Ted Stevens Anchorage International Airport

2014 MASTER PLAN UPDATE

APPENDIX I - AIRFIELD SIMULATION

FINAL
DECEMBER 2014

RS&H
IN ASSOCIATION WITH:
HDR
DOWL HKM
RIM Architects
ATAC

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TED STEVENS
ANCHORAGE INTERNATIONAL AIRPORT
MASTER PLAN UPDATE

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Prepared for:
Ted Stevens Anchorage International Airport
State of Alaska Department of Transportation & Public Facilities

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AKSAS Project No.: 54320
RS&H Project No. 226-2566-000

Ted Stevens
Anchorage
International Airport
AeroNexus®

“The preparation of this document was financed in part through a planning grant from the Federal Aviation Administration (FAA) as provided under Section 505 of the Airport and Airways Improvement Act of 1982, as amended by the Airway Safety and Capacity Expansion Act of 1987. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein, nor does it indicate that the proposed development is environmentally acceptable in accordance with applicable public laws.”

PREFACE

The Ted Stevens Anchorage International Airport (Airport) Master Plan Update (Master Plan Update) provides Airport management and the Alaska Department of Transportation & Public Facilities (DOT&PF) with a strategy to develop the Ted Stevens Anchorage International Airport. The intent of the Master Plan Update is to provide guidance that will enable Airport management to strategically position the Airport for the future by maximizing operational efficiency and business effectiveness, as well as by maximizing property availability for aeronautical development through efficient planning. While long-term development is considered in master planning efforts, the typical planning horizon for the Master Plan Update is 20 years.

The Federal Aviation Administration provides guidance for Master Plan development in *FAA Advisory Circular 150 / 5070-6B, Airport Master Plans*. Although not required, the Advisory Circular strongly recommends airports prepare a Master Plan. Funding for the Master Plan Update is provided primarily by the Federal Aviation Administration through an Airport Improvement Program grant.

A comprehensive Master Plan Update was last prepared in 2002 and a partial update was undertaken between 2006 and 2008. This Master Plan Update was initiated in June 2012 and concluded in December 2014. The DOT&PF entered into a contract with the firm RS&H to lead this effort. The Master Plan Update included a robust public and stakeholder involvement program.

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Acronyms and Abbreviations

ACP	Air Cargo Port
ADG	Airplane Design Group
AIAS	Alaska International Airport System
Airport	Ted Stevens Anchorage International Airport
ASPM	Aviation System Performance Metrics
ATC	Air Traffic Control
EAP	East Airpark
EM	Empire Airlines
FAA	Federal Aviation Administration
FDX	Federal Express Cargo
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
JBER	Joint Base Elmendorf-Richardson
LHD	Lake Hood Airport
MEP	Multi-Engine Piston
MOS	Modification of Standards
MTOW	Maximum Take-off Weight
NAP	North Airpark
PDARS	Performance Data Analysis and Reporting System
PMAD	Peak Month Average Day
SAP	South Airpark
SEP	Single-Engine Piston
STD	Standard Deviation
TA	Terminal Area
UPS	United Parcel Service Cargo
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
WAP	West Airpark

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SECTION 1
SIMMOND *PRO!* AND THE SIMULATION PROCESS

Developed by ATAC, Simmod *PRO!*® is a PC-based enhanced derivative of SIMMOD, a widely used airport and airspace simulation model. Simmod *PRO!* represents a suite of software tools including ATAC's latest version of the Federal Aviation Administration's (FAA's) validated SIMMOD simulation engine, a user-friendly graphical interface for preparing simulation inputs, a versatile traffic animator for replaying the simulated aircraft movement, and a flexible output analysis and reporting module. Simmod *PRO!* extends the capabilities of the basic simulation engine by allowing the implementation of rule-based logic as part of the simulation inputs. This offers the ability to specify rules that query the state of the simulation for dynamic decision making.

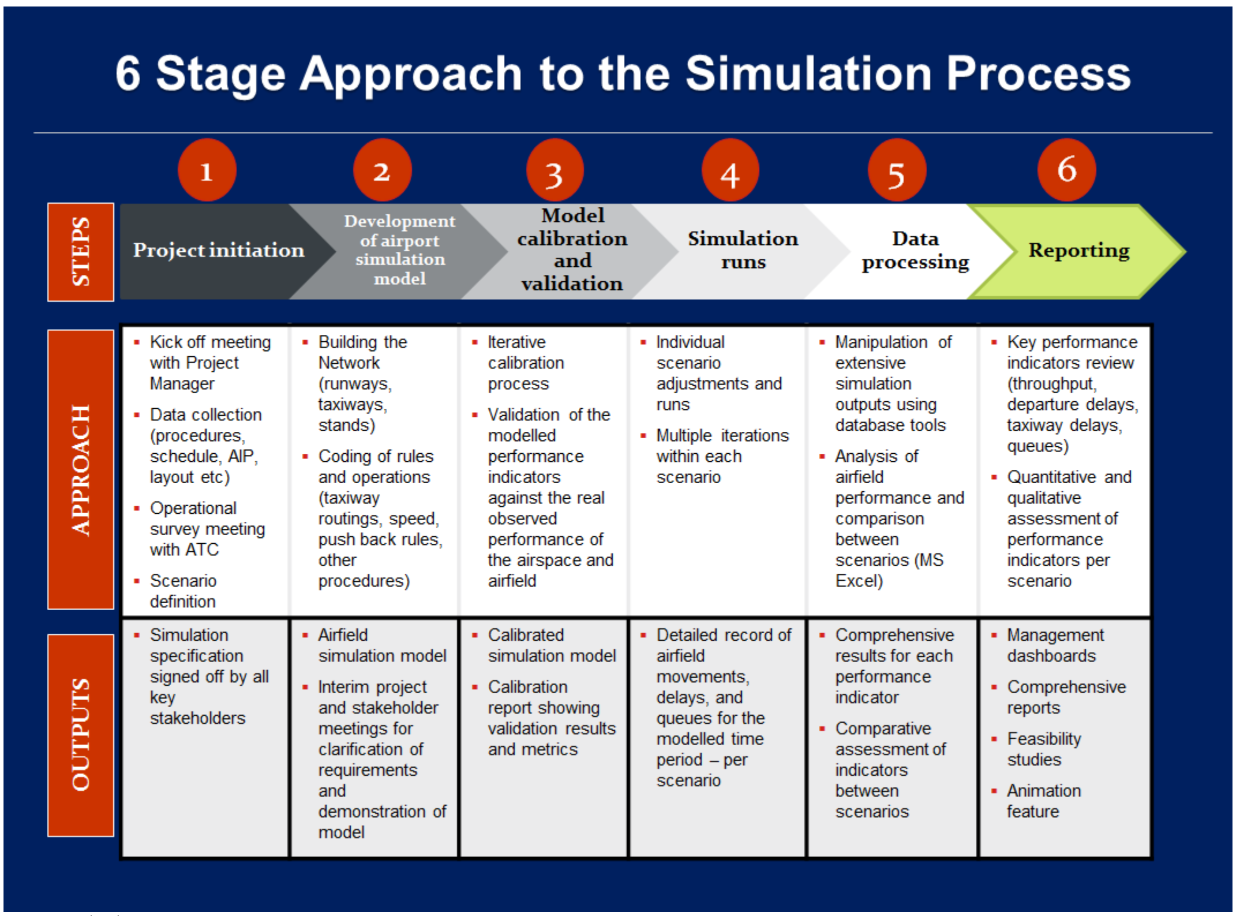
There is no conceptual limit to the number of airports, size of terminal airspace and / or en-route airspace, or number of flights that can be simulated by Simmod *PRO!*. The model properly captures the interactions between airport and airspace operations, including interactions among multiple neighboring airports. The model is capable of simulating current or potential airport facilities, runway configurations, dynamic gate use alternatives, runway and taxiway closings, dynamic runway switching, dynamic weather effects at an airport or in the airspace, airspace route structures, airspace sectorization, separation standards, traffic management techniques, and air traffic control procedures and policies.

In order to provide the flexibility of Simmod *PRO!* to simulate current, as well as a wide range of potential alternatives, many air traffic parameters are controlled by user input. The inputs are organized into three major categories: airfield-related input, airspace-related input, and simulation event input. The airfield-related input allows the user to specify the physical layouts of airports and operational parameters such as: gate, taxiway, and runway structure; gate utilization by airlines; taxiway routings between gates and runways; departure lineup strategies; and aircraft landing and takeoff strategies. The airspace-related input allows the user to specify: airspace routings; airspace sectorization; airspace separation standards including wake turbulence, arrival and departure procedures; metering and flow constraints; and strategies for resolving potential conflicts. Simulation event inputs provide the user with the capability to specify the departure and arrival demand schedules and desired changes in operating conditions including runway use configurations, terminal routing plans, and flow and metering constraints.

Because Simmod *PRO!* simulates the movement of each individual aircraft on the airfield and in the airspace, the model is capable of producing a wide variety of results at a detailed or aggregate level. Examples of output from Simmod *PRO!* include delay time, undelayed travel time, taxi-in time, taxi-out time, gate use, congestion, runway or airport capacity, and runway or airport traffic flows. The output data can be further refined by individual routes, taxi paths, airlines, sectors, gates, time periods, or individual aircraft.

Figure 1 demonstrates the six-stage approach to the simulation process. This document fits within the sixth stage of the process.

Figure 1
The Simulation Process



Source: ATAC, 2013.
Notes: AIP = Airport Improvement Program, ATC = Air Traffic Control

1.1 CALIBRATION AND VALIDATION OF MODEL

In order to accurately capture the complexities of the Ted Stevens Anchorage International Airport's (Airport's) operations under the various alternative scenarios, a computer simulation model based on the current conditions at the Airport was created. The surrounding terminal airspace directly impacting Airport ground operations was incorporated and the model was calibrated against existing conditions. This modeling effort ensures an accurate reflection of the current operations at the airport. This is a critical step in the modeling process since an accurately calibrated model is the foundation for all the alternative scenarios that have been developed for this study. The remainder of this section discusses the calibration process and simulation results.

To simulate the movements of aircraft in the model, Simmod *PRO!* utilizes link and node structures to create paths traversed by aircraft. Ground links, which represent the ground tracks of the aircraft on the airfield, can be accurately modeled since the paths of aircraft are constrained to existing taxiways and aprons at the airport. Duplicating these paths as ground links creates a fairly accurate representation of the ground route structure. However, unlike the ground routes, air routes are more difficult to model since no two aircraft trajectories are identical. Consequently, the simulation airspace is designed to capture an approximate air traffic flow of aircraft along a nominal path.

1.1.1 CALIBRATION PROCESS

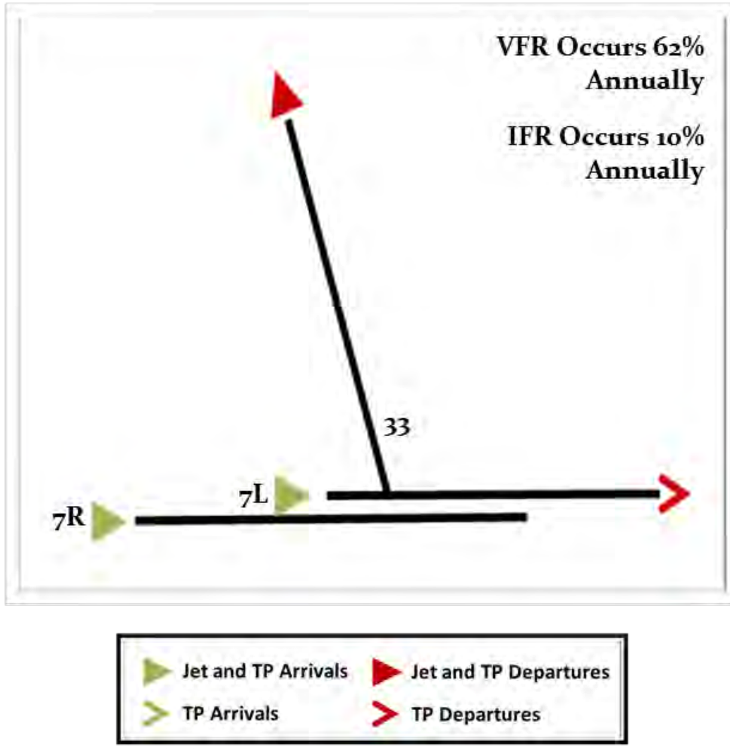
The airspace and airfield calibration analysis for the Airport considered the typical airspace and taxi path routings used when operating during Configuration 1. As shown in **Figure 2**, Configuration 1 operating procedures include arrivals to Runway 7R and Runway 7L with departures from Runway 33 and Runway 7L. This is the predominant configuration and is the preferred airfield configuration at the Airport, accounting for approximately 72% of the operating time annually.

Arrival and departure flight track data was generated from the FAA Performance Data Analysis and Reporting System (PDARS), as shown in **Figure 3** and **Figure 4**. The green and red tracks in these two figures show arrivals and departures respectively at the Airport for the sample day, January 23, 2013. The white lines overlaying the tracks depict the link / node structure used in the simulation to approximate the typical flow of aircraft. Thirty-nine days of Configuration 1 data were analyzed and used to validate assumptions regarding flight paths, altitudes, approach speeds, and airspace route assignments.

Data from the Aviation System Performance Metrics (ASPM) Taxi Times Standard Report allowed for the validation of aircraft taxiing speeds along taxiways and within ramp areas for both arrivals and departures. A snapshot of this table is shown in **Table 1**.

