

Never before in history have our skies been more crowded with so many different types of aircraft - as the aviation industry strives to meet society's continuously changing need for air travel. And as air travel continues to be a fundamental part of our lifestyle, our skies are expected to get even busier over the next two decades, tripling by some estimates.

How will the aviation community meet the demands of increasing air travel? By harnessing emerging advances in aircraft technology, aerodynamics, and on-board flight deck avionics, which are improving at an unprecedented speed. These improvements lead to innovative uses of new technologies to meet the public's need for a safer and more efficient air transportation system.

One of the most far-reaching achievements to more safely and efficiently use this seemingly vast expanse, today and in the future, is improving the way that aircraft can navigate.

The FAA is revolutionizing the way aircraft navigate our crowded skies by creating new flight paths, producing new navigation standards, and transforming our National Airspace...all through a new initiative called Performance-Based Navigation.

Designed to increase the efficiency, capacity, and safety of modern aviation, Performance-Based Navigation is a new method that uses on-board avionics to navigate with greater precision and accuracy.

Through this approach, the increasing demand for air travel can be managed in a safer and more efficient way.

With Performance-Based Navigation, aircraft use advanced flight management systems, on-board inertial systems, heads-up display systems, and other satellite and ground systems to compute position, speed, and other vital navigation information. The new approach virtually automates the aircraft's entire navigation function - from departure to landing.

And here's how it works: To begin with, there are two key elements associated with Performance-Based Navigation. The first is Area Navigation, better known as RNAV, and the second is Required Navigation Performance, known as RNP.

With RNAV, pilots no longer need to zig zag from one ground navigation station to another. Instead, they can fly a direct path to their final destination, which results in reduced flight distances and fuel costs.

With RNP, we introduce a new concept called: "containment," which allows aircraft to fly even more precise and accurate paths. The aircraft is "contained" within a narrow corridor. This means that with RNP, more "lanes" can be built into the same limited airspace, creating more capacity where we need it.

Together, RNAV and RNP are the basic building blocks of Performance-Based Navigation, advancing the Nation's air traffic management system into the future.

But the future is here now. To see how RNAV is changing navigation, we turn to Atlanta's Hartsfield Jackson International airport - the world's busiest airport - where 10,000 RNAV flights now depart every week.

Interview: Captain Jon Tovani-Delta Airlines

"Through the collaborative efforts of Delta and the Atlanta Tower TRACON and Center, we have developed and implemented the new RNAV system STARS. The economic and efficiency benefits of the new RNAV Atlanta procedures are consistent with our expectations and lay the groundwork for future capacity and efficiency improvements in Atlanta, especially with the new Runway 1028 to be completed in 2006."

Because these aircraft no longer rely on ground navigation equipment, departure points or gates can be placed anywhere in the terminal airspace, increasing throughput and reducing delays. Similar RNAV departure procedures have also been implemented at Dallas Fort Worth Airport.

Interview: Captain Brian Will-American Airlines

"I don't think the importance of RNAV and RNP can be overstated, especially in the commercial airlines industry. I think the Dallas Fort Worth RNAV SID program can be successfully implemented is a testimony to the competence, predictability, and efficiency of benefits that can be gained from RNAV and RNP."

Key features of these procedures at Atlanta and Dallas are parallel RNAV departures that improve traffic flow in the terminal airspace.

The FAA is implementing several hundred RNAV arrival and departure procedures at airports across the United States over the next few years.

RNAV aircraft arrive and depart with minimal controller voice instructions and fly the pre-defined routes reliably. This gives the controllers more time to sequence the aircraft efficiently and handle the bottlenecks safely.

Interview: Dave Scherer-Atlanta TRACON

"The workforce is very excited about the RNAV SIDs, not only has it made it easier for the controllers with less frequency congestion and workload, but we are also excited about the improvement to our industry and the airlines by fuel savings and expeditious movement over traffic."

Another way RNAV can improve navigation is by enabling pilots to go around weather fronts that often pop up along a flight path. RNAV allows pilots to use a safe and flexible reroute to bypass the weather front.

RNAV procedures, designed to help general aviation pilots navigate more directly through busy terminal areas are referred to as T-Routes. T-Routes allow General Aviation aircraft with Global Positioning System technology to avoid flying longer distances.

