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# AIRPORT DEVELOPMENT

The FAA is working on several near-term and long-term strategies to enhance airspace capacity. Significant airspace initiatives include the National Airspace Redesign Plan, the National Choke Points Initiative, the consolidation and expansion of terminal airspace control facilities, and the continuing development of area navigation routes. These initiatives are discussed below.

### 4.1 The National Airspace Redesign Plan

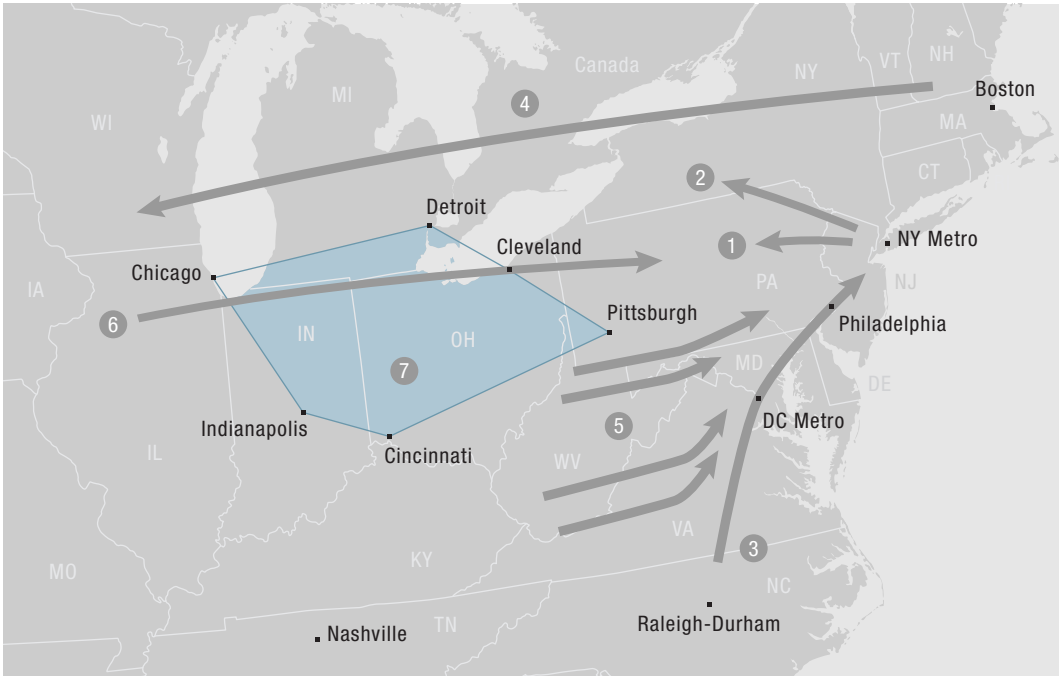
The National Airspace Redesign (NAR) Plan is a multi-year effort to increase the efficiency of the NAS through the re-routing of air traffic, the reconfiguration of the nation's airspace, and more efficient air traffic management. The NAR is pursuing incremental changes to the national airspace structure, consistent with evolving air traffic and avionics technologies. It is initially focused on near-term fixes to airspace choke points that significantly contribute to flight delays.

#### 4.1.1 The National Choke Points Initiative

The National Choke Points Initiative focuses on short-term actions to improve air traffic flow at seven problem areas in the area east of the Mississippi, as far north as Boston and as far south as Atlanta. This area includes many of the country's major population areas and most congested airports.

Figure 4-1, which identifies the seven national choke points, shows that the choke points are not actually discrete sites, but rather airways or sections of airspace. The figure also shows the extent to which the choke points overlap; congestion at one choke point can easily create or exacerbate congestion at another.

**Figure 4-1** National Choke Points Map



Twenty-one action items have been identified as solutions to the seven choke points. Sixteen of the action items have been completed, and the remaining items will be completed by July 2002. The seven choke points, the problems faced at each choke point, and the steps that have been or will be taken to correct those problems are described below.

*Choke Point 1: Westgate Departures*

In the New York Terminal Radar Approach Control facility (TRACON) the high volume of turboprop and air carrier jets that depart from the New York area airports to the west are required to navigate through the Westgate departure fixes. Traffic complexity escalates as a result of separating and sequencing the slower turboprop flights and the faster jet traffic, resulting in departure delays. Further complicating matters, Washington Dulles and Baltimore/Washington airport arrivals descend through New York departures.