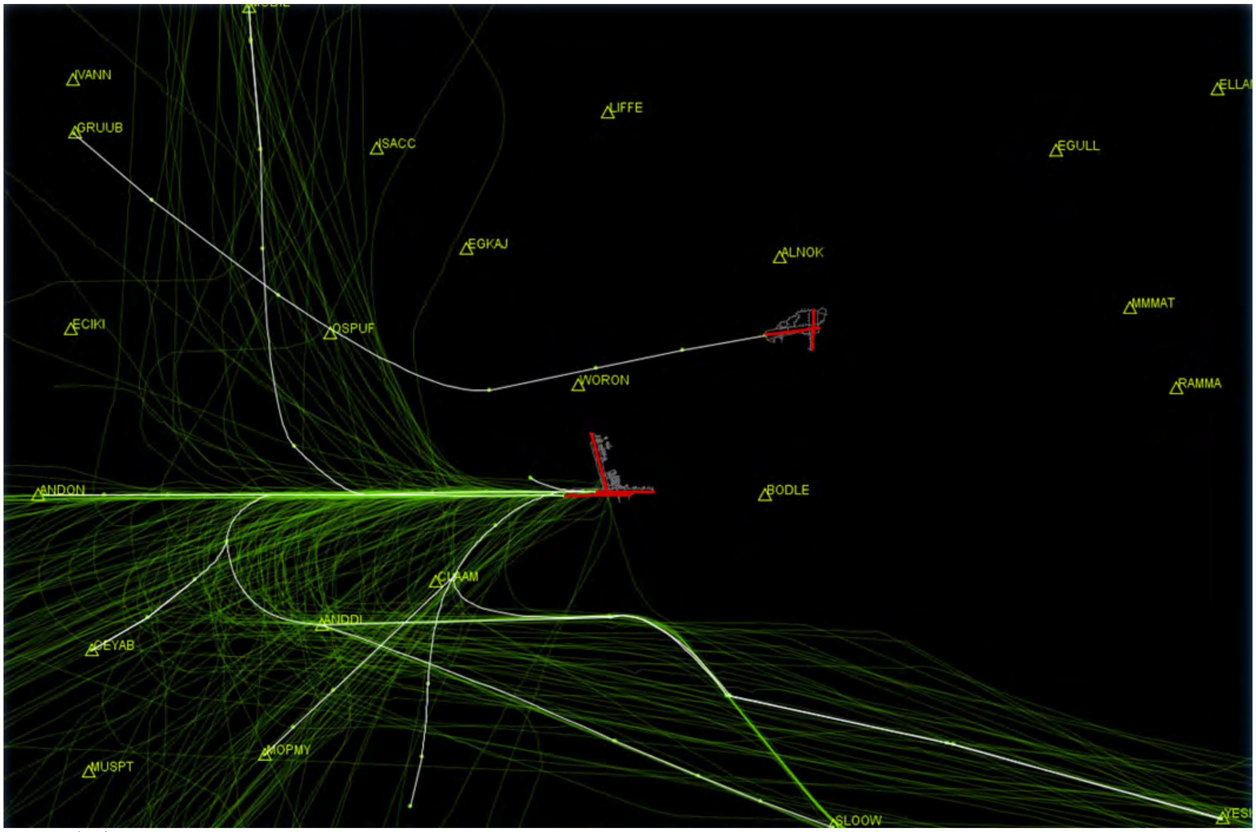
These same assumptions were the basis for other models used in this analysis following the completion of the calibration process.

Figure 2
Configuration 1 Procedures



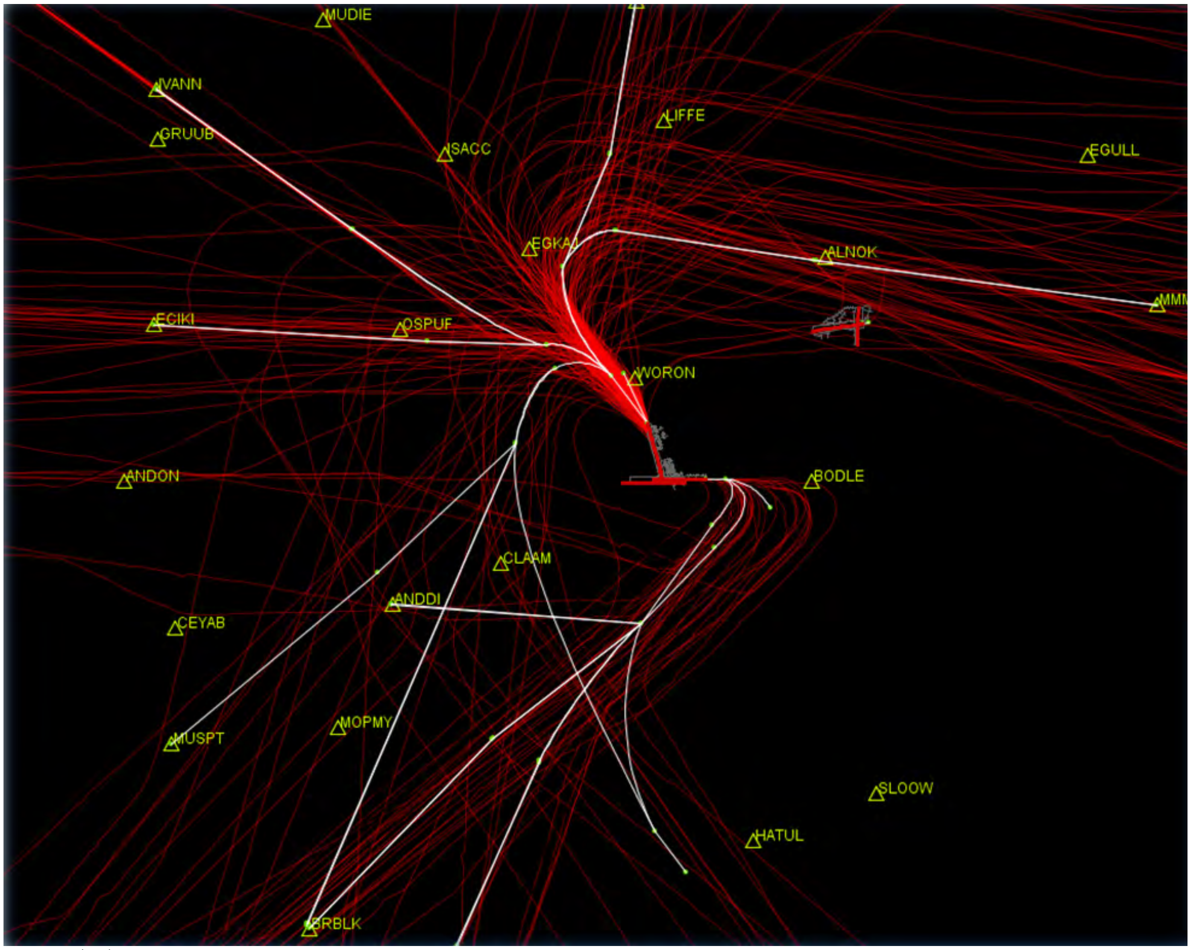
Source: ATAC, 2013.
Notes: VFR = Visual Flight Rules, IFR = Instrument Flight Rules, TP = Turboprop

Figure 3
PDARS Radar Data for Configuration 1 Arrivals



Source: ATAC, 2013.

Figure 4
PDARS Radar Data for Configuration 1 Departures



Source: ATAC, 2013.

The calibration process for the Airport also included data from previous modeling efforts performed for the Alaska International Airport System (AIAS). SIMMOD models created for the Airport were provided by the *2013 Alaska International Airport System Planning Study* (AIAS Planning Study) team. The models were then updated and modified based on current gate assumptions, airspace structure, and the ability to use the enhanced capabilities of the Simmod *PRO!* simulation engine.

Table 1
Snapshot of the ASPM Taxi Time Report

Aviation Performance Metrics Taxi Times Standard Report							
Facility	Date	Departures for Metric Computation	Total Taxi Out Time	Average Taxi Out Time	Arrivals For Metric Computation	Total Taxi Time	Average Taxi In Time
ANC	1/23/2013	184	1,960	10.65	164	655	3.99
ANC	1/25/2013	190	2,409	12.68	193	777	4.03
ANC	1/26/2013	171	1,780	10.41	153	626	4.09
ANC	1/27/2013	120	1,249	10.41	115	525	4.57
ANC	1/28/2013	133	1,408	10.59	117	496	4.24
ANC	1/29/2013	175	2,605	14.89	163	694	4.26
ANC	1/30/2013	184	2,672	14.52	183	813	4.44
ANC	1/31/2013	179	2,688	15.02	165	695	4.21
Total:		1,336	16,771	12.55	1,253	5,281	4.21

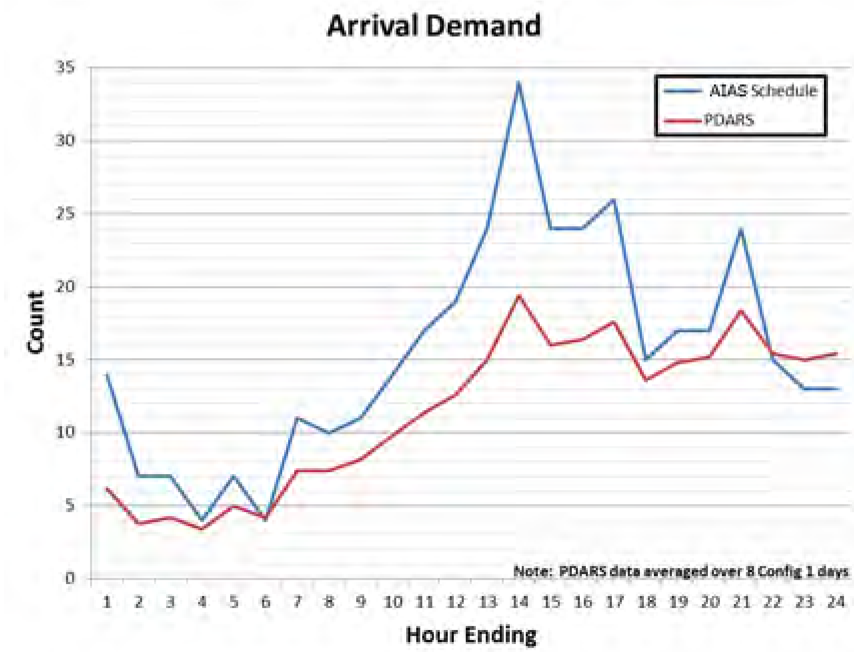
Report created on Sat Mar 23 18:35:14 EDT 2013
Source: ATAC, Aviation System Performance Metrics (ASPM), 2013.
Notes: Average Taxi Out Time – The average difference between Actual Gate Out time and Actual Wheels Off time, in minutes. Taxi Out time is observed for flights for which 0001 data are available, otherwise it is estimated.
Average Taxi In Time – The average difference between Actual Gate in time and Actual Wheels On time, in minutes. Taxi In time is observed for flights for which 0001 data are available, otherwise it is estimated.

1.1.2 CALIBRATION RESULTS

PDARS Data versus Schedule Demand

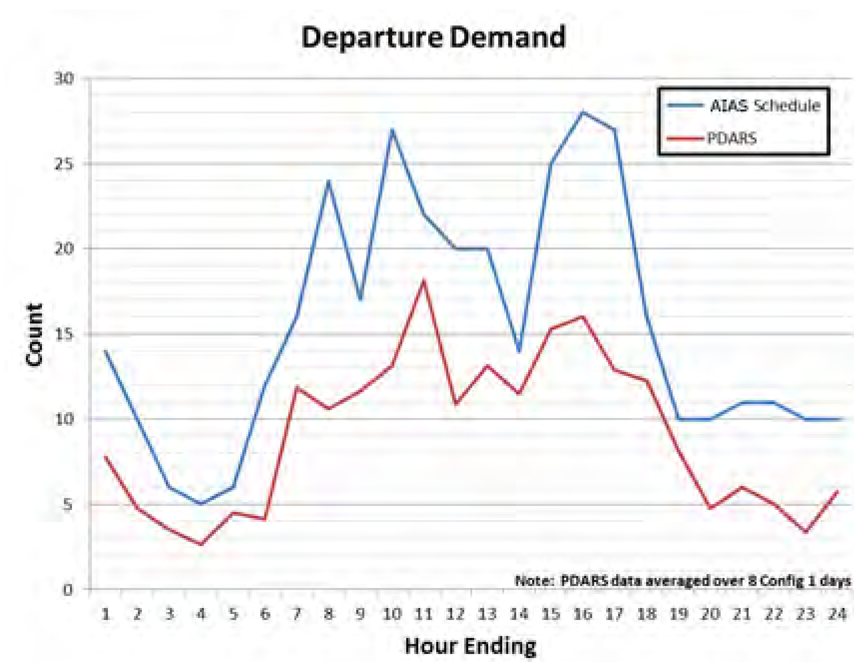
Figure 5 and **Figure 6** compare the arrival and departure demand levels respectively in the 2013 AIAS Planning Study SIMMOD schedule versus the radar data derived from PDARS. The PDARS data was analyzed and air traffic counts were averaged over eight Configuration 1 days in January 2013. Although the 2013 AIAS Planning Study schedule (blue line marked) reflects a greater demand level over a 24-hour period, the hourly trend between the 2013 AIAS Planning Study demand and the PDARS derived data is similar for both the arrival and departure demands. The 2013 AIAS Planning Study schedule is based on the average day within the peak month of the year, often referred to as "Peak Month Average Day" (PMAD), which is normally during the summer. PDARS data was not available for a directly comparable time frame. It was determined in discussions with Airport staff that the hourly trends between the two data sources mirrored each other and thus confirmed that the demand within the simulation schedules is appropriate for this analysis.

Figure 5
PDARS Data versus Schedule – Arrival Demand



Source: ATAC, 2013.
Note: PDARS = Performance Data Analysis and Reporting System, AIAS schedule = AIAS Planning Study team schedule.

Figure 6
PDARS Data versus Schedule - Departure Demand



Source: ATAC, 2013.
Note: PDARS = Performance Data Analysis and Reporting System, AIAS schedule = AIAS Planning Study team schedule.

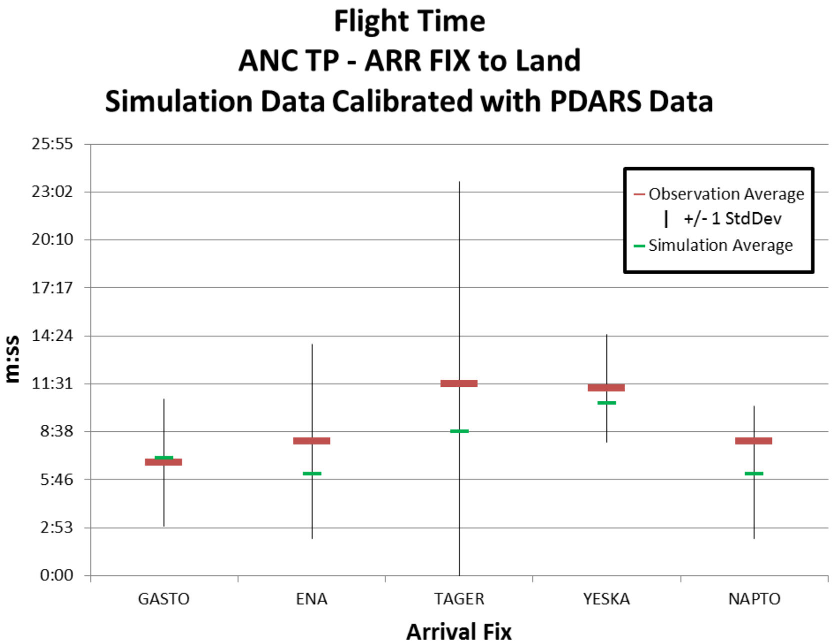
PDARS Airspace Analysis

Calibrating the simulated airspace is an iterative process. A route structure within the model is created by importing PDARS track data into Simmod *PRO!* and drawing routes that represent the typical, average flow of traffic on specific routes. Refer to **Figure 3** and **Figure 4** for pictorial representations of the actual flight tracks. As the airspace model is developed, inputs such as nominal aircraft speeds and average aircraft altitudes are added. The model is then run and output reports, such as travel time and delay, are created.

