NextGen Denver International Airport

Denver International Airport (DEN) is the fifth busiest airport in North America in terms of passenger traffic, which increased by 1.7 percent in 2014 to 53.5 million. The number of operations decreased by 2.5 percent during the same time, to 565,525. In 2014, 235,572 metric tons of cargo passed through DEN's facilities, an increase of 4.1 percent from the previous year. The three largest airlines serving DEN in terms of average daily domestic flights are United Airlines (including United Express), Southwest Airlines, and Frontier Airlines.

All airport information shown above is reported by Calendar Year (CY).

NextGen Capabilities

Airport Surface Detection Equipment — Model X (ASDE-X)
7/2009
Area Navigation (RNAV) Global Positioning System (GPS) Approaches
9/2010
External Surface Data Release
FY 2011
Automated Terminal Proximity Alert (ATPA) Phase 1
3/2012
Area Navigation (RNAV) Standard Terminal Arrival Routes (STARs)
11/2012
Optimized Profile Descents (OPDs)
11/2012
Required Navigation Performance (RNP) Authorization Required (AR) Approaches
11/2012
Area Navigation (RNAV) Global Positioning System (GPS) Approaches
11/2012
Area Navigation (RNAV) Standard Instrument Departures (SIDs)
1/2013
Situational Awareness and Alerting of Ground Vehicles
9/2014
Expanded Low-Visibility Operations Using Lower Runway Visual Range (RVR) Minima
11/2012
Deployment of Time Based Flow Management (TBFM)
by 8/2013
Advanced and Efficient Required Navigation Performance (RNP)
CY 2015
Converging Runway Display Aid (CRDA)
8/2015
Ground Based Interval Management-Spacing (GIM-S) adapted for Tower
3/2016
Departure Clearance Tower Service Initial Operating Capability
CY 2016 Q2
Wake Recategorization Phase 1 — Aircraft Recategorization
CY 2015 Q4

- Featured capabilities have extended descriptions.

This timeline reflects programmatic milestones, and excludes capabilities implemented across the National Airspace System.

Information as of July 13, 2016.

Airport Surface Detection Equipment — Model X (ASDE-X)

Learn more about surface surveillance capabilities in the 2016 NextGen Update.

Read how ASDE-X is used at other locations in the National Airspace System.

Area Navigation (RNAV) Global Positioning System (GPS) Approaches

Read how RNAV GPS Approaches and other NextGen technology are used at other locations in the National Airspace System.

External Surface Data Release

Read how surface data sharing is used at other locations in the National Airspace System.

Automated Terminal Proximity Alert (ATPA) Phase 1

Read how ATPA can help operations across the National Airspace System.

Area Navigation (RNAV) Standard Terminal Arrival Routes (STARs)

Read about Performance Based Navigation and RNAV in the 2016 NextGen Update.

Optimized Profile Descents (OPDs)

What are Optimized Profile Descents?

Conventional arrival procedures—the published routes and instructions that guide aircraft to the runway—are constrained by the availability and proximity of ground-based navigation aids. The advent of more precise Area Navigation (RNAV) technologies (based on GPS) eliminated this constraint and enabled the design of more efficient arrival procedures. Optimized Profile Descents (OPDs) are a type of RNAV arrival procedure that aims to reduce the number of altitude "step-descents" that were commonly flown in the past. OPD procedures can be used by arrival aircraft to facilitate descent from cruise altitude at or near idle power, eliminating the need for fuel-sapping changes to power settings. This allows aircraft to fly longer at more fuel-efficient cruise altitudes before initiating the descent to their final destination. While step descents may still be required for safe aircraft merging and sequencing, OPDs can reduce the time aircraft spend in level flight, and shift level flight to higher, more fuel efficient altitudes.

 Performance Based Navigation

How is OPD used in Denver?

Sixteen Area Navigation (RNAV) Optimized Profile Descent (OPD) arrival procedures were published for Denver International Airport (DEN) in FY 2013. At the time, 88 percent of arrivals at DEN approached the airport on flows that benefited from these procedures. Subsequent Performance Based Navigation (PBN) procedures implemented at DEN are being conducted through the FAA's Metroplex initiative, which takes a systematic approach to implementing PBN procedures and associated changes in airspace design for large geographic areas, rather than single airports.

