Air traffic management:

Despite cutbacks in scheduled flights and the failure of several airlines—the result of economic turbulence and last year’s record fuel prices—the FAA and its international counterparts are continuing to place high priority on modernizing the global air traffic management (ATM) system to achieve greater efficiency, lower costs, and reduced environmental impact.

The U.S. Next Generation Air Transportation System (NextGen) and the Single European Sky ATM Research (SESAR) programs are the primary efforts currently under way to achieve those goals, in addition to cooperative efforts with Canada, Mexico, China, Japan, and other international partners. Uncertainty about the global economy—especially the current volatility in the price of oil, which reached a record high in mid-2008 only to fall to a four-year low by November—has resulted in fewer passenger miles flown. Still, industry forecasts show the current outdated ATM system will continue to fall behind in meeting future aviation demand.

The first U.S. Air Commerce Act, passed in 1926, called for the Dept. of Commerce to implement basic air traffic rules, which began with an instruction to pilots not to take off until there was no risk of collision with other aircraft. Many larger airports initiated their own procedures—including the use of flags similar to naval semaphores—to direct both inbound and outbound flights. That was updated to radio communications in the 1950s and significantly improved with the introduction of ground-based radar.

**Forward momentum**

Today’s aviation environment is a complex of acronyms representing a host of current and planned policies, procedures, and technologies. Some are available, or soon will be; others remain in development.

“We think we have a lot of forward momentum, with all our major transformational programs under way, such as ADS-B [Automatic Dependent Surveillance-Broadcast], System-Wide Information Management, NAS [National Airspace System] Voice Switch, and NextGen Network-Enabled Weather,” Vicki Cox, senior vice president for NextGen and Operations Planning at the FAA’s Air Traffic Organization (ATO), tells Aerospace America.

“These are all long lead time efforts, delivered into the system in the next four to nine years. But we have to start them today, and all are well under way according to our plan and are meeting our milestones, taking advantage of current advances to reduce fuel burn, protect the environment, and save costs for the

**Gyrating fuel prices and turbulent economic times may have resulted in fewer airline flights for now, but the FAA and its global counterparts are still moving ahead on modernizing air traffic management. With capabilities predicted to lag behind future demand for air transportation, programs such as NextGen in the U.S. and SESAR in Europe are now under way. Environmental concerns are an important part of the picture as the U.S. and its international partners plan and coordinate improvements in this vital economic sector.**

by J.R. Wilson

Contributing writer
The next generation

operators as the FAA continues to meet its goal of delivering performance-based procedures throughout the U.S.

“The most significant was ADS-B, the first that we started and a key component of NextGen as a replacement for radar systems, using satellite-based technology. We made our major milestone—an in-service decision, meaning ADS-B is now operational in the Gulf of Mexico—at the end of November 2008,” Cox adds.

The program also has demonstrated potential for major fuel and emissions savings by rerouting aircraft flying over the Atlantic Ocean, setting the stage for new procedures and operations, adds Steve Bradford, ATO’s
chief scientist for architecture and NextGen development.

“We were already cooperating on SESAR before the joint mechanism was set up with Eurocontrol [European Organization for the Safety of Air Navigation],” Bradford says. “AIRE [Atlantic Interoperability Initiative to Reduce Emissions] is a memorandum of understanding with the European Union and FAA on Atlantic interoperability to reduce emissions, which is now rolled into SESAR and is part of the joint undertaking.

“We’re going to actively pursue joint cooperation on the international structure and are all very committed to working on the common elements of both programs, to remain harmonized—if we can’t have the same operations, at least we have common standards. We’ve held several workshops with SESAR, helping them develop concepts and architectures for their own NextGen. We also have a trilateral commission on future systems with Canada and Mexico and are working with Japan, China, and India through some of the standing programs in other hemispheres to look at where they want to go with NextGen capability. But most important, we actively work with the International Civil Aviation Organization on cooperation and coordination with all regions.”

Importance to U.S. economy

Cox says such international cooperation is vital to the global balance of trade.

“The economic situation puts us under even more pressure to protect this extremely important segment of the U.S. economy,” she says. “In terms of the congestion issues we’ve seen, while demand has gone down and total flights have been reduced, we’re still seeing high demand in congested areas. We’ve also looked at a long history of the performance of aviation and know the demand is very cyclical. So while it is down today, we expect it to come back to levels we were looking at previously. So we can’t let down our guard.