A comparison is then made between reports generated from PDARS and the reported output from the model. The goal is to get the model output to be within one standard deviation (1 STD) of the PDARS data for any given metric. Standard deviation is a common statistic used as a measure of the dispersion, or variation, from the average in a distribution. The PDARS data was analyzed to come up with both an average flight time from the arrival fixes to the runway thresholds and an average flight time from the runway thresholds to the departure fixes for jets and turboprops separately., The simulated output is required to be, at a minimum, within 1 STD of this average in order to validate the model's route structure. If the output is not within 1 STD, updates are made to the model, the model is exercised, and the output is rechecked. This process occurs numerous times until the output falls within the proper distribution.

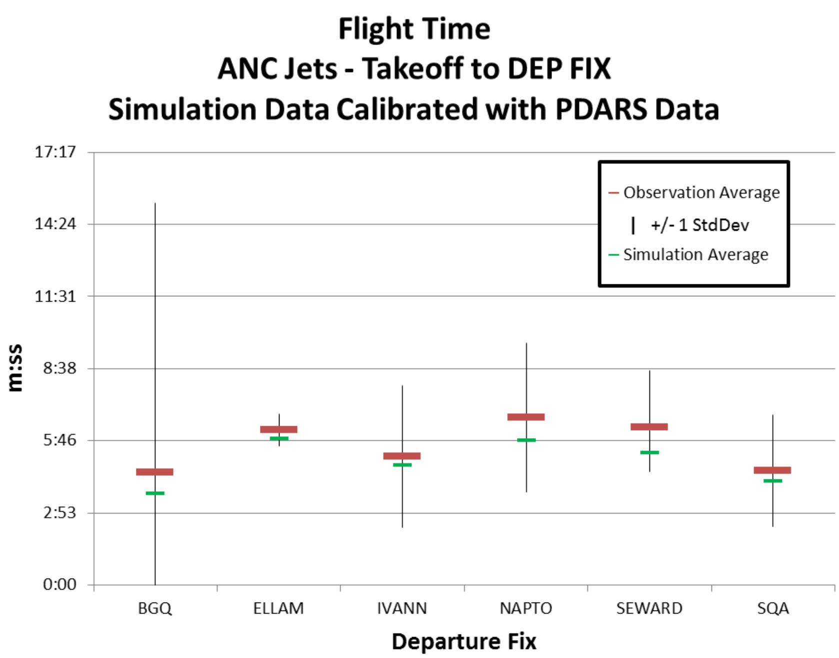
Figure 7 depicts the validation of the model's turboprop arrival route structure. The red horizontal lines represent the PDARS average flight time for turboprops beginning at the arrival fixes, shown along the x-axis, until they cross the runway threshold. The black vertical lines represent the dispersion of PDARS data from the average, or +/- 1 STD. The green horizontal lines depict where the model output lies within the 1 STD of the average. The green lines should cross the vertical lines as close to the red line as possible. **Figure 8** depicts the validation for jet departures.

Figure 7
Airspace Calibration - Turboprop Arrivals



Source: ATAC, 2013.

Figure 8
Airspace Calibration - Jet Departures

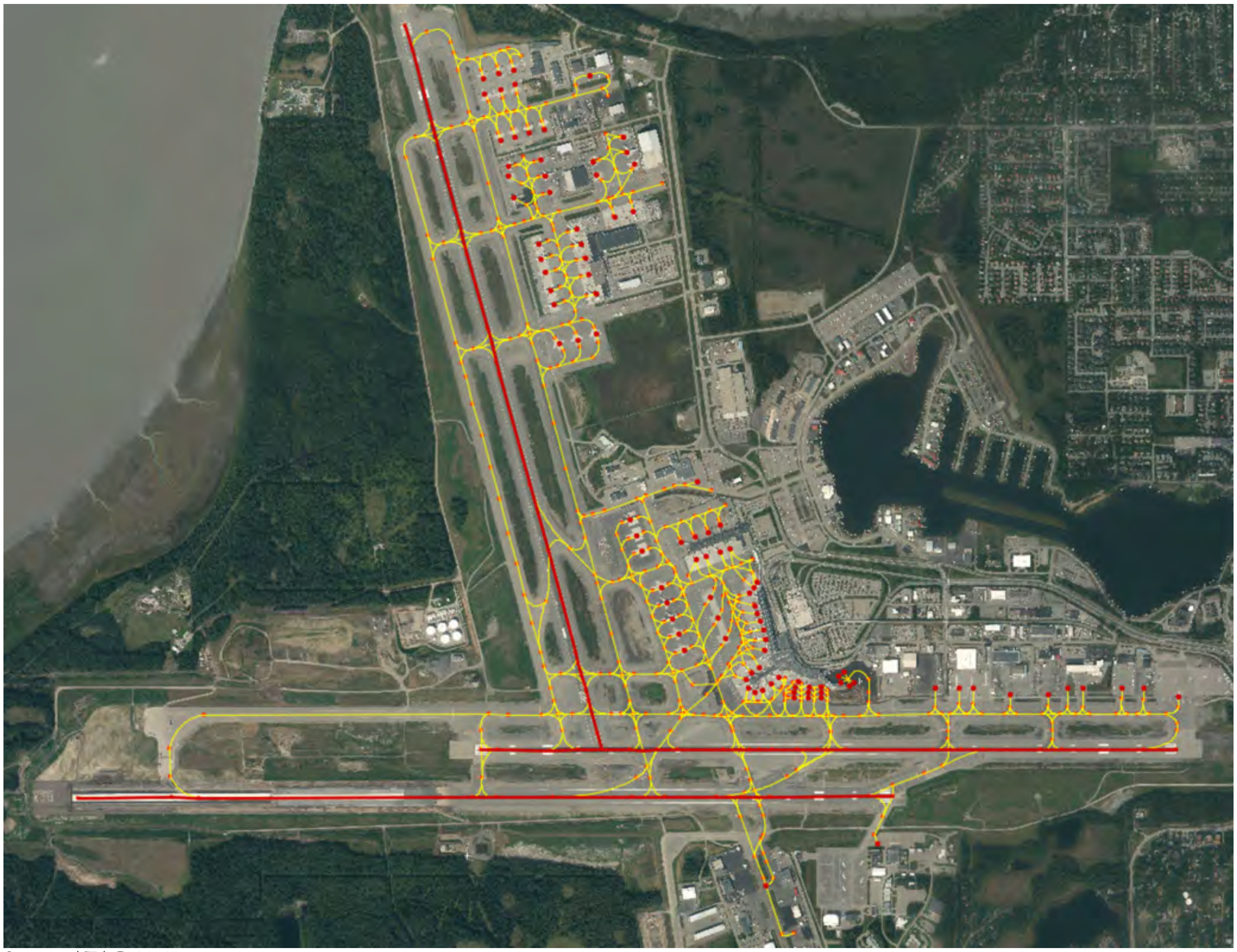


Source: ATAC, 2013.

ASPM Ground Analysis

Calibrating the airfield is also an iterative process. A link / node runway and taxiway structure is created with the help of aerial imagery and CAD drawings imported into Simmod *PRO!*, as shown in **Figure 9**.

Figure 9
SIMMOD Ground Link-Node Structure

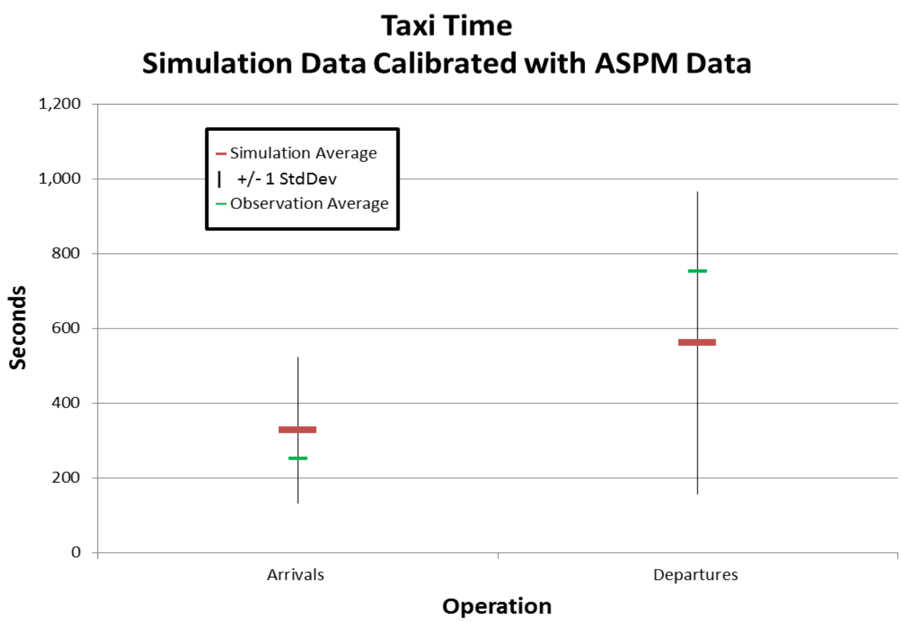


Source: ATAC, 2013.

Ground speeds along taxiways and within ramp areas, pushback and dwell times, and other defined ground activities typical of normal airfield and aircraft operating practices are all input into the model. The model is run and the output analyzed against the ASPM Taxi Time Report. The ASPM Taxi Time Report does not break out jets and turboprops but is rather an average of all aircraft types, which differs somewhat from the Simmod *PRO!* reporting. The process of validating the airfield is therefore different than that of the airspace. Because the ASPM only provides the average taxi time at airports and does not provide the underlying data, the dispersion from the average is not available. To validate taxi time, the simulation results are used to determine average taxi time and +/- 1 STD from the simulation average. The calibration goal is to get the ASPM data to be within 1 STD of the simulated data. If the data is not within 1 STD, updates are made to the model, the model is exercised, and the data is rechecked. This process is repeated until the output falls within the proper distribution.

Figure 10 displays the validation for the model's ground structure for both arrivals and departures. The red horizontal lines represent the simulation's average taxi time for arrivals from gate to wheels off. The black vertical lines represent the dispersion of the simulation data from the average, or +/- 1 STD. The green horizontal lines depict where the ASPM truth data falls within +/- 1 STD. The green lines should cross the vertical lines as close to the red line as possible.

Figure 10
Ground Calibration - Arrivals and Departures



Source: ATAC, 2013.

Calibration Conclusions

In March 2013, the calibration results were presented to Airport management staff and FAA Air Traffic Control (ATC) personnel. Truth data (PDARS) was used to validate air travel times for the Airport as well as for Joint Base Elmendorf-Richardson (JBER). The SIMMOD average flight times were shown to be within 1 STD of the collected data. ASPM truth data was used to validate the ground structure. ASPM average taxi times were shown to be within 1 STD of the SIMMOD average. Validation of the model was confirmed as being calibrated and operating within acceptable simulation tolerances.

SECTION 2
EXISTING AIRFIELD SIMULATION ASSUMPTIONS AND RESULTS

2.1 EXISTING AIRFIELD OVERVIEW

Figure 11 is the official Federal Aviation Administration (FAA) Airport Diagram of the Ted Stevens Anchorage International Airport (Airport) effective May 29, 2014. The Airport consists of two closely spaced east / west parallel runways, Runway 7L-25R and Runway 7R-25L, and one north / south runway, Runway 15-33. Runway 7L-25R extends 10,600 feet and Runway 7R-25L, the longest on the airfield, extends 12,400 feet. The two parallel runways are separated by 700 feet. At the time of the study, Runway 15-33 was 11,584 feet in length (the runway was shortened in 2014 to a length of 10,960 feet). **Figure 12** shows a satellite image of the Airport with a SIMMOD link-node structure overlay. The yellow lines represent the ground links and the red dots represent the ground nodes.

The Airport utilizes four general areas for aircraft gating and parking. The North Airpark (NAP) is used primarily by integrated cargo carriers; the exception being the Papa positions which are used by non-integrated tech stop (refuel and depart) airlines. The NAP is located on the north end of the airport east of Runway 15-33.

The Terminal Area (TA) includes the North Terminal and South Terminal and is centrally located on the airfield east of Runway 15-33 and north of Runway 7L-25R. The North Terminal is currently rarely used. Within the simulation model military aircraft are gated at the North Terminal. Military aircraft no longer park at the former Kulis Air National Guard apron, known today as the Kulis Business Park, which is located on the south side of the airfield.

Within the South Terminal, Alaska Airlines, the Airport's primary passenger airline, occupies the C Concourse, while the remaining passenger airliners utilize the B Concourse. Commuter airlines and air taxi operations occupy the A Concourse (L gates and A gates), located on the east side of the South Terminal building.

Finally, other aprons within the TA are used for general aviation and cargo aircraft parking. Single-engine piston (SEP) and multi-engine piston (MEP) general aviation aircraft that are unable to use the gravel runway (limited to aircraft less than 9,000 pounds) at Lake Hood Airport (LHD) park at the northern edge of the TA, along Taxiway V, in the area known as the Charlie Spots. The ramp west of the C Concourse and B Concourse contains the R positions which are used similarly to the Papa positions within the NAP. These positions are used by non-integrated technical stop airlines.

