WRITTEN SUBMISSION OF
AIR LINE PILOTS ASSOCIATION, INTERNATIONAL
TO THE
SUBCOMMITTEE ON AVIATION
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE
UNITED STATES HOUSE OF REPRESENTATIVES
ON
NEXTGEN SUCCESS STORIES
SEPTEMBER 12, 2012

The following statement is submitted by the Air Line Pilots Association, International (ALPA), representing over 52,000 pilots who fly for 37 passenger and all-cargo airlines in the United States and Canada. On behalf of our members, I want to thank you for the opportunity to provide our perspectives on some of the Next Generation Air Transportation System (NextGen) successes that are the result of the FAA, as the Air Traffic Service provider, and the pilots and operators that use the system, working together collaboratively.

NextGen has been discussed within the aviation community for over a decade. Much of the discussion has been philosophical and focused on potential benefits, the cost of equipage, and which users would be better positioned for the most benefit of NextGen. Airlines have long complained that due to slow NextGen implementation aircraft were being retired as no longer economically supportable before the carriers were able to use the avionics installed in these aircraft to their full capability. This avionics equipment was developed, bought, and installed with the hope that the capabilities could be used. Avionics, without the associated policies for implementation of the capability, procedures for its use, and training for pilots and air traffic controllers, is worthless.

However, as we have begun to implement some of the NextGen concepts, what were once referred to only as potential benefits are now becoming real. ALPA will outline some of these success stories, some new and some that go back many years, that directly affect our members and the airlines that employ them. Each of these is a result of collaboration between government and industry. Neither side could have accomplished these successes without that collaboration.

Some examples are specific initiatives at one or more airports, others are more programmatic, but they all represent specific examples of what NextGen is already doing to safely improve efficiency and capacity. They include:

- Seattle Greener Skies Initiative
- Metroplex - Optimization Of The Airspace And Procedures In The Metroplex (OAPM)
- Parallel Runway Operations at Airports
- Time-Based Flow Management
- Automatic Dependent Surveillance –Broadcast (ADS-B)
- RNP/RNAV En Route Airways (Q/T/TK Routes)
- Continued expansion of RNP/RNAV approach capability
- Increased Capacity in Oceanic Areas
- Reduced Vertical Separation Minima

Each of these has resulted in benefits like greater safety margins, reduced fuel expense, reduced emissions, and more efficient ways to move air traffic. These benefits directly affect the operations of the users as well as the FAA as the service provider. In some cases, the programs and initiatives have taken advantage of existing avionics and/or optimization of procedures and do not require new equipage for the aircraft or the FAA. Others, however, rely on a mutual understanding between FAA and industry of what equipage will be required and when it will be guaranteed to be used. An integral part of this discussion is the concept of what incentives for equipage should be developed to reduce the economic risk to airlines who want to equip their fleets. Reducing that risk will have the effect of encouraging earlier, more widespread implementation of equipment necessary to take full advantage of the efficiency and capacity gains represented by NextGen.

GREENER SKIES OVER SEATTLE INITIATIVE

The Greener Skies Over Seattle initiative, a collaborative project between the FAA, airlines, the Port of Seattle, and Boeing Corporation is a test program to implement extensive use of satellite-based navigation and other NextGen procedures at a busy airport with three parallel runways. The traditional process of potentially lengthy radar guided arrivals and multiple stair-stepped altitude reductions will be replaced by continuous idle-thrust descents along precise curved paths, all made possible by extremely accurate navigation and computer guidance to pilots. Alaska Airlines estimates a potential fuel savings of over 2 million gallons of fuel annually, with corresponding reductions in carbon emissions.

A goal of Greener Skies is to prove that a curved approach using the principles of Required Navigation Performance (RNP) is so precise and predictable, that when it is flown by an aircraft next to an aircraft performing a traditional straight-in approach to a parallel runway, the same lateral separation standard as two straight-in parallel approaches can be employed, increasing capacity and efficiency. That reduction in lateral spacing necessary for safe operations will in turn allow the aircraft on parallel runways to operate independent of one another, increasing the airport's capacity.