As a solution to the problems at this choke point, the FAA has begun rerouting propeller aircraft departing from the New York and New Jersey metropolitan airports and aircraft bound for Dulles and Baltimore/Washington that transit New York en route center airspace. This adjustment has reduced congestion and the number of ground delays. In addition, a coordinator position for the New York TRACON has been proposed to improve coordination between the New York TRACON and the area airports. When the new position is implemented, arrival flows will be expedited and the length of departure stops will be reduced.

*Choke Point 2: Northgate Departures*

This choke point is located in New York en route center airspace. Flights that depart north from the New York area airports are required to navigate through the Northgate departure fixes. Traffic management initiatives such as holding, departure stops, and miles-in-trail restrictions on departures are often required to alleviate congestion.

Traffic management restrictions are now being reviewed throughout the day to determine the most appropriate restrictions, with the objective of creating more efficient traffic flows. In addition improvements in automation have increased the amount of information about congested routes that is displayed to TRACON controllers, allowing them to be more selective in imposing flow restrictions and departure stops. Also, restricting Pittsburgh arrivals to flight level 280 has allowed New York departures to climb higher than the Pittsburgh arrivals, reducing complexity in this sector. As a result of these actions, departure stops at New York metropolitan airports were reduced 37 percent as measured in August of 2000. This is now a standard operating procedure.

*Choke Point 3: Washington Center Sectors*

Currently, the arrival flows into Newark and LaGuardia pass through narrow sectors located in the airspace of the Washington en route center. These sectors can only accommodate a few aircraft in a holding pattern.

Swapping arrival flows for Newark and LaGuardia will increase the flow rate for traffic to New York airports from the Washington en route center by balancing the traffic load. This change will reduce the need for holding of New York arrival traffic.

*Choke Point 4: Westbound Jet Route from Boston Center*

Jet route 547 (J547) is the major westbound airway from the Boston en route center. Miles-in-trail restrictions are normally imposed on traffic using this route to Chicago O'Hare, Chicago Midway, Detroit, and Cincinnati. The lack of alternate jet routes and use of air traffic restrictions results in ground and airborne delays.

Westbound flights from the New England region are being re-routed through Canadian airspace, reducing congestion in en route airspace and providing greater access to route J547 for New York departures. In addition, Detroit departures to seven locations, including Boston, Providence, and Kennedy airports have begun to traverse Canadian airspace when domestic routes are impacted by weather.

*Choke Point 5: Great Lakes Corridor*

The Great Lakes Corridor is the area south of the Great Lakes extending from Chicago to Pittsburgh to Cincinnati to Indianapolis. It includes airspace in Chicago, Cleveland, and Indianapolis Centers. These three en route centers have the responsibility for moving arrival and departure flows into and out of the New York Center and within the Great Lakes en route centers. The airspace in these en route centers is very complex and congested. When Cleveland Center provides spacing for flights to airports in the northeast, traffic backs up into Minneapolis Center, affecting departures from Chicago O'Hare to the south and east. Indianapolis Center sequences, spaces, and holds traffic bound for St Louis, Chicago O'Hare, Cincinnati, and Detroit. Cleveland Center imposes miles-in-trail restrictions for westbound traffic, and also provides spacing for the Washington airports and holds for Philadelphia. Traffic must flow around the Buckeye Military Operations Area, just northeast of Cincinnati, when the military is using that airspace.

One approach to this choke point has been to restrict aircraft flying between certain city-pair airports to lower altitudes. In addition, the national route program (NRP) routings east of the Mississippi have been tactically modified to provide more predictable departure times and reduce airspace congestion. Further, seven new sectors have been opened in this area to help manage the tremendous congestion. Also, the FAA Command Center reviews arrivals to Newark, New York Kennedy, and Philadelphia every day during its daily strategic planning teleconference to determine which traffic management initiatives should be implemented. Routes are then developed to provide more efficient flows.

*Choke Point 6: High Altitude Holding of East Coast Arrivals*

High altitude en route holding of traffic in the Cleveland, Indianapolis, Chicago, and New York en route centers bound for east coast airports is common. Sector capacity is reduced due to the large amount of airspace required for holding patterns at high altitudes, resulting in flight delays. This affects traffic at Chicago O'Hare, Detroit, Cleveland, Pittsburgh, and Cincinnati, incurring delays and unplanned departure stops.