“It is extremely important to make sure the aviation infrastructure supports the U.S. economic system. We [the aviation industry] are about 6% of GDP and account for about 11 million jobs. Aerospace—airframe and avionics manufacturers, system users, etc.—had the biggest positive balance of trade in FY08 for the U.S. at $61 billion. So we want to do everything we can to make sure we have the most modern, most flexible, most efficient system possible. Efficiency is extremely important in an era of high fuel costs.”

Efforts to improve the efficiency of the system—from enabling more flights into and out of major airports to saving time and fuel through better air routing—dominate discussions of NextGen. However, says Cox, the environmental issues are equally important.

A CLEEN start

“We are very focused on both noise and emissions in the NextGen program. There is a lot more talk about noise from the civil community, but the FAA is certainly aware of both, and we are addressing efficiencies in our air traffic operations and the research we are doing in alternative fuels and engine technologies,” Cox says.

“Two of our biggest demonstration programs—AIRE and ASPIRE [Asia and South Pacific Initiative to Reduce Emissions]—are both aimed at the environmental aspects of aviation. We’ve learned a lot from those and how to save fuel on the order of 3-4% of what normally would be used on an oceanic flight, as well as to reduce CO₂ emissions by the same percentage. In the noise area, we have started to apply procedures to significantly reduce noise around airports with our optimized profile descent.”

All of those efforts come together under CLEEN, a consortium of private industry and government pulling resources together to address environmental issues.

NextGen itself is a kind of consortium—a unified ATM plan that partners the FAA with NASA and the departments of Defense, Commerce, and Homeland Security. Success in such an endeavor requires not only cooperation, but also a merging of information and resources.
Sharing information to improve safety

An example of the latter is the effort to provide more weather information directly to the pilot to support decision-making.

“There are many sources of weather information that can be made available, so an issue with WTIC [Weather Technology in the Cockpit] and air traffic control is what information the different entities are looking at. So we are working closely with the National Weather Service on a single authoritative source for weather information that would go to any user in the system,” Cox says. “We want to provide more information to the cockpit, looking at important human factors elements—how do you best display that information, and how will it best be used by the pilot and work with the information the controller has about the weather?”

Another major cooperative effort is Aviation Safety and Information Analysis and Sharing (ASIAS). This initiative is intended to help the aviation industry move away from a forensic approach to safety—making improvements based on investigations of incidents after they happen—to a day-by-day collection and assessment of information to identify and address problems before an incident occurs.

“It is a tool to do proactive safety analysis,” Bradford explains, “an ongoing effort with information from the airlines and the FAA to allow us to more proactively look at trends and try to identify safety issues rather than responding to incidents, deviations, errors, and accidents; 2009 will be the first year of significant spending on ASIAS.

“Our safety management system already has us looking at what happens when we bring NextGen systems and procedures onboard. ASIAS will help us identify requirements for NextGen systems, so it is about not just evaluating NextGen but providing information to our development. Some elements of that are more mature than others.”

Five-year planning windows

A major interagency cooperation/coordination effort has been the creation of four joint FAA and NASA Research Transition Teams (RTTs) by the Joint Planning and Development Office (JPDO), the organization entrusted with NextGen planning and research coordination. The RTTs help coordinate the FAA’s near-term focus (the next five years) and NASA’s far-term view (2018 and beyond) with a shared midterm outlook (2013-2018).

“We plan in five-year windows under five-year budgets, so we have solid plans for the next five years, good plans for the five after that, and beyond that 10-year frame we rely on the JPDO. The RTTs help us define in all these timeframes, aligning with when and how our major systems will be updated and changed. The last of the midterm capabilities, DataComm, will be fully up and online in 2018, which is why that is the end of the midterm,” Cox says.

“We set up two teams to be near-term focused, one to be midterm, and one for the far term so we could get all aspects of transition,” Bradford explains. “The near-term are helping transition algorithms already developed into our trajectory management system. Midterm is doing concept and display development, looking at refining the concept for area flow, tool and display requirements, and fleshing out the midterm so we can set requirements for our system. That’s a place where both the FAA and NASA are working in the same timeframe and working collaboratively. Far term is looking at dynamic airspace and how we might do that, using concept exploration and validation.”

In his October 2008 column in the JPDO newsletter, JPDO Director Charles Leader

The objective of merging and spacing using ADS-B is to achieve a desired spacing between arriving aircraft. The desired interval should approximate that needed by the controller before to handoff to a downstream sector.
said one of the most important objectives he wants to stress for the organization going into 2009 is to promote interagency collaboration and cooperation in the development of NextGen.