The Greener Skies flight trials will validate air traffic control processes, procedures and traffic flow management. It will also provide the FAA with a template for how to implement these kinds of airspace improvements across the country. The FAA plans on creating similar procedures for major airports all over the country starting early next year.

Summary:

- The added accuracy of RNP/RNAV allows aircraft on parallel runways to operate independently from each other, increasing the arrival rate
- The Greener Skies Initiative provides an accurate predictable flight path that can be made shorter and flown using idle power which reduces fuel burn, emissions, and noise.
- The Greener Skies Initiative will serve as a model for how to use NextGen technology in a collaborative process between industry and government.

OPTIMIZATION OF AIRSPACE AND PROCEDURES IN THE METROPLEX (OAPM)

In 2010, following the recommendations of the aviation community, the FAA created an initiative called the Optimization of the Airspace and Procedures in the Metroplex (OAPM). The term Metroplex means a geographic area encompassing several airports in a large metropolitan area serving airlines, business and general aviation. Congestion at the air carrier airport(s), multiple airports in close geographical proximity, and factors such as environmental constraints on flight paths can create conflicting flight paths that reduce efficiency such areas.

OAPM is a collaborative government/ industry approach, combining advanced procedures and satellite-based navigation with airspace redesign, to provide the most efficient operation throughout the selected Metroplex. Rather than focusing on a single airport or set of procedures, traffic throughout the area is optimized so benefits accrue on a regional scale. Over the last two years, OAPM has completed several study and design reports for Washington, D.C., North Texas (Dallas-Ft Worth), Charlotte, Northern California, Southern California, Atlanta, and Houston. A Study and Design Team is currently completing reports in Southern Florida (Miami, Orlando, and Tampa). Design and Implementation teams are now underway at Washington DC, North Texas, and Houston.
Examination of the Houston OAPM will illustrate the advantages. The area around Houston has some of the busiest airspace in the country. Houston's air carrier airports are hubs for several airlines' domestic and international flights, there are numerous "satellite" airports in the region and the area also sees hundreds of helicopter flights into and out of the Gulf of Mexico every day.

The Houston OAPM is one of the 14 national infrastructure projects tracked on the President's Federal Infrastructure Dashboard. Based on studies already performed for Houston OAPM, this initiative will translate to an estimated annual savings of up to 6.9 million gallons of jet fuel, equivalent to nearly 21 million dollars at the current fuel cost. Carbon emissions are expected to be reduced annually by up to 71,000 metric tons-a significant reduction in greenhouse gas emissions by any measure. Additional savings in delay hours and other benefits will continue to be calculated based on the results of the project as more data comes in.

The operational improvements have been significant:

> With the new more precise procedures in place, flight paths into and out of the Houston airspace are more direct. Improved efficiency and capacity during severe weather is provided with a new arrival route in the southwest to be used when severe weather makes northwest routes unavailable.
>
> ATC is providing better service to users into and out of the Houston metropolitan area resulting from the coordinated redesign of the airspace. The new design affords a wider area of control by the Houston terminal controllers which allows use of separation standards of 3 miles instead of 5, increasing capacity. The expanded airspace provides lateral room to better accommodate the descents into Austin and San Antonio while allowing traffic to climb unimpeded. By assuming control of arrivals to satellite airports earlier, low altitude general aviation aircraft operate more efficiently by reducing the length of the route they are flying.

Analysis to date has shown notable decreases in flight distances and times overall in the region. Flights fly closer to the most direct path and with less variability in actual trajectories and minimal impact on other traffic.

All changes to the airspace and procedures must still comply with existing FAA and environmental standards, criteria and requirements. To expedite this process, FAA is using an Environmental Management System (EMS) approach to tightly integrate the National Environmental Policy Act (NEPA) reviews into FAA's internal approval process. This new, accelerated process can bring benefits to the Houston Metroplex in about 24 months.