Planned spacing of aircraft earlier in the flight and tactical modification of NRP routes reduces congestion and complexity in high altitudes and minimizes high altitude holding.

*Choke Point 7: Departure Access to Overhead Streams*

Saturated airways delay flights departing eastbound from Chicago O'Hare, east and southbound from Detroit, and north and eastbound from Cincinnati.

By adding new sectors, re-routing flights through Canadian airspace and restricting certain flights to lower altitudes between specific city-pairs, flights from Chicago, Detroit and Cincinnati to eight destinations requiring access to the overhead stream experienced 7.5 percent fewer delays in May 2001 as compared to May 2000.

### 4.2 High Altitude Redesign

Aircraft that are flying near or across sector boundaries are frequently delayed as they are handed off from one facility to another. The objective of high altitude airspace redesign is to allow users to fly preferred routes and altitudes with fewer restrictions and delays than the present system requires. The airspace above FL350 will be redesigned to allow this flexibility with minimal constraints due to sector boundary stratification by establishing a few very large high altitude sectors.

Current procedures to separate traffic require longitudinal separation of five miles in en route airspace. When two aircraft are flying along the same airway, they are kept in trail, one behind the other, which can delay the trailing plane. If the two aircraft are heading for different airports, it should be possible for them to fly on parallel routes, maintaining safe separation, but enabling both to operate at optimal speed. High altitude redesign will incorporate parallel routing where possible. Parallel routing will reduce the inefficiencies and workload created by placing aircraft in trail as the primary means of providing structure and controlling volume. A challenge for the FAA will be achieving the correct balance between structure (predefined routes) and flexibility (user preferred routes).

High altitude redesign will initially address changes that are supportable with currently available technology and resources. The airspace will be designed to provide the maximum utilization of advanced area navigation (RNAV) routing given these constraints. RNAV routes will be designed to most efficiently accommodate the transition to congested terminal areas. To achieve desired flexibility; the airspace will be designed to facilitate reduced vertical separation minima (RVSM), which will allow more aircraft to efficiently use the available airspace. Preliminary high-altitude airspace modifications will be tested in the northwest portion of the country in early 2003.

### 4.3 New York/New Jersey/Philadelphia Metropolitan Redesign Project

More passengers fly in and out of the New York/Philadelphia metropolitan area than any other area in the U.S. In one year, Kennedy, LaGuardia, Newark, and Philadelphia airports handle more than 99 million passengers.

These airports and their terminal area airspace were not designed to handle this volume of traffic, and as a result are among the ten most delayed airports in the U.S. No new runways are currently planned any of these airports, so modifying the airspace redesign is required to improve efficiency.

The FAA has devised at least four alternative concepts to relieve airspace congestion generated by Newark, Kennedy, LaGuardia, Philadelphia and several regional and general aviation airports in the New York metropolitan area. The alternatives address traffic

in the airspace currently controlled by the New York TRACON, roughly a 50-mile radius around the TRACON.

Under one concept, all departing aircraft would be routed eastbound over the Atlantic, regardless of their destination. Aircraft would turn back toward their destination after gaining altitude to reduce the impact of aircraft noise on the underlying communities. This alternative is supported by individuals in the communities currently subject to aircraft noise, but would increase flight costs.

Another concept would establish four arrival areas around the metropolitan area. Departing aircraft would be routed between the four arrival areas. A third concept would achieve efficiencies by making minor adjustments to existing traffic flows, and a fourth would combine the best features of the other alternatives. The FAA is holding a series of public meetings to further develop the concepts and to try to reach a consensus.

