

With safety management systems deemed essential in aviation, suggestions that risk analysis takes too long would seem out of line. In the context of accelerating implementation of the Next Generation Air Transportation System (NextGen) in the United States, however, the streamlining of risk analysis emerged as one of several safety-related issues raised by 50 speakers and panelists at the RTCA Spring Symposium, held April 6–7 in Washington, with about 350 attendees

from the aviation industry and the U.S. Federal Aviation Administration (FAA).

The event also covered issues such as global compatibility of technology, incentives for air carriers to equip aircraft, business cases, and political and environmental constraints.

Most of the symposium was devoted to how the FAA has adopted 28 recommendations of the 300-member RTCA NextGen Mid-Term Implementation Task Force, also called Task Force 5, which were issued in September 2009

and incorporated into the *FAA NextGen Implementation Plan* of March 2010.

Basically, NextGen is a comprehensive overhaul of the U.S. National Airspace System (NAS), which is already beginning to add capabilities that make air transportation safer and more reliable, increase the air traffic capacity of the NAS, and reduce the impact of aviation on the environment, the FAA says. Details of the next phase of formal interaction between the FAA and industry will be announced in May by the FAA NextGen Management Board.

BY WAYNE ROSENKRANS

NextGen *Safely*

Risk management shapes how fast transformation of the U.S. aviation system will occur.



“We can’t afford not to move forward with NextGen,” FAA Administrator Randy Babbitt told the symposium participants. “Let me say with emphasis: NextGen is under way. We are en route. We are not in the planning stages. We are airborne with this, and we can’t afford to lose time. We need NextGen now and ‘now’ as in right now.”

FAA acceptance of most task force recommendations signifies a critical consensus about mutual priorities, he added. “Now we are all tracking to true north on the same compass,” Babbitt said. “RTCA has collectively given the FAA the priorities that we need to set — like implementing closely spaced parallel approach sequencing and, for operations at critical airports, going as far as integrated traffic management.”

Sandy Samuel, vice president of transportation solutions, Information Systems and Global Services, Lockheed Martin, distilled a key industry concern. “From the data communications perspective, we could lay the whole infrastructure in place, but we know there’s this big public policy decision to be made about who should pay for [aircraft] equipage,” Samuel said. “I don’t really think it [could] be the technology that delays NextGen. I think it could be [making] some of the hard policy decisions ... before we get too far down the implementation path and then have to start over or stop altogether.”

Safety Perspectives

Brian Townsend, a captain in flight technical operations at US Airways, characterized the new *FAA NextGen Implementation Plan* as “heavily weighted toward research and data collection.” He expressed concern about potential duplication of effort in the name of safety. “We need to use a lot of the information that we have,” Townsend said. “We certainly don’t want to skip over the safety aspect — that’s extremely important to maintain in focus before we take the necessary [implementation] steps — but at some point we do have to take the plunge. We also need to take a very close look at the safety risk management process and make certain that, in some respects, it’s not hindering some

of the progress even though it’s a very important component. From some of my observations and experiences, at times it can really tend to hold us back.”

Operators bear the ultimate responsibility for safely moving passengers, crews and cargo, said Rip Torn, a Delta Air Lines captain and chairman, Air Traffic Services Group, Air Line Pilots Association, International. “No one will say, ‘We need safety to be the second, third or fourth [priority],’” he said.

U.S. aviation has a long track record of identifying human-in-the-loop risks early by thorough study before implementing changes to the NAS, Torn said. “Once a safety study is done and we start trapping the errors and coming up with risk mitigations, we get buy-in — people want to stick their toes in the water and try new procedures,” he added.

Bruce DeCleene, manager, avionics systems, FAA, said NextGen activities have been a major challenge so far for FAA aircraft certification offices. “We are resource-limited,” DeCleene said. “There have been times when installation of these technologies had to sit while we worked on other higher-priority projects. We are putting in place a change to our prioritization criteria so that our highest-priority projects will always be safety-related, such as something based on an airworthiness directive or something unsafe. Then, immediately beneath that, there will be the alterations to an aircraft in support of a national NextGen-related initiative.”

The key to full industry support of NextGen implementation will be definable benefits that must begin to be shown “this year or very soon,” said Ken Speir, a captain and Atlanta chief pilot at Delta. The industry wants to see teams assigned to *metroplexes* — that is, 23 multi-airport urban areas anchored by the nation’s 35 busiest airports — begin their work without delay, he added.