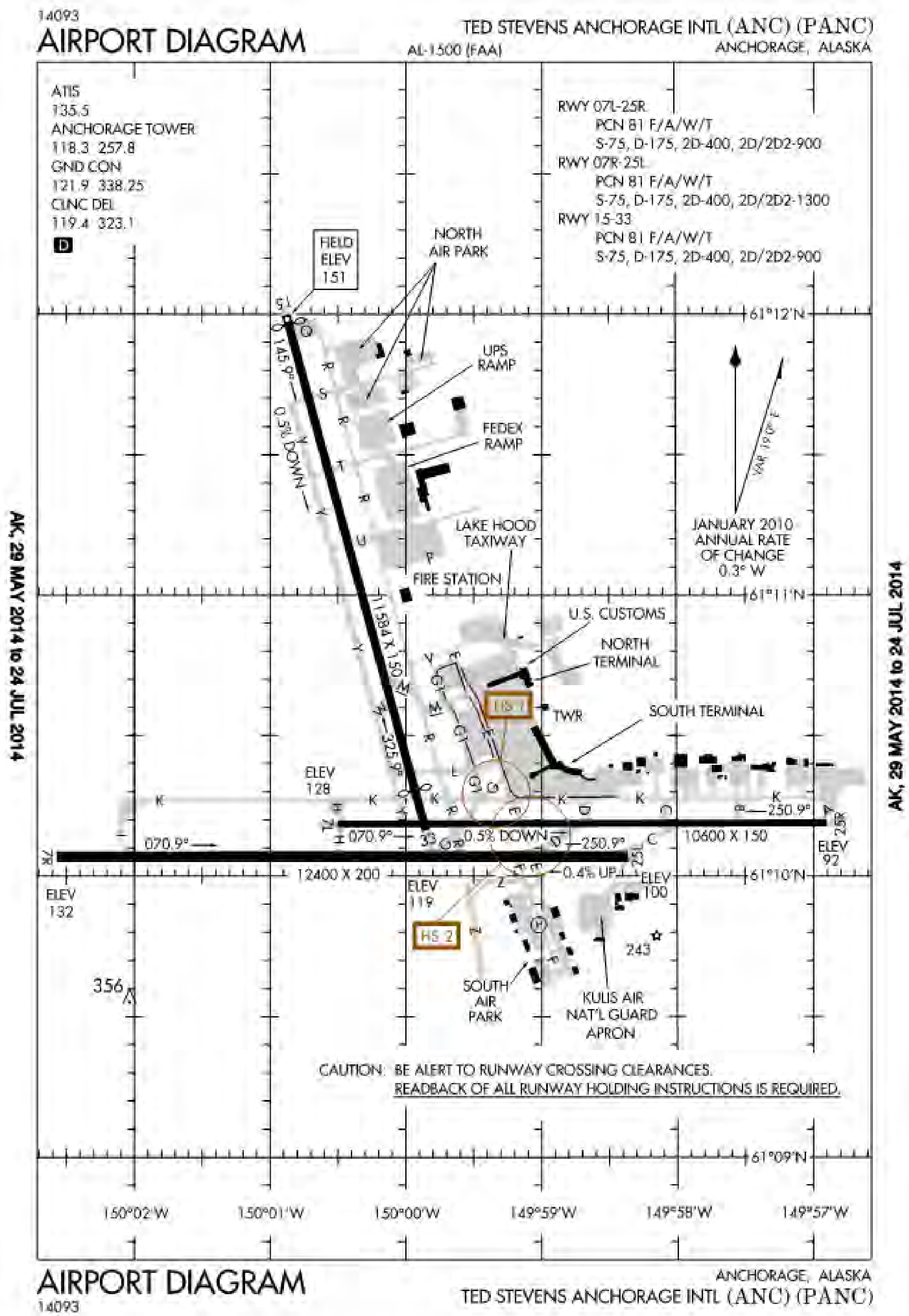
The East Airpark (EAP) is on the east end of the Airport and consists of apron areas and hangars used by commuter, air taxi, and cargo aircraft.

The South Airpark (SAP) is situated south of the parallel runways and houses general aviation and cargo aircraft. The Kulis Business Park is located at the east end of SAP.

The model does not include specific gates for aircraft parked in the SAP. Because any number of aircraft can park on the aprons, a super gate is used to represent the entire ramp area. Super gates are used in simulation models to represent parking locations in ramp areas at which multiple aircraft are permitted to park.

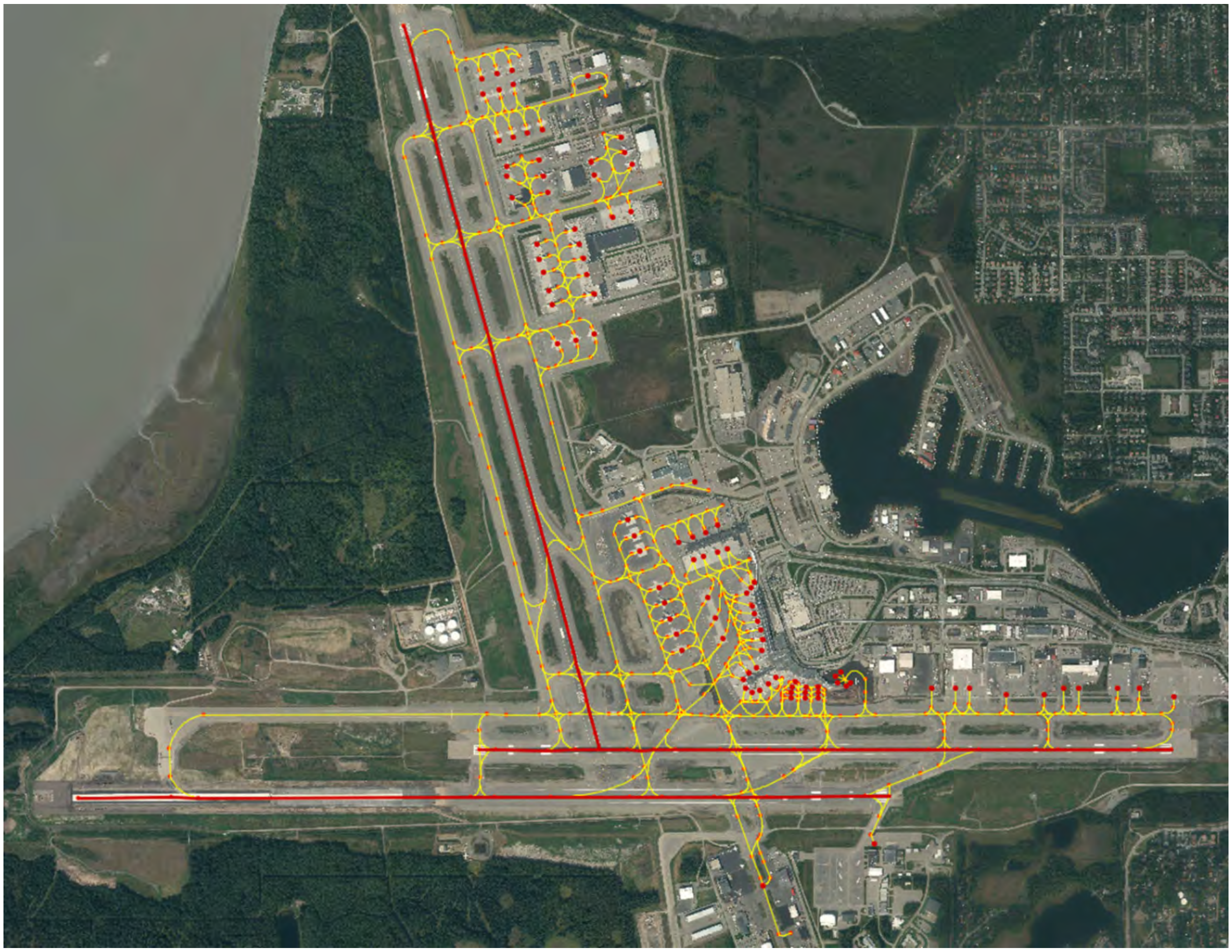
LHD lies to the east of the Airport and consists of one gravel runway and three water runways. The airspace and procedures used by LHD Air Traffic Control (ATC) do not conflict with Airport operations, thereby negating the need to consider LHD operations in this simulation study. However, during certain runway configurations, military operations to Joint Base Elmendorf-Richardson (JBER) do create conflicts with air traffic at the Airport. JBER operations are considered in this simulation study and are discussed further in upcoming sections.

Figure 11
Anchorage International Airport - Airport Diagram



Source: Federal Aviation Administration, 2014.

Figure 12
SIMMOD Ground Link-Node Structure



Source: ATAC, 2013.

2.2 GENERAL MODELING ASSUMPTIONS

This section contains a summary of all general assumptions that were made in the development of the airfield and airspace computer simulation models for the Airport and presents analysis results from these models.

2.2.1 AIRFIELD CONFIGURATIONS

The Airport operates using several different runway configurations depending on visibility, ceiling, winds, and noise abatement procedures. **Table 2** presents the occurrence of the four predominant airport configurations at the Airport on an annual basis. Visual Flight Rules (VFR) were applied to the simulation models that occurred during Visual Meteorological Conditions (VMC). Instrument Flight Rules (IFR) were applied to the simulation models that occurred during Instrument Meteorological Conditions (IMC). Throughout the remainder of this document, VMC and IMC weather conditions will be referenced as to their effect on the VFR and IFR simulation models.

Table 2
Annual Airport Operations

Operating Configurations	Weather Conditions	Percent Occurrence
Configuration 1	VMC	62%
	IMC	10%
Configuration 2	VMC	20%
	IMC	2%
Configuration 3	VMC	2%
Configuration 4	VMC	2%

Source: ATAC, 2013.

Each runway configuration will create variations in capacity and delay. This study focuses on the six most common weather and operating configurations, utilized in previous master plan studies, and as shown in **Figure 13**. Each of the six operating configurations was modeled using the 2012 demand schedule as well as the Future 1 and Future 2 demand schedules, which represent a 15% and 33% increase over 2012 baseline operations, respectively.

Configuration 1 is the predominant runway configuration, operating approximately 72% of the time. VFR operations account for 62% of the total annual traffic and IFR operations account for the other 10%. Runway 7R is the primary arrival runway with some overflow to Runway 7L when arrival demand is high. Runway 33 is the primary departure runway, with some small jets and turboprop aircraft departing from Runway 7L when conditions permit.

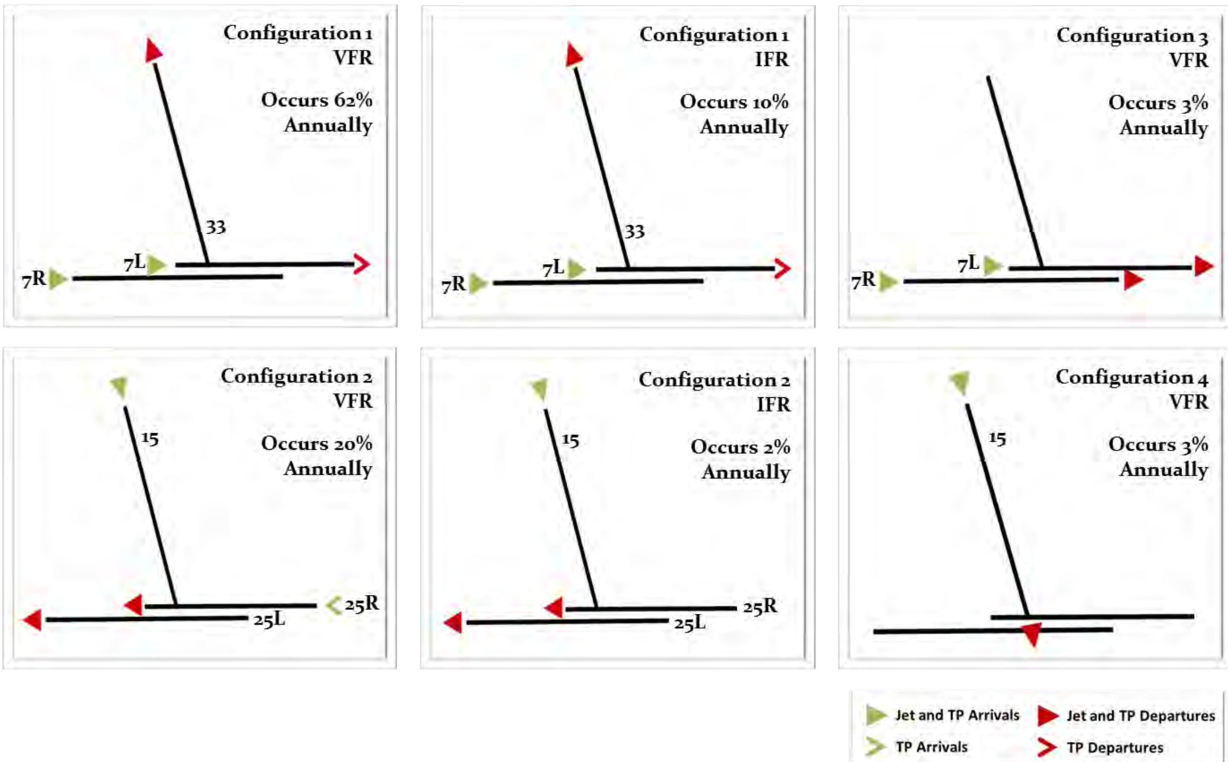
Configuration 2 operates approximately 22% annually with VFR and IFR operations occurring 20% and 2%, of the time, respectively. Runway 15 is the primary arrival runway, with some turboprop arrivals to Runway 25R. Runway 25R arrivals occur only in the VFR models. Runway 25L is the primary departure runway. A small number of flights will depart from Runway 25R depending on other traffic in the vicinity.

The following two configurations occur only 4% of the time and were modeled in VFR only.

Configuration 3 occurs approximately 2% of the time in VMC conditions with arrivals and departures to / from Runways 7L and 7R.

Configuration 4 occurs approximately 2% annually in VMC conditions with arrivals and departures to / from Runway 15.

Figure 13
Runway Configurations and Percent Usage



Source: ATAC, 2013.
Notes: VFR = Visual Flight Rules, IFR = Instrument Flight Rules, TP = Turboprop

2.2.2 AIRSPACE

To simulate the movements of aircraft in the model, Simmod *PRO!* utilizes node and link structures to create paths traversed by these aircraft. The airspace analysis for the Airport considered the typical airspace routes used when operating to and from all runways during the different runway configurations, and extended out approximately 20 miles from the airport. Flight tracks were generated from Performance Data Analysis and Reporting System (PDARS). This information was used to validate assumptions regarding flight paths, aircraft altitudes, aircraft approach speeds, and airspace route assignments.

The following section discusses the PDARS analysis and presents graphical representation for each of the configurations. The FAA's PDARS system was installed in January of 2013 during the initial stages of this analysis. Due to this fact, only three months of flight track data was available, and every configuration modeled in the study had not necessarily occurred in those three months. In addition to the PDARS data analysis, several interviews and discussions with FAA air traffic and Airport staff were conducted to determine modeling input concerning the traffic flows and normal operating procedures used under the various configurations.