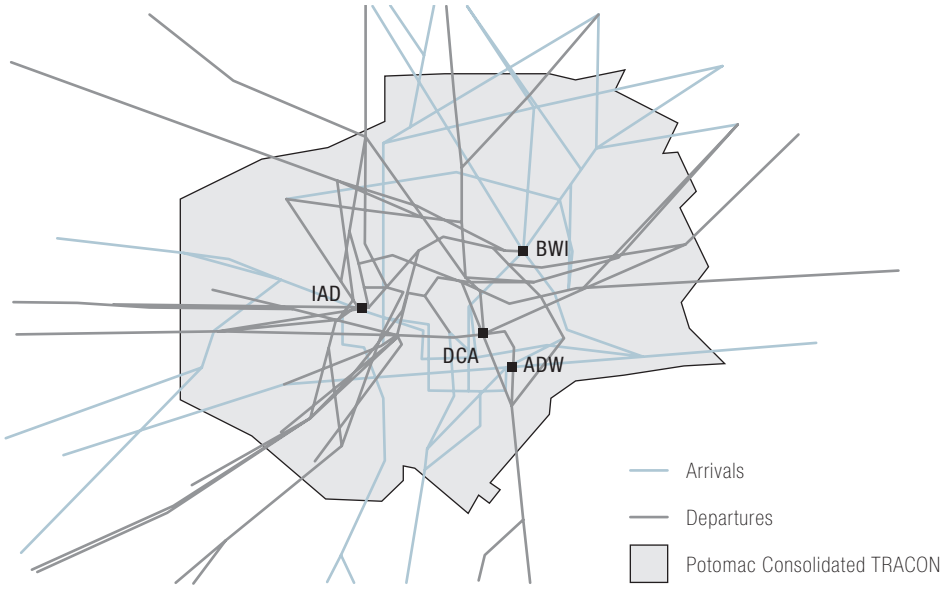
### 4.4 Consolidation of Terminal Airspace Control

Typically, a TRACON controls aircraft approaching and departing between 5 and 50 miles of an associated airport. In metropolitan areas with several airports, the terminal airspace of adjacent airports may overlap, creating a complicated airspace structure. In these circumstances, consolidating two or more TRACONs into a single facility can simplify that airspace structure. The consolidation improves communications among controllers handling operations over a wide geographic range and increases their flexibility in merging, maneuvering, and sequencing aircraft to and from the area airports. Additional flexibility can be gained by bringing portions of en route airspace under TRACON control, especially where comprehensive radar coverage allows three-mile spacing rather than the five-mile spacing that is customary in the en route environment. Two examples of significant FAA efforts to consolidate airspace control are the Potomac Consolidated TRACON (PCT), and the New York Integrated Control Complex (NYICC). The PCT primarily involves consolidation of TRACON airspace with the addition of relatively small areas of en route airspace. The NYICC would bring large amounts of en route airspace under TRACON control.

#### 4.4.1 Potomac Consolidated TRACON

The Washington/Baltimore Metropolitan Area is served by four major airports-Ronald Reagan Washington National (DCA), Dulles International (IAD), Baltimore-Washington International (BWI), and Andrews Air Force Base (ADW). These four airports are located within a geographic area that in many places would be served by a single airport. The existing airspace configuration of the four TRACONs is shown in Figure 4-2.

**Figure 4-2** Terminal Airspace in the Washington/Baltimore Area




In the Washington/Baltimore area, the responsibility for handing off departures from terminal airspace to an en route center is assigned to specific TRACONs based on the direction of each flight. For example, DCA coordinates the hand-off of southbound departures from each airport's airspace to the Washington Center. The Dulles TRACON is responsible for most west and northwest bound jet traffic, and the Baltimore TRACON is responsible for propeller traffic to the east and northeast.

Departures require significant vectoring to sequence them for hand-off to the appropriate en route center, which requires coordination among the TRACONs. For example, aircraft that depart southwest from BWI must be coordinated with controllers from BWI and DCA prior to being handed off to the Washington en route center. This one procedure requires the involvement of three controllers. Similarly, arrivals also require coordination among the TRACONs. The New York and Washington en route centers manage arrivals to the Washington airports as a series of single streams, separating them by destination only as each flight descends into TRACON airspace. But because of the complexity of the terminal airspace, more than one TRACON is usually involved. For example, some DCA arrivals from the West are routed through the IAD TRACON before being passed to the DCA TRACON.

The Potomac Consolidated TRACON will combine the four Baltimore/ Washington area TRACONs and the Richmond TRACON into a single new facility. The FAA expects to commission the new facility in May 2002.

