BEFORE THE

SUBCOMMITTEE ON AVIATION

OF THE

COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE

U.S. HOUSE OF REPRESENTATIVES

March 12, 2019

"Looking Forward: Aviation 2050"

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Mr. Chairman and members of the committee, thank you for giving me the opportunity to join you today to talk about Aviation 2050, the future vision for how our National Airspace System (NAS) evolves to serve the changing needs and demands of commerce, transportation, and the public at large. But before I share our thoughts on this important subset of the industry, please allow me to introduce my organization to you.

I'm the president of the Air Line Pilots Association, International (ALPA), which represents more than 61,000 professional airline pilots flying for 33 airlines in the United States and Canada. ALPA is the world's largest pilot union and the world's largest non-governmental aviation safety organization. We are the recognized voice of the airline piloting profession in North America, with a history of safety and security advocacy spanning more than 87 years. As the sole U.S. member of the International Federation of Airline Pilots Associations (IFALPA), ALPA has the unique ability to provide active airline pilot expertise to aviation safety issues worldwide, and to incorporate an international dimension to safety advocacy.

ALPA has seen incredible change in aviation over our history. We've seen airplanes evolve from doped fabric and wood, to carbon fiber and titanium alloys. We've seen radial piston engines give way to turbojets and, now, to the latest geared turbofans that can run on biofuel. And we've seen navigation evolve from spotting landmarks and light beacons to satellite-based positioning that can tell you where you are within a few feet, even at 600 miles per hour at 39,000 feet over the ocean. What is common to all of these changes is that they have moved from the realm of bleeding edge technology to being integrated as a routine part of operations.

Aviation Safety in 2050

When I think about aviation in 2050, there is one aspect above all others that I sincerely hope continues to improve: aviation safety. It is clear that the commercial aviation industry has reached unparalleled levels of safety in the United States, and I like to attribute that to a couple of key activities.

First, the efforts of the Commercial Aviation Safety Team (CAST) combined with Aviation Safety Information Analysis and Sharing (ASIAS) have led to dramatic improvements. Data analysis by CAST and ASIAS has resulted in a proactive safety culture that cuts across all airlines and stakeholders with unprecedented levels of collaboration, even when those same stakeholders often find more than enough to disagree about on any other part of industry policy. But safety isn't one of those areas. The predictive risk analysis conducted by the CAST and ASIAS allows the aviation community to collectively reach heightened levels of safety without waiting for a single drop of blood to be shed.

The second major breakthrough in safety was the improvements that Congress introduced and were signed into law as part of the FAA Authorization Extension Act of 2010. Unfortunately, these safety enhancements came about after four fatal airline accidents in a relatively short amount of time, including the crash of Colgan Flight 3407, which resulted in 50 fatalities. We recently marked the 10-year anniversary of that accident with resolve that the events of that night resulted in something better. We mourned the loss of those who perished, but we took

solace in the levels of safety that have resulted from the legislation passed soon after that tragic accident. Thank you for your leadership and oversight on that law. Since we are discussing innovation and technology today, I wanted to highlight the fact that, as a result of the legislation, there has been significant innovation on pilot training of upset prevention and recovery and extended envelope for flight crews.

As a result of the Colgan Flight 3407 accident, as well as a Pinnacle flight that crashed in Jefferson City, Mo., on October 24, 2004, ALPA promoted innovations in pilot training and has been a stalwart advocate and leader in upset prevention and recovery training. The requirements for this upset prevention and recovery training, which was called for in the FAA Authorization Extension Act of 2010, go into effect for airlines this month. The pioneering strategy deployed to improve the simulation devices for this training was no small task. Improvements on aircraft performance data as well as software enhancements to simulators were needed in order to provide pilots with this new training. The collective work of many organizations has led to better trained pilots in phases of flight that previously could not be simulated on the ground.

