



Easing airport congestion becomes a 21st Century challenge

Chapter 9: Getting Ready for NextGen

George W. Bush became the forty-third president on January 20, 2001. Five days later, former Member of Congress Norman Mineta (D-CA) took the oath of office as the nation's fourteenth Secretary of Transportation. The lone Democrat in George W. Bush's cabinet, Mineta had been Secretary of Commerce in the outgoing Clinton Administration, and was the first Asian Pacific American to hold this cabinet post. Mary Peters succeeded Mineta, who retired on October 24, 2006. Jane Garvey, who had been appointed to a five-year term as FAA Administrator remained in her position until the end of her term on August 2, 2002.

MARION BLAKEY [TERM: SEPTEMBER 13, 2002 - SEPTEMBER 13, 2007] became the 15th FAA Administrator on September 13, 2002. She had served for slightly less than one year as the National Transportation Safety Board (NTSB) chairperson. This native of Gadsden, Alabama, came to the FAA with varied experience both within and apart from the federal government. Her experience in previous Republican administrations included positions with the Department of Commerce, Department of Education, the National Endowment for the Humanities, and the White House. Under President H. W. Bush, she had served in the Department of Transportation (DOT), from 1992-1993, as the head of the National Highway Traffic Safety Administration. Following that, she had run her own public affairs consulting business for eight years.



Administrator Marion Blakey

When Administrator Blakey's five-year term ended on September 13, 2007, Deputy Administrator Robert A. Sturgell became acting administrator. The congressional elections in 2006 had brought a Democratic Party majority to the House of Representatives and the Senate [the Senate had 49 Democrats, 49 Republicans, and two democratic-caucusing Independents] for the first time in twelve years. The White House announced its intention to nominate Sturgell for his own five-year term as FAA Administrator and the Senate Commerce Committee held a confirmation hearing on February 7, 2008. Following the hearing, however, Democratic New Jersey Senators Frank Lautenberg and Bob Menendez placed the Sturgell nomination on hold, an action that prevented it from going to the Senate floor for a vote.

Security

With his administration less than a year old, President Bush and the transportation and aviation officials who advised him found themselves dealing with a major, tragic breach of aviation security. On September 11, 2001, nineteen radical Islamic extremists with the group al Qaeda penetrated security at three major airports and hijacked four U.S. domestic airliners. Then they turned three of the aircraft into missiles that destroyed the World Trade Center in New York City and damaged the Pentagon in Arlington, Virginia, killing thousands. Passengers on one of the planes fought the hijackers, causing the plane to crash in a Pennsylvania field, killing all on board. To prevent further immediate hijackings, FAA put a ground stop on all traffic for the first time in U.S. aviation history. Actions on September 11 included:

Eastern Standard Time

- 7:59 am: American Airlines Flight 11, a Boeing 767 with 92 people on board, takes off from Boston Logan airport for Los Angeles.

Scenes from September 11, 2001



- 8:14 am: United Air Lines Flight 175, a Boeing 767 with 65 people on board, takes off from Boston Logan airport for Los Angeles.
- 8:20 am: American Airlines Flight 77, a Boeing 757 with 64 people on board, takes off from Washington Dulles airport for Los Angeles.
- 8:38 am: FAA notifies the North American Aerospace Defense Command's (NORAD) Northeast Air Defense Sector about the suspected hijacking of American Flight 11.
- 8:42 am: United Air Lines Flight 93, a Boeing 757 with 44 people on board, takes off from Newark airport for San Francisco.
- 8:46 am: American Flight 11 crashes into the north tower of the World Trade Center.
- 9:03 am: United Flight 175 crashes into the south tower of the World Trade Center.
- 9:04 am: FAA's Boston Air Route Traffic Control Center stops all departures from airports in its jurisdiction (New England and eastern New York State).
- 9:06 am: FAA bans takeoffs of all flights bound to or through the airspace of New York Center from airports in that air route traffic control center and the three adjacent air route traffic control centers — Boston, Cleveland and Washington. This is referred to as a first tier ground stop and covers the Northeast from North Carolina north and as far west as eastern Michigan.
- 9:08 am: FAA bans all takeoffs nationwide for flights going to or through New York Center airspace.
- 9:15 am: FAA (New York Center) notifies NORAD's Northeast Air Defense Sector that United Airlines 175 was the second aircraft that crashed into the World Trade Center.
- 9:25 am: FAA bans takeoffs of all civilian aircraft regardless of destination — a national ground stop.
- 9:37 am: American Flight 77 crashes into the Pentagon.
- 9:45 am: In the first unplanned shutdown of U. S. airspace, FAA orders all aircraft to land at the nearest airport as soon as practical. At this time, there are more than 4,500 aircraft in the air on instrument flight rules (IFR) flight plans.
- 10:03 am: United Flight 93 crashes in Stony Creek Township, Pennsylvania.
- 10:39 am: Reaffirming the earlier order, FAA issues a notice to airmen (NOTAM) that halts takeoffs and landings at all airports.
 - 12:15 pm: The airspace over the 48 contiguous states is clear of all commercial and private flights.
 - 2:30 pm: FAA announces there will be no U.S. air traffic until noon eastern standard Time Wednesday at the earliest.



U.S. Marshals patrol Washington Reagan National Airport

DOT Secretary Norman Mineta announced on September 12 FAA would allow a limited reopening of the nation's commercial airspace system so that flights that had been diverted the day before could continue to their original destinations. He also said FAA had temporarily extended the overall ground stop order imposed the previous day to make it possible for the agency to initiate additional security measures. FAA permitted flights only in special limited circumstances and under vastly tightened security guidelines. Only passengers on the original flights would be allowed to re-board, and only after airports and airlines had implemented strict screening measures.

FAA instituted a variety of stepped-up security measures at the airports once they re-opened:

- A thorough search and security check of all airplanes and airports before passengers would be allowed to enter and board aircraft
- Discontinuance of curbside check-in at the airport
- Discontinuance off-airport check-in
- Only ticketed passengers would be allowed to proceed past airport screeners to catch their flights
- Vehicles near airport terminals would be monitored more closely

On September 14 Secretary Mineta approved restoration of the next phase of national air service. Effective at 4:00 pm eastern standard time, he allowed certain general aviation flights to resume IFR operations. Temporarily, however, general aviation aircraft would not be allowed to fly within 25 nautical miles of New York City and Washington, DC. On September 19 FAA lifted most restrictions on U.S. registered general aviation (Part 91) aircraft, operating under visual flight rules (VFRs), outside of a 30-mile radius of 30 major U.S. airports.

FAA kept restrictions (except in Hawaii) on the following flying activities: civil aircraft VFR flight training operations, VFR operations for banner towing, news reporting, traffic watch, airship/blimps, and Part 91 sightseeing. FAA also restricted flying of any kind within 3,000 feet of

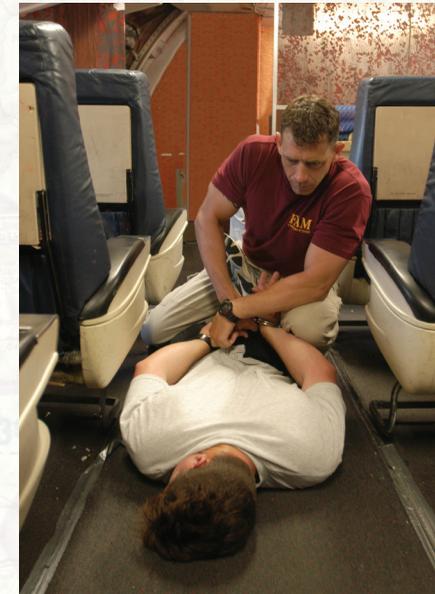


Federal Air Marshals at the practice range

altitude and three nautical miles of major sporting events or large open-air gatherings of people, such as football and baseball stadiums, race tracks, and concerts. Four days later, FAA, in conjunction with other federal agencies, issued a NOTAM banning agricultural/crop-duster flights from operating. In addition, no aircraft capable of or equipped for agriculture operations could operate during the ban.

In a September 27 speech at Chicago's O'Hare airport, President Bush announced three measures to enhance aviation safety and security. First, he would continue to expand FAA's air marshal program and seek congressional approval to make this expansion permanent.

Second, he would ensure that, effective October 1, a fund of \$500 million would be established to finance aircraft modifications to deny or delay access to the cockpit. Third, he would work with Congress to put the federal government in charge of airport security and screening services. The president said that fully implementing the extensive security proposal might take four to six months. In the meantime, to ensure that every airport had a strong security presence, he asked the governors of all fifty states to call up the National Guard — at federal expense — to augment existing security staff at every commercial airport nationwide. FAA would provide the necessary training for National Guard personnel.



Federal Air Marshal training

After the president's speech, FAA launched a nationwide search for personnel to join the air marshal program. In the interim, FAA trained agents from other federal agencies, including the Customs Service, the Secret Service, the Immigration and Naturalization Service, and the Bureau of Alcohol, Tobacco and Firearms. The existing experience of these law enforcement officials was quickly augmented with schooling on handling situations amounting to warfare in a confined space — aboard a jet at 37,000 feet.

On September 28 FAA alerted civilian pilots of their new responsibilities in light of a recent Department of Defense (DoD) announcement. They were to avoid restricted airspace and, if they were to find themselves near or in prohibited airspace, they were to land immediately if so ordered. The military authorities reserved, as a last resort, the right to use deadly force upon non-compliant aircraft. Furthermore, new security decisions required that additional airspace be barred to civilian aircraft. FAA anticipated announcing new restricted and prohibited areas throughout the United States. This additional airspace would be over areas that required protection for national security reasons.

Prohibited areas would be revised periodically, and new or extended restrictions would be announced.

