Integrated Approach

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Abstract

The Federal Aviation Administration (FAA), with its NextGen Air Transportation System (NextGen) and Performance-Based Navigation (PBN) initiatives, is moving towards a concept of integrated procedures implementation. Performance-Based Navigation initiatives include implementing Area Navigation (RNAV) and Required Navigation Performance (RNP) routes and procedures. The integrative concept of implementation of these procedures would mean a migration away from site by site (or runway by runway) procedure implementation process towards a NextGen readiness concept. This concept will include development of an integrated system of PBN routes and procedures by geographic area (incorporating metro areas and outlying airports). This concept delivers optimum benefits for the air traffic and carrier community. In addition, the integrative approach helps in prioritizing and formulating the funding requests to combine airspace, environmental, and procedures development. This paper discusses different aspects of this integrative approach.

Integrated Procedures Implementation – Concept Defined

Through NextGen, the FAA is addressing the impact of air traffic growth by increasing NAS capacity and efficiency while simultaneously improving safety, reducing environmental impacts, and providing better user access to the NAS. We are implementing new routes and procedures that leverage emerging aircraft navigation capabilities, including PBN, which is helping FAA to achieve its NextGen goals.

As NextGen continues to evolve, commitments such as those detailed in the

Roadmap for Performance-Based Navigation are being incorporated into the NextGen Implementation Plan. In fact, many NextGen solutions are dependent on RNAV and RNP procedures as enabling technology in the NAS, including:

- Increased Capacity Using RNAV and RNP
- Increased Flexibility in the Terminal Environment
- Integrated Arrival/Departure Management
- Optimized Profile Descent
- Time-Based Metering Using RNAV and RNP Route Assignments
- Trajectory-Based Operations

As a cornerstone of NextGen, PBN – including RNAV and RNP – is already in place in the National Airspace System (NAS), delivering benefits to aviation stakeholders via navigation flexibility, predictability and repeatability that can be applied to air traffic routes, instrument procedures, or defined airspace. These advances in aircraft capabilities and air traffic system operations may contribute to reduced separation and support the transition from rules-based operations to performance-based operations.

Certain RNP operations require advanced features of the onboard navigation function and approved training and crew procedures. The operations that are characterized as Special Aircraft and Aircrew Authorization Required (SAAAR), must receive approvals similar to approvals required for operations to conduct Instrument Landing System Category II and III approaches.
Figure 1. Example of an Integrated Approach to De-conflict Arrival/Departure Interactions

Collectively, RNAV and RNP SAAAR procedures result in improved safety, access, capacity, predictability, operational efficiency, and a reduced environmental impact. Specifically, improved access and flexibility for point-to-point operations help enhance reliability and reduce delays by defining more precise terminal area procedures that meet operational constraints. They also provide fuel and emissions savings.

The FAA has already made great strides in moving towards NextGen. The integrated implementation concept can optimize existing PBN operations throughout the NAS that will help reduce departure delays for the traveling public and aid air carriers in realizing additional fuel and flight time savings.

Working collaboratively with The MITRE Corporation’s Center for Advanced Aviation System Development (CAASD), the FAA is studying three variables that have negative impacts on current NAS operations: 1) Arrival and departure interactions; 2) primary and satellite airport interactions; and 3) city-pair congestion between heavily-traveled routes and airports, which are discussed in the next sections.

Arrival/Departure Interactions

Current Operations: Today, NAS operations are characterized by arrival and departure interactions in which departures are subordinate to arrivals and bottlenecks in the en route streams. These traffic flow interactions create sequencing priorities and dependencies resulting in departure delays.

Integrated Concept: To address this issue within an integrated framework, the FAA has begun and will continue to develop RNAV Standard Terminal Arrivals (STARs) and Standard Instrument Departures (SIDs) simultaneously at airports, whenever and wherever feasible. Concurrent, integrated design and turn-on of RNAV STARs and SIDs in this manner will help to ensure that arrival and departure flows are not conflicted. An example of this type of interaction is depicted above in Figure 1 along with a notional integrated design that reduces “level offs” without requiring an environmental impact study.
Primary/Satellite Airport Interactions

**Current Operations:** There are inter-airport traffic dependencies (e.g., Chicago O’Hare and Midway) that manifest sequencing and coordination complexities that are detrimental to each airport’s operations. Additionally, there are areas of conflict and complexity between primary and satellite airports due to multiplex Terminal Radar Approach Control (TRACON) growth that cause flight delays.

**Integrated Concept:** With an integrative approach, creation of separate satellite RNAV and RNP procedures could mutually benefit primary and satellite airports by decoupling their operations. Integrated RNAV and RNP procedure design would ensure optimal configuration operations for both airports with minimal or no interference, and independence of primary and secondary airports departure/arrival flows, combined with the resulting increase in their predictability, will lead to increased efficiency, capacity, throughput, and safety in TRACON operations.

City-Pair Congestion between Heavily-Traveled Routes/Airports

**Current Operations:** Operations counts are limited by current ground-based navigational aid infrastructure resulting in traffic flow management initiatives aimed at reducing congestion and delays. In fact, recent departure delay analyses of city-pair routes show that a small number of airports – most on the East coast – are responsible for the largest percentage of delayed departures (e.g., Atlanta, Charlotte, Chicago, Los Angeles, Dallas-Fort Worth, Newark, New York, and Philadelphia).

**Integrated Concept:** Using the integrative approach to combat departure delays, a connection of city and TRACON pair(s) in the “right” way can be made by providing a direct connection between busy city pairs. This example is depicted above in Figure 2. These “highways in the sky” (e.g., Q-routes) could shave minutes off flight times, reduce fuel burn, and reduce the impact of traffic flow management through congested airspace. Additionally, integration with TRACON STARs and SIDs for dedicated city/TRACON pair Q-routes and other less structured en route operations may decrease delay and controller/pilot workload while increasing flexibility in the NAS. With a solid foundation of routes and procedures in place, FAA is exploring ways to accelerate PBN and NextGen. The integrated design and implementation makes sense and may help to reduce the departure delays that continue to impact the public and industry.
In 2009, FAA and CAASD will complete analyses of arrival/departure interactions, primary/satellite airport interactions, and city-pair congestion between heavily-traveled routes/airports as they relate to the integrated concept of procedure implementation.

With the movement towards NextGen and the application of more advanced technology, the procedures and airspace problems require a more integrated and end-to-end perspective. The FAA is moving forward with updating Flight Plans Goals to reflect this new approach. Additionally, research is underway to determine the processes, tools and data, benefits metrics to needed to achieve success in this new paradigm.

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