

SEEKING GUIDANCE

BY WILLIAM SHUMANN

Airlines clearly believe numerous forecasts of strong traffic growth over the next 20 years; the number of airplanes on order is proof of that, an order surge mirrored by corporate operators. But unanswered is how air traffic control (ATC) systems in Europe and the United States, already straining at the seams, will be able to handle the onslaught, and do so with an increased level of safety.

Politics present the biggest obstacle to implementing a well-defined technology solution in both the United States and Europe. The nature of the problem in each place, however, is vastly different.

Both regions have numerous unambiguous predictions of the looming crunch, with variations just in the degree of the challenge. In Europe, Eurocontrol expects the number of

flights to double — from 10.5 million in 2005 to 21 million in 2025. In the U.S., the Federal Aviation Administration (FAA) estimates that the growth in revenue passenger miles will increase by as much as 1.8 to 2.4 times during the 2004–2025 period.

Adding to this range of uncertainty (Figure 1, page 14) is the unclear future mix of aircraft; the United States jet airline fleet, FAA estimates, will grow from just under 4,000 in 2006 to 6,000 by 2020. Will airlines continue to shift flights to smaller jets, meaning more aircraft movements to carry the expected number of passengers? How popular will the new very light jets prove to be for business travelers? How will ATC systems accommodate unmanned aerial vehicles, and how many will there be? What impact will the Airbus A380 have on traffic flow?



Those running the quest for new generation ATC systems are fighting to overcome political problems, not technical problems.

The political problems ATC modernization faces in Europe and the United States are much more complex and daunting than the technical issues, exacerbated by the assumption of many that any new-generation ATC system should improve safety along with capacity; the stated goal in Europe is to handle double the traffic while cutting the accident rate in half.

In the United States, Congress, the FAA, airlines and general aviation have been embroiled this year in debate over reauthorization legislation for the agency's budget for the next five years. The legislation sets program guidelines, general spending limits and, more importantly, the taxes that fund a large portion of the FAA. This year, the government and the airlines began by advocating a switch from taxes on airline passenger tickets and fuel to a system of fees paid

by ATC users, similar to what is done in Europe, Canada and elsewhere. The general aviation organizations' vehement opposition to the change made it unlikely Congress will approve a new tax system by the expiration of the current system at the end of September.

Regardless of how much Congress agrees to spend on the FAA's five-year plan, the agency's programs are vulnerable to annual funding fights with Congress, during which money may be increased, cut or reallocated for whatever programs that Congress chooses. But even before it starts trying to convince Congress of its needs, the FAA must contend with conflicting demands for resources during the administration's budget development process.

Europe's air navigation service providers (ANSPs) have a much different financial situation, receiving a steady stream of funds from user fees and other charges imposed on those who fly, and from the European Commission and other government agencies. "We don't have a (financial) resource problem," says Bo Redeborn, Eurocontrol's director of air traffic management strategies.

But Europe does have a well-known problem absent in the United States — fragmentation. There are 27 nations in the European Union (EU) and 38 in Eurocontrol. Virtually all Eurocontrol members jealously guard their own airspace, ANSPs, regulations, equipment and procedures. Further complicating the situation is the amount of airspace set aside for military operations in many countries, distorting air traffic flows.

FAA is running out of room to increase the number of sectors (below) as a method of dealing with booming hub traffic growth (left).