On November 19, 2001, President George W. Bush signed into law the Aviation and Transportation Security Act. Among other provisions of the new legislation was the establishment of a new agency to be responsible for aviation security — the Transportation Security Administration (TSA) within DOT. FAA remained

responsible for aviation security until February 13, 2002, when TSA took over those responsibilities. Before the year was out, however, the November 25, 2002, passage of the Homeland Security Act (Public Law 107-296) brought TSA into the new Department of Homeland Security on March 1, 2003.

While waiting for TSA to begin operations, FAA continued to enforce a number of new security measures. In December 2001, for example, FAA required each airport operator and aircraft operator that had a mandatory security program to conduct fingerprint-based criminal history record checks for individuals who had not already undergone such checks. A new rule followed in January 2002 ordering airlines to inspect all checked baggage for explosives. In this rule, the agency also mandated new standards, authorized under the Aviation and Transportation Security Act, to protect cockpits from intruders and the effects of small arms fire or fragmentation devices, such as grenades.

Operators of more than 6,000 airplanes were told to install reinforced doors by April 9, 2003. As well, FAA issued a special federal aviation regulation (SFAR) requiring operators to install temporary internal locking devices within 45 days on all passenger airplanes and on airplanes equipped with cargo cockpit doors. To compensate for any undue hardship, however, the agency issued a series of SFARs in October 2002 authorizing certain types of short-term door



Airport security increases after September 11



Long lines in baggage screening areas

reinforcements while airlines and cargo operators were struggling to meet the new standards. As a result, the major U.S. airlines voluntarily installed short-term fixes to the cockpit doors of 4,000 aircraft in 32 days.

By October 2001, as a result of the attacks on September 11, 2001, President Bush had announced a global war on terrorism and ordered an invasion of Afghanistan to overthrow the Taliban, destroy Al-Qaeda, and capture Osama bin Laden. In March 2003 he ordered the invasion of Iraq.

Reorganizing for the Future

FAA selected its first Air Traffic Organization (ATO) Chief Operating Officer (COO), Russell Chew, in June 2003. With the COO in place, FAA went forward with a major reorganization of its air traffic and research and acquisition organizations. On November 18, 2003, Transportation Secretary Norman Mineta announced initial details of the new ATO business structure. The



New aviation challenges require organizational changes

ATO consolidated FAA's air traffic services, research and acquisitions, and free flight program activities into a smaller, more efficient organization with a strict focus on providing the best service for the best value to the aviation industry and the traveling public. The establishment of the ATO had been first recommended by the 1997 National Civil Aviation Review Commission, chaired by Secretary Mineta. In April

2000 Congress had enacted the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century that mandated establishment of a Chief Operating Officer position to oversee the air traffic control system. Executive Order 13180 officially created the ATO with the Chief Operating Officer as its head.

The Vision 100 — Century of Aviation Reauthorization Act (Public Law 108-176), signed by President Bush in December 2003, abolished the Air Traffic Services Subcommittee of the Federal Aviation Management Advisory Council and created, separate from the Council, an Air Traffic Services Committee. This new committee received substantial governmental authority, including the power to approve FAA's strategic plan for the air traffic control system, approve certain large procurements, appoint and determine the pay of the FAA Chief Operating Officer, dictate major FAA reorganizations, and control FAA cost accounting and financial management structures. The legislation also endorsed the concept of the Next Generation Air Transportation System (NextGen) and directed DOT management to create a Joint Planning and Development Office to facilitate NextGen activities.

The ATO officially began operations on February 8, 2004. FAA realignment gave it responsibility for providing air traffic services and research and acquisition. In line with other agency efforts to improve efficiency, in December 2005 the COO restructured ATO administrative and support functions in the field. By eliminating duplication of administrative and support services, FAA expected to reduce ATO operating costs by an estimated \$360-\$460 million over the next ten years.

In June 2006 FAA instituted a new ATO Service Center structure. Three service centers replaced the nine service area offices within En Route, Terminal, and Technical Operations. Each of the service centers was made up of five functional groups: administrative services, business services, safety assurance, system support, and

planning and requirements. A sixth group, engineering services, remained in place in the existing locations.

With the ATO structure in place, the agency's first COO resigned from FAA on February 23, 2007. Administrator Marion Blakey assigned COO responsibilities to Deputy Administrator Robert A. Sturgell as collateral duties until a new COO came on board. On October 1, 2007, Administrator Blakey hired the agency's second COO, Henry Krakowski.

Union Negotiations

In December 2003 FAA and the National Air Traffic Controllers Association (NATCA) signed a two-year contract extension that expanded “pay-for-performance” to include air traffic controllers and provided potential savings of several million dollars. The contract extension increased the number of agency employees whose pay was tied partly to performance from 37 percent to 75 percent. The pay for performance compensation system for over 15,000 air traffic controllers was based on safety and capacity targets set forth in FAA's strategic plan. The targets included reducing operational errors and runway incursions and increasing on-time performance and arrival efficiency rates. FAA and the union also agreed that, when a provision binding FAA to maintain a fixed number of controllers each year expired at the end of September, the agency could adjust staffing levels based on actual workload.

With the two-year extension scheduled to expire in September 2005, FAA and NATCA began contract negotiations on July 20, 2005. FAA Administrator Marion Blakey called for federal mediation to help the agency reach a voluntary contract agreement with the air traffic controllers union on November 28, 2005. FAA's request, hand-delivered to NATCA, sought help from the Federal Mediation and Conciliation Service (FMCS) to reach a voluntary agreement after four and a half months of negotiations. NATCA believed

mediation was not appropriate at the time, since the two parties were making progress in the negotiations. While the existing contract had technically expired on September 30, an “evergreen” clause had allowed the original contract to remain in place so long as talks continued.

NATCA worked with Congress to have legislation introduced that would change the contract negotiation process. On January 26, 2006, a number of Senators introduced a bill (S 2201) that would deny FAA any ability to impose a contract without the consent of Congress. FAA argued that section 40122 of title 49 of the U.S. Code said that in the event of a breakdown in negotiations — an impasse — FAA could send the contract to Congress, providing legislators the opportunity to get involved. If Congress did not act, then FAA could legally impose its last, best contract offer unilaterally on NATCA. The House of Representatives subsequently sponsored a bill similar to that proposed by the Senate. On June 7 the House of Representatives passed their version of the bill, known as the Fair FAA Act (HR 4755). The Senate, however, did not act on its version of the bill.



Evening air traffic control tower operations

To publicly counter NATCA criticism of its contract proposal, FAA released findings from an international accounting firm on January 30, 2006. The agency announced this study had validated

its calculation that the average 2005 air traffic controller compensation package exceeded \$166,000. FAA further noted that other independently validated figures revealed that, between 1998 and 2005, controller compensation had increased by 75 percent and the wage gap between controllers and all other FAA employees had doubled.

As requested by NATCA on February 23, 2006, a two-week session of federally mediated contract negotiations began on March 6. Before these talks ended, FAA called, on March 15, for the FMCS to extend contract talks for up to a week to allow around-the-clock negotiations in an effort to reach an agreement. FMCS agreed to continue talks into the following week.

FAA and NATCA exchanged their final contract proposals on April 3. With neither side satisfied with the proposals, an impasse was reached. Several days later, FAA dismissed public speculation that it was preparing to return to the negotiating table. In a letter to the NATCA President on April 24, Administrator Blakey rejected the union's call to resume contract negotiations. On April 25, FAA officially ended contract negotiations with NATCA and planned to submit its final proposal to Congress. The legislators would then have 60 days to review FAA's proposal and NATCA's objections. By statute, FAA was authorized to implement its own proposal if Congress did not act within the specified review period, which ended on June 4. Receiving no response from Congress, FAA announced on June 5, 2006, it would begin the process of implementing the contract.

NATCA filed unfair labor practices with the Federal Labor Relations Authority (FLRA) in April, July, and September 2006. The charges related to the negotiation and implementation of the contract. In August 2007 FLRA concluded that there was no merit to NATCA's claims, FAA had bargained in good faith, and the agency's implementation of the contract was lawful.

Contract negotiations with Professional Airways Systems Specialists (PASS), a labor group representing systems technicians, also proved difficult and forced FAA to seek outside mediation. On January 3, 2006, the Federal Service Impasse Panel ruled that contract negotiations between FAA and PASS would begin on February 6 and continue through July 21. The contract between the disputing parties had expired in July 2005, but no new negotiations had begun because the agency and the union could not agree on a timetable.

On March 30, 2006, the PASS bargaining team accepted FAA's contract proposal affecting PASS ATO technical employees. The bargaining team made it clear that it did not think the agency's offer was either fair or reasonable. It would, however, leave the decision to the union's voting members. Because PASS nominally accepted the agreement, FAA had to await the conclusion of the voting process before taking any other action. FAA system specialists voted to reject the contract offer on August 3 and called for the agency to return to the bargaining table.



Technician conducts maintenance check

Controller Staffing

FAA issued a ten-year air traffic controller staffing plan in December 2004. That plan called for hiring 12,500 controllers over ten years to cover projected total retirement and non-retirement controller losses. In August 2006 FAA released an updated Air Traffic



ARTCC controller

a schedule designed to provide adequate training lead-time and to address changing air traffic demands over the coming decade.

NATCA responded to the plan saying FAA had underestimated future controller retirements. The union said that one in four

Controller Workforce Plan designed to address the anticipated retirement and replacement of air traffic controllers over the coming decade.