The consolidated TRACON will have continuous radar coverage from south of Richmond, Virginia to north of Philadelphia, Pennsylvania, and from as far west as Cumberland, Maryland and east to Cambridge, Maryland. The PCT will gain control of several pieces of airspace that are currently controlled by the en route centers. The expanded and consolidated terminal area airspace will allow the PCT to handle inbound and

departing aircraft more efficiently. Proposed airspace changes are the subject of an ongoing environmental impact study (EIS) analyzing traffic patterns and alternatives with the goal of increasing air traffic system efficiencies, enhancing the safety of flight, and reducing aircraft noise exposure to the public. One alternative for more efficient routing of traffic is a ring of fixes around the Baltimore/Washington area to allow direct routing to and from major cities (Figure 4-3). Another alternative is similar to a "four-corner post" structure, which would establish four arrival and departure areas around the Baltimore/Washington area (Figure 4-4). The FAA plans to name its preferred alternative in the fall of 2002, and to implement the new airspace design by March 2003 (approximately one year after the PCT is commissioned).

**Figure 4-3** PCT Jet Traffic Routing Alternative: Ring of Fixes

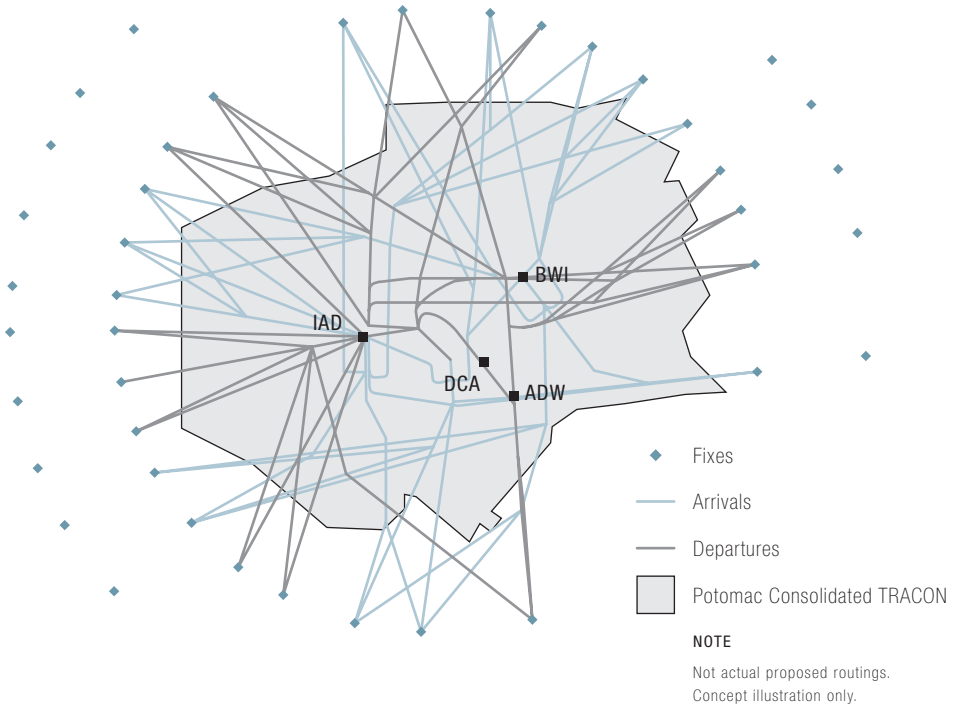
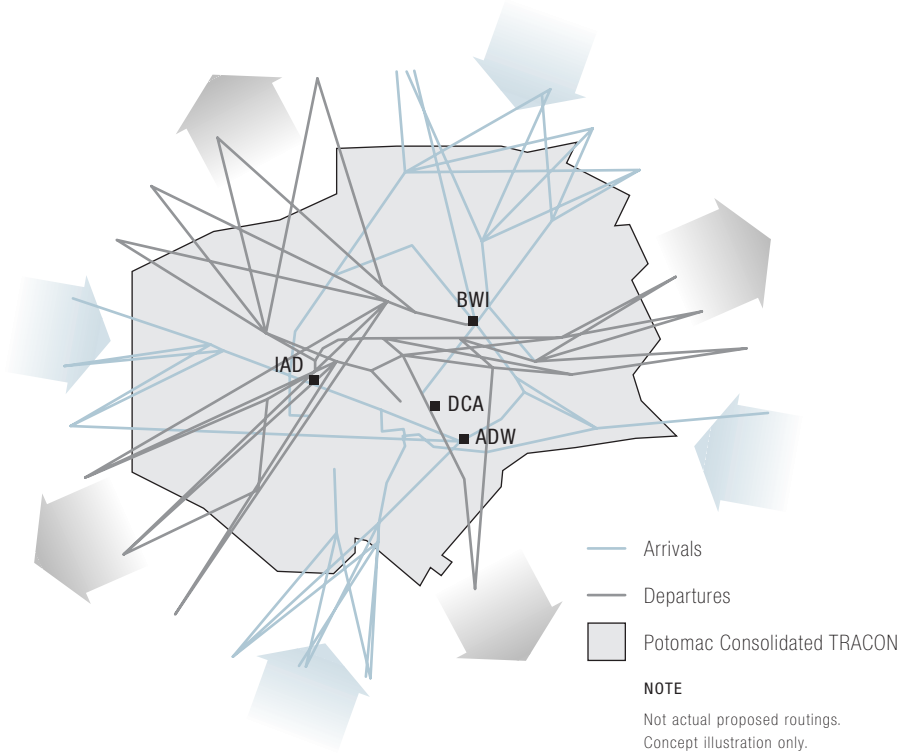