Summary:

- Optimization of Airspace and Procedures in the Metroplex (OAPM) - identifies efficiency and capacity gains on a regional scale, rather than focusing on a single airport or set of procedures
- OAPM allows more efficient, multiple coordinated flight tracks to funnel multiple streams of aircraft into or out of the metroplex, thus reducing fuel burn, noise, and emissions.
- An example is Houston, one of the 14 national infrastructure projects tracked on the President's Federal Infrastructure Dashboard
- Houston OAPM also uses an expedited environmental assessment process to reduce implementation time from about 36 months to 24 months

PARALLEL RUNWAY OPERATIONS AT AIRPORTS

On January 18, 2012, the FAA began allowing the use of RNP/RNAV GPS-based approaches on parallel runways. Without the use of these more accurate technology enhanced procedures, aircraft simultaneously using parallel runways in bad weather were required to use traditional ground based Instrument Landing System approaches. If both runways were not so equipped, or if the equipment malfunctioned, only one runway was useable, dramatically reducing capacity in bad weather and therefore increasing delays considerably. With the proven accuracy of GPS, airports can maintain a high arrival rate even without ILS, thus increasing capacity over what was previously achievable.

Similar gains can be realized by capitalizing on more precise navigation capability for departures. Atlanta's international airport is the busiest in the world. Any delay can cause a ripple through the entire ATC system. By taking advantage of the more precise navigation offered by state-of-the-art Performance Based Navigation (PBN) systems already on many aircraft, the airport now has the capability of an additional 12 departures each hour. The FAA and industry, working together, developed the new procedure, called Equivalent Lateral Spacing Operation (ELSO), which safely reduces the angle between the departure routes at Atlanta from 15 degrees to 10 degrees. In the past, the larger angle was necessary to accommodate variations in actual position resulting from less precise navigation than is currently possible. More precise navigation allows this change without any additional risk of aircraft straying too near one another's paths.

Atlanta is the first airport to gain approval for use of the new standard. The additional departures mean aircraft spend less time burning fuel on taxiways and in line for take-off. It translates to an

estimated annual savings of $10 million in fuel costs and a reduction in aircraft exhaust emissions.

Summary:

- With the added accuracy of GPS, aircraft on parallel runways may continue to operate in bad weather even in the absence of traditional ILS, eliminating significant delays
- A prototype program at Atlanta has clearly demonstrated that taking advantage of increase navigation accuracy can allow development of departure procedures that reduce departure delays

TIME-BASED FLOW MANAGEMENT

FAA's Air Route Traffic Control Centers manage streams of traffic frequently departing from or arriving at airports well beyond the Center's boundaries. Historically, ATC in these areas has been a matter of separating traffic within the Center's airspace and attempting to facilitate the best routes and altitudes for aircraft, but with little or no knowledge of what conflicts might exist far "downstream" at the ultimate destination. This methodology can lead to many arrivals converging in a terminal area, creating congestion and delays. A key to reducing delays from uncoordinated arrivals is the ability to know with high precision what all aircraft's "4-D trajectories" are, meaning track, altitude and time. Improved navigation accuracy, combined with better knowledge of winds and weather support a NextGen automation tool that helps Center controllers do just that. Time-Based Flow Management, or TBFM, predicts what time all the flights will get to the point in the air where they start to make their descent to the airport, about an hour before arrival. TBFM determines the exact times the aircraft needs to be at certain intermediate points along the way in order to meet its scheduled time to begin to make its descent.

Controllers receive these scheduled times of arrival on their radar screens. They then guide the flights so that each aircraft reaches its intermediate points at the right time while maintaining the required separation between the aircraft. This is an activity known as time-based metering. By making small speed adjustments early in a flight while flights are still at high altitude, delays close to the airport and at low altitude are avoided.