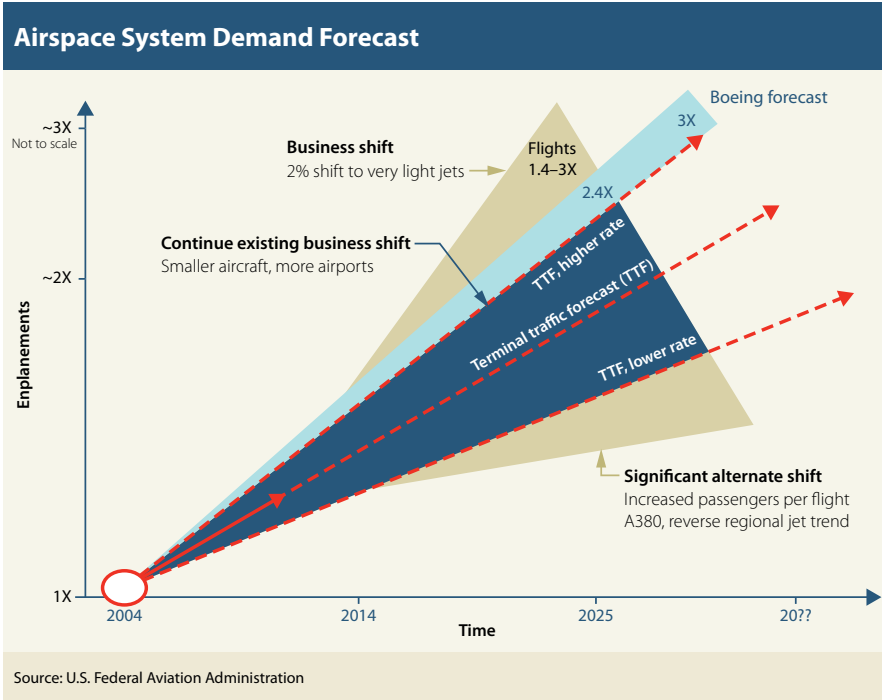


Figure 1

As Alexander ter Kuile, secretary-general of the Civil Air Navigation Services Organisation (CANSO), an organization of ANSPs, put it in a July letter to *The Economist*: “In Europe, aircraft are transferred between control centers that seem to be allocated on the basis of the 1648 Treaty of Münster, with no regard to operational efficiency . . . Governments must address this problem for the good of the system.”

The European Commission started addressing it as early as 1999, when Loyola de Palacio, European transport commissioner at the time, proposed the Single European Sky (SES). The need for it is clear — Europe has 50 en route air traffic control centers; the European Commission estimates the system is half as efficient as the U.S. ATC en route system, which has 20 centers in the contiguous 48 states, plus centers in Alaska, Hawaii, Puerto Rico and Guam. Eurocontrol’s Performance Review Commission says the lack of a united European sky costs the economy 3.3 billion euros

(US\$4.5 billion) annually in airline and society losses, including things like passengers’ time stuck in airplanes.

In 2004, EU members and their ANSPs agreed to work together to develop functional airspace blocks (FABs), multinational volumes of high-altitude airspace to simplify traffic flows. For example, the Northern Upper Area Control FAB would include the airspace of Denmark and Sweden, and possibly that of Estonia, Finland and Norway.

The FABs were supposed to be developed by the end of 2008. However, no one now believes that target will be met. The airlines, led by International Air Transport Association, are decrying the lack of progress, blaming some countries for refusing to give up sovereignty over their airspace and calling for more leadership from the European Commission.

The ANSPs reply that developing FABs is more complex than anyone predicted. Ter Kuile argues that FABs involve highly complex national, institutional and military issues about who

should control and use the airspace. Among the complexities are different ATC philosophies, technologies and even definitions of basic terms.

Eurocontrol’s Redeborn agrees that the expectation of FABs as a solution to the fragmentation of European airspace “is overblown” and not as easily achieved as the political authorities believed. There are no guidelines for dealing with the legal, institutional and liability issues in the Netherlands, he adds. The only current FAB is Eurocontrol’s long-standing Maastricht center, which controls the high-altitude airspace over the Benelux nations and part of northern Germany. Redeborn believes that it’s possible to reduce the numbers of ANSPs and ATC centers without relying solely on FABs by using other initiatives, such as a common ground communication system or expanding the Maastricht airspace. He is “not disappointed at all” in the slow progress with FABs and believes that 2012–2015 is a more realistic time frame in which European airspace will be less fragmented and better-managed.