Each Metroplex project is supported by broad stakeholder participation through five phases: Study, Design, Evaluation, Implementation and Post-Implementation. The Denver Metroplex project—currently in the design phase—will address many of the 90 operational issues submitted to the Denver Study Team in 2014. In general, these issues relate to inefficient lateral and vertical

flight paths, dependencies between arriving and departing traffic, underutilized transitions from en route to terminal airspace, and air traffic control/pilot complexity. The solutions under development will lead to more efficient and predictable flight paths, which will reduce fuel consumption and alleviate controller/pilot workload.

How did it impact operations?

Following the implementation of these procedures in Denver, the FAA found that aircraft were 8 percent more likely to perform fuel efficient, continuous descents. Flights that still conducted step-descents following implementation did so more efficiently, exhibiting a 10 percent reduction in the average number of level segments. This reflects fewer step-descents, which consume more fuel than continuous descents. In addition, these flights exhibited a 5 percent increase in the average altitude in level flight. These average impacts were measured over all Denver airport arrivals, not just those that used the procedures.

Looking at Optimized Profile Descent (OPD) implementations in FY13 (spanning 11 airports), the FAA found significant improvement in the efficiency of descents by airport arrivals. Specifically, it observed two significant impacts that indicate improved fuel efficiency:

- Aircraft were 5 percent more likely to perform continuous descents
- Flights that conducted step-descents did so more efficiently, exhibiting:
  - An 8 percent reduction in the average number of level segments. This reflects fewer step-descents, which translates to less fuel and fewer communication exchanges between pilots and controllers to safely manage arrival flows.
  - A 6 percent reduction in the average time and distance in level flight. This reflects more time in continuous descent, which is more fuel efficient than level flight.
  - A 5 percent increase in the average altitude in level flight. Aircraft are generally more fuel efficient at higher altitudes.

Not surprisingly, these improvements tended to be greater at airports where the new OPDs could be used by a higher proportion of arrivals.

Click here for a full description of the NextGen Operational Performance Assessment.

What is the value of this improvement?

While the FAA did not monetize the specific impacts of Optimized Profile Descents (OPDs) at Denver International Airport, it estimates that the observed efficiency gains from the 41 OPDs at 11 airports implemented in FY13 translated to $4 million in fuel cost savings to aircraft operators between 2013 and 2014. These savings, expressed in 2015 dollars, apply only to the share of flights at each of the airports that were in position to use the newly implemented OPD procedures. FAA monetized the observed reductions in level flight time using fleet-specific cost factors that reflect the lower fuel burn associated with idle descent.

Where else is it implemented?

In Fiscal Year 2013, the FAA published 41 Area Navigation Standard Terminal Approach Route procedures with Optimized Profile Descents (OPDs) at 11 airports. As of March 31, 2016, there are a total of 225 active OPD procedures at 116 airports in the National Airspace System.

Additional information available on the NextGen Portfolio pages.

Required Navigation Performance (RNP) Authorization Required (AR)

Approaches

Read how RNP AR Approaches are used at other locations in the National Airspace System.

Area Navigation (RNAV) Global Positioning System (GPS) Approaches

Read how RNAV GPS Approaches and other NextGen technology are used at other locations in the National Airspace System.

Area Navigation (RNAV) Standard Instrument Departures (SIDs)

View a training video for using the RNAV SID phraseology.

Situational Awareness and Alerting of Ground Vehicles

Read more about System Wide Information Management (SWIM).

Expanded Low-Visibility Operations Using Lower Runway Visual Range (RVR) Minima

Read how expanded low visibility operations have impacted the National Airspace System.

Deployment of Time Based Flow Management (TBFM)

Read how Time Based Flow Management (TBFM) is used at other locations in the National Airspace System.

Advanced and Efficient Required Navigation Performance (RNP)

Read about RNP and other PBN procedures in the 2016 NextGen Update.

Ground Based Interval Management-Spacing (GIM-S) adapted for Tower

Read about decision support systems in the 2016 NextGen Update.

Departure Clearance Tower Service Initial Operating Capability

Read more about Data Comm in the 2016 NextGen Update.

Wake Recategorization Phase 1 — Aircraft Recategorization

See page two of the NextGen Priorities Joint Implementation Plan- Revision I for additional information about Wake Recategorization Implementation in the National Airspace System.

