Our current air traffic control system has been compared to a series of traffic lights at busy intersections. I’d take it a step further and say it’s like a busy intersection, but where the cars don’t just go across, but up and down, and approach at various angles. And, of course, it’s always rush hour. NextGen is the solution.

Marion C. Blakey
President and CEO
Aerospace Industries Association
Imagine if U.S. policymakers overwhelmingly supported one government program that promised to create more than 500,000 jobs, reduce carbon emissions by 16 million tons and generate more than $90 billion in national economic output – all by expanding the use of proven technologies already deployed across the country?

The Next Generation Air Transportation System – called NextGen – is just such a program. NextGen, a critical upgrade of the nation’s air traffic control (ATC) system, updates a woefully out-of-date segment of our national transportation infrastructure and holds tremendous promise for air travelers and the U.S. economy.

The need has never been greater. The nation’s current ATC system of beacons, radars and radios is based on aging and ineffective technology. Despite the advent of advanced GPS and digital technology, the current system steers aircraft toward radio beacons installed in the same locations where bonfires guided cross-country airmail flights in the 1920s. Flights are guided in straight lines between a series of fixed points and controllers ask pilots via analog radios to increase or decrease altitude in steps – rather than by gradual and continuous descents and climbs.

NextGen will bring air traffic control fully into the 21st century. When fully deployed in 2025, NextGen will help ease congestion in an era when the number of commercial air passengers is expected to double. It will lead to cleaner skies through lower aircraft CO₂ emissions and dramatically decrease the amount of fuel used by air carriers.

But threats to NextGen implementation remain. Competing federal priorities, short-term budgeting and draconian sequestration cuts have slowed NextGen implementation and threaten its future success.

Major investment in U.S. transportation infrastructure has always called for visionary leadership, long-term financial commitment and an acknowledgement that the status quo endangers the potential for future economic growth and prosperity.

In the early 20th century, U.S. transportation advocates were focused on the condition of the nation’s roads, which at the time were “little more than trails that were muddy in the rain and dusty the rest of the time.”

In 1919, when it took a young Dwight D. Eisenhower 62 days to cross the country by car, policymakers were just beginning to recognize the need for a road system that would not rely solely on local funding and maintenance. But it would take decades before funding would be granted for a remedy that – in the words of federal road agent General Roy Stone – would be “as radical as the disease [was] deep-seated.”

Approximately 40 years later, President Eisenhower would sign the Federal Aid Highway Act, funding construction of the interstate highway system – a project of historic ambitions that changed the country forever and unleashed a wave of economic growth.

Today, air travel needs advocates like Eisenhower. Long-term commitment to NextGen must remain a national priority, not just in the aerospace industry and among its various stakeholders, but among leaders who understand the link between a strong aerospace sector and future job creation, economic growth and ongoing U.S. global competitiveness in the skies.
"Flight delay degrades the quality of the airline product. While many air travelers choose to ‘grin and bear it’ others respond by switching to alternative transportation modes, or simply not traveling at all."

— NEXTOR Study, 2008

A Compelling Need
America’s current air traffic control infrastructure can be described as a mid-20th century system serving 21st century aviation. It relies on decades-old systems and equipment that will soon be unable to handle soaring increases in U.S. and global air traffic.

In 2012, more than 815 million passengers traveled on carriers serving the U.S., an increase of 1.3 percent over 2011. According to the Federal Aviation Administration (FAA), this number is projected to reach 1.2 billion by 2030. Globally, more than 3 billion air passengers are expected to travel in 2014 and air cargo volumes in North America alone are expected to rise at a rate of 4.8 percent each year over the next several decades.

Airport congestion – already a national transportation challenge – will only get worse without NextGen deployment. Traffic at 35 major airports in the U.S. is expected to increase 19 percent by 2018.

Without NextGen, costly flight delays will become more common. The current cost of flight delays in America is $32.9 billion, $16.7 billion of which is borne by passengers. Delays currently account for a $4 billion loss of GDP and an additional $3.9 billion is unrealized from “loss of demand” – missed opportunities, jobs and revenue left on the table.

“Flight delay degrades the quality of the airline product,” write the authors of a 2008 industry study. “While many air travelers choose to ‘grin and bear it’ others respond by switching to alternative transportation modes, or simply not traveling at all.”
NextGen is critical for enabling safe and widespread utilization of unmanned systems in domestic airspace. The FAA and its partners are developing solutions that would integrate data from UAS ground control stations, share real-time flight data with ATC systems and establish two-way communications between UAS pilots and air traffic controllers. NASA is also contributing research that would help incorporate UAS flights in domestic airspace, including NextGen’s 4D trajectory operations, automated systems, integrated weather prediction and other capabilities.