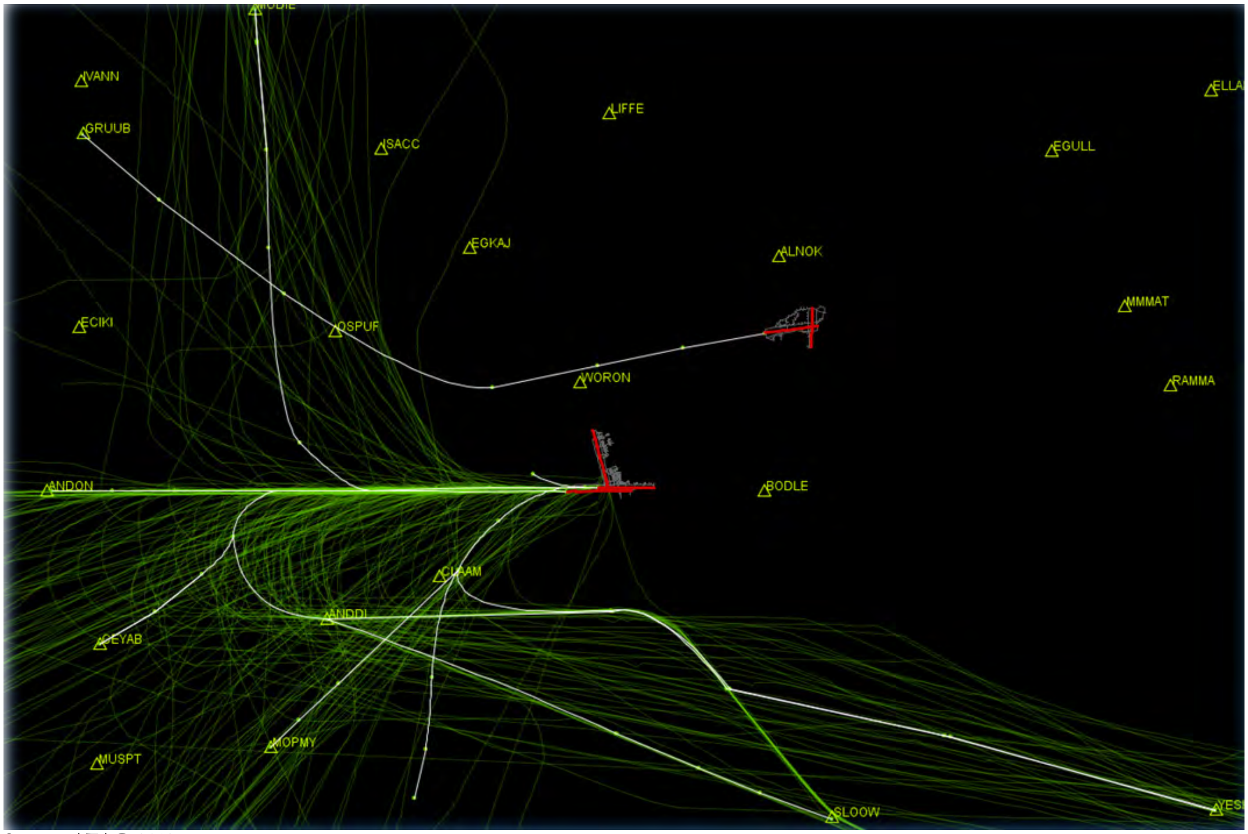
Configuration 1 Airspace

Thirty-nine days of PDARS data between January and March 2013 was used in the analysis of the airspace and runway usage for arrivals and departures during Configuration 1.

Figure 14 is a graphical representation of the PDARS generated track data for Airport arrivals. The green tracks depict arrivals to the Airport on a sample day, January 23, 2013. The white lines overlaying the tracks show the link / node structure used in the simulation models to approximate the typical flow of aircraft. Analysis of 7,750 arrivals revealed the following assumptions, confirmed by interviews:

- 84% of jets arrive Runway 7R and 16% arrive Runway 7L.
- 49% of turboprops arrive Runway 7R and 51% arrive Runway 7L.
- Simultaneous arrivals to Runways 7R and 7L are not permitted.
- Arrivals to Runways 7R and 7L are staggered.
- In IMC weather conditions, all arrivals land Runway 7R; arrivals block departures from Runway 7L until the arrival touches down.
- Reflecting a lighter schedule during IMC weather conditions, single and multi-engine piston aircraft parking at LHD are removed from IFR models.

Figure 14
PDARS Radar Data for Configuration 1 Arrivals



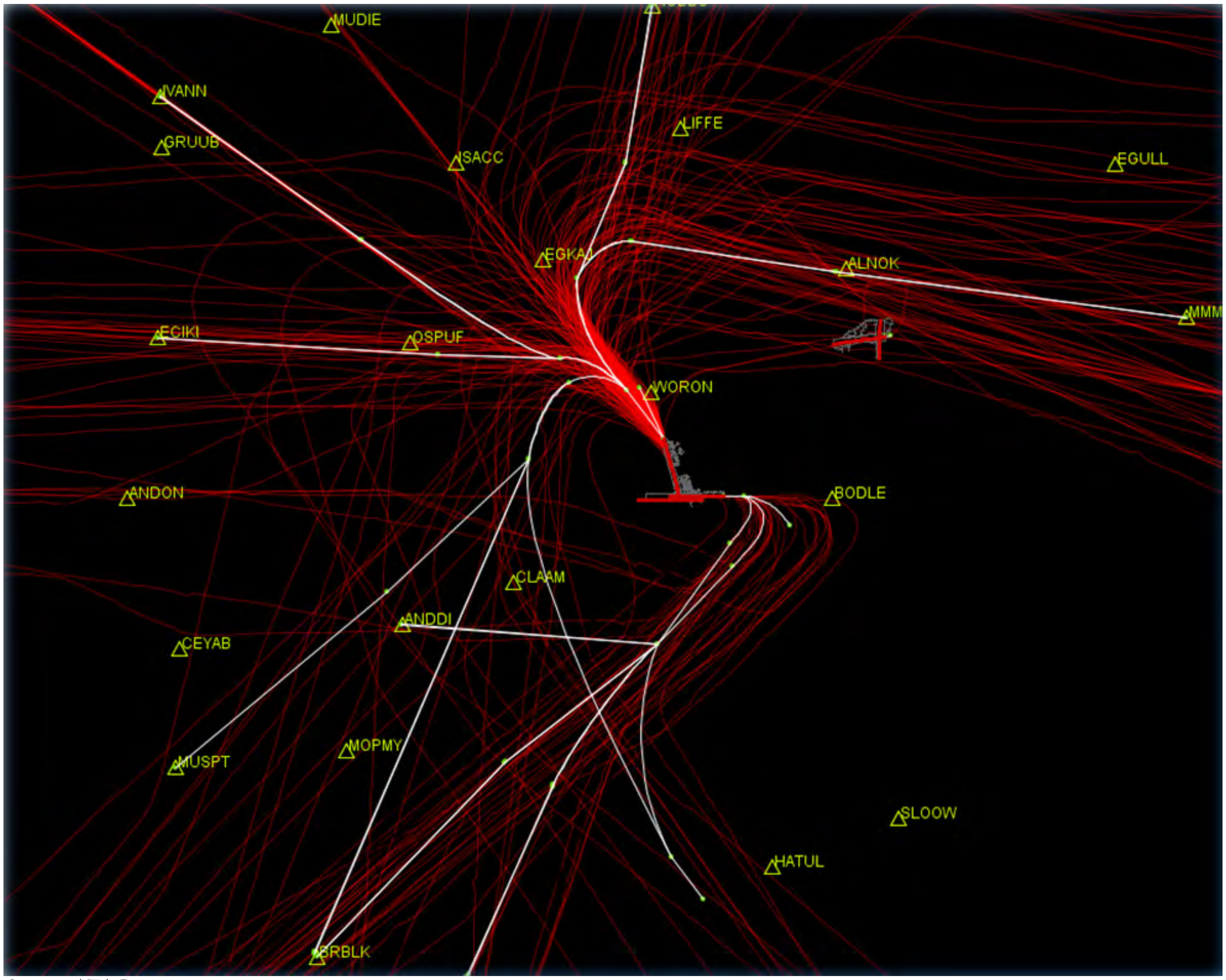
Source: ATAC, 2013.

Figure 15 is a graphical representation of the PDARS generated track data for departures. The red tracks depict departures from the Airport on a sample day, January 23, 2013. The white lines overlaying the tracks show the link / node structure used in the simulation to approximate the typical flow of aircraft. Analysis of 7,712 departures revealed the following assumptions, confirmed by interviews:

- The majority of jets (97%) depart Runway 33 with a few small jets departing Runway 7L.
- 46% of turboprops depart Runway 33 and 54% depart Runway7L.
- Runway assignments for turboprops are determined by gating location, direction of flight, and avoidance of congestion areas.
- Due to jet blast, Runway 33 departures are required to be abeam Taxiway M (see **Figure 11**) prior to Runway 7R arrivals crossing the runway threshold, and abeam Taxiway U prior to Runway 7L arrivals crossing the threshold.
- In IMC weather conditions, departures from Runway 7L are blocked by arrivals to Runway 7R until the arrival touches down.

- Reflecting a lighter schedule during IMC weather conditions, single and multi-engine piston aircraft parking at LHD are removed from IFR models.
- Runway 33 departure queues:
  - Jets depart from either the east or west side of the runway on Taxiway K
  - 10% of Boeing 747-200 and Boeing 747-300 aircraft depart full length entering the runway via Taxiway R and Runway 7L-25R
  - Small general aviation aircraft from LHD or SAP depart via the intersection at Taxiway M
- Runway 7L departure queues:
  - Small jets and large turboprops depart full length from Taxiway H
  - Turboprops depart from intersection at Taxiway E
  - Turboprops from SAP depart from intersection at Taxiway E on the south side of the runway
- Straight-in arrivals to JBER Runway 6 block Runway 33 departures at the Airport until the JBER arrival is clear of the Runway 33 departure path.

Figure 15
PDARS Radar Data for Configuration 1 Departures



Source: ATAC, 2013.

Configuration 2 Airspace

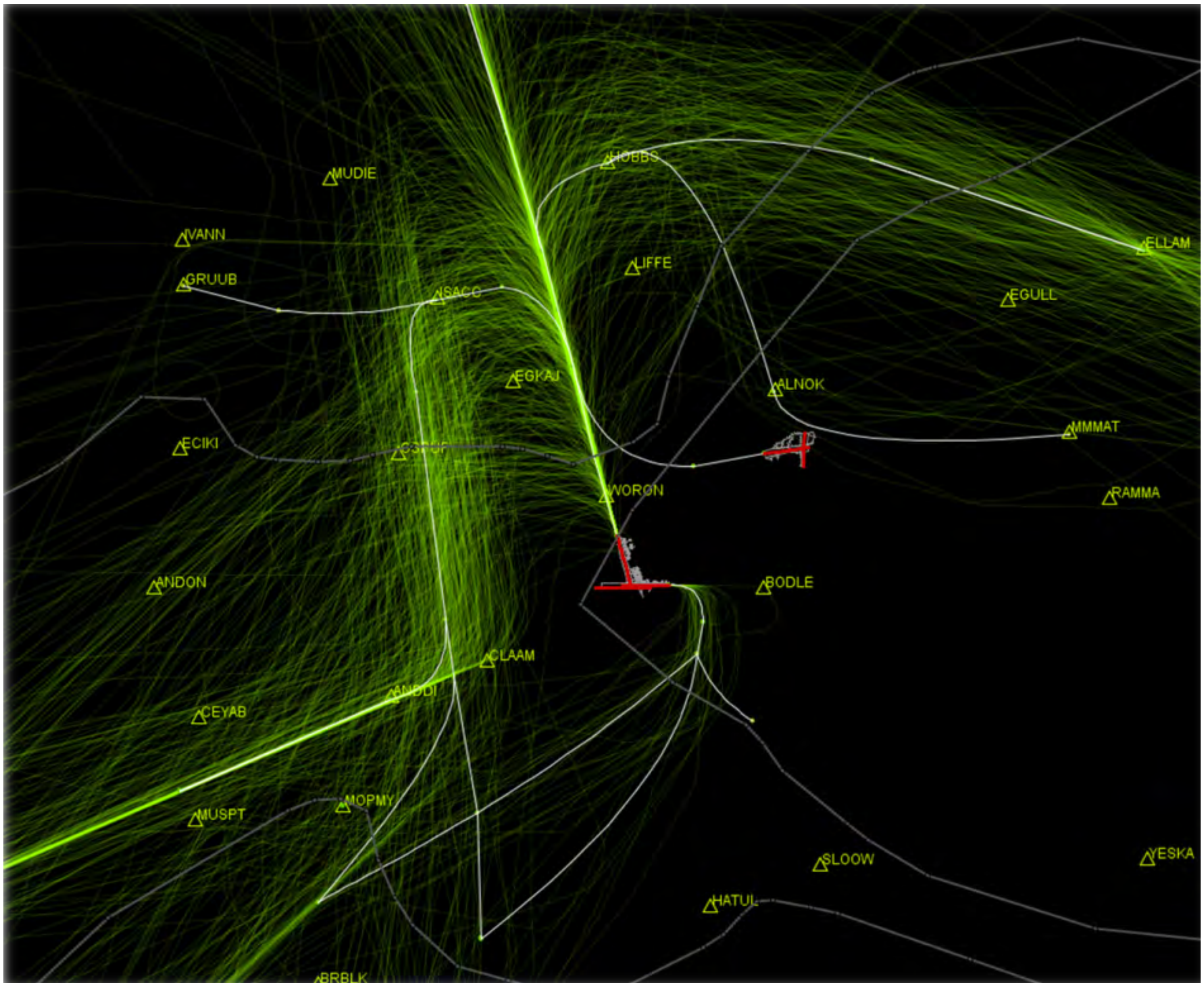
During the 3 month period of PDARS data collection, Configuration 2 did not occur during any full 24-hour period. Therefore, the model development and simulation analysis was based on mixed configuration days. All assumptions and model input were confirmed through FAA and airport personnel interviews.

Figure 16 is a graphical representation of the PDARS generated flight track data for Airport arrivals. The green tracks depict arrivals during six mixed configuration days. The white lines overlaying the tracks show the link / node structure used in the simulation to approximate the typical flow of aircraft.