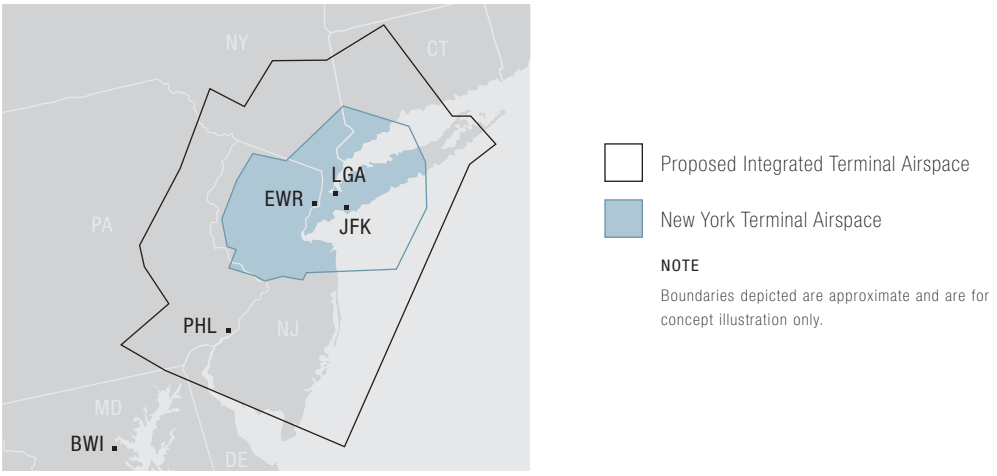
**Figure 4-4** PCT Jet Traffic Routing Alternative: Four Cornerpost




### 4.4.2 New York Integrated Control Complex (NYICC)

The FAA is in the planning stages of the redesign of the airspace in the New York metropolitan area. This concept, the New York Integrated Control Complex (NYICC) involves the "terminalization" of portions of the en route airspace currently controlled by the en route facilities abutting the New York TRACON (Figure 4-5). Bringing portions of en route airspace under TRACON control will allow for reduced separation and better coordination, resulting in greater efficiency in airspace management around New York.

**Figure 4-5** Single Facility for En Route and Terminal Operations in New York



Specifically, NYICC would combine terminal airspace from the New York TRACON with airspace from the en route centers in New York, Boston and Washington, as well as that of adjacent TRACONs. Presently, fragmentation of arrival and departure corridors across multiple en route centers causes inefficient use of existing airspace. Arrival and departure management decisions spread among multiple facilities limits responsiveness and the flexibility needed to address the dynamic nature of the northeast corridor traffic flows.

The area encompassed by NYICC will provide additional airspace to support load balancing and holding patterns within the TRACON, adding efficiency to arrival and departure operations of the busy New York, New Jersey, and Philadelphia airports. NYICC will enhance benefits expected from the airspace design changes proposed in the NY/NJ/PHL Metropolitan Redesign Project. The resulting terminal benefits will include reduced delays, reduced restrictions, increased flexibility, and enhance operations during severe weather events.

### 4.5 Area Navigation Routing

One of the limiting factors of the NAS is that aircraft must generally follow airways that are based on a system of ground-based navigational aids. Following those airways involves flying from one navigational fix to another, connecting a series of doglegs, which increases the distance flown and the time required to do so. Over the past four years the FAA has been developing advanced area navigation routes, which are typically more direct than routes determined by ground-based navigational aids. Advanced RNAV routes can be safely flown by aircraft equipped with present day flight management systems (FMS) or GPS. Several recent advanced RNAV route development initiatives are described briefly below.