Summary:

- Time-based Flow Management reduces delays by metering flights further from the airport
- Metering of aircraft into an airport provides a more predictable arrival flow
- Flow Management keeps aircraft higher longer which reduced fuel burn and aircraft emissions

AUTOMATIC DEPENDENT SURVEILLANCE –BROADCAST (ADS-B)

In March, 2007, Administrator Blakey announced the surveillance system of the future—Automatic Dependent Surveillance-Broadcast (ADS-B). ADS-B does not rely on a ground-based

radar system. With ADS-B, each aircraft broadcasts its GPS-derived position along with additional information. The information can be sent to controllers and also to other suitably equipped aircraft. The system offers advantages not only in accuracy, but in coverage as it is not subject to the "line-of-sight" limitation of conventional radar surveillance. Just as radar increased the air traffic controllers' situational awareness when it was introduced, ADS-B will increase situational awareness for everyone in the system.

In May, 2010, the FAA issued a regulation requiring ADS-B "Out" equipment on all aircraft operating in certain classes of airspace within the NAS by 2020. ADS-B "Out" refers to the broadcast of the position signal by the aircraft to ground stations. The FAA has not issued a regulation proposing a time frame for the adoption of ADS-B "In," which would allow not only ground facilities, but also other suitably equipped aircraft, to receive the inbound signal.

ADS-B allows identification of aircraft position with greater accuracy, integrity, and reliability than the current radar-based system. Over 400 of the 793 ground transceivers that comprise the ADS-B ground system are now in place with the remainder to be will be in place by the end of 2013. ADS-B targets on controller screens update more frequently than radar and show information including aircraft type, call sign, heading, altitude, and speed. Controllers, and flight crews with access to the appropriate equipment, will know the real-time position of aircraft on the ground or in the air.

Summary:

- ADS-B does not require ground-based radar, so it can be used for surveillance in mountainous, oceanic and remote areas where radar coverage is not available.
- ADS-B provides more precise position information than radar.
- ADS-B provides a common picture for pilots and controllers while increasing situational awareness for everyone.
- By 2020, the FAA will require ADS-B "Out" equipment on all aircraft operating in certain classes of airspaces with the NAS.
- Over 50% of the ADS-B ground system is in place with the remainder to be completed by the end of 2013.

RNP/RNAV EN ROUTE AIRWAYS (Q/T/TK Routes)

As aircraft equipage with GPS reduces the reliance on ground-based traditional navigational aids, specific RNAV routes can be developed based solely on GPS and the number of ground-based navigational aids can be reduced, saving significant infrastructure costs. Known as Q/T/TK-Routes, 171 RNAV routes are already in use in the Western U.S. as well as in the Gulf of Mexico. Aircraft can now fly from central Florida directly to Louisiana and Texas, navigating accurately beyond the range of land-based navigation aids.

Today, more than 85% of the U.S. air carrier fleet is RNAV-capable, and the percentage of aircraft operating in the turbojet cruise environment is even higher. GPS-based routes provide more direct routing compared to conventional routes and allow creation of parallel routes where

a single route existed before. Direct routes improve airspace capacity and relieve congestion while reducing direct operating expenses, such as fuel costs, to the aircraft operator.

Reduced reliance on fixed, ground-based facilities will lead to more efficient design of airspace and procedures and, collectively lead to improved safety, access, capacity, predictability, and operational efficiency for airlines and ATC. By eliminating the need for airways to be tied to NAVAIDs, aircraft gain the flexibility of point-to-point operations.

Summary:

- GPS-based routes provide flexibility in the NAS by allowing aircraft to navigate more efficiently
- The benefits include reduced mileage, fewer conflicts between routes, and additional routes within the same airspace.
- Use of GPS-based routes will allow a reduction in ground-based navigational aids infrastructure with the associated cost saving
- More than 85 percent of the U.S. air carrier fleet and aircraft operating in the turbojet cruise environment are RNAV-capable.