Suffice it to say, it is my hope that in 2050 the safety improvements directed by Congress in 2010 will still be in place and will no longer be the target of those who wish to roll them back. But I also hope that by 2050, we will have taken safety a step further and will have raised the bar of airline safety so that all commercial airline operations are on the same level of safety. Today, Part 121 commercial all-cargo safety levels are lagging the safety levels of Part 121

passenger operations. We must make this a focus area immediately, and we need to apply just as much focus on this safety issue as we have on passenger airlines.

While it is way too early to know what caused the Atlas 3591 accident, we do know that it is yet another fatal Part 121 all-cargo accident in a period of time where there has been only a single passenger fatality in the United States on U.S. passenger airlines. I believe that I can speak for all airline pilots when I say that we need to identify the safety gaps in all-cargo airline operations and put a plan in place to ensure that the safety levels we have come to expect with passenger airlines are also achieved by the all-cargo operating community. Our society certainly benefits from the innovations of all-cargo package delivery operators; we should expect the same level of commitment to safety as consumers have come to expect on efficiency.

New Entrants Become Established NAS Operators

It is with this keen eye on safety, that we offer our enthusiastic support to those organizations who are diligently looking to deploy new capabilities in the NAS. With the knowledge, experience, and operational perspectives that ALPA can bring to the table, we also extend our offer to help usher in these new capabilities safely.

As we look toward 2050, we need to recognize that the new entrants of today will be just another operator in the future. In fact, the FAA is already well underway in laying the foundation for integration of both Unmanned Aircraft Systems (UAS) and commercial space operations into routine NAS operations. Thanks to FAA leadership, and the direction provided

by Congress in last year's FAA reauthorization, we can already start to envision the day when all UAS operations are performed safely and within the law, and space launches occur routinely without partitioning or blocking off large sections of airspace. As UAS and commercial space transition from new entrants to established NAS users, we can see the next opportunities on the horizon: urban mobility, the return of commercial supersonic transportation, the building of wireless data infrastructure through high-altitude long-endurance vehicles, and even suborbital hypersonic transportation. As a long-time pilot first in the military and then at both passenger and cargo airlines, these are exciting concepts that I look forward to seeing come to fruition. However, we note that many of these new types of operations will not have pilots on-board the aircraft, and most are striving for autonomous flight, which means that there will be no pilot in command of the flight. Understanding the implications of this fundamental change bears careful examination.

Unmanned Aircraft System Integration

ALPA recognizes that UAS represent a significant potential for economic and societal benefit. They are uniquely suited for performing many types of dangerous flying that can keep pilots out of harm's way. ALPA supports robust development of this technology with one single overriding condition: integration of UAS into the NAS must be done safely, deliberately, thoughtfully, and with full understanding and effective mitigation of the possible risks. We must do this right, or the enviable safety record we have achieved in airline operations will be at risk and, with it, the promise of employing UAS for the benefit of the population.

Recently, a company approached the FAA to obtain exemptions that would allow them to bypass more than 200 Federal Aviation Regulations (FARs) in order to start a commercial UAS package delivery service without any limitations to flying over residential or other populated areas.

Granting this petition for exemption would allow the petitioner to bypass the FAA UAS implementation policy of "crawl, walk, and run" for the introduction of new technology, capabilities, and procedures. The FAA has historically established regulations based on accidents and incidents to establish the current FARs. Aviation regulations represent a safety framework for which commercial for-hire operations are conducted. Issuing exemptions to so many of the requested areas appears to erode the safety levels established by the FAA through regulation, many of which were established as a result of accidents and incidents with injury and loss of life to passengers and people on the ground.

As required under 14 CFR Part 11.35 (b), the FAA withheld proprietary company manuals and related material, including the petitioner's safety case justification. Therefore, many of the exemptions requested could not be thoroughly evaluated by industry stakeholders. If successful, we can anticipate that other manned and unmanned operators would seek similar exemptions from the same regulations included in this Petition for Exemption, awarding them to others without a clear safety justification. This is not how UAS operations should be implemented in the NAS if the objective is to make UAS a standard participant in routine NAS operations.