Analysis of 878 arrivals as well as interviews revealed the following assumptions, confirmed by interviews:

- All jets arrive Runway 15.
- The majority of turboprops (88%) arrive Runway 15 and 12% arrive Runway 25R .
- Runway 25 turboprop arrivals are from the southwest.
- Runways 15 and 25R are dependent; arrivals to Runway 15 block all operations on Runway 25R until landing is confirmed.
- Runways 15 and 25L are independent; arrivals to Runway 15 do not block operations on Runway 25L.
- In IMC weather conditions, all arrivals land Runway 15.
- Reflecting a lighter schedule during IMC weather conditions, single and multi-engine piston aircraft parking at LHD are removed from IFR models.
- Arrivals to JBER Runway 6 are integrated with arrivals to the Airport.
- Runway 15 and cross the Airport inbound track approximately 6 miles from the Runway 15 threshold.

Figure 16
PDARS Radar Data for Configuration 2 Arrivals



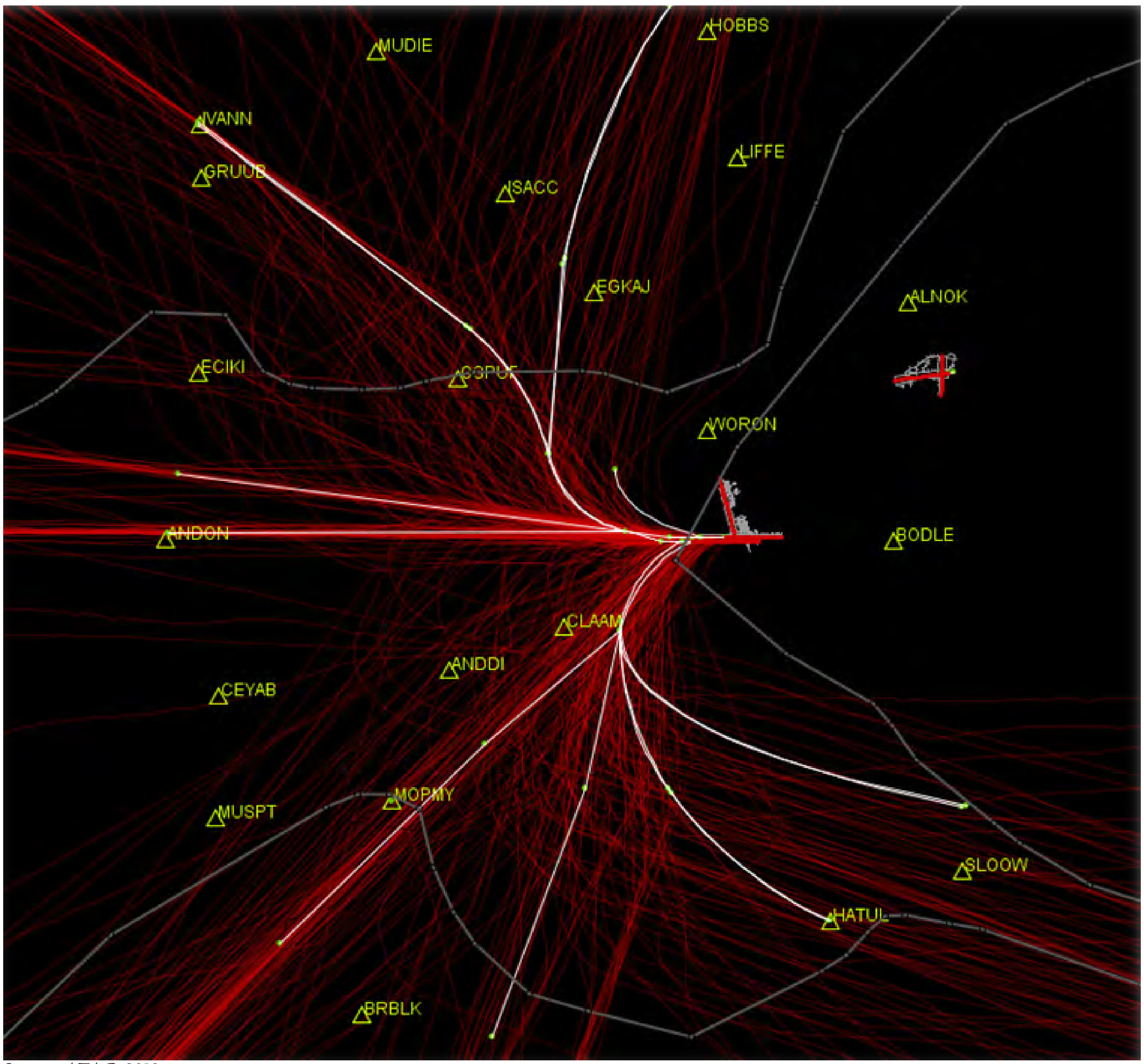
Source: ATAC, 2013.

Figure 17 is a graphical representation of the PDARS-generated track data for departures during Configuration 2. The red tracks depict departures from the Airport during six mixed-configuration days. The white lines overlaying the tracks show the link / node structure used in the simulation to approximate the typical flow of aircraft. Analysis of 525 departures revealed the following assumptions, confirmed through interviews:

- The majority of all aircraft depart Runway 25L.
- Only 3% of jets and 5% of turboprops depart Runway 25R, and they usually depart to the north or west.
- Reflecting a lighter schedule during IMC weather conditions, single and multi-engine piston aircraft parking at LHD are removed from IFR models.

- Runway 25L departure queues:
  - Majority depart full length from Taxiway C
  - Turboprop aircraft from SAP depart from the intersection at Taxiway F
- Runway 25R departure queues:
  - Jets depart full length from Taxiway A
  - Turboprops depart either full length or from intersection at Taxiway C, if feasible

Figure 17
PDARS Radar Data for Configuration 2 Departures



Source: ATAC, 2013.

Configuration 3 Airspace

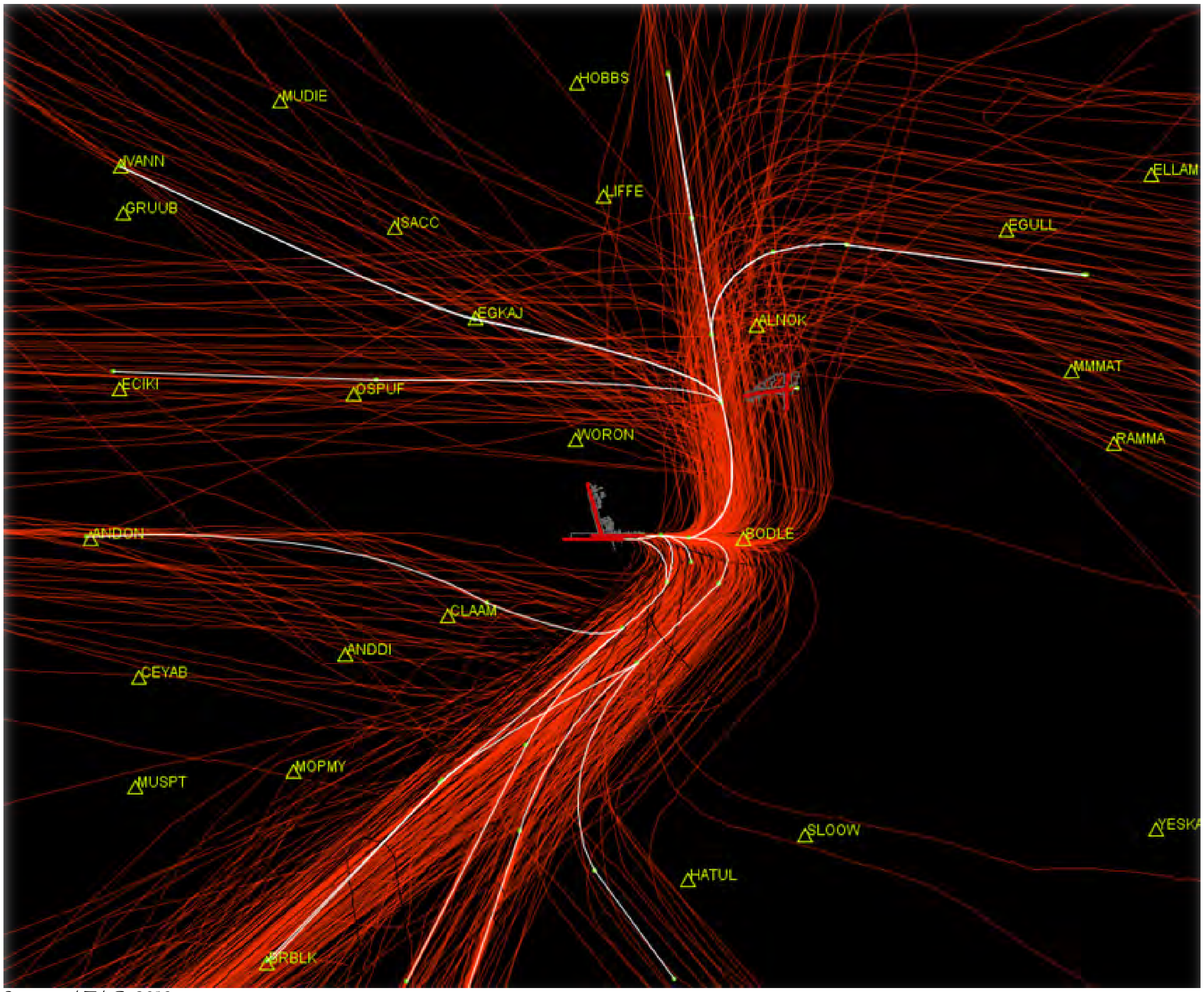
The arrival routes in Configuration 3 are identical to those in Configuration 1 (see **Figure 14**). There is a slight difference in arrival traffic between the two configurations. In Configuration 3, Runway 7L is predominantly used for departures and therefore very few arrivals utilize Runway 7L. Configuration 3 was not modeled under IFR since it is such a rare occurrence.

PDARS data did not record a complete 24-hour period during Configuration 3 and its occurrence was very rare in the timeframe of the initial data collection. However, during the week of May 20th 2013, Runway 15-33 was repainted and Configuration 3 operations were in effect for much of the time. PDARS data was collected and analyzed confirming the departure route structure previously developed utilizing personnel interviews.

Figure 18 is a graphical representation of the PDARS-generated track data for Airport departures during Configuration 3. The red tracks depict departures from the Airport while the white lines overlaying the tracks show the link / node structure used in the simulation to approximate the typical flow of aircraft. Analysis of 650 departures and the data provided in interviews revealed the following assumptions, confirmed through interviews:

- Runway 7L is the primary departure runway.
- As needed, when there are no arrivals on the Runway 7R final, Runway 7R may be utilized for departures.
- Runway 7L departure queues:
  - Jets depart full length from Taxiway H
  - Turboprops depart either full length or from the intersection at Taxiway E
  - Turboprops from SAP depart from intersection at Taxiway E on the south side of the runway
- Runway 7R departure queues:
  - When used, all depart full length from Taxiway J

Figure 18
PDARS Radar Data for Configuration 3 Departures



Source: ATAC, 2013.

Configuration 4 Airspace

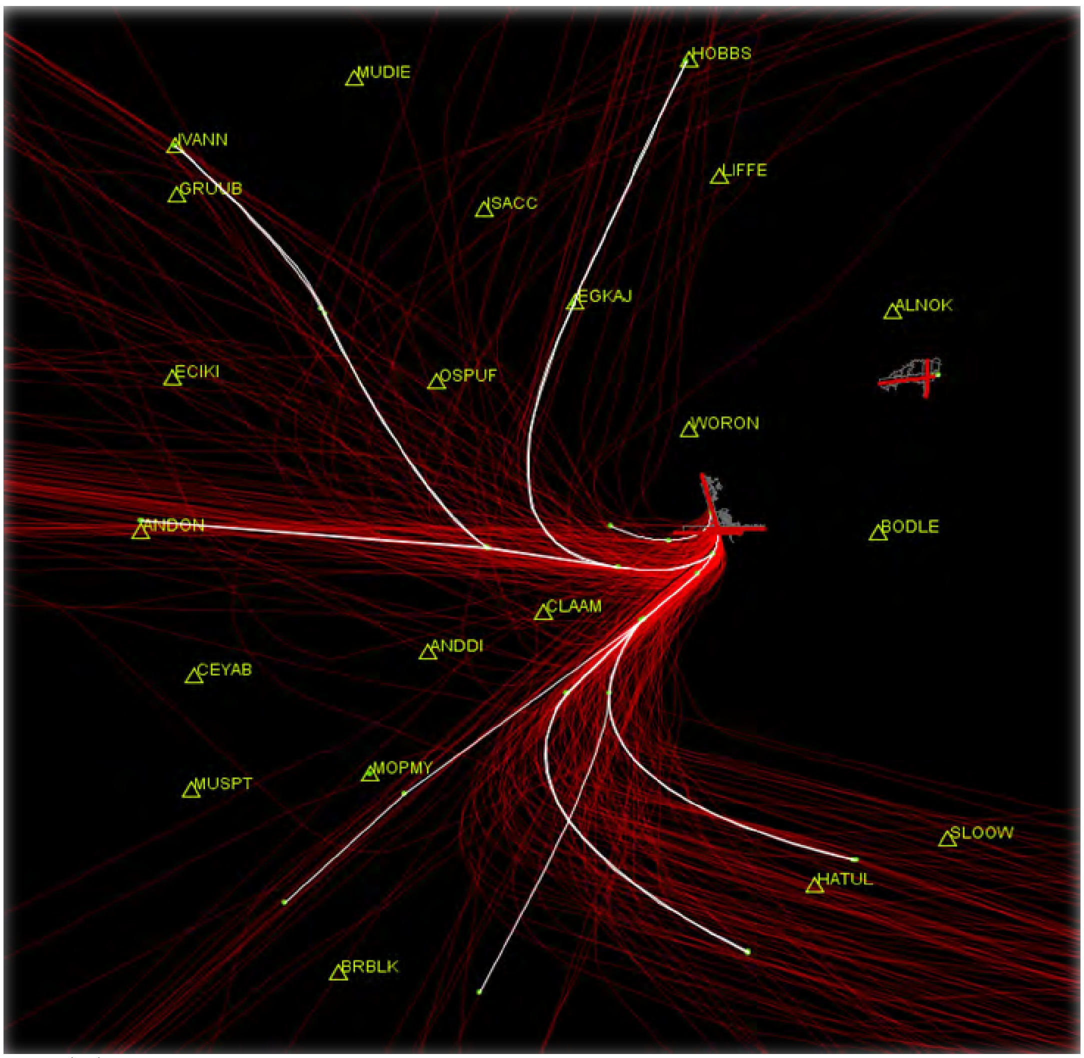
Configuration 4 was not recorded by PDARS for a 24-hour day during the three month data collection period. Therefore, the model development and simulation analysis was based on mixed configuration days. All assumptions model input were confirmed through FAA and Airport staff interviews.