Like the FAA, however, NASA’s aeronautic research budget is threatened by budget cuts that would not only impact NextGen deployment, but also endanger U.S. leadership in global air traffic control integration.

"With NextGen, we are leading the global pack and it is important as a part of the harmonization of global air traffic management," says Dr. Jaiwon Shin, Associate Administrator of NASA’s Aeronautics Research Mission Directorate. "If we take the leadership role, we’re being good citizens of the world, but at the same time we have the advantage of setting the standard." 

The Cost of Limitations on Unmanned Systems

Largely absent from calculations of traffic increases and aviation growth potential is the impact of an entirely different class of aircraft, the unmanned aircraft system (UAS).

While unmanned systems have been used for decades, they are increasing in number and effectiveness as aircraft, sensor and automation technologies mature. Consequently, the potential benefits of these systems are projected to extend well beyond military use – to a variety of civilian applications that will improve the safety of communities, strengthen public services and achieve countless benefits to a wide variety of commercial and government organizations.

Some estimates project UAS spending to nearly double over the next decade, from $6.6 billion to $11.4 billion on an annual basis, with the segment generating $89 billion over the next 10 years. Importantly, many of the applications of UAS will be equally relevant and valuable overseas; a healthy domestic UAS market will assure future export opportunities and more jobs.

If everybody [operating an unmanned system] has to be stuck at 35,000 feet and in the same lane, then it defeats the purpose. Any future vehicle development should be considered in the context of NextGen capabilities.

Dr. Jaiwon Shin
Associate Administrator
NASA Aeronautics Research Mission Directorate
A fundamental enabling technology of NextGen is the Automatic Dependent Surveillance-Broadcast (ADS-B), a satellite-based surveillance system that uses GPS to pinpoint an aircraft’s precise location and constantly broadcasts that information and other critical data (altitude and air speed, for example) to nearby aircraft and air traffic controllers.

With ADS-B, for the first time, both pilots and controllers will see the same real-time displays of air traffic. This breakthrough toward common, situational awareness in the cockpit and the control tower will enhance safety and enable more efficient use of airspace.

ADS-B is undergoing a phased implementation. As of August 2013, 547 ADS-B transmitters were operational nationwide, achieving coverage throughout the continental U.S.

How does it work?
NextGen will use satellites and GPS technology that will take the place of 1960s-era radars, increasing the accuracy of location information, enabling planes to fly closer together safely and provide pilots with a real-time picture of air traffic. The system will also allow planes to land and depart quickly, with less noise and greater fuel efficiency.

NextGen is a major leap forward for the nation’s current ATC system, which still traces its technological roots back to ground-based radar, voice navigation and radio beacons first used in the 1930s.

NextGen is actually a “system of systems.” It is comprised of satellite-based communications, navigation and surveillance systems that will integrate advanced routes and procedures and a common weather picture with the necessary ground infrastructure, including:

- Performance-based Navigation (PBN)
- Time-based Flow Management (TBFM)
- Automatic Dependent Surveillance-Broadcast (ADS-B)
- Data Communications (Data Comm)
- System Wide Information Management (SWIM)

These capabilities are achieved through new ground-based computer stations, GPS navigation equipment in the cockpit and critical data links between the aircraft and control tower.

What is NextGen?

Today, pilots don’t fly across the country directly from point A to point B along a continuous path. The current air traffic control system is still based on a system that guides pilots between beacons at fixed points along the way, rather than following a continuous, optimal route to their destinations. It’s an inefficient, outmoded system.

Wide Area Augmentation System
ADS-B
Automatic Dependent Surveillance Broadcast (ADS-B) is a technology that allows pilots in the cockpit and air traffic controllers on the ground to “see” aircraft traffic with heightened precision. ADS-B also broadcasts real-time weather information to pilots, which significantly enhances situational awareness and increases flight safety. ADS-B transceiver-equipped aircraft broadcast their precise position along with other data, including airspeed, altitude, and whether the aircraft is climbing or descending. ADS-B receivers that are integrated into the air traffic control system or installed aboard other aircraft provide users with an accurate depiction of real-time aviation traffic, both in the air and on the ground.

GBAS
Ground Based Augmentation System (GBAS) is a ground-based augmentation to GPS that focuses its service on the airport area for precision approach, departure procedures and terminal area operations. It broadcasts a correction message via radio data link from a ground-based transmitter, and yields the high accuracy, availability and integrity necessary for precision approaches. This system will provide the ability for more flexible approach paths.

Data Comm
Data Communications (Data Comm) is the term given to the implementation of advanced flight controller and flight crew communication capabilities, which will contribute significantly to increased efficiency, capacity and safety under NextGen. Data Comm is the first phase of a permanent transition from the current analog voice system to an internationally compliant system in which digital communication becomes the predominant mode.