“This is a critical part of our enabling legislation and an important component of the JPDO mission,” Leader wrote. “One of the JPDO’s most notable successes has been in technology transfer. Under JPDO sponsorship, [the RTTs] meet to coordinate aviation research planning, all the way through development, maturity, and handoff. The benefits of this work, in terms of delivering products when they are needed, and in the most cost-efficient manner, are already yielding results.”

“Technology transfer and the facilitation role that the JPDO plays in this effort is an important part of our mission—and one that will offer substantial benefits to NextGen, both in its development phases and in its implementation,” the JPDO director continued.

An integrated focus
Bradford says 2008 was devoted to evolving the RTTs and their approach from an original single-topic focus to an eventual multiyear view. “We’ve taken the FAA’s plans for near to mid term and NASA’s mid-to-far term and seen how the two research efforts coordinate. The structure is a vast improvement over our previous approach, showing how research transitions into our architecture and future systems,” he notes.

“They have been very supportive on some demonstrations, such as 3D path arrival management. We’ll probably share the NASA testbed in Dallas to run experiments looking at both near and far term together, to great advantage. We’re providing them with operational expertise for some of their far-term work, for example. We’ve only been into it for about a year but are using lessons learned for each meeting and moving forward to some real product definition. The NASA people now have a better sense of where their endeavors and systems will fit into the FAA’s future systems.”

Alongside the development and evolution of NextGen have been changes in the structural organization promoting it.

“In the past, the FAA has operated in a program-by-program way. NextGen is a system of many programs, all of which have to be aligned and integrated, so we established this integration and function to manage that,” Cox says of her new office, which stood up in May 2008. “We have a number of different program offices, both legacy and new—the five transformational programs—all managed as stand-alone programs. But under the oversight of this office, they are integrated to deliver their products in a very well-planned way.

“The program continues to advance rather smoothly. The integration and implementation responsibility for NextGen is a new function in the FAA and was added to this office to serve as the overall program management function for NextGen activities. That new function is working very well to pull together all the diverse pieces of NextGen and track how they are functioning in cooperation with each other. It’s a new structure and coordination in management functions, including budgetary responsibility for NextGen appropriated funds, and allows us to operate in a new way.”

Realignment for progress
Part of that new approach was the creation of Cox’s office within ATO and a realignment of the JPDO, which now reports to her. It was a change that brought some criticism from Congress, but Cox believes it has been beneficial to the overall progress of NextGen.

“Previously, the JPDO reported by policy to the [FAA] administrator, but in management it reported to the chief operating officer of the ATO. So reporting to the ATO is not really a change for the JPDO,” she says. “The COO decided to streamline his organization. In the past, he had the director of JPDO and

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**NextGen programs**

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some 10 vice presidents reporting directly to him. Now he has established four senior vice presidents to whom the other VPs and the director of JPDO report. So it was part of an overall structural change within ATO.

“When the JPDO stood up in 2004, they were to develop a vision, a concept of operations, and an integrated plan. All those have been delivered, the last in September 2008. Everything we are doing is aligned with the JPDO vision, CONOPs [concept of operations], an integrated plan,” says Cox.

While those plans were in development, the FAA worked closely with JPDO to get a jump-start on developing a budget that would allow them to begin work on NextGen before the final JPDO plans were actually delivered, she points out.

“Beginning in 2006, when their CONOPs had been developed enough for us to have a good idea of where they were going, we were able to formulate our next two-year budget, which we are now operating under,” Cox says. As they moved to the 2009 budget, they were ahead of the game, Cox believes. “If we had waited to budget until the final plan was delivered, we would have been too late for the 2010 budget. So we worked very well with the JPDO to get out as fast as possible and get our budgets aligned with the plan.”

In the last meeting of the House Committee on Science and Technology in the 110th Congress in September, committee chairman Rep. Bart Gordon (D-Tenn.) emphasized the continuing importance of NextGen to the U.S. and global aviation community, along with the challenges to be met.

“We should have no illusions about the magnitude of the task. NextGen is a systems engineering, management, and regulatory challenge as complex as any the nation has ever faced—and success is not guaranteed,” he said. “The next president needs to make the NextGen initiative a national priority and ensure that it is given the resources, management attention, and sense of urgency that it warrants.”

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