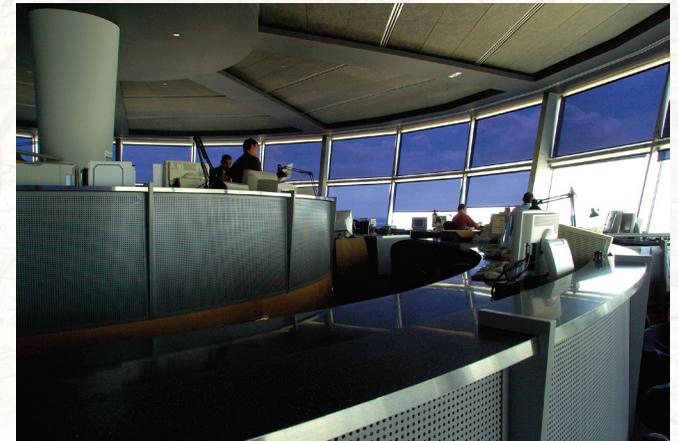
The revised document outlined the agency's plans to hire more than 11,800 new air traffic controllers in this time span. The revised plan was based on updated traffic forecasts, experience with productivity increases, actual retirements, and improved mathematical models. As part of the revised plan, FAA planned to hire 930 controllers by the end of fiscal year 2006. The plan also outlined how FAA would bring on new controllers using

controllers nationwide would reach their retirement eligibility date before the end 2007, and that — because of the imposed contract — many of them would leave as soon as they were eligible.

FAA released an updated air traffic controller workforce plan on March 7, 2007. The new plan provided a range of authorized controller staffing numbers for each of FAA's 314 staffed facilities across the country. The agency claimed this broad approach increased its flexibility to match the distribution of controllers with traffic volume and workload and revealed that it planned to hire and train more than 15,000 controllers over the next decade.

In February 2008 testimony before the Subcommittee on Aviation,

House Committee on Transportation and Infrastructure, a Government Accountability Office (GAO) executive warned that data collected in preparation for 2010 were indicating that controllers were retiring at a faster rate than FAA anticipated. He continued: "For fiscal year 2006, FAA estimated that 467 controllers would retire, but 583 actually retired — about 25 percent more than planned. For fiscal year 2007, FAA anticipated 700 controller retirements, while 828 controllers actually retired — an 18 percent increase over anticipated retirements."



Air traffic controllers in the tower at Philadelphia International Airport

GAO also warned that by 2010 up to 40 percent of the controller workforce would have less than five years of experience. The high percentage of newly hired controllers would continue for a number of years, making it important for FAA to balance the ratio of trainees to certified controllers carefully at each air traffic control facility. Another challenge would be to train controllers on the current system and on new air traffic management procedures envisioned for the future, such as precise navigation procedures that minimize pilot-controller communication. At the same hearing, the DOT Inspector General raised similar concerns, saying FAA must address attrition and training of air traffic controllers.

Competitive Sourcing of Flight Service Operations

When President Bush issued his first “Management Agenda” for fiscal year 2002, he called for federal agencies to complete public-private, or “direct,” conversion competition on not less

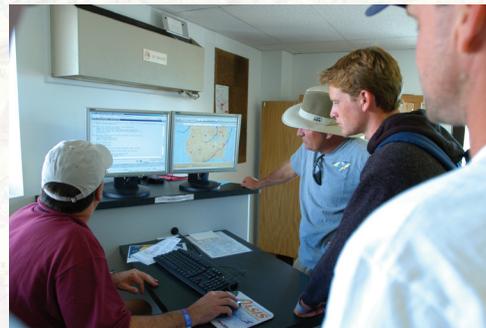


Millville automated flight service station

than five percent of the full-time equivalent employees listed on the 1998 Federal Activities Inventory Reform Act inventories. This legislation mandated that, by the end of the third quarter of each fiscal year, the heads of each executive agency would have to advise the Director of the Office of Management and Budget of activities performed by their federal government sources that were not inherently governmental functions. After completing a careful review, FAA formally announced in December

2003 that its flight service stations met the criteria for competitive sourcing. FAA subsequently conducted a competition under the Office of Management and Budget’s Circular A-76 guidelines for an improved way to provide flight service operations.

In May 2004 FAA released a Screening Information Request for an automated flight service station public-private competition. Per this announcement, potential service providers were required to submit technical proposals in August 2004 and cost proposals a month later. The agency planned to award the contract no later than March 17, 2005.



Flight service station

FAA announced the contract award on February 1, 2005. After evaluating five competing service providers, including the incumbent government organization, FAA selected a team headed by Lockheed Martin to take over services then being provided by the agency’s own automated flight service stations. The total evaluated cost of the five-year contract, with five additional option years, was \$1.9 billion — an estimated savings of \$2.2 billion over the following ten years.

Lockheed Martin assumed operation of the flight service stations on October 4, 2005, and began incremental consolidation of the 58 current flight service stations in April 2006.



Flight service personnel aid general aviation pilots

Modernization Progress

From Free Flight to the Next Generation Air Transportation System (NextGen)

Although much federal funding during the George W. Bush Administration was focused on national security and the global war on terrorism, FAA was able to maintain sufficient funding to continue deployment of a number of new technologies designed to increase capacity and safety in the national airspace system (NAS). In various stages of development and implementation, those technologies included:

- *En Route Automation Modernization (ERAM)* – planned as a replacement for the en route host computer system at all ARTCCs, the effort would create or improve capabilities affecting such vital operational areas as communications, real-time electronic aeronautical information processing, information security, and surveillance.
- *Weather Systems Processor* – forecast gust-front-induced wind shifts, detected precipitation, and tracked storms to better inform controllers and pilots about potentially hazardous microburst and wind shear weather events.
- *Weather and Radar Processor* – displayed Doppler weather information directly to controllers on the same screen as they used to view aircraft position data to improve their ability to reroute air traffic around areas of severe weather.
- *User Request Evaluation Tool (URET)* – let controllers “see” traffic 20 minutes into the future so they could more safely assign and grant pilot requests for more direct and more fuel efficient routes.
- *Operational and Supportability Implementation System* – provided in-flight planning and up-to-date weather information to general aviation pilots.

- *Airport Surveillance Radar* – provided improved digital aircraft and weather input needed by FAA’s new air traffic control automation systems, such as the Standard Terminal Automation Replacement System (STARS).
- *Advanced Technologies and Oceanic Procedures* – detected conflicts between aircraft and providing satellite data link communication and position information that helped air traffic controllers to safely separate aircraft in areas, such as over the ocean, that were outside radar coverage or direct radio communication.
- *En Route Communications Gateway (ECG)* – consolidated all gateway functions into a single system and provided the foundation to support new communications sources and new radar/surveillance sources, such as Automatic Dependent Surveillance.
- *Adaptive Compression* – developed a new software program that automatically filled vacant arrival slots with the next available flight, helping to reduce airport delays during bad weather.
- *Airport Surface Detection Equipment, Model X (ASDE-X)* – used ground surveillance data collected from a variety of sources, including traditional radar, Automatic Dependent Surveillance-Broadcast (ADS-B), and aircraft transponders



Controller views ASDE-X display

to present controllers in the tower with a color display of aircraft and vehicle positions overlaid on a map of the airport’s runways, taxiways, and approach corridors.

- *Wide Area Augmentation System (WAAS)* – improved the accuracy, availability, and integrity of the U.S. Global Positioning System (GPS) in support of a navigation and landing system that could deliver precision guidance to aircraft at thousands of airports and airstrips lacking precision landing capability.

The agency also awarded a number of contracts, such as these, to upgrade the NAS:

- \$125 million dollar contract to Lockheed Martin Corporation to develop and field the technology needed to replace dated Peripheral Adapter Module Replacement Item (PAMRI) equipment with the new En Route Communications Gateway. This new ECG would process radar data more efficiently while reducing system outages.
- \$16.7 million to Honeywell International to develop and deploy the Local Area Augmentation System (LAAS), a satellite navigation landing system that would allow pilots to guide planes safely into busy airports in bad weather and significantly increase the accuracy, availability, continuity, and integrity of the information received from the GPS constellation of satellites.
- \$13.5 million to Computer Sciences Corporation to design an advanced computer platform that would use air traffic data from across the country to predict when the numbers of flights might exceed available routes and capacity.
- \$10 million to Lockheed Martin to undertake the risk mitigation phase of the En Route Modernization program designed to replace the existing en route air traffic control automation system and selected en route infrastructure.

Although a number of modernization projects steadily made progress, STARS continued to face delays. In late 1999 and early

2000 El Paso, Texas, and Syracuse, New York, had received an early version of STARS, which attached STARS to the processing system of the Automated Radar Terminal System (ARTS). In May 2002 FAA began operational use of the first true STARS installation in El Paso, Texas. This upgraded version, referred to as full STARS, consisted of state-of-the-art displays and computers providing radar service and a backup service. The full system was being developed in phases so that the concerns of technicians and air traffic controllers could be addressed.

In June 2003 FAA commissioned the first STARS at a large, busy airport — Philadelphia International Airport. FAA planned to replace computers and displays at more than 300 air traffic control facilities nationwide with STARS. In 2004, faced with increasing costs for STARS, FAA rethought its terminal modernization

approach and shifted to a phased process. FAA committed STARS to just 50 sites at an estimated cost of \$1.46 billion, as opposed to the original plan to deploy STARS at 172 sites at a cost of



Syracuse tower receives early version of STARS

\$940 million. FAA renamed the modernization effort the Terminal Automation Modernization–Replacement (TAMR) initiative. In 2005 FAA approved modernizing five additional small sites with STARS and replacing the aging displays at four large, complex facilities at a cost of \$57 million.

Because working with its international partners would provide a common air traffic management system, FAA and Eurocontrol signed a memorandum of cooperation on September 24, 2004, to increase joint air traffic management and research efforts.

Two years later, in July 2006 FAA Administrator Marion Blakey and European Commission Vice President Jacques Barrot signed a memorandum of understanding (MOU) to increase their



Philadelphia air traffic control tower

cooperative efforts to build a more efficient and seamless air traffic system between Europe and the United States. The MOU focused on building administrative bridges between the United States' and the Commission's air traffic modernization programs. In addition to annual meetings and regular, informal communications between FAA and the Commission, the MOU formalized pre-existing

exchanges for facilitating enhanced understanding of these international programs. The memorandum acknowledged the importance of participation by both European and U.S. industry in each other's modernization efforts.