Read how Wake Recategorization is used at another location in the National Airspace System.

Scorecard

The following metrics summarize performance over a large set of diverse operations at this location. As such, their purpose is to reflect general trends as experienced by aircraft operators and passengers, without regard to their underlying drivers. For this reason, metric values should not be compared to operational impacts attributed to specific NextGen capabilities, where these are provided.

Reportable Hours for DEN
07:00 - 21:59 local time
All Information below is in Fiscal Years (October 1 - September 30).

Efficiency
Capacity

Efficiency Performance Indicators

Performance Indicator (FY)	2009	2010	2011	2012	2013	2014	2015
Average Gate Arrival Delay *Minutes per Flight* **During reportable hours, the yearly average of the difference between the Actual Gate-In Time and the Scheduled Gate-In Time for flights to the selected airport from any of the ASPM airports. The delay for each fiscal year (FY) is calculated based on the 0.5th — 99.5th percentile of the distributions for the year. Flights may depart outside reportable hours, but must arrive during them. The reportable hours vary by airport.**	2.5	-0.5	0.8	-0.5	4.7	7.0	3.1
Average Number of Level-offs per Flight *Counts per Flight* **The count of level-offs as flights descend from cruise altitudes to the arrival airport, averaged for the fiscal year.**	[1]	[1]	2.0	1.9	1.6	1.5	1.6
Distance in Level Flight from Top of Descent to Runway Threshold *Nautical Miles per Flight* **The distance flown during level-off segments as flights descend from cruise altitudes to the arrival airport, averaged for the fiscal year (FY).**	[1]	[1]	26.6	24.6	22.8	22.0	22.3
Effective Gate-to-Gate Time *Minutes per Flight* **During reportable hours, the difference between the Actual Gate-In Time at the destination (selected) airport and the Scheduled Gate-Out Time at the origin airport. Flights may depart outside reportable hours, but must arrive during them. The reportable hours vary by airport and the results are reported by fiscal year (FY).**	142.6	142.4	143.8	144.8	151.4	153.3	154.1
Taxi-In Time *Minutes per Flight* **During reportable hours, the yearly average of the difference between Wheels-On Time and Gate-In Time for flights arriving at the selected airport from any of the Aviation System Performance Metrics (ASPM) airports. Flights may depart outside reportable hours, but must arrive during them. The reportable hours vary by airport.**	8.3	8.4	8.2	8.1	8.7	8.5	8.4
Taxi-Out Time *Minutes per Flight* **During reportable hours, the yearly average of the difference between Gate-Out Time and Wheels-Off Time for flights from the selected airport to any of the ASPM airports. Flights must depart during reportable hours, but may arrive outside them. The reportable hours vary by airport.**	15.8	15.4	14.4	14.0	14.8	15.3	15.8

[1] Consistent data for the time period prior to FY 2011 are not available.

As described by the International Civil Aviation Organization (ICAO), *efficiency addresses the operational and economic cost-effectiveness of gate-to-gate flight operations from a single-flight perspective. In all phases of flight, airspace users want to depart and arrive at the times they select and fly the trajectory they determine to be optimum.*

Capacity Performance Indicator

Performance Indicator (FY)	2009	2010	2011	2012	2013	2014	2015
Average Daily Capacity *Number of Operations* **During reportable hours, the average daily sum of the Airport Departure Rate (ADR) and Airport Arrival Rate (AAR) reported by fiscal year (FY). The reportable hours vary by airport.**	3,349	3,391	3,441	3,307	3,099	3,106	2,890
Average Hourly Capacity During Instrument Meteorological Conditions (IMC) *Number of Operations* **The average hourly capacity reported during IMC weather conditions (as defined by ASPM). Capacity is defined as the sum of Airport Departure Rate (ADR) and Airport Arrival Rate (AAR). It is calculated based on the reportable hours at the destination airport. The reportable hours vary by airport.**	188	184	197	168	140	156	139

As described by the International Civil Aviation Organization (ICAO): *The global Air Traffic Management (ATM) system should exploit the inherent capacity to meet airspace user demands at peak times and locations while minimizing restrictions on traffic flow. ICAO also notes: The ATM system must be resilient to service disruption and the resulting temporary loss of capacity.*

Additional Links

NextGen Implementation Plan

View City Pairs Data