Risk analysis under safety management systems and environmental impact studies ranks high among the aviation community’s concerns, Speir added. “I don’t know how we will get through the safety-management activities, as

Near-term NextGen plans call for RNAV (GPS) and RNP approaches enabling closely spaced parallel operations.



NextGen Timeline Excerpts

FY 2010

- Final regulation requiring ADS-B Out avionics.
- Acceleration of FAA process for developing RNAV and RNP procedures.
- Final SMS risk analysis of required time of arrival capability.
- Study of pilot blunder model, wake turbulence and target level of safety for closely spaced parallel operations.
- Final human error safety analysis of NextGen ATC operations in 2012–2018.
- Air traffic safety action plan to consistently achieve 3.0-nm and 5.0-nm (5.6-km and 9.3-km) separation.

FY 2011

- Data exchange capability enables ATC predeparture reroutes.
- First RNAV (GPS) and RNP approaches with closely spaced parallel operations for landing.

FY 2012–2015

- National ADS-B ground receiver infrastructure completed.
- NAS-wide airborne traffic and flight information services.
- Data exchange capability enables ATC airborne reroutes (2014).
- Performance-based navigation capabilities expand to begin linking U.S. metroplexes.
- Limited 4D FMS trajectory-based operations begin.
- Collaborative air traffic management with operators begins.
- Conflict-resolution methods established using aircraft intent data.
- ADS-B surface alerting capability enabled.
- Final human factors analysis of NextGen arrivals, including required time of arrival.
- Final rights and release policies for FAA surface and en route data sharing with operators.
- Final safety case studies on closer runway spacing for simultaneous independent approaches.
- Final R&D for combinations of RNP and ADS-B paired approaches for closely spaced parallel operations.

FY 2015–2018

- Complex and revised RNAV departure clearances via ATN (2016).
- Airborne reroutes enabled via data communication for equipped aircraft (2016).

4D = four-dimensional (latitude, longitude, altitude, time); ADS-B = automatic dependent surveillance–broadcast; ATC = air traffic control; ATN = aeronautical telecommunications network; FAA = U.S. Federal Aviation Administration; FMS = flight management system; FY = federal fiscal year (Oct. 1–Sept. 30); GPS = global positioning system; NAS = U.S. National Airspace System; NextGen = U.S. Next Generation Air Transportation System; R&D = research and development; RNAV = area navigation; RNP = required navigation performance; SMS = safety management system

Source: FAA NextGen Implementation Plan, March 2010

Figure 1

well as the environmental issues, to really get everything that we need to get out of NextGen.” Real-world implementation will reveal unanticipated safety issues, he said. “I was very

involved in the area navigation [RNAV] implementation in Atlanta, for example,” Speir said. “Never in a million years would we have believed [before implementation] that the no. 1 obstruction to RNAV off the runway or RNAV standard instrument departure [SID] and standard instrument arrival [STAR] applications actually was the pilot putting the correct runway into the flight management system [FMS]. If we can’t do RNAV off the runway today, how are we ever going to make the NextGen of 2018 a reality?”

FAA Air Traffic Organization (ATO) terminal personnel in Atlanta told the National Air Traffic Controllers Association (NATCA) that FMS programming errors by pilots have led to 13 turning errors out of 250,000 RNAV off the runway departures, responded Dale Wright, NATCA’s director of safety and technology. “What [the errors] boiled down to was that runways were changed, and the pilots had the RNAV [procedure in the FMS] but did not have the correct runway in [the FMS],” Wright said. “[Atlanta tower] controllers are keeping their airplanes on their frequencies longer and making sure pilots turn the right way, or they ensure pilots are on the right departure.

“Typically, most of the performance-based navigation [PBN] errors we’ve had ... have been a gradual conflict, very controllable, [because of inherent] increased levels of safety as opposed to errors that might have been more drastic in the ‘pre-PBN’ world.”

Controllers need to be trained appropriately but also need confidence that the pilots in their airspace have been trained to correctly conduct RNAV and required navigation performance (RNP) procedures. Air traffic control (ATC) also needs to be able to determine, from a glance at tags accompanying aircraft targets on their displays, how aircraft are equipped for NextGen capabilities. “That way, the controller remains focused on the scopes, not looking around with attention diverted,” Wright said.

Written consensus about launching metroplex-level teams is tangible evidence of progress, said Chris Oswald, vice president, safety and technical operations, Airports Council International–North America. “We will

have multiple [metroplex] test beds — whether two or five or 10 initially — and ways to adjust what we are doing with NextGen to reflect real-world, local situations, such as the ways that runway flow configurations operate in a particular metroplex,” Oswald said.