Arrival routes in Configuration 4 are similar to those in Configuration 2 (see **Figure 16**). Configuration 4 does differ from Configuration 2 in that there are no arrivals to Runway 25R. Configuration 4 was not modeled under VFR because it is too rare an occurrence.

Figure 19 is a graphical representation of the PDARS generated flight track data for Airport departures during Configuration 4. The red tracks depict departures from the Airport during six mixed configuration days. The white lines overlaying the tracks show the link / node structure used in the simulation to approximate the typical flow of aircraft. The PDARS analysis as well as information derived through interviews revealed the following assumptions, confirmed through interviews:

- All arrivals and departures utilize Runway 15.
- Arrivals to JBER Runway 6 are integrated with arrivals to Runway 15 at the Airport and cross the Airport inbound track approximately 6 miles from the Runway 15 threshold.
- Runway 15 departure queue:
    - All aircraft depart full length from Taxiway Q

Figure 19
PDARS Radar Data for Configuration 4 Departures



Source: ATAC, 2013.

2.2.3 AIRCRAFT SEPARATION

Aircraft in the simulation demand schedules are grouped into one of nine groups. They are defined within **Table 3**.

Table 3
Simulation Aircraft Groups

Aircraft Group	Identifier	Description	Example(s)
Super	SUPER	A designation that currently only refers to the Airbus 380 with a maximum take-off weight of 1,230,000 pounds	A380
Heavy Jet	H_JET	Jet aircraft with a maximum gross takeoff weight limit greater than 255,000 pounds	B772, B748
B757	H_757	Boeing 757, all models	B757
Large Jet	L_JET	Jet aircraft with a maximum gross takeoff weight limit greater than 41,000 pounds and less than 255,000 pounds	B739, A320
Large Turboprop	L_TRB	Large turbine-propeller and piston-propeller powered aircraft with a maximum gross takeoff weight limit greater than 41,000 pounds	C130, SF34
Small Jet	S_JET	Jet aircraft with a maximum gross takeoff weight limit less than 41,000 pounds	LJ35
Small Turboprop	S_TRB	Small turbine-propeller and piston-propeller driven aircraft with a maximum gross takeoff weight limit between 12,000 and 41,000 pounds	DH8A, BE20
Small Twin Piston	S_TWN	Small twin piston-propeller powered aircraft with a maximum gross takeoff weight limit less than 12,000 pounds	PA31, MEP
Small Single Piston	S_SNG	Small single piston-propeller powered aircraft with a maximum gross takeoff weight limit less than 12,000 pounds	C182, SEP

Source: ATAC, 2013.

Standard separation between two aircraft in terminal airspace is normally 3 miles. This separation standard may increase or decrease in certain situations. Faster aircraft behind slower aircraft may require increased spacing if different arrival routes / altitudes are not assigned. During VMC weather conditions, a decrease in separation between aircraft is permitted if visual approaches are utilized. In the model, wake turbulence separation is applied as presented below.

- Super / heavy behind super – 5.5 miles
- Heavy behind heavy – 4 miles
- Boeing 757 / large behind super – 6 miles
- Large / heavy behind Boeing 757 – 4 miles
- Small behind Boeing 757 – 5 miles

- Small / large behind heavy – 5 miles
- Small behind super – 7 miles

Radar separation applied in this modeling effort conforms to the criteria contained in the document *Ted Stevens Anchorage International Airport 2008 Master Plan Study Report*, January 2009. Chapter 3, page 6 of that document defines the separation requirements between aircraft of different weight classes operating in different sequences: an arrival followed by another arrival, an arrival followed by a departure, and a departure followed by another departure. These separation values include buffers added on to standard FAA separation requirements to represent the fact that controllers rarely maintain the absolute minimum separation distance, and typically allow additional spacing.

Table 4 and **Table 5** show Airport VFR and IFR separations between aircraft. These separation standards were derived from ATC radar data and confirmed with FAA ATC personnel in 2006.

Table 4
VFR Separations

Lead Aircraft	Following Aircraft								
	H_757	H_JET	L_JET	L_TRB	S_JET	S_SNG	S_TRB	S_TWN	SUPER
H_757	4.2	4.1	4.1	4.0	5.0	5.0	5.0	5.0	4.1
H_JET	4.8	4.1	5.0	5.0	5.0	5.1	5.0	5.1	4.1
L_JET	3.1	3.3	3.1	3.0	3.0	3.4	3.6	3.4	3.3
L_TRB	3.1	3.3	3.1	3.0	3.0	3.6	3.4	3.6	3.3
S_JET	3.1	3.3	3.1	3.0	3.0	3.6	3.4	3.6	3.3
S_SNG	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.1
S_TRB	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0
S_TWN	3.1	3.1	3.1	3.0	3.0	3.0	3.0	3.0	3.0
SUPER	4.8	4.1	5.0	5.0	5.0	5.1	5.0	5.1	4.1

Source: ATAC, 2013.
Note: See Table 3 for lead aircraft definitions.

Table 5
IFR Separations

Lead Aircraft	Following Aircraft								
	H_757	H_JET	L_JET	L_TRB	S_JET	S_SNG	S_TRB	S_TWN	SUPER
H_757	5.2	5.5	5.2	4.9	4.9	5.8	5.8	5.8	5.5
H_JET	6.3	5.5	6.3	5.9	5.9	6.8	6.8	6.8	5.5
L_JET	4.2	4.4	4.2	3.9	3.9	4.8	4.8	4.8	4.4
L_TRB	4.2	4.4	4.2	3.9	3.9	4.8	4.8	4.8	4.4
S_JET	4.2	4.4	4.2	3.9	3.9	4.8	4.8	4.8	4.4
S_SNG	4.2	4.4	4.2	3.9	3.9	3.8	3.9	3.8	4.4
S_TRB	4.2	4.4	4.2	3.9	3.9	3.8	3.9	3.8	4.4
S_TWN	4.2	4.4	4.2	3.9	3.9	3.8	3.9	3.8	4.4
SUPER	6.3	5.5	6.3	5.9	5.9	6.8	6.8	6.8	5.5

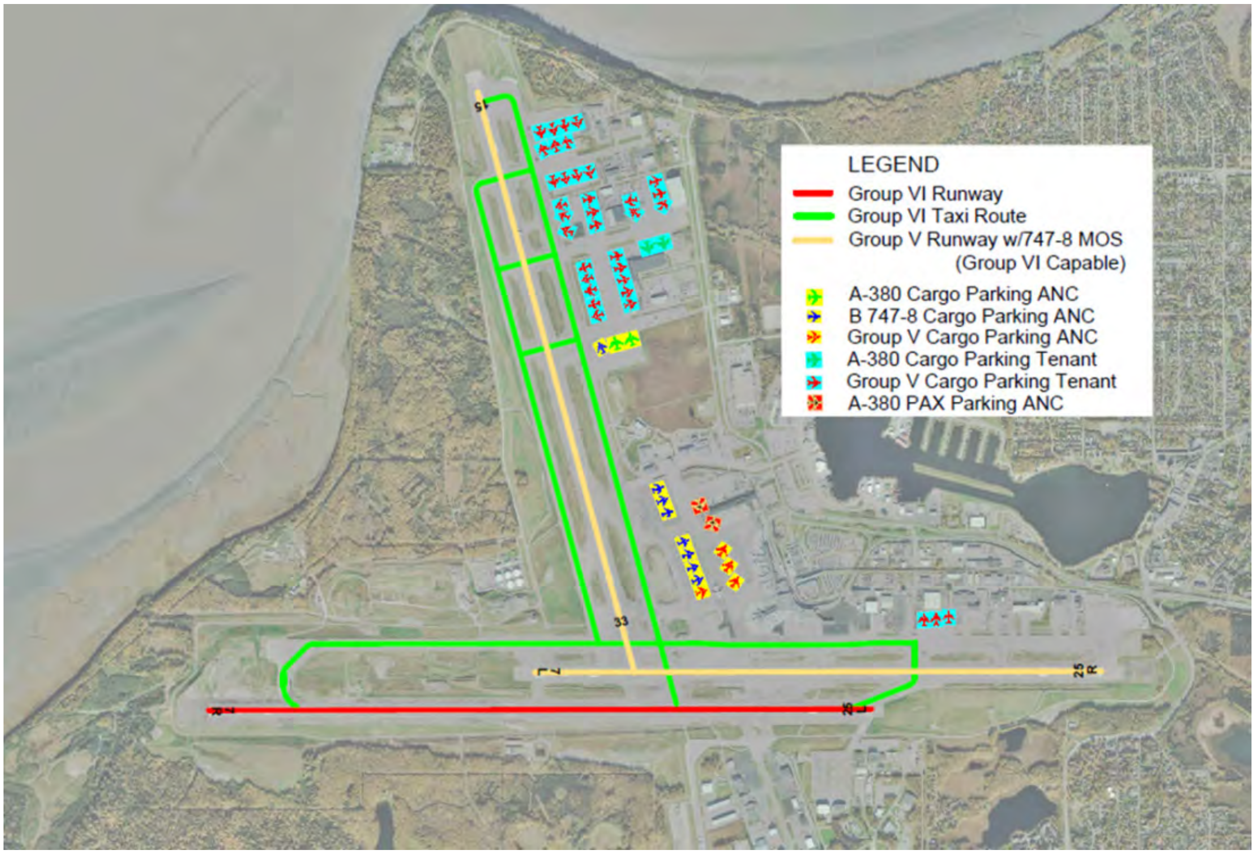
Source: ATAC, 2013.
Note: See Table 3 for lead aircraft definitions.

2.2.4 AIRFIELD

Figure 20 shows the available runways, taxiways, and gates permitted for use by Airplane Design Group (ADG)-V and ADG-VI aircraft. Although this figure shows ADG-V as the largest group to utilize Runway 33, a Modification of Standards (MOS) was issued to the Airport to allow for ADG-VI as well. Due to taxiway limitations and obstruction clearance constraints, no aircraft group larger than ADG-II can utilize Taxiway V; this taxiway is only used by LHD traffic.

Table 6 is a list of the airlines used in the simulation models, as well as their parking locations and airline codes. Some airlines that operate at the Airport may not be listed. Airlines used in the simulations are those included in the schedules provided by the 2013 AIAS Planning Study team and represent the primary users.

Figure 20
ADG-V and ADG-VI Taxi and Runway Restrictions



Source: ATAC, 2013.

Table 6
Airline Parking Locations

Airline ID	Airline Name	Terminal	Airline ID	Airline Name	Terminal
H6 [1]	Hageland Aviation Services	A	GV	Grant Aviation	L
7H	Era Aviation	A	YP	YP	L
KO	Alaska Central Express	ACP	GA	General Aviation	LHD, SAP
VTS	Everts Air Alaska, Everts Air Cargo	ACP	MIL	Military	N
5Y	Atlas Air	ACP	WO	World Airways	N
PO	Polar Air Cargo	ACP	BR	EVA Air	P or R
CON	Continental Oil	B	CA	Air China	P or R
AC	Air Canada	B	CI	China Airlines	P or R
DE	Condor Flugdienst	B	CK	China Cargo Airlines	P or R
F9	Frontier Airlines	B	CX	Cathay Pacific	P or R
CO [2]	Continental Airlines	B	CZ	China Southern Airlines	P or R
UA	United Airlines	B	EZ	Evergreen International Airlines	P or R
AA	American Airlines	B	K4	Kalitta Air	P or R
DL	Delta Air Lines	B	KE	Korean Air	P or R
SY	Sun Country Airlines	B	KZ	Nippon Cargo Airlines	P or R
US	US Airways	B	OZ	Asiana	P or R
B6	JetBlue Airlines	B	QF	Quantas	P or R
AS	Alaska Airlines	C	SOO	Southern Air	P or R
IAR	Iliamna Air Taxi	EAP	SQ	Singapore Airlines	P or R
TNV	Transnorthern	EAP	Y8	Yangtze River Express	P or R
NC	Northern Air Cargo	EAP	CNK	Sunwest Home Aviation	SAP
FX	Federal Express	FDX	LYC	Lynden Air Cargo	SAP
EM	Empire Airlines	FDX	SVX	Security Aviation	SAP
KS	Peninsula Airways	L	V8	ATRAN Cargo Airlines	SAP
8E	Bering Air	L	5X	United Parcel Service	UPS

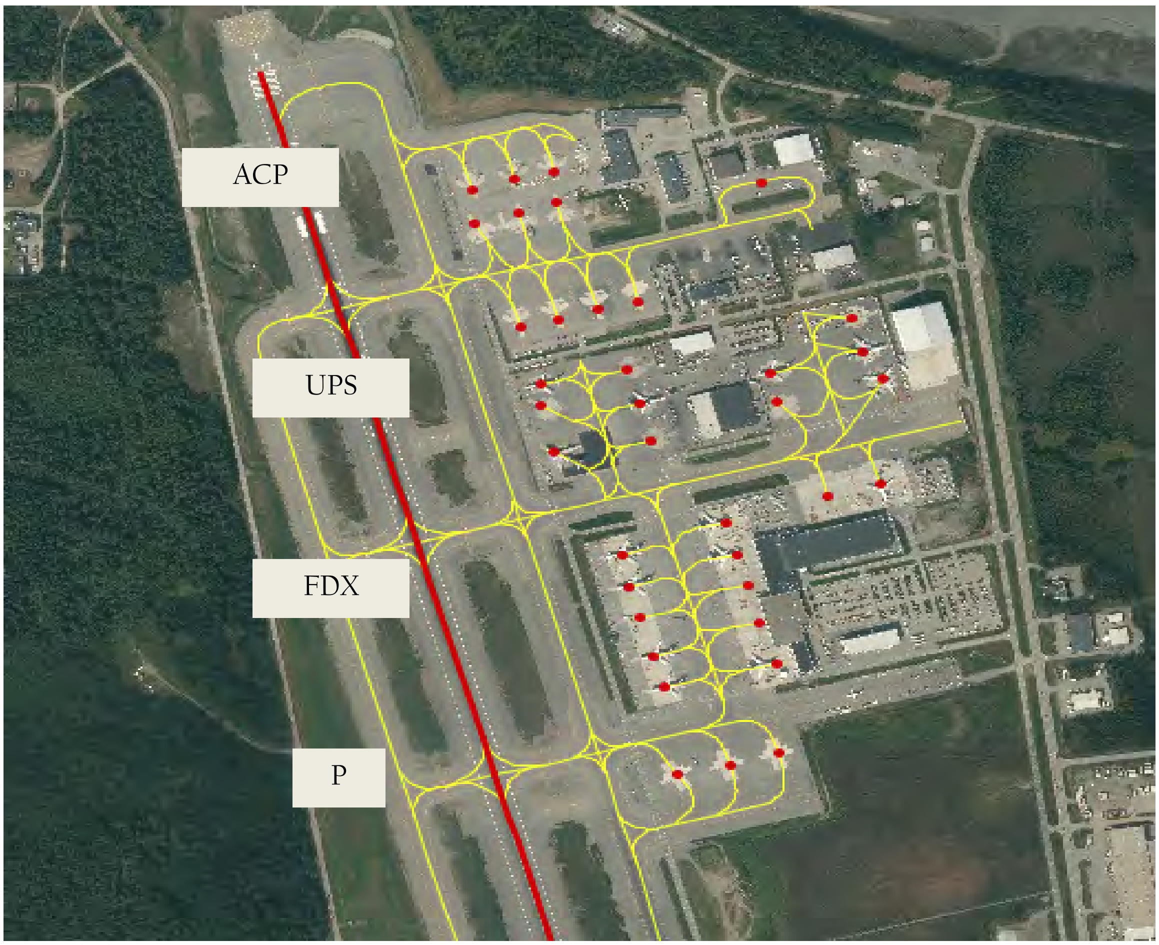
Source: ATAC, 2013.
Notes: 1 - H6 change to 7H
2- CO changed to UA

The gating, parking, and refueling areas at the Airport are split into four different areas, North Airpark, Terminal Area, East Airpark, and South Airpark, as discussed in **Section 2.1**.