SWIM
System Wide Information Management (SWIM) is an advanced technology program designed to facilitate greater sharing of air traffic information, such as airport operational status, weather information, flight data, status of special use airspace and national airspace system (NAS) restrictions. SWIM will support current and future NAS programs by providing a flexible and secure information management architecture for sharing NAS information. SWIM will use commercial off-the-shelf hardware and software to facilitate the addition of new systems and data exchanges, and increase common situational awareness.
As air traffic increases, so does the pressure on air carriers, manufacturers and airport facilities to confront some of the aviation industry’s most difficult challenges. Among these are flight delays, fuel costs, noise and air pollution. NextGen’s upgrade of the nation’s ATC system, however, will do more to advance the causes of safety, fuel efficiency and clean skies than any U.S. government program in existence today.

**Improved flight safety**

Thanks to NextGen’s GPS-based navigation systems, for the first time pilots and controllers will be able to look at the same real-time displays of air traffic.

Controllers and pilots will communicate using data and text, sent digitally, rather than relying on radio voice communication, which can be unreliable and lead to serious – sometimes fatal – errors.

ADS-B technology, in particular, helps pilots see other aircraft on a cockpit display, rather than through visual or radio contact, a capability projected to reduce fatal accidents by more than 40 percent.\(^{13}\)

The Ground Based Augmentation System (GBAS) is a ground-based augmentation to GPS that brings its benefits to the airport area for precision approach, departure procedures and terminal area operations. It yields the high accuracy, availability, and integrity necessary for precision approaches. This system will provide the ability for more flexible, safe approach paths.

**Reduced flight delays**

According to the FAA, flight delays under full NextGen implementation would be reduced by an estimated 35 percent – or approximately 4 million hours – thanks to a reduction in the amount of time aircraft spend sitting on runways, holding in the air or being re-routed around bad weather.

Currently, 70 percent of flight delays are attributable to weather. NextGen will also create a single national weather information system, updated in real time and networked with controllers and pilots. More accurate detection and tracking information, along with better coordination and communication, will cut weather-related delays in half.

Fuel savings and other efficiencies from reducing delays will amount to $18 billion of net benefits in the United States each year between 2012 and 2030.\(^{14}\)

**Clean, quiet skies**

With NextGen, flight will be quieter, cleaner and more fuel-efficient. It is estimated that NextGen will save 1.6 billion gallons of fuel and eliminate 16 million metric tons of carbon emissions by 2030.\(^{15}\) Full implementation of NextGen could reduce greenhouse gas emissions from aircraft by up to 12 percent by 2025 – the equivalent of taking 2.2 million cars off the road for an entire year.\(^{16}\)

Continuous descent arrivals enabled by NextGen would save 3.75 million tons of carbon dioxide emissions each year at the top 10 U.S. airports alone, saving more than 1.4 billion gallons of fuel.

FAA models project aircraft noise levels decreasing by 30-40 decibels nationwide under full NextGen implementation, as flight paths become more precise and areas on the ground affected by the sound of arriving and departing flights become smaller.\(^{17}\)
NextGen technology in the field today is yielding benefits for airlines, airports and the communities and passengers they serve:

- **Memphis** – Increased airport capacity by 20 percent.

- **Washington, D.C.** (Dulles and Reagan airports) – Saved $2.3 million in fuel annually and cut greenhouse gas emissions by 7,300 metric tons.

- **Atlanta** – Increased departures to 8-12 per hour (up 10 percent), with an initial benefit of $20 million in 2013 – and reduced runway departure wait times by 11,000 hours.

- **Dallas/Ft. Worth** – Added capacity of 11-20 flights per hour resulting in $8.5-$12.9 million in delay savings per year.

- **Seattle/Tacoma** – Reduced its landing approach route by 17 miles, resulting in less noise and saving Alaska Airlines $17.6 million and 200,000 gallons of fuel in 2012.

NextGen could reduce greenhouse gas emissions from aircraft by up to 12% by 2025.²⁵

The equivalent of taking 2.2 million cars off the road for an entire year.

= 1,000 CARS
A recent economic forecast stated that aviation’s direct contribution to global GDP will increase by 4 percent per annum over the next 20 years, helping to create 874,000 additional jobs across North America by 2030.\(^\text{18}\)

Standing in the way of this growth potential, however, is airspace that is too congested, airports that are too crowded and the continued downward pressure on the aviation industry posed by fuel costs and CO\(_2\) emissions.

Yet despite the tremendous economic, environmental and performance benefits to be realized from NextGen, the program has been repeatedly threatened by short-term funding measures, a lack of future commitments and sequestration.