CONTINUED EXPANSION OF RNP/RNAV APPROACH CAPABILITY

The ability to develop instrument approach procedures that are independent of ground-based infrastructure represents a dramatic improvement in all-weather access to airports. The FAA has developed over 12,000 instrument approach procedures based on RNP/RNAV, with many more in progress. These procedures provide extremely accurate navigation guidance to runway ends around the country, many of which previously had little or no such capability. Eliminating the need for complex ground-based infrastructure means instrument approach procedures can be developed for airports previously limited by significant challenges posed by terrain and obstacles. Even for those airports with existing ground-based systems like ILS, inclusion of space-based RNAV/ RNP capability represents additional reliability. Should the ILS be unavailable, if the same capability can be provided through an RNP/RNAV procedure, it is no longer necessary to curtail the arrival rate at even the busiest airports, resulting in fewer delays, diversions and cancellations.

The most significant safety gain that the continuing use of RNP/RNAV capability provides is at airports without any existing advanced approach aid capability. Many airports, including those served by air carriers on a regular basis, are unable to afford or justify installation of the latest approach aids. As a result, pilots of aircraft serving these destinations must rely on equipment and procedures developed well over 60 years ago. The absence of precision vertical guidance to runways is a well-established leading cause of “controlled flight into terrain (CFIT)” accidents. Use of RNP/RNAV procedures to mitigate that risk allows pilots, using state-of-the-art on board equipment and GPS precision, to perform a far more stable approach to a safe touchdown in any weather. Providing this all-weather, precise guidance to an ever-increasing number of runways is a marked improvement in safety, capacity and reliability.

Summary:

- GPS-based RNP/RNAV approach procedures continue to be developed and implemented at airports throughout the country
- Use of these procedures provides improved access to runway ends at airports that previously had little or no such access, and can provide valuable redundancy at airports with existing capability
- Use of RNP/RNAV procedures, particularly at airports that previously had no modern approach aids, represents a significant improvement in safety and capacity.

INCREASED CAPACITY IN OCEANIC AIRSPACE

NextGen technology is also providing benefits in oceanic airspace. Areas like the North Atlantic routes between Europe and North America, and the Pacific routes between North America and Australia/New Zealand were the first areas to use GPS. The use of GPS, combined with satellite communications and automatic position reporting equipment developed for use on the aircraft, allows air traffic control to have a more accurate position for each aircraft and therefore reduce separation in oceanic areas, increasing capacity.

The use of GPS for reducing aircraft separation began in the largest controlled airspace in the world. Together the U.S., Australia, and New Zealand provide air traffic control services to over 23 million square miles of airspace in the Pacific. In 2005, air traffic control providers used this technology to safely reduce the separation between GPS-equipped aircraft to 30 NM in-trail separation and 30 NM separation between routes. The new separation standard now only requires the controller to "protect" – meaning they ensure that no other aircraft encroach on any given aircraft's protected space—only 6% of the airspace previously protected. The net result is safely increased airspace capacity and route flexibility which in turn leads to more efficient routes, substantially decreased fuel burn per flight, and decreased CO2 emissions.

Summary:

- In oceanic routes, precise GPS navigation equipment allows aircraft to fly more efficient routes at optimum altitudes
- GPS has increased capacity of oceanic routes in Atlantic and Pacific
- GPS provides for a safer operation that allows aircraft to fly more efficient routes,
- substantially decreases fuel burn per flight, and decreases CO2 emissions.

REDUCED VERTICAL SEPARATION MINIMA (RVSM)

As has been described above, the ability to have technology in the aircraft and on the ground to more accurately determine an aircraft's position leads directly to the ability to safely reduce the distance between aircraft in a variety of situations. The same is true for increased accuracy in determining vertical position, more commonly referred to as aircraft altitude. Aircraft barometric altimeters have been the standard for determining altitude for decades. Older models of these devices were subject to a number of known limitations on accuracy, as was the available

ground technology. This potential for an aircraft to be at a "true" altitude different than that which was being shown to the pilots, combined with the need for ATC to ensure vertical as well as lateral separation to maintain safety, led to a need for large safety margins that had to be applied between altitudes available for aircraft use. At the altitudes typically used by modern turbojet aircraft, this resulted in an airspace structure that could put aircraft several thousand feet above or below the most fuel efficient altitude, resulting in additional fuel burn and emissions.