The advantages of RNAV are numerous. They include navigational flexibility, greater safety, shorter routes, reduced time, and less use of fuel, which affects engine exhaust emissions and environmental impact.

The second fundamental element of Performance-Based Navigation - RNP - allows aircraft to fly even more precise and accurate paths.

Here's how it works: Through a concept called "containment, aircraft can use on board avionics and flight management systems to fly through a highway in the sky

traversing the airspace more directly and efficiently. Pilots are able to fly this highway with pin-point accuracy and repeatability. With RNP, more accurate paths can be placed where they are needed in the limited airspace, creating additional lanes and more capacity.

Accurate navigation is enabled by the satellite navigation technology of GPS, the government's Global Positioning System. On board the aircraft GPS receivers allow continuous and reliable reception of navigation signals virtually anywhere in the airspace.

RNP will be transforming approach procedures at New York's John F. Kennedy airport, which is located in the center of one of the world's busiest airspaces.

Interview: Captain Dusty Somerville-jetBlue Airways

"For jetBlue the primary advantages of these RNP approaches is enhanced safety. As a New York-based airline, we frequently fly the Canarsie approach to Runway 13L at JFK. Historically this has been a challenging approach to fly for many airlines. Fortunately, we now have the technology and procedures which have allowed us to design a significantly better approach. The new approaches now provide us with both lateral and vertical guidance which can be flown with the autopilot. This significantly reduces pilot workload while flying this complex curved-path approach. In addition to the safety benefits, these approaches provide several other significant advantages. A constant 3-degree descent path has replaced what used to be a dive and drive approach. Descending with a stable approach power setting significantly improves the environmental impact by reducing noise; it also saves us fuel and reduces emissions."

With its accuracy and reliability, RNP has the potential for enabling simultaneous approaches to closely-spaced parallel runways in reduced visibility conditions, resulting in increased airport capacity.

The FAA is now pursuing the implementation of RNP approach procedures at the top 100 airports in the United States.

RNP also benefits some of the world's most remote airports, which are often located in mountainous terrain.

For example, RNP procedures have provided vastly improved safety and access to Juneau's airport. Sited at the end of the winding Gastineau Channel, Juneau is flanked by some of the world's most scenic yet forbidding mountain peaks. On a clear day, on the approach to the airport, the beauty of the dramatic terrain on either side of the channel is breathtaking.

But if weather conditions deteriorate and visibility is reduced, predictable access to the airport is lost and the typical conventional procedure into Juneau is suspended. Pilots must divert or cancel their flights, leaving passengers stranded.

With RNP, however, the approach and landing into Juneau airport is safe and predictable, with fully stabilized and guided navigation pin-point accuracy is achieved every single time.

Interview: Captain Mike Adams-Alaska Airlines

"For many years Alaska Airlines has operated out of airports with substantial terrain in close proximity to the airport as well as to the departure and arrival corridor. This often resulted in flying circling approaches off of both VOR and NDB type aviation facilities. With the advent of RNP, we now have a precise lateral and vertical flight path to virtually every runway, and in our system in the state of Alaska."

Together, RNAV and RNP form the basis of Performance-Based Navigation. From RNAV's new highways in the sky, providing additional capacity en route - to RNP's approaches into the world's busiest airports - RNAV and RNP are opening up new opportunities and solutions in air transportation across the U.S. and around the world.

RNAV and RNP concepts and implementation strategies - which are described in detail in the FAA's Roadmap for Performance-Based Navigation - are formulated to provide even greater benefits in the future. The Roadmap also recognizes the synergies between Performance-Based Navigation and other emerging technologies, such as ADS-B, data-link, enhanced-vision systems, and advanced air traffic flow management systems. All together, these can provide even greater benefits.

Partnering with key government agencies in the Joint Planning and Development Office and with the aviation community in the U.S. and abroad, the FAA is implementing these strategies - steadily and purposefully - to make the 21st century Next Generation Air Transportation System a reality.

Our sky is a limited resource, and as air travel continues to be a vital part of our lifestyle and our economy, we must learn how to manage it more wisely.

Using RNAV and RNP, the FAA is building new highways in the sky to more safely and efficiently use this limited resource we call the National Airspace System.

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