NextGen Seattle-Tacoma International Airport

Seattle-Tacoma International Airport (SEA) is the 14th busiest airport in North America in terms of passenger traffic, which grew 7.7 percent in 2014 to 37.5 million. The number of operations increased by 7.3 percent from 2013, to 337,132. In 2014, SEA was the 20th busiest airport in terms of cargo volume, with 326,582 metric tons of freight and mail passing through its facilities, an increase of 11.6 percent. SEA is the main hub for Alaska Airlines and its regional subsidiary Horizon Air, and is an international gateway to Asia and Europe for Delta Air Lines.

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

NextGen Capabilities

Airport Surface Detection Equipment — Model X (ASDE-X)
2/2006
Area Navigation (RNAV) Global Positioning System (GPS) Approaches
1/2007
Area Navigation (RNAV) Global Positioning System (GPS) Approaches
11/2008
Approved for FAA Order JO 7110.308 Airports
11/2008
Area Navigation (RNAV) Standard Instrument Departures (SIDs)
5/2009
Required Navigation Performance (RNP) Authorization Required (AR) Approaches
5/2009
External Surface Data Release
FY 2011
Expanded Low-Visibility Operations Using Lower Runway Visual Range (RVR) Minima
5/2011
Required Navigation Performance (RNP) Authorization Required (AR) Approaches
5/2012
Area Navigation (RNAV) Standard Terminal Arrival Routes (STARs)
3/2013
Optimized Profile Descents (OPD)
3/2013
Required Navigation Performance (RNP) Authorization Required (AR) Approaches
3/2013
Expanded Low-Visibility Operations Using Lower Runway Visual Range (RVR) Minima
3/2013
Deployment of Time Based Flow Management (TBFM)
by 8/2013
Advanced and Efficient RNP
CY 2014
Qualifies for Dependent Runway Standards in Order 7110.65
12/2015
Ground Based Interval Management-Spacing (GIM-S) adapted for Tower
5/2016

- Featured capabilities have extended descriptions.

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

Information as of September 29, 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.

Deployment of Time Based Flow Management (TBFM)

Learn more about TBFM in the 2016 NextGen Update.

Read how TBFM 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.

Approved for FAA Order JO 7110.308 Airports

View FAA Order 7110.308A.

Area Navigation (RNAV) Standard Instrument Departures (SIDs)

View a training video for using the RNAV SID phraseology.

Required Navigation Performance (RNP) Authorization Required (AR) Approaches

Read how RNP Approaches 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.

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

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

Required Navigation Performance (RNP) Authorization Required (AR) Approaches

Read how RNP Approaches are used at other locations in 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 (OPD)

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 eased the design of more efficient arrival procedures. Optimized Profile Descents (OPD) are RNAV arrival procedures that aim to reduce 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, minimizing changes in the thrust. 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 them to higher, more fuel efficient altitudes.

 Performance Based Navigation

How are OPDs used in Seattle?

Two Area Navigation Optimized Profile Descent arrival procedures were published for Seattle-Tacoma International Airport (SEA) in March 2013. A procedure named "MARNR" serves arrivals from the northwest, while another named "HAWKZ" serves arrivals from the south and southwest. At the time, about 44 percent of arrivals to SEA approached the airport on the flows that benefited from these procedures.

How did it impact operations?

Following the implementation of these procedures at Seattle-Tacoma International Airport (SEA), the FAA found aircraft were 9 percent more likely to perform fuel efficient, continuous descents. Flights that still conducted step-descents following implementation did so more efficiently, exhibiting at least 6 percent reductions in the average time and distance in level flight, respectively. This reflects more time in continuous descent, which is more fuel efficient than level flight. These average impacts were measured over all SEA airport arrivals, not just those that used the procedures.

Over all Optimized Profile Descent (OPD) implementations in Fiscal Year 2013 spanning 11 airports, the FAA found significant improvements in the efficiency of descents by airport arrivals. Specifically, the agency observed two significant kinds of 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 with all else equal translates to less fuel used 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, respectively. 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 this NextGen Operational Performance Assessment.

What is the value of this improvement?

While the FAA did not monetize the specific impacts of Optimized Profile Descents (OPD) at Seattle-Tacoma International Airport, the FAA estimates the observed efficiency gains — from the 41 OPDs at 11 airports implemented in Fiscal Year 2013 — translated into $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 a 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?

As of September 15, 2016,there are a total of 240 active OPD procedures at 114 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 Approaches are used at other locations in the National Airspace System.

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

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

Advanced and Efficient RNP

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

Qualifies for Dependent Runway Standards in Order 7110.65

Read about Closely Spaced Parallel Operations 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.

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 SEA
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.**	1.4	-4.0	-0.9	-2.8	-0.2	1.3	0.4
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]	1.1	1.1	0.9	1.0	1.1
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]	13.9	11.1	9.7	9.7	12.4
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).**	198.8	196.4	199.0	197.3	201.2	199.5	198.9
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.**	6.9	6.0	6.0	6.2	6.6	6.7	7.6
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.**	16.9	15.0	14.9	14.9	15.3	15.7	16.6

[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.**	1,335	1,411	1,396	1,431	1,412	1,399	1,238
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.**	86	90	91	91	92	90	79

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