Last November, EU Transportation Commissioner Jacques Barrot appointed a high level group (HLG) to examine what is delaying the SES. The 10 members included the heads of three civil aviation authorities and senior executives representing the airlines and other users, airports, ANSPs and Eurocontrol. Among the 10 recommendations the HLG produced was a call for the EC to address hurdles to achieving the SES and to draw up a framework for new economic regulation of ANSPs, providing incentives for them to improve performance without jeopardizing safety.

The HLG report said, “In the evolution of the Eurocontrol organization” responsibilities seem to be shifting; the HLG “supports the integration of

the operations of the Maastricht Upper Area Control Centre into the relevant FAB under governance arrangements as defined by the states responsible. These states should strive to have the new arrangements in place as soon as possible and no later than 2012.” These “new arrangements” may shift responsibilities outside the traditional Eurocontrol organization.

While Europe continues struggling to create a unified ATC system, the United States is attempting to move its unified system into new technology that can cope with the rising demand for air travel by shifting from ground-based aircraft

surveillance and separation to space- and aircraft-based surveillance and separation. Originally known as the Next Generation Air Transportation System (NGATS), now it is simply called NextGen.

“At the FAA, there’s nothing more important than NextGen,” FAA Administrator Marion C. Blakey said in July.

What the FAA calls “a unique public/private partnership,” the Joint Planning and Development Office (JPDO), is charged with planning and implementing NextGen through 2025. The JPDO includes representatives from the departments of Commerce, Defense, Homeland Security and Transportation, the White House Office of Science and Technology Policy, the FAA and the National Aeronautics and Space Administration, with the last two providing most of the staff. It also has a number of working groups that include representatives of the various stakeholders outside government such as airlines, airports, aerospace companies, general aviation groups and unions.

As evidence of the progress being made, JPDO Director Charles A. Leader cited three key documents that were released this summer:

- **Concept of Operations:** Version 2.0 describes the full scope of NextGen operations and how they will affect various stakeholders. It emphasizes the importance of developing the structure, policies and procedures to make NextGen a reality;
- **Enterprise Architecture:** Similar to a set of blueprints, it defines the key capabilities

The 38 Eurocontrol nations (below) manage European airspace with 50 en route control centers (bottom).



of NextGen and how they will be integrated. It is synchronized with the Concept of Operations; and,

- **Integrated Work Plan:** This document complements the first two by providing the programmatic and funding details of the transition to NextGen.

Leader emphasized that there is “no gee-whiz technology in NextGen.” What it will require is a great quantity of software and a new information technology (IT) infrastructure for implementation over a period of almost 20 years. Three key IT programs will be launched later this year or early in 2008, Leader said. They are:

- **Systemwide Information Management:** An FAA system similar to the Defense Department’s Global Information Grid, it will provide communications throughout the FAA and between it and other agencies;
- **Data Communications:** Providing data-link communications between aircraft and controllers, this system has two key benefits, Leader believes: “deconfliction of trajectories,” where controllers will spot aircraft route conflicts and resolve them more efficiently, and better utilization of special use airspace, now reserved for military use; and,
- **Next-Generation Network-Enabled Weather:** Using the first two new IT programs to provide four-dimensional weather information to pilots and controllers, adding time to the other three dimensions. This system will involve the National Weather Service, U.S. Air Force, U.S. Navy and the FAA. It should produce a major reduction in the 70 percent of airline delays

caused by bad weather, Leader said. One issue to be resolved later, he added, is what portion of the costs each service will pay.

However, some issues remain to be dealt with, according to the Government Accountability Office (GAO), the investigative agency of Congress.

In reports and congressional testimony this spring, GAO pointed to the “leadership gap” facing the FAA. Blakey’s five-year term ends in September, and, at press time, President George W. Bush had not named a successor. When Bush, a Republican, makes his pick, that person must then be confirmed by the Democratic-controlled Senate. Either a lack of a nomination or a political logjam in the Senate could produce a leadership vacuum when Blakey leaves. Also, the chief operating officer of the FAA’s Air Traffic Organization (ATO), of which the JPDO is a part, left in February and has not been replaced.