As we have for many years, ALPA continues to be an active partner with both government and industry in developing standards that will lead to safe operation of UAS in the NAS. Concurrently, we recognize that these standards are far from complete. Defining a safety framework for any new technology is necessarily a painstaking process, and ALPA, along with hundreds of extremely talented representatives from across aviation, is diligently pursuing that goal.

While it is tempting to leap-frog this process and accelerate approvals for implementation, the only way to ensure safety is to methodologically work through each step of risk assessment. We believe there may be ways to accelerate the integration, with additional resources and innovative use of technology for data collection. But we would be concerned if the process were to be accelerated without systematically working through all of the risks.

ALPA believes that safe integration of UAS includes four fundamental elements:

1. *Education*: Anyone who plans to fly UAS must understand their aircraft, the airspace, and the other aircraft that could be encountered while flying.

   In the case of UAS that might be flown for compensation or hire in civil airspace, the pilot must hold a commercial pilot certificate to ensure he or she possesses the appropriate skill and experience to meet safety standards designed to protect the flying public.

Those flying UAS for recreational purposes must adhere to the FAA regulations and guidelines, including potential minimum age requirements, keeping the UAS within line of sight, and flying at heights under 500 feet.

2. *Registration*: Gathering basic information about the identity of the individual purchasing the UAS not only allows law enforcement authorities to identify the owner if the UAS were to encounter a problem, but it also helps make clear the serious nature of operating a UAS in the NAS and the responsibility to safeguard public safety. We continue to urge Congress and the FAA to require registration to occur at the point of sale of the UAS.

3. *Technology*: If UAS, either intentionally or unintentionally, are operated in airspace that airliners use, airline pilots need to be able to see them on cockpit displays, controllers need the ability to see them on radar scopes, and the UAS must be equipped with active technologies that ensure that it is capable of avoiding collision with manned aircraft. In these types of operations, technology must enable the pilots to control and interact with them in the same manner as if the pilot were on board.

   If a UAS is restricted by regulations from operating in a particular geographic area and/or altitude, it must have technology that cannot be overridden that limits the geographic areas and altitude in which it can operate. This may include permanent

locations such as the White House and all public airports, as well as temporary restrictions such as for wildfires or natural disaster areas.

4. *Penalties and enforcement*: UAS pilots must be properly trained and understand the consequences of unsafe operations. Anyone flying a UAS that is a hazard to other aircraft in the airspace, especially those who choose to do so recklessly near airports, must be identified and appropriately prosecuted. We support the criminalizing of intentionally unsafe operation of UAS and penalties for unintentional unsafe UAS operations. If additional funding is needed for this purpose, Congress should provide the resources needed without delay.

ALPA applauds Congress for its clarification of FAA's authority to fully regulate all UAS operations in the 2018 FAA Reauthorization (P.L. 115-254), to include model and hobby operators, who previously were exempted from regulation. We are especially grateful for this subcommittee and Chairman DeFazio for the dedication to promote safe UAS operations. We are also grateful to observe that the FAA has already made progress in addressing all four of these elements.

Urban Mobility—Another Airspace User

Another new type of operation that is relatively close to earth is emerging with tremendous momentum and energy: urban mobility aircraft. Several companies have visions for urban mobility that in some cases involve an autonomous or remotely piloted aircraft that carries

passengers. Again, the challenges of certification and economic viability are significant, but so are the challenges with integration of the airspace. In fact, urban mobility aircraft may need to integrate with low-altitude piloted aircraft such as rotorcraft as well as small UAS, in airspace managed by Air Traffic Control. But because some of their concepts include operations at large air carrier airports, they will also need to interact with the traditional national airspace system. Because almost all of us had to sit in traffic to get here today, I don't think anyone wants progress for this type of aircraft operation to be slowed for any reason. And so again, just like with other types of innovative operations envisioned for the NAS, ALPA will be ready to offer our assistance and knowledge to ensure that this integration challenge is successful and safe.