“The safety risk management piece ... is essential, but we need to approach it realistically. How much time is that really going to take as we get into each of these metroplexes? Are there ways that ... those processes can be streamlined without compromising safety? You can’t model all of the airport detail, all of the weather conditions or all the flow configurations.”

Metroplexes and Misalignments

The following examples show how the few gaps and misalignments between the task force recommendations and the FAA’s latest implementation plan shaped the discussions. The recommendation that called for the agency to integrate and optimize airspace and procedure design at a task force-identified subset of metroplexes seeks traffic decongestion of airports, RNP with radius-to-fix capability (that is, curved flight paths) and expanded use of ATC terminal separation, said Gisele Mohler, manager, airspace and PBN integration, ATO System Operations, FAA.

Metroplexes became such a major focus of task force efforts because of delays and inefficiencies that have developed where multiple airports in close proximity compete for the same airspace, and traffic loading and flow imbalances exist across egress and ingress routes, runways and city pairs, explained Lillian Ryals, director, system operations, safety and performance, The MITRE Corp.

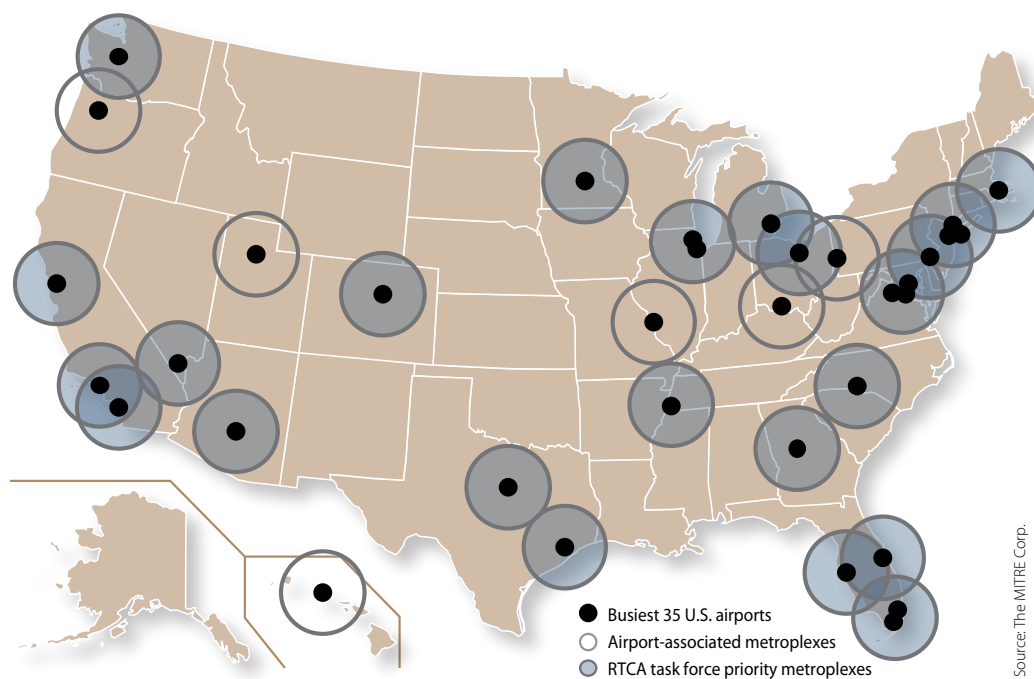
Among locations considered NextGen proving grounds, Ryals cited RNAV at Atlanta-Hartsfield International Airport; optimized

profile descents at Phoenix Sky Harbor Airport in Arizona; integrated airspace and routes built around an optimal set of RNAV SIDs and STARs at Denver International Airport; advanced aircraft equipage for PBN at Chicago O’Hare International Airport, including RNP applications to prevent conflicts among Chicago Midway Airport arrivals and O’Hare departures; and expedited west gate departures with higher and faster initial climb in the New York metroplex.

“Metroplex-related recommendations call for automation that helps controllers in metering, monitoring and merging traffic along RNAV arrival routes,” Ryals said. “We also understand that metroplex operations are interconnected end to end across all phases of flight, including surface operations, access to airport airspace and runways, and cruise and cross-cutting capabilities [that is, leveraging integrated air traffic management and data communications].”

Victoria Cox, senior vice president, NextGen and Operations Planning Services, FAA ATO, noted why metroplex selection is pending. “We do intend to identify specific locations, but ... we’ve got to conduct business and safety assessments of capabilities. ... Some of the recommended locations for some capabilities, particularly locations with low traffic volume, may

In 2012–2018, NextGen plans call for introducing new capabilities on the basis of multi-airport U.S. metroplexes.



