



Federal Aviation
Administration

Performance-Based Navigation (PBN)



What Is PBN?

Performance-Based Navigation (PBN) is comprised of Area Navigation (RNAV) and Required Navigation Performance (RNP) and describes an aircraft's capability to navigate using performance standards.

What Is RNAV?

RNAV enables aircraft to fly on any desired flight path within the coverage of ground- or spaced-based navigation aids, within the limits of the capability of the self-contained systems, or a combination of both capabilities. RNAV aircraft have better access and flexibility for point-to-point operations.

What Is OPD?

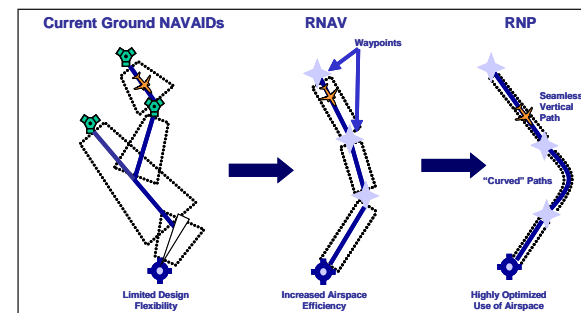
Optimized Profile Descent (OPD) is designed to reduce fuel consumption, emissions, and noise during descent by allowing pilots to set aircraft engines near idle throttle while they descend. OPDs use the capabilities of the aircraft Flight Management System to fly a continuous, descending path without level segments. Where possible, we are implementing OPDs with RNAV to make them environmentally-friendly or "green."

What Is RNP?

RNP is RNAV with the addition of an onboard performance monitoring and alerting capability. A defining characteristic of RNP operations is the ability of the aircraft navigation system to monitor the navigation performance it achieves and inform the crew if the requirement is not met during an operation. This onboard monitoring and alerting capability enhances the pilot's situation awareness and can enable reduced obstacle clearance.

Certain RNP operations require advanced features of the onboard navigation function and approved training and crew procedures. These operations must receive approvals that are characterized as Authorization Required (AR), similar to approvals required for operations to conduct Instrument Landing System Category II and III approaches.

Evolution to PBN



Resources

FAA RNAV/RNP Group Web Site

<http://faa.gov/ato?k=pbv>

FAA Next Generation Air Transportation System

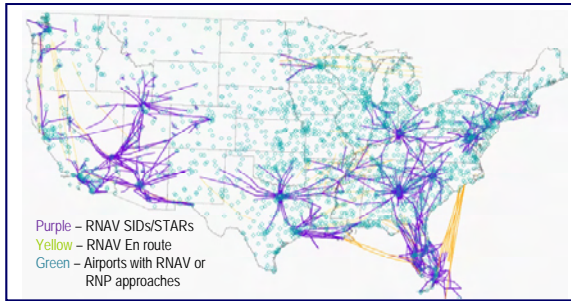
<http://www.faa.gov/about/initiatives/nextgen>

ICAO PBN Programme Office

www.icao.int/pbn

Contact us at: 9-AJR-37-PBN@faa.gov

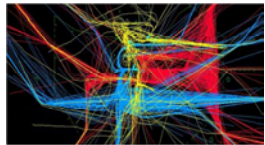
PBN Implementation in the U.S.



RNAV and RNP procedures in the terminal and en route domains have demonstrated benefits by:

- ◆ Reducing miles flown, saving fuel and time
- ◆ Reducing fuel burn and emissions with more continuous climbs and descents
- ◆ De-coupling traffic flows in complex airspaces
- ◆ Decreasing required air/ground voice communications

PBN Implementation Challenges



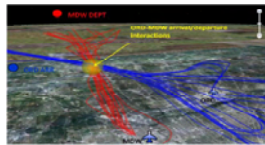
Takeoff and Departure Challenges

- Complex flows include satellite airport traffic
- Terrain avoidance
- Environmental and noise restrictions
- Operator readiness and approvals
- Training
- Avionics equipage variations