In 2012, lawmakers finally passed a long-term FAA authorization after 23 temporary funding measures, some of which were as short as four months. However, sequestration remains a threat and could delay NextGen implementation for up to a decade. The potential cost of this delay, in terms of lost opportunities for the U.S. economy, include the loss of 500,000 to 1 million U.S. jobs, $46-$51 billion in lost wages and $96-$192 billion in unrealized economic output.\(^\text{19}\)

While capital funding for NextGen could survive sequestration, there must also be stable operations funding to keep NextGen on track.

“The budget profile even under the sequester would provide capital funding required to meet most [NextGen] commitments,” says FAA Administrator Michael Huerta. “But to make this happen, we also have to have the operations funds to maintain active work force participation in key activities. If we’re not able to keep that work force engagement, it’s very difficult to meet all of our current commitments and the associated timelines… It’s one thing to deploy a system; it’s quite another thing to make it operational.”\(^\text{20}\)

**NextGen 2025: The Way Forward**

Just as the national highway system in the 1950s had advocates like President Dwight D. Eisenhower, the nation’s air traffic control system needs its champions and visionaries. Only long-range commitments and increased public awareness of NextGen benefits will ensure that the aviation sector can continue to create jobs and meet future demands on capacity.
Other critical factors for NextGen success include:

**Collaboration**
Collaboration among stakeholders representing industry facilities, communities and government agencies must continue. The FAA has formed a variety of inter-agency and inter-regional working groups to track and evaluate NextGen deployment progress. Temporary funding recently restarted the Optimization of Airspace and Procedures in the Metroplex (OAPM) program. With the goal of improving air traffic flows in congested metro regions, its study teams consist of the FAA, airline representatives and other stakeholders, who meet to identify efficiency gains through measures such as adjusting airspace sectors and implementing advanced navigation procedures. Funding for programs like this must continue.

A lack of stakeholder engagement can result in setbacks. At airports where new NextGen-enabled flight paths were determined without community input, for example, public opposition to additional flights and noise complaints actually increased. 21

**Commitment to the system, not the parts**
As a “system of systems,” NextGen’s benefits only become a reality with full deployment. Therefore, funding commitments must continue for every part of the NextGen program, including incentives for aircraft equipage and funding for critical components such as data communications integration and System Wide Information Management.

**Public education**
In seeking support for major public investments, policy leaders must make an effective case to the American people. NextGen’s clear benefit to the lives of all Americans, however, eases the task of public education. For industry and government officials charged with communicating the importance of NextGen to mass audiences, it is important to link the program’s deployment to the potential for greener, quieter and more efficient air travel in the U.S. and worldwide.

“It’s one thing to deploy a system; it’s quite another thing to make it operational.”
- FAA Administrator, Michael Huerta

Regardless of the issue most important to any given stakeholder – whether it is environmental stewardship or job creation – there is a NextGen message that frequent fliers, industry leaders and community advocates will find compelling.

The aerospace industry’s important role in the U.S. economy should drive any discussion of NextGen deployment. The industry is the largest contributor to U.S. export revenue, which last year reached $95.5 billion dollars – exceeding imports by $63.5 billion – and is responsible for sustaining 630,000 jobs across the country. 22

NextGen is a vital engine that will enable ongoing economic growth. NextGen lays a foundation that will continually improve and accommodate the future of air travel while strengthening the economy with one seamless, global sky.

If sequestration and other funding cuts delay NextGen, airspace capacity will not increase, and a safe but inefficient air traffic system will gridlock long before the expected growth in commercial airline sales and passenger volume comes to pass.

Demand will soar past seat and cargo capacity, delays will increase dramatically and ticket prices and cargo rates will rise. The economic engine that is air transportation – the sector that for decades has propelled the nation’s economy – will sputter and stall.

Commitment to full NextGen deployment will ensure cleaner, quieter and safer skies and provide the lift required for the aviation industry, its customers and the United States economy to reach new heights.

2 Ibid.


9 Ibid.


13 “NextGen 101: Addressing the NextGen Challenge, Next Generation Air Transportation System Joint Planning and Development Office.”


15 Ibid.

16 Dr. Gerald L. Dillingham, Director of Civil Aviation Issues for the U.S. Government Accountability Office (GAO), May 2008, testimony before the House Transportation and Infrastructure Subcommittee on Aviation.


Charts, callouts, sidebars:


24 NextGen JPDO

25 Dr. Gerald L. Dillingham, Director of Civil Aviation Issues for the U.S. Government Accountability Office (GAO), May 2008, testimony before the House Transportation and Infrastructure Subcommittee on Aviation.

26 Wall Street Journal, August 19, 2013 and Statement of Michael P. Huerta, Administrator, FAA, Before the Committee on Transportation and Infrastructure, Subcommittee on Aviation, on Causes of Delays to FAA’s NextGen Program, July 17, 2013.

27 AIA/Econsult