Source: The MITRE Corp.

not prove to be cost beneficial and may not get selected for implementation.”

The FAA’s Mohler emphasized that the agency will move forward “expeditiously and prudently” on establishing the metroplex teams, however. Over roughly a 24-month period, each team will have a common toolbox; a subgroup that quantitatively and qualitatively assesses current operations, and explores potential improvements; and a decision-making subgroup. The second subgroup will prioritize NextGen changes based on the assessment, available resources and constraints, then select target activities for FAA design and implementation teams.

Elizabeth Lynn Ray, director, airspace and aeronautical information management, FAA, cautioned against expecting perfectly implemented NextGen capabilities in metroplexes. “We are not going to get a perfect answer for every metroplex but collectively ... we will come up with a 75- or 80-percent solution that will multiply over time. From the airspace and PBN perspective, this metroplex work easily could be 75 to 80 percent of the entire [NextGen] work plan.”

In response to the recommendation for increased use of parallel, staggered and converging runway operations, the FAA is upgrading ATC displays with runway path indicators, a major software change to terminal operation systems that will provide greater benefits but over a longer time than requested, said Leo Eldredge, manager, Global Navigation Satellite System Group, ATO Technical Operations, FAA. The FAA also will begin the phase-in of closely spaced parallel operations, including staggered approaches, at Newark, Memphis and Seattle, and will investigate Washington Dulles International Airport and Denver.

“Flying airplanes close together on final approach is subject to what the

blunder of one aircraft [pilot] can do to the other aircraft flying in parallel operations,” Eldredge said. “There is no guarantee that there will be a positive outcome [from analysis under] a newer target level of safety.”

One related recommendation called for using multilateration — that is, determining aircraft position using time difference of arrival of transponder signals at multiple antenna sites — as a replacement or substitute for ATC precision runway monitoring radar to enable closely spaced parallel operations. “We are going to collect [proprietary Detroit, Michigan,] data and also look at Atlanta as a possible source of data, and have a business case established before we take the next step to establish multilateration as an FAA program,” Eldredge said.

The FAA’s work on these ideas had begun even before the 2009 task force was convened, noted Margaret Gilligan, associate administrator for aviation safety, FAA. “Clearly, technology offers us the opportunity to make the safety case for a closer spacing between parallel runways — safely. ... We have taken a scientific approach, collecting new data, and trying to better understand the issue of pilot blunder, how that plays [into risk] and how we can be sure we can protect the airspace necessary to assure the level of safety that we have presently. At the same time, we’ll look at whether the distances that we have set now are necessary. Whether they come down to a 700-ft [213-m] standard — I don’t know yet.”

Another recommendation sought to establish satellite-based navigation as equivalent to an instrument landing system (ILS) for purposes of widely and closely spaced runway operations. “There are over 2,000 LPV [localizer performance with vertical guidance] approaches and over 4,000 global

positioning system-based RNAV approaches in the NAS today,” the FAA’s Eldredge said. “Our plan is to complete the safety risk management this year, and to do it as fast as we can.”

Kip Spurio, system engineering manager and chief system engineer, ATO Terminal Services, FAA, told the symposium participants that the recommendation to initiate surveillance in the non-movement areas of airports is being studied in light of the FAA’s deployment of other surface-surveillance systems and its new capability for data dissemination.

“There are a lot of questions around data release,” added Teri Bristol, vice president, technical operations services, FAA. “Near-term, we’re making changes to [FAA Order 1200.22D, “FAA National Airspace System (NAS) Data and Interface Equipment Used by Outside Interests”] to streamline [decisions] in the environment we are in today. There are a lot of different classes of users, and different people need information for different things. We also follow processes that determine how we share data, how we release data and who needs access to data.”

Surveillance cannot be introduced in some metroplexes as recommended, however, said Stephen Ryan, senior system engineer, ATO Terminal Services, FAA. Aside from the unresolved data-sharing policy, the reason is that the FAA first will have to complete its 2012–2018 mid-term roadmap of air traffic management capabilities and upgrade its traffic flow management system. This is the same system that later will introduce electronic negotiation of flight paths between aircraft pilots and ATC. Nevertheless, the FAA agreed to work on data-sharing frameworks. 🌐

To read an enhanced version of this story, go to the FSF Web site <www.flightsafety.org/asw/apr10/rtca-nextgen.html>.