Reducing the Impact of Commercial Space

Commercial space operations are not new. In fact, it has been more than 30 years since Congress established a the Office of Commercial Space Transportation in the Department of Transportation (DOT), which now resides at the FAA. The industry is mature, and thanks to a series of events over the past decade, it is thriving through an expansion in proposed spaceports and significantly increased operational frequency. I was excited to see that the SpaceX Crew Dragon spacecraft undocked from the space station and returned to earth safely in its test run, before launching with astronauts.

These are truly exciting times for America as we experience innovation and advancements that are literally blasting off before our eyes. However, we must keep commercial aviation part of a discussion on commercial space. Future growth and success of U.S. commercial aviation

depends upon continued safe, dependable, and efficient access to shared public resources such as the National Airspace System, air traffic management, ground infrastructure, and airport services. The need to integrate commercial space operations and commercial aviation operations into the NAS is an urgent need that will require careful planning and commitment from many different parts of the industry.

One thing is clear, expanded markets and technology advances in space are enabling new commercial companies to access these limited resources, which has become a critical challenge for the aviation community. Air traffic management, airports, and the NAS are regulated and managed according to strict operational and safety regulations, which will not sufficiently accommodate the projected growth and evolution of space transportation, without enhancements to how space flight is accommodated by the NAS. There must be a means to safely integrate with existing aircraft operations and infrastructure without decreasing the level of safety or efficiency for existing operations. Full integration will allow space operations to plan and execute launches without extensive coordination like they do now, and full integration will also eliminate the need for segregation of space operations from commercial airline flights. Bottom line: Commercial space integration improves safety and efficiency of the NAS for all airspace users. A strategy to fully integrate commercial space operations into existing NAS operations is a critical first step to achieving this important goal.

Neither industry would be successful today without the other. Each sector generates hundreds of billions of dollars in annual economic returns for the United States and immeasurable

benefits to society. The FAA has coordinated the activities of both airplanes and rockets successfully for more than 60 years. In many ways, there is a false distinction between the two sectors, since several aircraft types travel into outer space, and all space vehicles travel through the atmosphere. As spaceflight becomes more diffuse and routine, both sectors must cooperate to create policies, regulations, and procedures to manage shared national aerospace resources safely and efficiently.

An important reason to keep the commercial space industry a part of the aviation 2050 discussion is that there are going to be innovations in safety and efficiency that will likely find their way into commercial aviation. For example, Virgin Galactic plans to utilize a spacecraft for multiple flights with paying passengers (technically speaking, they are participants), and this experience will likely help the commercial airlines better understand the interest in hypersonic travel and the potential issues that would accompany a transition to this type of travel in the future.

ALPA is very interested in supporting the commercial space industry's efforts to advance through the full integration into the NAS. To fully articulate the complementary nature of commercial space and commercial aviation, we published a white paper that documents the role of the government agencies and industry, both historically as well as today. That whitepaper can be found at www.alpa.org/whitepapers.

Super and Hypersonic Technologies

ALPA recognizes that super and hypersonic technology will continue to advance and provide for the significant potential for economic and societal benefit. Although supersonic commercial airline transportation itself is not new, it is also not routine. Supersonic technology was birthed in commercial aviation in the 1970s with the introduction on the Concorde. Pilots of the Concorde routinely logged more supersonic time in a year than military pilots logged in their entire military career. What few people may remember is that Braniff, an ALPA carrier, briefly operated a Concorde on a route from Dallas-Fort Worth to Washington Dulles using Air France and British Airways aircraft.