NextGen

The Vision 100 — Century of Aviation Reauthorization Act (Public Law 108-176), signed by President Bush in December 2003, endorsed the Next Generation Air Transportation System (NextGen) concept and directed the Department of Transportation to create with the FAA a multi-agency Joint Planning and

Development Office (JPDO) to facilitate the process. On January 27, 2004, in a luncheon speech to the Aero Club of Washington, DOT Secretary Norman Mineta announced plans for a new, multi-year, multi-agency effort to develop the air transportation system for the year 2025 and beyond. The new system would have expanded capacity to relieve congestion, prevent gridlock, and secure America's place as global leader in aviation's second century. The NextGen system would offer a cleaner, quieter system based on 21st-century technology, seamless security, and added capacity to relieve congestion.

As mandated, Secretary Mineta created a JPDO comprised of representatives from FAA, NASA, the Departments of Transportation, Defense, Homeland Security, Commerce, and the White House Office of Science and Technology Policy. Its mission was to create and carry out an integrated plan for NextGen, spearhead planning, and coordinate research, demonstrations, and development in cooperation with relevant programs of other departments and agencies and with the private sector.



Building a global air traffic management system

Secretary Mineta unveiled the Integrated Plan for the Next Generation Air Transportation System on December 15, 2004. The plan laid out goals, objectives, and requirements necessary to create an air transportation system for 2025. The document was divided into eight goal areas:

- *Network-Enabled Information Access:* Usable, secure information would be immediately available to all necessary

parties. Greater accessibility of information would improve the speed, efficiency, and quality of decisions.

- *Performance-Based Operations and Services:* Procedures and regulations would be described in terms of performance, rather than specific technology or equipment. This emphasis would benefit both service providers and users by allowing the former to define capability improvements in terms of users' existing equipment. Users would be able to continue working with their existing equipment as long as it met certain requirements. This approach would maximize the value of the users' investments.
- *Weather-Assimilated Decision Making:* Real-time weather information would be available to pilots, controllers, etc., to improve decision making. Directly incorporating weather information into the data bases of tools used to make air traffic management decisions would increase the effective use of weather information. This approach would minimize the adverse effects of weather on the NAS.
- *Layered Adaptive Security:* Security would be built upon "layers of defense," technology, procedures, and policies that help reduce the overall risk that a threat would harm the system. NextGen security would adapt its systems and procedures to the current risk level, depending on the situation rather than being bound to an inflexible "one-size-fits-all" approach. In sum, this approach would minimize risk.
- *Broad-Area Precision Navigation:* Pilots would receive services where and when they needed them, under nearly all conditions. Geographic and weather constraints would no longer be factors in the system. Instead, pilots would have the ability to define their desired flight paths based on their own objectives.
- *Aircraft Trajectory-Based Operations:* Pilots would gain the ability to tailor individual flight paths based on the

four-dimensional trajectories, which would include altitude, longitude, and latitude, plus time, of other aircraft. Each aircraft would both transmit and receive precise positioning information, telling it where and when it and others in the area would cross key points along their respective paths.

- *Equivalent Visual Operations:* With improved information tools and displays, pilots would gain the ability to know the locations of other planes without having to physically see them. This capability would help increase accessibility, both on the ground and during arrivals and departures. Service providers also would have the ability to manage traffic in all visibility conditions, leading to more predictable and efficient operations.
- *Super Density Operations:* New procedures would maximize the amount of traffic through both the busiest airports and airspace. Without jeopardizing safety and security, there would be improved airport ground movement, and reduced spacing and separation standards between aircraft in the sky. Controllers and pilots would better manage the flow of traffic in and around busy metropolitan areas to maximize the use of all airspace.

The development of innovative public-private partnerships was key to accomplishing the NextGen vision. In March 2005 FAA Administrator Blakey announced creation of



NextGen air traffic management tools will ease airport congestion

the Next Generation Air Transportation System Institute as the mechanism through which the Joint Planning and Development Office would access world-class private sector expertise, tools, and facilities for application to NextGen activities and tasks. When the JPDO needed industry expertise, it would call on the institute to provide personnel to serve on its various working groups. Co-located with the JPDO, the Institute was fully engaged in day-to-day NextGen activities.

The first phase of NextGen focused on the development and implementation of existing key technologies and capabilities under development by FAA. The initiatives included allowing increased use of precision navigation departures and arrivals as a means to increase capacity and safety while reducing fuel consumption, noise, and emissions. The starting phase also included the essential research and development (R&D) needed to support the evolution of NextGen — such as the development of advanced weather forecasting and traffic flow management tools. The second phase built on this foundation to begin critical implementation of NextGen capabilities. At this point, many aircraft in the fleet would begin using on-board NextGen tools. This technology would allow greater expansion of precision navigation capabilities, implementation of advanced weather capabilities, advanced data communications, and the development of the critical infrastructure for operations in high-density areas. The third phase would see the maturation of core NextGen capabilities into a nationwide system.

In 2006 the JPDO issued its Weather Concept of Operations. This innovation was followed within a year by the NextGen Concept of Operations, the Security Concept of Operations, the NextGen Enterprise Architecture, and the NextGen business case.

Because of the need for global harmonization of NextGen to allow operability across international lines, in May 2007 FAA Administrator Marion Blakey and her counterparts from Canada

and Mexico signed a formal agreement establishing a cooperative NextGen strategy group. The agreement encouraged all three countries to share information regarding strategic roadmaps, technologies, and environmental metrics, as well as to coordinate the North American harmonization efforts of the International Civil Aviation Organization (ICAO). FAA signed a similar agreement with China on February 27, 2008.

The JPDO was neither an implementing nor an executing aviation agency, but the new technologies and operational changes required to realize the NextGen vision needed to be developed and deployed on precisely coordinated implementation schedules. As a result, FAA and its JPDO partner agencies worked diligently to improve their levels of teamwork. In June 2007 FAA decided to take the Operational Evolution Plan it had created in 2001 to improve capacity, rename it the Operational Evolution Partnership (OEP), and use it to guide the agency's own transformation to NextGen. The new OEP laid out the agency's path to 2025 and tied NextGen initiatives to the agency's established budget process.



New technologies reduce controller workload

FAA announced, in August 2007, a \$1.8 billion contract to ITT Corporation to build ADS-B ground stations — the cornerstone of the NextGen system. The vendor would later own and operate the equipment, collecting subscription fees from the

FAA for broadcasting a wide range of ADS-B data to suitably equipped aircraft and air traffic control facilities. Along with air traffic displays, ADS-B would provide pilots graphical weather information, terrain maps, and flight information, including temporary flight restrictions and notices to airmen. The system would alert controllers and pilots to the precise location of aircraft, enabling them to negotiate more direct flight routes that would enhance airspace efficiency, reduce delays, and — most importantly — improve safety.

In May 2008 FAA established a senior vice president for NextGen and Operations Planning position to provide increased focus on the modernization of the nation's air traffic control system through the NextGen implementation and delivery plan. The JPDO now reported to the new senior vice president.

Enhancing Capacity

On June 6, 2001, FAA released its Operational Evolution Plan (OEP). Written in collaboration with the aviation industry, the plan outlined a 10-year capacity enhancement plan to allow 30 percent more traffic into the commercial aviation system while easing delays and increasing safety. The OEP focused on four critical problems: arrival/departure rates; airport weather conditions; en route congestion and severe weather. The plan addressed these four

problems by concentrating on near-term solutions (2001), mid-term solutions (2002 through 2004), and long-term solutions (2005 through 2010). New runway construction and airport infrastructure improvements were a key part of the FAA plan. The plan gave priority to ongoing efforts to redesign the nation's air space to open up new flight sectors and give pilots and controllers more routes and more options around bad weather. The plan also included an element to exploit technology to bring planes closer together at higher altitudes and when they land by:

- Expanding implementation of area navigation (RNAV) procedures;
- Completing the Wide Area Augmentation System (WAAS) of satellite-based navigation;
- Introducing datalink to reduce voice communications between pilots and controllers; and
- Reducing vertical separation of aircraft at high altitudes from 2,000 feet to 1,000 feet.

Several months after the release of the OEP, the events of September 11 resulted in a down turn in air travel. The industry, however, quickly recovered and air traffic growth in the NAS began to outpace airport and airspace capacity. Constraints in en route airspace and the airspace surrounding U.S. airports began to result in flight delays, schedule disruptions, passenger and operator inconveniences, and inefficient flight operations. Because no one solution would allow the industry to expand service safely and minimize environmental impacts in the face of growing challenges,



NextGen weather tools will minimize the effects of adverse weather



NextGen technologies will improve communications

FAA began to look for immediate solutions. Understanding the need to integrate viable and affordable solutions to increase capacity, FAA began working to achieve a performance-based system.

On September 9, 2002, FAA announced plans to develop and implement, within the next year, a plan to establish an air navigation concept called Required Navigation Performance (RNP). Under



New technologies and procedures help reduce flight cancellations and delays

RNP, the NAS would evolve from a ground-based design to one in which aircraft could take full advantage of advanced technologies for precision guidance in the en route (high-altitude) and terminal (about a 40-mile radius of the airport) areas. As promised, in July 2003, the agency released an RNP

roadmap identifying steps and milestones that would transition the U.S. airspace system from reliance on airways running over ground-based navigation aids to a point-to-point navigation concept — one that would fully employ advanced automation capabilities aboard aircraft. The plan, which would be updated regularly, contained three implementation timeframes:

- Near-Term (2003-2006). FAA and industry would implement a first set of RNP and area navigation (RNAV) procedures for all phases of flight. The agency also would continue to develop criteria and guidance for more advanced RNP/RNAV operations.
- Mid-Term (2007-2012). RNAV would become the primary means of navigation in U.S. airspace. Additional RNP

procedures would be made available as more aircraft were equipped with advanced technologies. FAA would begin to remove some ground-based navigation aids, routes, and procedures from service starting in 2010.