Leader is relentlessly optimistic, saying that Blakey’s strong initiative and focus on NextGen, bipartisan support in Congress and the backing of the concept from the aviation industry have given the program “so much momentum” that it will survive a gap between FAA administrators. He expects a new head of the ATO to be named shortly.

In contrast, Eurocontrol announced in early July that David McMillan, now director general of civil aviation in the United Kingdom, will succeed Victor M. Aguado as Eurocontrol’s director general on Jan. 1, when Aguado’s seven-year term ends.

The GAO also cited the need for the JPDO to seek greater involvement of all the stakeholders, particularly the air traffic controllers. Leader agrees with GAO that NextGen will change the role of the controllers as they shift from controlling specific aircraft to managing air traffic

flows. He said that members of the National Air Traffic Controllers Association (NATCA) are involved in NextGen and called the union “a co-equal partner.” Acknowledging the current strife between the FAA and NATCA over a number of contentious issues, including the lack of a negotiated contract, staffing and a new dress code in ATC facilities, Leader said the JPDO stays completely apart from labor issues.

NATCA, however, maintains that the FAA excluded controllers from the NextGen development process in 2002 and has not relented, even though NATCA very much wants to be involved (“AirMail,” p. 6).

Leader also said that NextGen will include a new safety management system that will analyze enormous amounts of data to detect evolving patterns of incidents and threats, becoming predictive rather than “forensic” and relying on accident investigations.

Leader said the goal is to develop common reporting requirements — the same data points — for aviation in the United States as elsewhere, with the eventual development of a single global database.

The technology the FAA calls the “backbone” of NextGen and “the future of air traffic control” is automatic dependent surveillance-broadcast (ADS-B), in which each aircraft every second broadcasts its identification, position derived from global positioning system (GPS) data, speed and altitude. Ground stations and aircraft with the proper equipment will receive these data bursts. Ground stations will search for conflicts, and a cockpit display in receiving aircraft will show nearby aircraft locations and other information. ADS-B, already in limited use, provides faster updates and is independent of the ground-based radar system.

The FAA at deadline was about to award the first phase of a contract to build ground stations; competing were industry teams led by ITT, Lockheed Martin and Raytheon. Vincent Capezzuto, FAA director of surveillance and broadcast services, said that the FAA will place primary emphasis on the contractors' costs and how quickly they can get their systems in operation and then expand nationwide.

"We're buying services, not black boxes," he emphasized, explaining that the agency is specifying what the system should do and not the specific equipment to be used. The FAA will be following the same approach in late September, when it issues a notice of proposed rulemaking (NPRM) for the equipment in the aircraft, following a dual-track strategy (Figure 2) in developing the ground structure and the aircraft equipment at roughly the same time. If successful, deployment of the ground infrastructure and aircraft equipment requirements will begin in 2010, Capezzuto said.

The upcoming NPRM will cover only ADS-B "Out," an equipped aircraft

broadcasting its position. ADS-B "In" refers to receiving ADS-B transmissions from other aircraft and from ground stations. Mandating ADS-B Out in much of U.S. airspace is essential to achieve the maximum benefits from the system, Capezzuto said.

The NPRM will require ADS-B Out capability for all domestic and non-U.S. aircraft that fly in Class A airspace at 18,000 ft and above, in the Class B airspace around the 30 largest metropolitan areas and in Class C airspace around smaller controlled airports with radar service and a relatively high number of instrument approaches. An altitude-encoding transponder already is required to fly in these areas. Capezzuto said that the FAA expects that airlines, business aircraft owners and other operators will equip their aircraft with ADS-B In at the same time they get ADS-B Out to maximize their benefits.

A provision in the NPRM will require that ADS-B's cockpit display abilities meet the current horizontal separation standards for radar — 5 nm (9 km) in the

en route environment and 3 nm (6 km) in terminal areas — for eventual self-separation. Capezzuto said that the FAA believes further development and experience with ADS-B will lead eventually to reduced horizontal separation standards, which in turn will increase capacity.