Within the last decade, the technology available in the cockpit, improved manufacturing and maintenance processes, and the development of highly accurate "height monitoring" devices on the ground have made it possible to display a more accurate altitude, assure the continued accuracy of the instrument, and verify that altitude from the ground. This significantly improved accuracy and reliability of the overall system now allows use of Reduced Vertical Separation Minima (RVSM) in most of the airspace around the world. RVSM improved both capacity and efficiency by allowing more aircraft in the same airspace and by allowing ATC to assign altitudes much closer to the most fuel efficient altitude for the aircraft.

Summary:

- Advances in technology, both in the aircraft and on the ground, allow much more accurate indication of aircraft altitude than has previously been possible.
- This improved accuracy allows ATC to assign aircraft to us altitudes with less vertical separation than in the past, known as using Reduced Vertical Separation Minima (RVSM)
- Use of RVSM allows more aircraft in the same airspace and allows aircraft to fly at altitudes closer to the most efficient altitude, increasing capacity and decreasing fuel used.

CONCLUSION

NextGen technology has transformed aviation from a ground based navigation system to a space-based navigation system. In the future, as space-based surveillance systems evolve, NextGen will become an even more integral part of an increasingly safe and efficient aviation infrastructure. By contrast not only do ground-based navigation and surveillance systems have well defined limitations, but the cost of maintaining them is very high. Simply put, when we look at the vastly improved accuracy provided by NextGen we see a win-win outcome on safety and operational grounds. If we expect to maintain the world-leading safety record that we point to with pride, NextGen technologies must be funded and implemented.

Today, our members safely and efficiently fly 100's of millions of passengers and millions of tons of cargo around the globe using some of the most advanced aircraft in the world. NextGen technologies have well-established benefits and an even brighter future.

The challenge is to ensure that the programs and procedures necessary to realize these gains are not compromised due to lack of understanding of the benefits, reduced funding for long-term efforts, or lack of political will to maintain leadership in this critical area. ALPA applauds this

committee and the Congress efforts for continuing to explore the possibilities of NextGen. Detailed knowledge of the wide variety of operational areas in which NextGen offers potential benefits will be invaluable in understanding the need for sustained long-term funding. Such funding is an investment in the future of aviation, and will result in both operational and environmental improvements.

As we have noted frequently, new equipment on the aircraft and on the ground is key to many of the NextGen initiatives. As we have also noted, that equipment is useless without plans and programs in place to ensure its use in a timely, efficient manner that justifies the investment. Much of NextGen is built on "enabling technology" such as ADS-B. Such technologies provide some limited benefit of their own, but the true long term value is realized only after investment in additional technology to create a synergy that provides greatly improved efficiency and significant capacity gains. Airlines may be unwilling, or be willing but financially unable, to make such investments only on the promise of "good things to come." The government-industry collaboration that has become the hallmark of NextGen success must continue to explore ways to provide incentives for airlines to equip their fleets, or the full benefits of NextGen may never be realized.

Summary:

- NextGen is beginning to transform aviation from a ground-based navigation and surveillance system to a space-based system
- As space-based systems evolve, NextGen will become an even more integral part of the aviation infrastructure
- Cost of maintaining a redundant ground-based navigation system is high
- NextGen provides a critical safety benefit to the nation's aviation infrastructure
- NextGen importance must be recognized, supported by sustained long term funding and other resources
- Programs to ensure that airlines can develop a satisfactory business case for equipping their fleets with the technology to ensure NextGen benefits are realized must continue to be pursued by both government and industry.