Far-Term (2013-2020). Based on previous demonstration of RNP/RNAV benefits, the U.S. aircraft fleet would continue to advance its capabilities. By 2020 operators would use RNP and RNAV procedures operationally in all areas. A minimal operational network of ground-based navigation aids would, however, remain in place.

FAA's Performance-Based Operations Aviation Rulemaking Committee, a government and industry group, released the second version of the Roadmap for Performance-Based Navigation in July 2006. The first roadmap covered concepts and principles, but included very few details. The revised version spelled out how FAA planned to proceed in each of the three time frames, and outlined dates for mandates on the types of equipment that would be needed by the airlines, business aircraft, and general aviation operators.

With the release of the plan, FAA began championing the concept of performance-based navigation to facilitate more efficient airspace and procedure design and to improve safety, access, capacity, and operational efficiencies. With performance-



Advanced navigation systems facilitate performance-based operations

based navigation, aircraft used advanced flight management systems; onboard inertial systems; “heads-up” display systems; and other satellite and ground systems to compute position, speed, and other vital navigation information. Performance-based navigation encompassed both RNAV and RPN concepts. “Area navigation” removed the requirement for a direct link between aircraft navigation and a navigational aid, thereby allowing aircraft better access and permitting flexibility of point-to-point operations. By using more efficient routes for take-offs and landings, RNAV enabled reductions in fuel burn and emissions and increased capacity. During 2005-2007, FAA authorized more than 200 RNAV procedures at over 38 airports.

Required Navigation Performance added an onboard monitoring and alerting function to RNAV. The onboard capability enhanced the pilot’s situational awareness, providing greater access to airports in challenging terrain. RNP increased airport access during marginal weather, thereby reducing diversions to alternate airports. RNP also reduced aviation’s overall noise footprint and aggregate emissions. By the end of 2007 FAA had authorized over 60 RNP procedures at 18 airports.

In addition to its work on RNAV and RNP, FAA also implemented the use of Reduced Vertical Separation Minima (RVSM) to increase

airspace capacity. The ICAO-approved procedure was already in effect in Europe and Australia and over most of the North Atlantic and Pacific oceans. In October 2003 FAA issued a rule reducing the minimum vertical separation between aircraft from the 2,000 feet

in effect at the time to 1,000 feet for all aircraft flying between 29,000 feet and 41,000 feet. Implementation of these RVSM criteria significantly increased the routes and altitudes available and allowed more efficient routings that would save time and fuel. The rule detailed equipment requirements, including dual altimeters and a more advanced autopilot system. Aircraft equipped with the second version of the traffic alert and collision avoidance system had to be updated with software that was compatible with RVSM operations. FAA planned to implement RVSM on January 20, 2005, to give airlines and other aircraft operators time



New air routes enhance capacity and safety

to install the more accurate altimeters and autopilot systems that would help to ensure the highest level of safety.

As planned, on January 20, 2005, at 4:01 am eastern standard time, air traffic controllers inaugurated RVSM. Although invisible to passengers, the procedural change doubled airspace routes at the affected altitudes and greatly increased the routing options available to pilots and air traffic controllers. Canadian, Mexican, Caribbean, and South American civil aviation authorities also began RVSM on this date.

Reducing Congestion

While new technology would help ensure safe, efficient travel once deployed, the FAA faced a more immediate challenge of how to reduce congestion in the NAS. Air traffic delay, as defined by DOT, included five categories:

- *Air Carrier:* The cause of the cancellation or delay was due to circumstances within the airline's control (e.g., maintenance or crew problems, aircraft cleaning, baggage loading, fueling, etc.).
- *Extreme Weather:* Significant meteorological conditions (actual or forecasted) that, in the judgment of the carrier, delay or prevent the operation of a flight such as tornado, blizzard or hurricane.
- *National Aviation System:* Delays and cancellations attributable to the national aviation system that refer to a broad set of conditions, such as non-extreme weather conditions, airport operations, heavy traffic volume, and air traffic control.
- *Late-arriving aircraft:* A previous flight with same aircraft arrived late, causing the present flight to depart late.
- *Security:* Delays or cancellations caused by evacuation of a terminal or concourse, re-boarding of aircraft because of a security breach, inoperative screening equipment and/or long lines in excess of 29 minutes at screening areas.



NextGen security initiatives will speed passengers to their gates

In a June 2003 rule, the Department of Transportation required air carriers that have 1 percent of total domestic scheduled-service passenger revenue to report on-time data and the causes of delay. In 2008, there were 20 carriers reporting these numbers, including two that reported voluntarily. (See Figure 1.)

Figure 1: Delay Caused by Year
Percent of Total Delayed Minutes

	2003	2004	2005	2006	2007
	<i>(Jun-Dec)</i>				
<i>Air Carrier Delay</i>	26.30%	25.80%	28.00%	27.80%	28.50%
<i>Aircraft Arriving Late</i>	30.90%	33.60%	34.20%	37.00%	37.70%
<i>Security Delay</i>	0.30%	0.30%	0.20%	0.30%	0.20%
<i>NAS Delay</i>	36.50%	33.50%	31.40%	29.40%	27.90%
<i>Extreme Weather</i>	6.10%	6.90%	6.20%	5.60%	5.70%

Source: Bureau of Transportation Statistics

In addition to deploying new technologies and employing new procedures to decrease delay at major airports, FAA also worked with the airports to increase airport infrastructure — terminals, taxiways, runways, and gates — and began work with airlines to better manage airport capacity.

Between 2001 and 2007, ten miles of new runways opened at ten of the busiest U.S. airports reducing delay by approximately five minutes at these facilities. FAA expected new runway projects to be completed at seven additional airports by 2010. As air

travel demand continued to rise, however, simply adding pavement to the existing airports proved insufficient to ease delays.

In addition to new runways and airport infrastructure, capacity management became crucial in the early part of the 21st Century. An airport's capacity to handle traffic was a function of its size, the layout of its runways, the air traffic patterns (both arriving and departing), and the time frame in which a surge of traffic had to be dealt with due to airline scheduling. In 1999 FAA began a multi-year effort to redesign the nation's airspace hoping to reduce delays by optimizing local airspace to increase efficiency for flights in and out of terminal areas.

FAA created new routes along the East Coast in October 2005 to help ease flight delays into Florida. The Florida airspace optimization plan made significant changes to airspace controlled



President George W. Bush, Secretary of Transportation Mary Peters, and FAA Acting Administrator Robert Sturgell meet to discuss air traffic congestion

by air traffic control centers (Washington, DC, Jacksonville, and Miami) and by various terminal radar control facilities (TRACONS) in Florida. The emphasis was to create more efficient routings between northern points and Florida airports by implementing new air routes over the ocean. This strategy made it possible to get southeast-bound air traffic off the ground faster, and thus reduce delays at airports in the north and northeastern U.S.

In December 2005 FAA announced four proposals to modify aircraft routes and air traffic control procedures affecting the New York/New Jersey/Philadelphia metropolitan airspace, one of the busiest in the world. The area, in the northeastern corridor of the United States, served as a hub



Philadelphia International Airport

for international, as well as domestic air traffic. Frequent delays in this airspace, often caused by adverse weather, routinely created a ripple effect that slowed down major portions of the NAS.

After holding more than 120 public meetings in New York, New Jersey, Pennsylvania, Delaware, and Connecticut, FAA announced in March 2007 its preferred redesign proposal. The "Integrated Airspace Alternative" would replace the 31 square-mile layered airspace structure over the five state area with one that combined high-altitude and low-altitude airspace to create more efficient arrival and departure routes. Proposed change encompassed new flight patterns and new procedures at 15 FAA facilities. FAA studies showed this alternative would reduce delays, complexity of the

current air traffic system, fuel consumption and carbon emissions, and aircraft noise. In September 2007, after additional public meetings, FAA issued its final decision to implement the plan. Benefits, in the form of reduced delays, were estimated to reach 20 percent by the year 2011 compared to the level of delays the air traffic system would have incurred without the changes.

FAA also initiated an airspace flow program in the summer of 2006 to reduce delays at seven northeast corridor locations chosen for their combination of heavy traffic and frequent bad weather. The program allowed airlines the option of either accepting delays for flights scheduled to fly through storms or flying longer routes to maneuver safely around them. On bad weather days, delays fell by 9 percent compared to the year before. Cost savings for the airlines and the flying public from the program were estimated to be \$100 million annually. FAA expanded the program in 2007, adding 11 new locations to the original seven.

Beyond airspace redesign efforts, FAA worked with the airlines to reduce flight congestion. In January 2004, DOT Secretary Norman



FAA and the aviation community work together to reduce congestion

Mineta announced a new order intended to reduce flight congestion and passenger inconvenience at Chicago's O'Hare International Airport. Under terms of the order signed by FAA Administrator Marion Blakey, American Airlines and United Airlines both agreed to reduce their operations by five percent during the peak hours between 1:00 pm and 8:00 pm. The reduction of 62 scheduled

flights, which took effect in early March and lasted for six months, returned scheduled O'Hare operations to October 2003 levels, the last month prior to significant delays.

In April 2004 Mineta announced new plans by the cooperating airlines to reduce their daily schedules by another 2.5 percent starting in early June. Both carriers rescheduled the majority of their targeted flights to slower times of the day, but each also canceled some operations. By August domestic airlines serving O'Hare agreed to a voluntary limit of 88 scheduled arrivals per hour between 7:00 am and 8:00 pm. The new limit on scheduled arrivals during peak hours, effective November 1, brought schedules more in line with O'Hare's capacity and cut the amount of time lost due to delays by 20 percent. United and American Airlines, then operating 86 percent of flights at O'Hare, offered the largest reductions. United agreed to reduce 20 arrivals and American canceled 17 incoming flights scheduled between noon and 8:00 pm Other airlines with fewer operations also reduced or changed schedules to cut delays.