Although the Concorde is long retired, a new generation of aircraft manufacturers is looking to develop supersonic civilian aircraft. Aside from the challenges of economic viability and community acceptance of noise from possible sonic booms, these aircraft will also need to integrate into the NAS. While the aircraft are anticipated to cruise much higher than current air transport aircraft, they still must climb and descend through congested airspace and take off and land at busy airports. Depending on their performance at lower altitudes, this could present additional integration challenges to operations and ATC automation.

Supersonic aircraft technologies allow for significant reductions in flight times, which is realized on long distance routes. While this technology continues to develop, supersonic technology may be quickly overcome by hypersonic flight, as the aviation industry saw with the microwave landing system. ALPA supports the robust development of this technology, but we must ensure that the integration of this technology is done safely.

A step beyond supersonic aircraft is hypersonic or suborbital vehicles. Several commercial space companies have already presented visions of flights from Asia to the East Coast of the United States taking 90 minutes or less. While these spacecraft may have fewer concerns when it comes to sonic booms, they still must integrate with the rest of the NAS and ATC. Depending on their exact flight profiles, this operation may look like a conventional aircraft, a spacecraft, or something in between, thus presenting its own integration challenges.

Supersonic and Hypersonic Certification Standards Must Account for Technology Advancements

This month we celebrated the 50th anniversary of the first flight of the Concorde, but when it comes to large transport category aircraft, the materials used to reinvigorate such travel are still in their infancy. Although the use of carbon composite structure dates back before the 70s, it was the Boeing 787, unveiled in 2007, that broke world records with the use of carbon composites in more than 50 percent of the airplane's primary structure.

Carbon-based and other composite structures bring a great advantage to the aviation industry. They are lightweight, easy to configure into complex geometries, and can be easy to repair. However, because composites are a newer manufacturing technique to the aircraft manufacturing industry they are also more difficult and subjective to inspect, not standardized similar to metallic materials, and have less empirical data providing a clear picture of the their damage tolerance and fatigue capabilities, even less so when considering the large disparity in

operational environments between current large-transport aircraft and those operating in a super or hypersonic regime.

Additive manufacturing, more commonly known as 3D printing, is another area in which technological enhancements to materials are reinvigorating the exploration of super and hypersonic air travel. By printing an aircraft part from scratch, manufacturers have discovered a way to reduce material waste, increase part quality, and reduce weight while enabling the manufacture of complex parts previously impossible to machine. Although “printed” rather than forged or cast, these parts can be manufactured with the same properties of their parent materials. But with any new technological advancement, such strides are accompanied by new deficiencies not previously envisioned.

Printed aircraft parts are, similar to composites, beholden to the process under which they are manufactured. And although composites have been used for many years, 3D printing only recently became economically viable on a large scale. As such, testing and airworthiness guidance has not been thoroughly developed, tested, or used. Certification standards must now account for the effect process has on the material integrity as well as initial part design and continued durability.

ALPA supports the enhancements that material development such as proliferation of composite structures or 3D printed parts can have on the aviation industry. To ensure the safety of the

NAS and the traveling public, this technology must be fully vetted and completely mature before it can be used in commercial service.

Super and Hypersonic Powerplant Reliability Must Be Maintained and Improved

Advancements in propulsion technologies are a huge key to the proliferation of super and hypersonic commercial aviation because it impacts fuel efficiency, operational costs, environmental impact, and safety. This was a primary driver in the retirement of the Concorde from commercial service almost two decades ago. A large part of increasing fuel efficiency, and thus operational costs, is to reduce the weight of the engine. However, to do so, engine tolerances must become smaller, which leads to an engine that may be more susceptible to failure.

ALPA continues to be an active stakeholder in ensuring engine testing is robust, both from a certification and a continued operability standpoint. Although we have certification standards for debris ingestion, continued operational power, and contained failures, to name a few, we must continue to ensure that engine designs become more reliable. The criticality of powerplants cannot be understated for commercial aviation, and even more so when operating at super and hypersonic speeds.