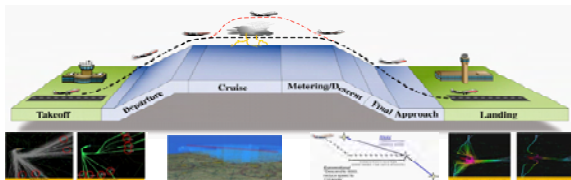
En Route Challenges

- Multi-facility coordination
- Terminal transitions to/from en-route
- Avoiding restricted airspace
- Integrating with automation



Arrival and Approach Challenges

- Adjacent airport flow interactions
- Environmental and noise restrictions
- Controlling and managing a mixed equipage environment
- Availability of controller decision support tools

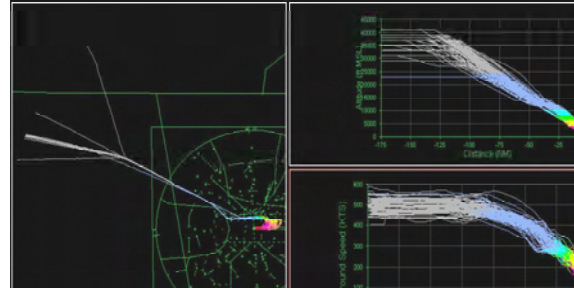


Benefits of Performance-Based Navigation

Atlanta (ATL) OPD RNAV Arrivals

Atlanta designed RNAV Standard Terminal Arrival (STAR) procedures with OPD to reduce emissions and environmental impact. Eventually, these RNAV OPD procedures could generate approximate benefits of:

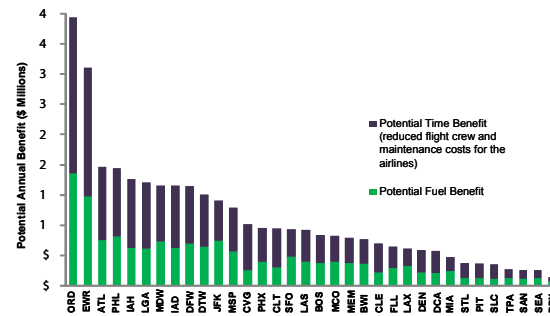
- ◆ 700,000 gallons of fuel savings per year
- ◆ 4,500 metric tons of carbon dioxide emissions saved per year



ATL NOTRE OPD STAR arrival

Fuel Efficient Operations in the Terminal Environment

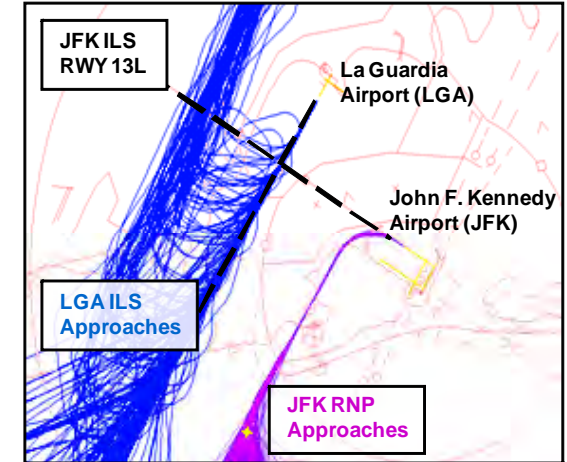
Complete implementation of OPDs and uninterrupted climb operations at some of the busiest airports would generate benefits of approximately:



Benefit analyses conducted by The MITRE Corporation/Center for Advanced Aviation System Development

New York (JFK) Traffic Decoupling Using RNP AR

RNP AR approaches to Runway 13L at JFK would eliminate conflicts with traffic using the Instrument Landing System (ILS) on Runway 4 at LaGuardia.



Dallas-Fort Worth (DFW) RNAV Departures

RNAV allowed DFW to implement initially diverging, fanned routes in September 2005. These new RNAV Standard Instrument Departures (SIDs) resulted in benefits of:

- ◆ 45% reduction in delay during peak demand
- ◆ \$25 million in operator benefits through 2008
- ◆ 10 additional departures per hour per runway