Beginning on March 30, 2008, FAA took steps to reduce a persistent number of flights above capacity during peak hours at New York's John F. Kennedy International Airport (JFK). After meeting with air carriers and the Port Authority of New York and New Jersey, FAA temporarily limited the number of scheduled operations there. From February 2007 through July 2007, the airport's average actual airport capacity had been 81 operations per hour. The scheduled demand during the busiest hour, 4:00 pm, was over 110 arrivals and departures during the summer 2007.

Corresponding to the increased operations, on-time performance and other delay metrics declined year after year. The on-time arrival performance at JFK (defined as the aircraft's arrival at the gate within 15 minutes of the scheduled time) declined from 68.5 percent in fiscal year 2006 to 62.19 percent in fiscal year 2007. On-time arrivals during the peak travel months of June, July, and August

declined from 63.37 percent in 2006 to 58.53 percent in 2007 while on-time departures declined from 67.49 percent to 59.89 percent. For the entire 2007 fiscal year, the average daily arrival delays exceeding one hour increased by 87 percent over fiscal year 2006 levels. The increased congestion and delays at JFK airport had an adverse effect on other airports in the region and on the NAS. For instance, Newark International Airport and LaGuardia Airport, which share airspace with JFK, were consistently among the nation's most delay-prone airports. The flight operations limits would be in effect through October 29, 2009.



Newark International Airport

Mother Nature Disrupts Air Traffic

Efforts to increase capacity and reduce delay were interrupted on August 29, 2005, when Hurricane Katrina, a storm that had formed over the Bahamas on August 23, crossed southern Florida as a Category 1 hurricane. The storm then strengthened in the Gulf of Mexico and made its second and third landfalls as a Category 3 storm in southeast Louisiana and at the Louisiana/Mississippi state line. The storm surge caused severe damage along the Gulf Coast, closing all airports in the region.



FAA immediately went to work to repair air traffic control facilities in the areas hit by the hurricane. On September 1 FAA restored both runways at New Orleans International Airport to 24-hour availability for hurricane relief flights. FAA said New Orleans could handle nine landings per hour, but only in VFR conditions. From September 2-7 FAA personnel supported the largest airlift operation on United States soil, Operation Air Care. By September 8 FAA restored scheduled commercial passenger service to the Gulfport-Biloxi, Mississippi, airport, with two roundtrip flights originating from Memphis, Tennessee. On September 13 FAA restored scheduled commercial passenger service to Louis Armstrong New Orleans airport, with two roundtrip flights originating from Memphis.

With Hurricane Katrina relief and rebuilding operations underway, FAA



Rebuilding after Hurricane Katrina

faced a second challenge with Hurricane Rita. Rita had formed over the Turks and Caicos Islands in the Caribbean on September 18 as a tropic storm and moved toward the Florida Keys. When the storm was re-categorized as a hurricane on September 20, FAA closed the air traffic control tower at the airport in Key West, Florida. FAA reopened the tower two days later. On September 24

Hurricane Rita made landfall between Sabine Pass, Texas, and Johnsons Bayou, Louisiana, as a Category 3 hurricane. The storm surge caused extensive damage along the Louisiana and extreme southeastern Texas coasts and completely destroyed some coastal communities.

The Lake Charles Regional Airport in Louisiana and Beaumont-Port Arthur Airport in Texas closed because of damage. FAA instituted a temporary flight restriction along the Texas and Louisiana coast area to support relief and recovery operations. On September 26 FAA reopened its air traffic control tower at Beaumont-Port Arthur Airport, in Texas, for visual flight operations only. FAA also quickly resumed visual flight operations at the Lake Charles Regional Airport tower in Louisiana, and reopened the TRACON facility at the airport.



FAA supports disaster relief efforts after Hurricane Katrina

Safety

Between 2001 and 2007, aviation witnessed one of its safest periods for scheduled air carriers (Part 121). Not counting the terrorist activities of September 11, 2001, there were only three fatal accidents in 2001; none in 2002; two in 2003; one in 2004; three in 2005; two in 2006; and none in 2007. According to NTSB statistics, over the past two decades, the number of flight hours

logged by air carriers had almost doubled and the number of departures had increased by 50 percent. For example, in 2006 major air carriers experienced on average only one accident every 266 million miles, 630,000 hours flown, or 368,000 departures. Fatal accidents were rare events with only .01 accidents per 100,000 flight hours or .018 accidents per 100,000 departures.

A number of FAA safety campaigns contributed to the low accident rate early in the new century. The work of the Commercial Aviation Safety Team (CAST), for example, showed great results. Since its creation ten years earlier, CAST analyzed data from approximately 500 accidents and thousands of safety incidents worldwide developing safety enhancements to reduce the leading cause of commercial aviation accidents in the United States. It also reached out to improve aviation safety worldwide by facilitating cooperative regional safety alliances on nearly every continent modeled after the CAST process. In its second decade CAST began transitioning to a fully-incident-based risk methodology that used risk prediction to identify issues and new mitigation strategies before new types of accidents could emerge.

Other safety actions also added to improved safety rates. FAA announced in early 2001 that U.S. airlines had complied with the deadline to retrofit commercial airplanes with fire detection and suppression systems. The agency also required approximately 300 all-cargo airplanes to install fire detection systems. The Enhanced Airworthiness Program for Airplane Systems, a FAA initiative unveiled in April 2001, was designed to enhance the continued safety of aircraft wiring systems from their design and installation through their retirement. This plan combined a variety of near- and longer-term actions to increase awareness of wiring system degradation, implement improved procedures for wiring maintenance and design, and spread that information throughout the aviation community.

In the aftermath of the 1996 TWA 800 tragedy, aviation safety experts focused research on how to prevent center fuel tank explosions. The accident had fundamentally altered the assumptions held not only by FAA and NTSB, but by the entire aviation community. In the years since the accident, FAA issued more than 100 airworthiness directives (ADs) and a special federal aviation regulation to reduce or eliminate ignition sources. The ADs addressed a broad range of issues, including fuel pump manufacturing discrepancies, wear of fuel system wiring, shielding of fuel system components, and the overheating of solenoids. The SFAR, issued in May 2001, changed the way airplanes were designed, operated, and maintained. By the end of 2002 the required manufacturer design reviews resulted in the identification of more than 200 previously unknown ignition sources.

As new potential ignition sources were identified, FAA issued additional directives to address them. FAA research concentrated on a number of different safety options, including how to eliminate ignition sources and how to reduce the flammability of fuel tanks. In May 2002 FAA unveiled a prototype on-board inerting system. The low cost system replaced the oxygen in the fuel tank with an inert gas such as nitrogen, preventing the potential ignition of fuel vapor.

A rare fatal accident occurred on November 12, 2001, when the vertical fin of American Airlines Flight 587 separated from the plane over Queens, New York, shortly after taking off from John F. Kennedy

International Airport. All 260 people aboard the plane and five people on the ground were killed. Some witnesses reported that a burning engine fell from the sky before the aircraft did, and others described a midair explosion. The wreckage fell in three places. One cylindrical piece fell onto a Texaco station. Most of the fuselage crashed into an intersection, sending columns of dense black smoke aloft over leaping flames. The third element, a wing section, plunged into Jamaica Bay. Investigators subsequently determined the probable cause of the crash was the in-flight separation of the vertical stabilizer as a result of the loads beyond ultimate design that were created by the first officer's unnecessary and excessive rudder pedal inputs. Contributing to these rudder pedal inputs were characteristics of the Airbus A300-600 rudder system design and elements of the American Airlines Advanced Aircraft Maneuvering Program. After the accident, FAA immediately ordered inspections of all Airbus A300 composite rudders as part of an enhanced safety initiative.



American Airlines Flight 587 accident site

In January 2003 Air Midwest Flight 5481, a Beechcraft 1900D operating as US Airways Express Flight 5481, crashed into an airport hangar and burst into flames 37 seconds after taking off from Charlotte/Douglas International Airport in Charlotte, North Carolina. All 19 passengers and two pilots aboard were killed in the accident, one person on the ground received minor injuries. NTSB determined that the probable cause of the accident was the airplane's loss of pitch control during takeoff. This flight condition probably resulted from a combination of an incorrect rigging of the elevator control system together with a weight distribution that caused the airplane's center of gravity to shift dangerously far aft.

As aircraft became more reliable and technological failures rare, FAA worked to improve human performance. Research indicated that 70-80 percent of aviation accidents were the result of human error. Although the majority of aviation accidents pointed to human error, most investigation and prevention programs were not designed around any theoretical framework of human error. To fill the knowledge gap, FAA research helped develop the Human Factors Analysis and Certification System (HFACS) to assist accident investigators in understanding how and why human errors occur. Originally developed for the U.S. Navy and Marine Corps, HFACS examined human error at all levels from mistakes in the cockpit to failings in personnel communications.

As part of long-term efforts to account for human factors as contributors to aviation accidents, in June 2003 FAA issued the Human Factors Design Standard, a compilation of human factors practices and principles integral to the procurement, design, development, and testing of FAA systems, facilities, and equipment. The guide, which superseded the 1996 Human Factors Design Guide, provided a single easy-to-use source of human factors design criteria, oriented to the needs of FAA mission and systems.

To reaffirm publicly its commitment to safety, FAA published its first five-year strategic plan that included goals and metrics. The Flight Plan, developed in cooperation with the aviation community and linked to the agency's budget requests, grouped anticipated work into four broad categories: safety, capacity, international leadership, and organizational excellence.

One safety area garnering significant FAA attention was runway safety. During the Bush Administration, the agency aggressively implemented a number of new technologies and procedures to reduce the risk of runway incursions. FAA installed the Airport Movement Area Safety System at the nation's top 34 airports and began deploying the Airport Surface Detection Equipment, Model-X (ASDE-X) to airports. This state-of-the-art surface detection system integrated data from a variety of sources, including surface movement radars located on air traffic control towers or remote towers, sensors, and aircraft transponders. Data from the new system gave controllers a more reliable view — especially during bad weather — of airport operations.