Environmental Impact of Super and Hypersonic Operations Must Be Addressed

One of the challenges the Concorde faced was sonic booms. In the United States, supersonic flight is restricted to eliminate the impact of sonic booms on people and wildlife. Sonic booms

can be disruptive to wildlife, which is damaging to our ecosystems. Sonic booms are also a nuisance to people and can damage property. In recent years, several studies have researched the effects of wing shape with the goal of developing a wing that will create a softer or nearly imperceptible sonic boom. While these technologies are being developed to reduce the noise footprint for the sonic boom, the environmental impact of these technologies must be fully researched and clear standards developed.

Super and Hypersonic Operational Requirements Must Provide an Equivalent Level of Safety

Super and hypersonic aircraft will, by their nature, be traveling much faster than aircraft currently flying today. This type of air travel will likely not be replacing today's but rather augmenting it. For this reason, consideration must be made of how to safely and successfully integrate super and hypersonic transportation into the NAS infrastructure.

ALPA's position is that the foundation of operating an aircraft, regardless of altitude and speed therein, in a safe and responsible manner must be maintained at the same level of safety. Super and hypersonic aircraft operators must be required operate to an equivalent level of safety to air carrier operations, and regulations must ensure that the unique operational needs are addressed to ensure the safety of the NAS and the traveling public. These must include provisions for the unique environment that the operations are conducted.

FAA Modernization: Improved NAS Capabilities for Safe Integration

In addition to robust design standards and safe rules of operation for the new aircraft described above, another key for successful integration is to improve the capabilities of the NAS itself. This might include development and integration of a UAS traffic management system that can interoperate in real-time with the Air Traffic Control system when necessary or procedures and automation to handle high-altitude/long-endurance aircraft. For commercial space, capabilities include the development of real-time data sharing of spacecraft launch and trajectory information with ATC, so that large blocks of airspace are not closed for hours at a time but instead can be managed in real-time.

Better integration will make it easier for UAS and commercial space to meet their operational goals while maintaining the target level of safety for pilots, passengers, and the public on the ground.

An example of a potential near-term NAS improvement with both safety and efficiency benefits is Space-Based Automatic Dependent Surveillance – Broadcast (ADS-B), or the use of satellites to receive position reports from aircraft, and potentially spacecraft, while over the ocean. The beauty of this capability is that it does not require the aircraft to be equipped with any additional equipment beyond what is already required for flight after January 1, 2020. Space-Based ADS-B allows ATC to receive position updates every eight seconds, as compared with today's minimum update interval of 14 minutes. One immediate improvement to aviation safety is that near-real-time tracking of aircraft becomes a reality. This will hopefully make delays in accident investigations like Air France Flight 447, in which the main part of the aircraft

wreckage was not located for two years after the crash, a thing of the past. It may also help prevent another Malaysia Airlines Flight 370 incident, as the location of this aircraft is still unknown.

Beyond the safety improvement, trials are already planned for reduced separation based on this new surveillance improvement. With additional improvements in communications capability to go with Space-Based ADS-B, a revolution in how oceanic operations are performed could occur, leading to significant increases in both safety and efficiency. The FAA is already evaluating how to incorporate Space-Based ADS-B into operations, and ALPA fully supports these initiatives.

It appears that there is now a need for a broader oceanic airspace modernization initiative. For example, in addition to Space Based ADS-B, we anticipate that improvements in communications between pilots and air traffic controllers will also be needed for the continued reduction of aircraft separation. Voice communications via satellite relay are currently carried out via a third-party relay—it is not like domestic VHF radio communications where the pilot and controller speak directly with each other using a simple press of their radio button.