After analyzing comments on the NPRM, the FAA plans to issue a final rule in November 2009, with equipage of aircraft expected to begin soon thereafter.

Meanwhile, the FAA is expanding real-world testing of ADS-B. Following the successful Capstone Project in Alaska, where use of ADS-B in a nonradar environment led to a 40 percent decrease in general aviation accidents, testing of ADS-B is continuing around Juneau, where mountainous terrain severely limits radar coverage. Elsewhere, UPS has outfitted nearly 300 of its freighters with ADS-B to improve operations at its hub in Louisville, Kentucky, where it has achieved significant reductions in fuel consumption, noise and emissions. The airline plans to expand testing to its hub at Philadelphia, which is busier, more congested and

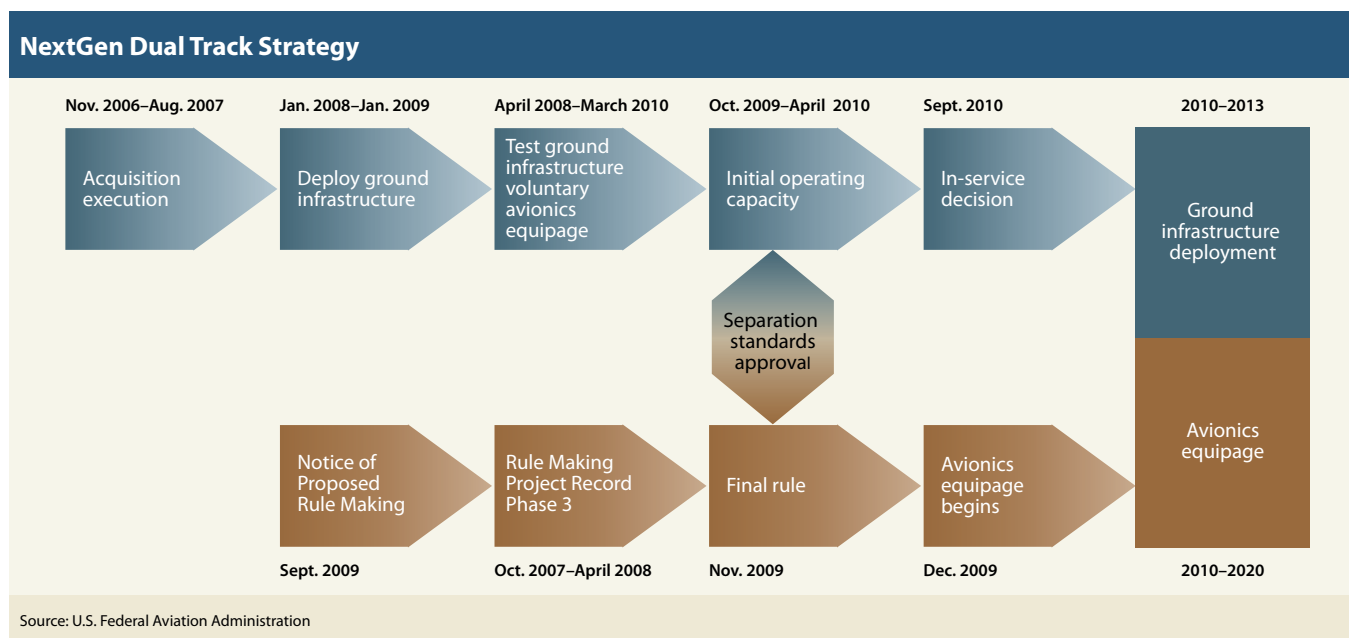


Figure 2

uses a different terminal radar system, and is considering expanding the program to its hub at Hanover, Germany.

Extensive ADS-B testing in the Gulf of Mexico is slated to begin in late 2009. In partnership with helicopter operators there, ground stations will be installed on oil drilling platforms in the Gulf to provide coverage at low altitudes. Additional stations on new stand-alone platforms will provide precise high-altitude coverage for airlines flying between the eastern United States and parts of Mexico.