FAA Planning Documents

Airports

- *National Airport Plan, 1944-1967*
- *National Airport System Plan, 1973-2000*
- *National Plan of Integrated Airport Systems, 2001-present*

National Airspace System

- *National Airspace System Plan, 1981-1990*
- *Capital Investment Plan, 1991-present*
- *Operational Evolution Plan, 2001-2006*
- *Operational Evolution Partnership, 2007-present*

Research and Development

- *National Plan for Research, Engineering and Development, 1987-1998*
- *National Aviation Research Plan, 1999-present*

Strategic

- *Flight Plan, 2003-present*

FAA also began testing new technologies that alert pilots to potential runway incursions. Runway Status Lights — an advanced series of runway entrance lights — indicate to a pilot whether or not runways are clear. FAA completed the operational evaluation of this system, in conjunction with ASDE-X surface surveillance, in June 2005 at Dallas-Ft. Forth International Airport. Other new technologies that were tested included an experimental system, the Final Approach Runway Occupancy Signal, which might prevent accidents on airport runways by activating a flashing light visible to landing pilots to warn them that the runway was occupied and hazardous.

Believing that safety was also the responsibility of system users, FAA Administrator Marion Blakey held a meeting in August 2007 with over 40

aviation leaders to identify short-term remedies for reducing runway incursions. She asked meeting participants to consider solutions in four areas: cockpit procedures, airport signage and markings, air traffic procedures, and technology. The aviation community agreed to a short-term plan and to implement the first four elements within 60 days:

- Begin safety reviews (by teams of FAA, airport operators, and airline personnel) at the airports where wrong-runway departures and runway incursions were the greatest concern.
- Disseminate information and training across the entire aviation industry.
- Accelerate the deployment of improved airport signage and markings at the top 75 airports, well ahead of the June 2008 mandated deadline.
- Review cockpit procedures and air traffic control clearance procedures.
- Implement a voluntary self-reporting system for all ATO safety personnel, such as air traffic controllers and technicians.



New technologies prevent runway incursions

- Focus new mid- to long-term procedures and technologies to maximize situational awareness, minimize pilot distractions, and eliminate runway incursions.

In January 2008 FAA announced aviation community progress towards the runway safety action plan. Among those accomplishments:

- 71 of the targeted 75 airports that had more than 1.5 million annual enplanements completed voluntary enhancements of airport markings.
- 62 airports certified under Part 39 had voluntarily upgraded their markings — 121 airports planned to complete the work by the end of fiscal year 2008, and 25 during fiscal year 2009.
- FAA completed runway safety reviews at 20 airports that resulted in 100 short-term and numerous mid- and long-term initiatives.
- All 112 active air carriers complied with rules to provide pilots with simulator or other training based upon realistic airport scenarios.

Unmanned Aerial Vehicles (UAVs)

Because of their ability to operate far beyond manned aircraft in terms of costs and endurances, a UAV offers certain important military and commercial advantages over traditional piloted aircraft. Unmanned aircraft vehicles are fundamentally remote-controlled aircraft. They are operated by pilots who are physically separated from the aircraft. They can be land-, air-, or ship-launched and can be auto-piloted or remotely controlled by pilots on the ground. Generally, a UAV consists of an unmanned aircraft and associated elements required to operate it safely. They range from a hand launched model weighing several-ounces to the size of a commercial jet aircraft. They encompass a broad span of altitude and endurance

capabilities. Such aircraft have long been used primarily in military applications of intelligence, surveillance, and reconnaissance. Recent rapid growth of UAV industry has broadened their applications to homeland securities, such as border security and war on terror, as well as scientific studies of earth, weather, oceanic, and arctic sciences, and other commercial purposes.

To prepare for the advent of increasing numbers of unmanned aircraft vehicles, FAA has begun work to ensure their full and safe integration into the NAS. The establishment of standards for UAV operations will be key to ingrating these new vehicles in the airspace system. Rigorous regulatory standards governing the existing NAS



UAV test at Wallops Island, Virginia

users will have to be extended to include UAVs. This requires the development of methodologies and tools to define UAV designs, performance characteristics, and operations in the NAS. In September 2005 the agency issued the first airworthiness certificate for a civil UAV, the General Atomics Altair. The Altair's FAA airworthiness certificate was in the “experimental” category and limited flights to R&D, operational training, or market survey. The agency specified a number of safety conditions for the Altair's operation — including weather, altitude, and geographic restrictions, as well as a requirement for a ground-based pilot and observer. FAA also collaborated with manufacturers

to collect vital technical and operational data that would improve UAV regulatory processes. In addition, FAA asked RTCA, a group that frequently had advised the agency on technical issues, to help develop UAV standards.

Full and safe integration of UAVs into civil aviation required FAA to work closely with other government agencies, industry, and international entities that had experience in developing



UAV prepares for flight

and operating such air vehicles. In August 2006, the FAA signed a Memorandum of Agreement with the United States Air Force Research Laboratory Control Science Division to conduct flight tests of technologies developed by the Air Force for Global Hawk and Predator UAV. The objective of this flight test program was to demonstrate the feasibility of technologies that will provide UAVs with the ability to sense conflicting aircraft, determine if there is a collision hazard, and autonomously maneuver to avoid mid-air and near mid-air collisions. Under this agreement, the Air Force Research Laboratory provided a surrogate aircraft to simulate UAV flights and FAA provided airplanes to fly as cooperative and non-cooperative intruding aircraft. To best use the flight test program, the FAA also provided the Air Force with Automatic Dependent Surveillance — Broadcast (ADS-B) equipment to collect and analyze actual operational data.

Commercial Space

Commercial manned space flights became reality in the first decade of the 21st century with wealthy space travelers sparing no expense to rocket to the International Space Station. Creating a market for commonplace spaceflight, however, depended on price and safety concerns. To achieve reliable, safe, and affordable space travel, and to interest the general public in it, private industry began to invest heavily in technical research and promotional campaigns.

In 1996 the X-Prize Foundation announced an international competition to launch a manned, reusable private vehicle into space and return it safely to Earth. The winning submission would win \$10 million. FAA required a sub-orbital space flight license for prize contenders and on April 1, 2004, issued the world's first license for a sub-orbital manned rocket flight. The license was issued to Scaled Composites of Mojave, California, headed by aviation record-holder Burt Rutan, for a sequence of sub-orbital flights spanning a one-year period. On April 23 FAA announced it had issued a second license for a manned sub-orbital rocket flight to XCOR Aerospace Incorporated of Mojave, California, which sought to develop a passenger carrying space vehicle for adventure travelers in the future.

On June 21 Rutan's SpaceShipOne reached an altitude of 328,491 feet (approximately 62 miles), making pilot Mike Melville the first civilian to fly a private spaceship out of the atmosphere. Melville successfully reached suborbital space again on September 29. On October 4 Brian Binnie successfully flew the second orbital flight in the prescribed

timeframe. The X Prize foundation awarded its \$10 million prize to Scaled Composites for being the first company to launch a vehicle capable of carrying three people to a height of 100 kilometers (62.5 miles), return them safely to Earth, and repeat the flight with the same vehicle within two weeks.

In the years following 1996, FAA licensed six spaceports in the United States: California Spaceport at Vandenberg Air Force Base; Spaceport Florida at Cape Canaveral Air Force Station; the Virginia Space Flight Center, now known as the Mid-Atlantic Regional Spaceport, at Wallops



Artist's rendition of New Mexico spaceport



SpaceShipOne

Island; Kodiak Launch Complex on Kodiak Island, Alaska; the inland Mojave Spaceport in California; and the Oklahoma Spaceport run by the Oklahoma Space Industry Development Authority site at Burns Flat. In July 2004 FAA issued a license to the Mojave Airport in California, which became the first inland commercial space launch site, and the fifth licensed commercial spaceport, in the U.S.

President George W. Bush signed the Commercial Space Launch Amendments Act of 2004 (Public Law 108-492) in December 2004. The legislation gave FAA authority to promote the development of the nation's commercial space flight industry and to ensure public safety. As a result of its new mandate and in accordance with the rulemaking process, in December 2006 FAA issued final regulations for crew and spaceflight participants. The new regulations required a reusable launch vehicle (RLV) operator to inform space tourists, in writing, about the safety record of the vehicle they would fly in and compare that record with those of other manned space vehicles. After being given time to ask questions about the risks of flight, passengers would have to provide written consent prior to the flight. Each passenger would have to receive safety training on how to respond to emergency situations — which would include cabin depressurization, fire, smoke, and emergency egress.

To ensure optimal performance and safety, FAA needed to develop a better understanding of the physiological challenges of manned space flight. Accordingly, the agency began a research program focused on the health and safety of commercial space passengers. In 2006 its researchers defined and recommended appropriate biomedical parameters for additional pre-flight, in-flight, and post-flight monitoring of space passengers and crews. The research allowed FAA to better specify the types of biomedical data that launch operators need to monitor the physiological effects of short duration spaceflight.

Also in 2006 FAA and the U.S. Air Force Space Command issued new, common federal launch safety standards designed to create consistent, integrated space launch rules for the nation. The rules strengthened public safety by harmonizing launch procedures that identified potential problems early, and by implementing a formal system of safety checks and balances. The regulations governed commercial launch operations at non-federal as well as federal launch sites.

To ensure the continued safety of prototype reusable craft, and to facilitate research, development, and testing of new design concepts, in April 2007 FAA issued guidelines allowing developers to obtain one-year experimental launch permits for reusable spacecraft. These provisions gave businesses the opportunity to fly and test their vehicles before applying for a launch license. A permit covered multiple vehicles of a particular design and could be used for an unlimited number of launches. Applicants had to provide FAA a program description, a flight test plan, operational safety documentation (including a hazard analysis), and a plan for responding to any mishap. None of the flights covered by an experimental permit could be flown for profit, and the permits could only be renewed following a favorable FAA review.