At some point, oceanic communications will limit the extent to which reductions in aircraft spacing can be achieved. Today's use of voice communications in the oceanic environment is cumbersome, and most pilots would say that voice communications are generally inadequate for real-time air traffic control communications with flight crews. As satellite technologies

continue to evolve, the use of direct controller-pilot voice communications in a manner similar to domestic en route airspace may make oceanic operations significantly safer and more efficient. With the ability for controllers to give revised clearances quickly, pilots would be able to reduce time spent flying through turbulence and avoid hazardous weather conditions, thus improving safety for passengers and crews. With the correct planning, the airspace over the oceans may not require the use of preestablished "oceanic tracks" for aircraft to navigate. Someday, just like domestic airspace, the oceanic airspace may allow airline aircraft to fly the most direct and efficient path between departure and destination airports. Improvements to the oceanic airspace environment may also assist commercial space operators through increased real-time access to be able to launch on an orbital trajectory from the coastlines of the United States. However, to define and implement these visionary concepts by 2050, we must get started right away.

NASA Contribution to Aviation 2050

When we talk about air and space, the National Aeronautics and Space Administration (NASA) is a key research organization that has laid the groundwork for many of the innovations we see in commercial aviation today. ALPA applauds NASA's past efforts, and we encourage NASA to expand the scope of its research to work much more closely with the FAA to ensure that new concepts and technology not only work as a proof of concept, but also meet the needs of the FAA and industry. This will assist the FAA and industry in taking the next steps toward integration. Examples of excellent NASA research that would have benefitted from further maturation and closer collaboration with the FAA include use of Automatic Dependent

Surveillance – Broadcast (ADS-B) for spacing applications as well as its air traffic management automation research programs. NASA's goal should extend beyond the research and include the collaboration and work necessary to see research through to implementation.

Looking at the UTM concepts, the NASA work does not appear to provide FAA with an implementable solution, but rather is a series of technology demonstrations that may or may not be usable by the FAA for establishment of traffic management at low altitude airspace for UAS, rotorcraft, and urban mobility concepts. There is a need for additional discussion about the role of the FAA in managing low-altitude airspace, as well as public debate on whether the FAA should turn over air traffic management in low-altitude airspace to commercial vendors. To date, that discussion has not yet occurred, but ALPA believes it should begin in earnest.

Workforce for the Future

As we look toward the future, aviation faces a challenge also seen by other technology-focused industries: how to develop and shape today's youth to become tomorrow's high technology workforce. The FAA is already seeing significant challenges in replacing the Air Traffic Controller workforce as today's controllers reach retirement age. ALPA sees many opportunities to improve our overall education and training system, which will serve aviation and the country well.

First, to get the sheer numbers of people needed to work in all aspects of aviation, we must improve diversity in the aviation workforce and harness the limitless talent available in the

United States, which can be accomplished through easy and affordable access to education beginning in elementary and secondary education with a focus on developing a passion for Science, Technology, Engineering, and Mathematics in our youth. This must be followed by affordable college educational opportunities at traditional four-year institutions, but also should include new and expanded use of community colleges and vocational or apprenticeship programs. For example, the Community College of Beaver County, PA., and Green River Community College of Auburn, WA., are just 2 of 36 institutions offering programs that can lead to jobs in air traffic control or aviation maintenance technology.

Taking action now is the only way to ensure a sufficient workforce will exist to fly airplanes, control air traffic, maintain aircraft and ATC equipment, and develop the new capabilities that will be needed for aviation into the future.

In closing, ALPA sees a bright and exciting future that builds on the past century of aviation development. As with the past, the new types of aircraft operations we are discussing today will become the established operators of tomorrow—and new ideas and technologies are already on the horizon to take their place. All of these great ideas must be introduced with safety as the top priority to ensure that the airline industry can continue to improve upon the impressive safety record that we have worked together to attain. This level of safety was not created by luck, but by hard work to ensure that current operations are safely performed and that new operations can be safely integrated with those already in place.

To maintain and improve this level of safety, we must ensure that this hard work continues and make investments now in our workforce so that we have the people with the skill, expertise and passion to ensure that the future public can be as confident in our aviation system as we are today.

Thank you for the opportunity to participate in this important discussion today.