- In the Eastern Region, 104 RNAV city-pair routes were developed collaboratively between local air traffic facilities and Atlantic Coast Airlines. The routes are flown daily by the airline, resulting in an estimated savings of $4.1 million annually, exceeding the cost of equipping the airline fleet with GPS.
- In the Western-Pacific and Northwest Mountain Regions, 21 RNAV off-airway direct routes between key cities in the Pacific Northwest (Seattle, Portland, Vancouver) and the Western-Pacific Region (Los Angeles, San Francisco, San Jose, Oakland, Ontario, Palm Springs, John Wayne-Orange County, Las Vegas, and Phoenix) were developed in conjunction with Alaska Airlines and the Western-Pacific and Northwest Mountain regional air traffic facilities in coordination with the Air Transport Association. The objective of these routes is to provide seamless RNAV departure, en route, and arrival between the selected airports for all appropriately equipped aircraft. Annual savings to Alaska Airlines are projected to approach $800,000.
- In the Southern Region, the FAA designed and implemented 36 routes for use by aircraft equipped with advanced navigation systems, primarily between Atlanta, Daytona Beach, Jacksonville, Orlando, Tampa, West Palm Beach, Ft. Lauderdale, and Miami. Delta Airlines is the principal air carrier utilizing the routes,

operating 117 flights daily. Delta projects a yearly savings of $2.6 million. Additional RNAV routes are being developed from Charlotte to the seven Florida airports with US Airways as the principal user. The development of RNAV departure and arrival routes at Atlanta Hartsfield, Miami, and Ft. Lauderdale airports will provide RNAV benefits from runway to runway. The remaining central Florida airports will be included as airspace redesign is completed on the Suncoast TRACON project.

- In 1999, Atlantic Southeast Airlines (ASA) requested city-pair RNAV routes to complement the acquisition of 50 new regional jets over a four-year period. The FAA Southern region in coordination with associated regions and air traffic facilities established 56 routes to facilitate traffic flow in terminal airspace, resulting in projected annual savings of $2 million for ASA.

- Until recently, general aviation aircraft flying between the Northeastern U.S. and Florida had to bypass restricted airspace surrounding the Charlotte N.C. airport, increasing their flight distance by as much as 50 miles. FAA personnel at the Charlotte air traffic control tower identified 12 routes through the Class B restricted airspace that would keep RNAV-capable aircraft that fly at low altitudes clear of the major air carrier's primary traffic corridors. Aircraft that file these routes are assigned altitudes from 4,000 to 6,000 feet. Pilots who do not have the appropriate GPS equipment may request vectors along the new routes. The new routes went into effect in January 2001.

- In September 2001 three new advanced RNAV routes were implemented in the northeastern Gulf of Mexico. Even in the short time they have been in existence, these routes have provided a tremendous benefit to both the controllers who manage the airspace and the system users. The airlines have estimated that the cost savings they will realize from the use of these new routes will exceed $21 million per year. Delays due to capacity constraints have been greatly reduced, and the flexibility afforded by having three routes instead of one has proven to be a highly effective tool for air traffic controllers.

### 4.6 RNAV Terminal Routes

Airspace congestion in the vicinity of airports and en route often causes arrival and departure delays. At many airports, flights must funnel through common arrival or departure fixes, which due to traffic volume and the variety of aircraft types with different performance characteristics flying the in the same airspace, reduces throughput rates. Optimizing traffic flow in the terminal area to allow users to efficiently transition in and out of terminal airspace while making maximum use of airspace and airport capacity is an important component of the national airspace redesign. The development of RNAV arrival and departure procedures will allow for more efficient use of constrained terminal airspace.

RNAV allows for the creation of arrival and departure routes that are independent of existing fixes and navigation aids, and provides multiple entries to existing Standard Terminal Arrival Routes (STARs) and multiple exits from Departure Procedures (DPs).

Airports with multiple runways or with shared or congested departure fixes benefit the most from segregating departures and providing additional routings.

FAA regions have identified RNAV terminal procedure needs for the next four years. The FAA, with the support of MITRE/CAASD has developed a standardized process and tool for designing, modeling, and simulating aircraft navigation using RNAV terminal routes called Terminal Area Route Generation, Evaluation, and Traffic Simulation (TARGETS). TARGETS will be used to support the development of new RNAV terminal routes.