Aviation Goes “Green”

In a 2004 report to Congress, the authors of “Aviation and the Environment: A National Vision Statement, Framework for Goals and Recommended Actions” declared: “Immediate action is required to address the interdependent challenges of aviation noise, local air quality and climate impacts. Environmental impacts may be the fundamental constraint on air transportation growth in the 21st century.” The writers, academicians affiliated with the FAA, advised the nation to “develop more effective metrics and tools to assess and communicate aviation’s environmental effects.”



Aviation is becoming a good neighbor

In response to this recommendation, FAA researchers began developing a comprehensive suite of software tools that would thoroughly assess the environmental effects of aviation. Although the research to develop this analytical tool suite was expected to last a decade, initial capabilities began to come online between 2006 and 2009. The ongoing and intensive development effort involved participation by the FAA, NASA, industry, academia, and Transport Canada and required coordination with foreign counterparts through the ICAO Committee on Aviation Environment Protection (CAEP).

The Partnership for Air Transportation Noise and Emissions Reduction (PARTNER), a Center of Excellence co-sponsored by the FAA, NASA, and Transport Canada, together with DOT's



Aircraft noise measurements

The center's key program involved the development of a new suite of analytical tools: Environmental Design Space (EDS), the Aviation Environmental Design Tool (AEDT), and the Aviation environmental Portfolio Management Tool (APMT).

Volpe National Transportation Systems Center, had the lead in developing new software tools to assess the effects of aviation on the environment. Ten universities comprised PARTNER, with projects funded at three additional colleges.

The Aviation Environmental Design Tool would serve as the central building block of the new suite of tools. When fully developed, AEDT would integrate the FAA's existing noise and emissions models, including the Integrated Noise Model (INM), the Model for Assessing Global Exposure to the Noise of Transport Aircraft (MAGENTA), the Emissions and Dispersion Modeling System (EDMS), and the System for Assessing Aviation Global Emissions (SAGE). The consolidated result would allow experts to assess the interdependencies between aviation-related noise and emissions. AEDT would use detailed schedule and fleet information as input and provide noise and emissions inventories, both locally and globally. The tool would compute and identify mutual relationships among noise, fuel burn, and various emissions at the local, regional, and global levels — both for base years and for future scenarios.



FAA is developing new tools to combat aviation noise and emissions

The Aviation Environmental Portfolio Management Tool would provide the economic analysis component of the comprehensive suite of software tools needed to assess the environmental effects of aviation. To help evaluate policy costs, APMT architecture would use aviation demand and guideline scenarios to simulate producer and consumer behavior. Detailed operational modeling of the air transportation system would provide estimates of the emissions and noise outputs. A benefits valuation module would put a price tag on the health and welfare impacts of aviation noise, local air quality, and climate effects.

FAA also began to make progress in the design of the Environmental Design Space Tool, a mathematical model that would estimate source noise, exhaust emissions, performance, and economic parameters for future aircraft designs incorporating varying levels of technology. EDS was designed to explore trade-offs within current technology, and explore the impacts of potential future technical resources. Once EDS became connected to AEDT and APMT, the FAA expected the combined tool suite to be able to assess operational, policy, and market scenarios.

Early in the new century, with growth in air traffic predicted to double in 15 years, both government and industry were concerned about fuel cost and efficiency. Together, they saw the rising costs of petroleum as, perhaps, the single largest driver for the adoption of alternative fuels.

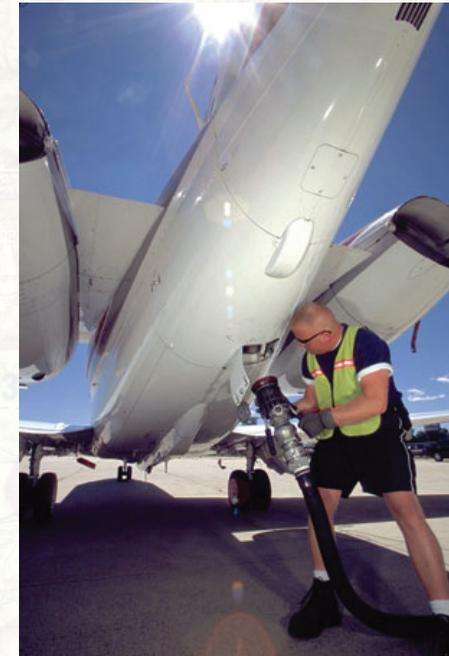
Commercial aircraft were still using a stringently regulated kerosene-type fuel, refined from oil. At roughly double their historical average, in 2007 fuel costs constituted 20 to 30 percent of total airline operating costs. Approximately 53.4 million gallons of jet fuel per day, or 19.5 billion gallons per year, were required to fuel U.S. airlines. When the price increased by a single penny per gallon, the airline industry incurred an additional \$195 million in annual operating costs. As a way to reduce expenses and reduce aviation's environmental footprint, FAA and the airline industry began exploring options for alternative fuels created from sources other than oil.

In the fall of 2005 FAA hosted a long-term strategic brainstorming session with its Research and Engineering Development Advisory Committee (REDAC) subcommittee. Representatives from the airports, airlines, manufacturers, and government communities cited fuel-efficiency, cost, and supply availability as potentially the most challenging issues facing aviation. The committee drafted a series of "scoping" questions to look at the potential of alternative

fuels to improve the environment and capacity in civil aviation. The group also urged the FAA to start a modest investment to address this potentially critical issue.

In May 2006 experts from the FAA met in Seattle, Washington, with other concerned groups for a one-day workshop exploring alternative fuels for aviation.

Government participants represented DoD, the U.S. Department of Energy, and NASA. Members of the national and international fuel supply, aircraft and engine manufacturers, and airline industries represented their organizations. Primarily sponsored by the FAA, the Air Transport Association of America, Incorporated (ATA), and the Aerospace Industries Association (AIA), the workshop also received support from the Boeing Company and the Port of Seattle. Workshop participants agreed that commercial aviation sponsors and stakeholders should work together with DoD and DOE to pursue alternative fuels for the purpose of securing a stable fuel supply, furthering research and analysis, and quantifying the ability to reduce environmental impacts and improve aircraft operations.



FAA is working with industry to develop environmentally-friendly fuels

A follow-up meeting held in October 2006 brought together approximately 80 representatives of airlines, aircraft and engine

manufacturers, energy companies, and a number of U.S. Government agencies. The creation of the Commercial Aviation Alternative Fuels Initiative (CAAFI) emerged from these discussions. Led by the FAA, AIA, ATA — along with the Airports Council International-North America (ACI-NA) — the membership of this new organization discussed the present state and future requirements of R&D, the process for certification and qualification, environmental benefits and costs, and business cases and policy needs for alternative fuels.

Over the course of two days, the CAAFI founders agreed on a set of high level goals and next steps to pursue going forward. These objectives included:

- Securing a stable fuel supply
- Furthering research and analysis
- Quantifying the ability to reduce environmental impacts
- Improving aircraft operations

CAAFI had developed, and would continue to maintain, roadmaps for advancing and communicating details of alternative aviation fuels, including their adoption status.

The engine and commercial aircraft R&D communities were also investigating the practicality of using alternative fuels in near-, mid-, and far-term aircraft. Research indicated that a “drop in” jet fuel replacement, a fuel alternative that mimicked the properties of the available kerosene jet fuel, might become available for existing and near-term aircraft. Future mid-term aircraft might also use bio- or synthetic blends to fuel new, or possibly existing, airplane designs. But the likelihood remained that the long-term engines and aircraft of the future might have to be specifically designed to use a low or near zero-carbon fuel.

Of the current replacements for kerosene, synthetic liquid fuels manufactured from coal, biomass, or natural gas were not only viable, but they were already in limited use. These alternatives might also reduce serious air pollutants such as particulate matter. DoD embarked on an aggressive program to promote synthetic fuels and, in the summer and fall of 2006, conducted several successful tests with synthetic jet fuel. Since military jet fuel was almost identical to commercial jet fuel, the DoD efforts could stimulate alternative aviation fuel viability for the commercial sector.

To ensure that aviation efficiency and capacity gains did not negatively affect the global environment, in 2007 the United States and the European Commission launched an effort to reduce transatlantic aircraft emissions and noise. The initiative, called the



The U.S. and Europe are working together to reduce aircraft noise and emissions

Atlantic Interoperability Initiative to Reduce Emissions or AIRE, promised to provide a foundation for aviation interests on both sides of the Atlantic to work together on ongoing research with the dual goal of aiding the environment while making air transportation more efficient. In addition to facilitating cooperation among aviation authorities, AIRE also involved industry partners, such as aircraft manufacturers Airbus and Boeing, the operators Air France, Scandinavian Airlines, Delta, and FEDEX, and providers of aviation navigation services, making this a partnership that brought together the global aviation community with a single goal of environmental stewardship.

The first steps in implementing AIRE were to examine the ongoing environmental initiatives on both sides of the Atlantic. The second phase involved combining those efforts. For example, one of the methods being examined by FAA to reduce greenhouse gas emissions and noise was the continuous descent approach (CDA). FAA research had proved the environmental benefits of CDA, which included significant reduction in noise, fuel burn and emissions, and shorter flights.

Continuous descent required an aircraft to begin its final descent to the destination airport from greater distance and altitude than

the previously conventional approach to landing. Using CDA, a pilot maintained a steady angle of descent during the approach, as opposed to the staggered descent of the conventional landing, which required additional thrust each time the pilot leveled the aircraft. FAA researchers began demonstrating CDA in 2003. Research results proved so positive that in 2007 Los Angeles International

Airport (LAX) implemented the first operational CDA procedure in the United States.

The U.S. and European Commission also focused research on the environmental benefits of oceanic trajectory optimization, using NextGen and Europe's Single European Sky Air Traffic Management Research Program programs. The goal of this work was to

develop new technologies and procedures that would give air traffic controllers the ability to track flow and offer alternative, more fuel efficient routes to aircraft crossing the Atlantic.



Aircraft landing at Los Angeles International Airport