The FAA expects that by 2020, ADS-B will allow it to shut down all but about 40 terminal radars and 150 en route radars, about half the current total, which will remain to provide backup coverage in case of a GPS failure. Those closures are expected to bring significant savings in operational and maintenance costs. FAA does expect to start shutting down some VHF omnidirectional radios (VORs) and nondirectional beacons (NDBs), but as a result of wide area augmentation system, a GPS complement, not ADS-B.

Capezuto said that the FAA is working closely with Eurocontrol, Air Services Australia and Nav Canada in coordinating ADS-B development in their areas. Eurocontrol also is using performance-based standards to ensure that the systems will be compatible, he said.

The European equivalent of NextGen is the SES Air Traffic Management Research (SESAR) program, with the goal of attaining the following objectives by 2020:

- Triple system capacity;
- Reduce costs by 50 percent;
- Reduce the environmental impact of each flight by 10 percent; and,
- Improve safety — double the traffic with no increase in accidents.

Eurocontrol has divided SESAR into three phases. The first, the definition phase, is on schedule to produce the

air traffic management (ATM) master plan by March of next year. The work is being done by the SESAR Consortium, a group of 30 partners, with more than 20 subcontractors and associates, including airlines and other users, the ANSPs, airports, manufacturers and other suppliers, and the military.

The development phase, from 2008 to 2013, will involve the development and validation work and preparation of the necessary regulatory measures. Details of the deployment phase from 2014 to 2020 are still being developed.

Eurocontrol's Redeborn says SESAR is very similar to NextGen, with some differences in systems architecture. As a result, the United States and European ATM systems "will be very similar in 15 years," he said. ADS-B will be a major component of SESAR. Redeborn also expects ADS-B eventually to replace ground-based radars other than those retained to back up the satellite system. He also expects that VORs and NDBs will be phased out in Europe after 2020.

The SESAR safety goal presents special challenges in Europe because of the number of countries and the numerous legal, regulatory and cultural differences among them and their ANSPs.

In its July report, the HLG cited the need to deliver continuously improving safety, the importance of facilitating the uniform application of a "just culture" and the requirement for the EU to "harmonize safety oversight."

In December 2006, Eurocontrol's Performance Review Commission (PRC) released a detailed study, *Legal and Cultural Issues in Relation to ATM Safety Occurrence Reporting in Europe*. It emphasized the need for full, open, transparent reporting of safety incidents in an atmosphere of just culture.

Radu Cioponea, a PRC staff member, safety specialist and former air

traffic controller, said that there are no hard data on just how safe ATC in Europe is due to widely varying reporting of safety data among Eurocontrol members. Some countries, he said, are very transparent and open. The PRC report said that some ANSPs fear that openness would damage their relations with the public, insurance companies and investors, and view a safety incident as a failure and a crisis.

The PRC report says that safety communication between ANSP managers and controllers "is far from perfect in a majority" of countries. It cited the need for more training and encouragement of open reporting and said that these efforts should be ongoing. Retraining a controller following an incident is good, but it must not be seen as punitive. The report said that a controller should be relieved of duty with pay after a stressful incident, as in Denmark, whereas in Croatia and Romania, an incident leads to a reduction in pay.

The challenge for Eurocontrol, according to Cioponea, is to resolve the differences between the aviation regulators and ANSPs in countries where they are a barrier to a just culture and the differences between the regulators and their national legal systems¹. "We need targeted action ... to approach the right people who can actually make changes," he said. ●

Shumann had a 35-year career in aviation journalism and public relations. After stints at Aviation Week, the Air Line Pilots Association, GE and Lockheed Martin, he joined the FAA in 1997, where he was the principal spokesperson for the air traffic control system. He retired in 2005.

Note

1. The safety cultures in the FAA Air Traffic Organization and in the United Kingdom were described in the July 2007 issue of *AeroSafety World*.