North Airpark (NAP), as shown in **Figure 21** includes:

- Air Cargo Port (ACP) – 11 parking locations for 5Y, PO, KO, 3Z, and Pen Air Maintenance, KS
- United Parcel Service Cargo (UPS) – 11 parking locations for 5X
- Federal Express Cargo (FDX) – 12 parking locations for FX, including two shared with Empire Airlines (EM
- Papa Positions (P) – 3 parking locations that provide refueling for non-integrated cargo airlines

Figure 21
North Airpark Gating



Source: ATAC, 2013.

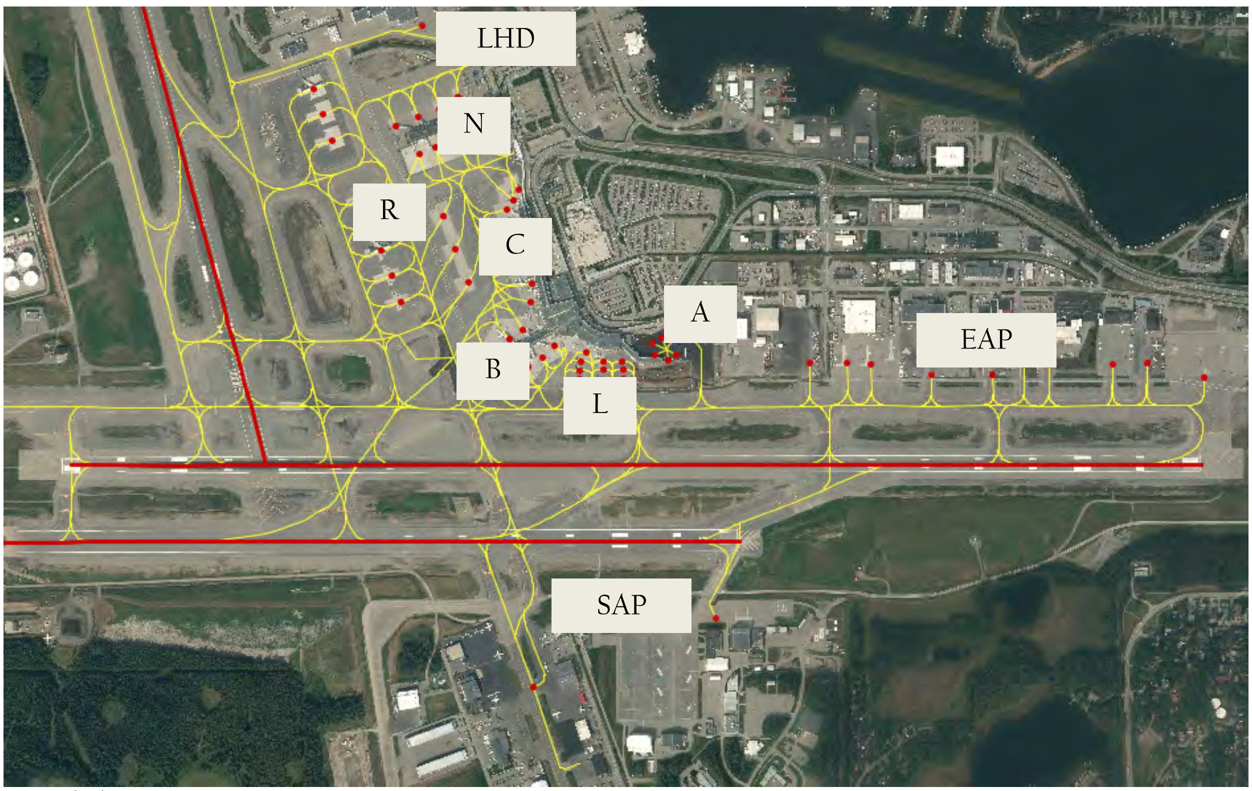
Terminal Area (TA), as shown in **Figure 22** includes:

- Charlie Spots or LHD – General Aviation Single-Engine Piston and Multi-Engine Piston parking
- North Terminal (N) – 8 parking locations for WO and military aircraft
- C Concourse (C) - 9 parking locations for AS
- B Concourse (B)– 8 parking locations for CON and passenger airlines

- A Concourse (A gates) (A) – 5 parking locations for commuter and air taxi airlines
- A Concourse (L gates) (L) – 10 parking locations for commuter and air taxi airlines
- R Gates (R) – 11 parking locations that provide refueling for non-integrated cargo airlines

East Airpark (EAP), shown in **Figure 22**, includes numerous parking aprons for passenger, commuter, air taxi, and cargo aircraft. South Airpark (SAP), shown in Figure 22, includes parking aprons for general aviation and cargo aircraft.

Figure 22
Terminal Area, East Airpark, South Airpark Gating



Source: ATAC, 2013.

Configuration 1 Airfield

The Airport airfield operates in Configuration 1 VFR 62% of the time annually and in IFR roughly 10% of the time. The airspace and runway utilization assumptions can be found in **Section 2.2.2**, Configuration 1 Airspace.

Upon landing, runway exit utilization is dependent upon both aircraft performance and destination terminal. Runway exits as well as arrival taxi flow during Configuration 1 are shown in **Figure 23**. While heavier aircraft generally require greater landing distances and use exits further down runways, at the Airport cargo aprons located in the northern part of the airfield do have an impact on runway exit choice. The majority of the heavy arrival aircraft use Runway 7R, allowing for a longer runway roll prior to the first high speed exit at Taxiway G, which is the preferred exit.

Figure 23
Configuration 1 Arrival Taxi Flow

Source: ATAC, 2013.

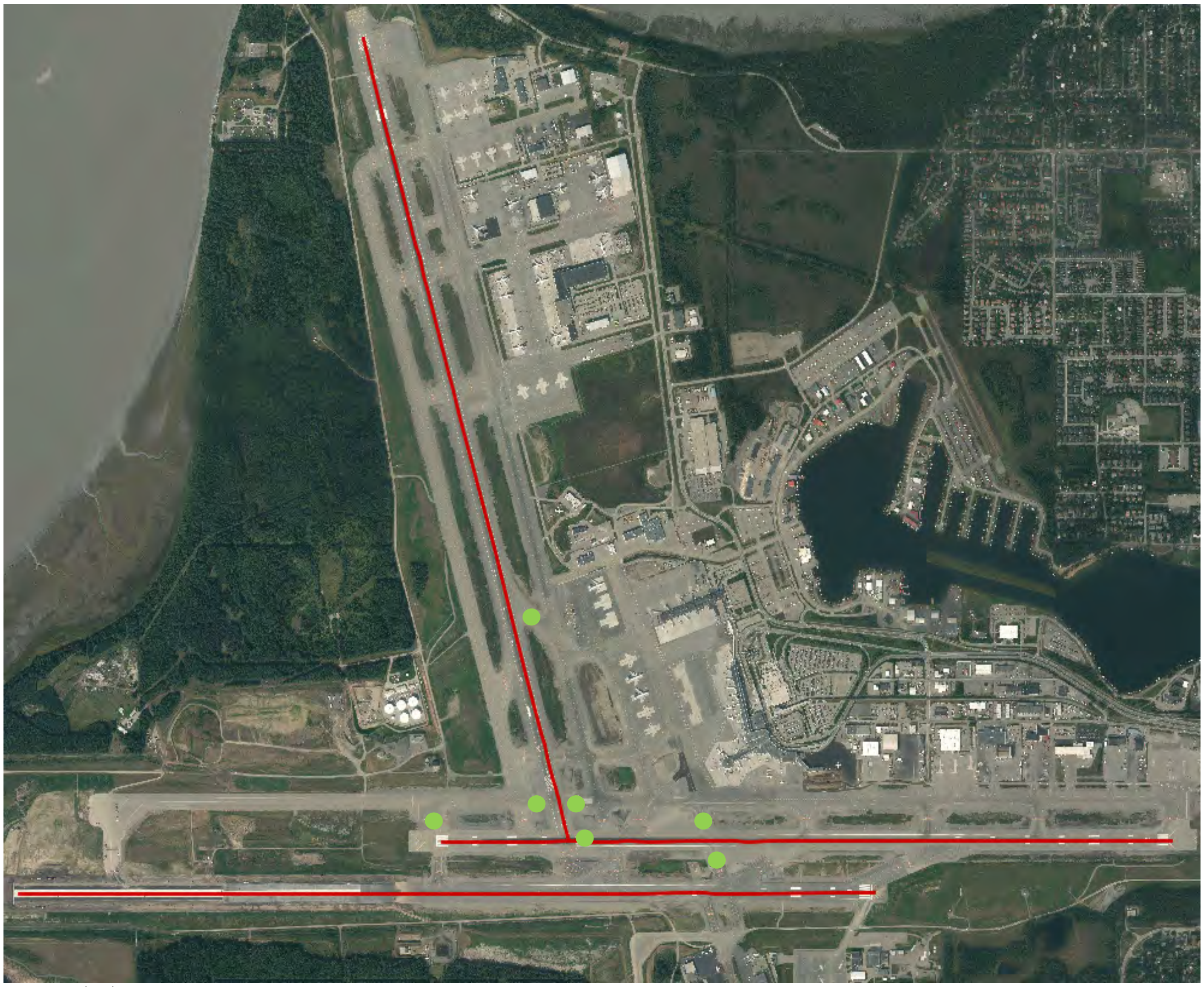
Runway exits Taxiway E and Taxiway D are the primary exits utilized by all other aircraft with parking locations in the TA or EAP. The Runway exit at Taxiway G is regularly used as well; however the area just north of Runway 7L, where Taxiway G, Taxiway E and Taxiway K intersect, is considered a congestion Hot Spot. A Hot Spot is defined by the FAA as "a location on an aerodrome movement area with a history or potential risk of collision or runway incursion." Departing aircraft taxi westbound along Taxiway K in order to depart Runway 7L at Taxiway E or full length from Taxiway H, as well as to queue for departure on Runway 33 along Taxiway K. This creates a congestion condition for aircraft exiting on Taxiway G and needing to taxi to the east, in the face of taxiing departure aircraft. Cargo aircraft on the other hand can exit and taxi directly north along Taxiway G1 avoiding the congestion area altogether.

The runway exit at Taxiway E is often bypassed by arriving aircraft due to turboprop aircraft queuing for the intersection departure at Taxiway E. When this queuing occurs, arriving aircraft will continue their roll to the runway exit at Taxiway D and occasionally at Taxiway C.

The majority of jets depart Runway 33 with some small jets departing full length on Runway 7L. Turboprop aircraft are split between departing Runway 33 or via an intersection departure from Runway 7L. Departure runway assignment for turboprops is determined by gating location, direction of flight, and avoidance of congestion areas, specifically the intersection area of Taxiway G, Taxiway K, Taxiway R, and Taxiway E where aircraft queue for departures as well as taxi to gates upon arrival.

Figure 24 shows the departure taxi flow on the airfield as well as the location of departure queues, depicted by green circles.

Figure 24
Configuration 1 Departure Taxi Flow



Source: ATAC, 2013.

Runway 33 jet departures normally queue on the east side of the runway along Taxiway K, however, cargo aircraft from NAP are frequently delayed by northbound arrival traffic along Taxiway R and therefore will utilize Taxiway Y to taxi to the departure queue on the west side of the runway along Taxiway K. A small number of carriers require their pilots to request full length departures. For modeling purposes, 10% of Boeing 747-200 and Boeing 747-300 aircraft were programmed to depart full length. When feasible, small general aviation aircraft utilize Taxiway M for Runway 33 intersection departures.

Departures from Runway 7L typically depart via the intersection at Taxiway E, either on the north or south side depending on from which parking area they are taxiing. Occasionally, some small jets and large turboprops will depart full length from Taxiway H.

In all weather conditions, departures from Runway 33 are dependent on operations to / from Runway 7R and Runway 7L. When heavy and large aircraft spool up for departure on Runway 33, they create a strong jet blast across Runway 7L and Runway 7R. When this occurs, arrivals to Runway 7R and Runway 7L are unable to land due to the effects of the jet blast crossing the arrival runway rollout and taxiway areas. Current airport procedures require Runway 33 departures to be abeam Taxiway M prior to Runway 7R arrivals crossing the threshold; and for Runway 7L arrivals, the departure must be abeam Taxiway U prior to crossing the threshold. Likewise, full length departures on Runway 7L are also blocked until Runway 33 departures are abeam Taxiway U. Small jets and turboprops departing full length Runway 33 do not create sufficient jet blast / prop wash and are not included in the dependencies of the runways.

All Runway 33 departures are also dependent on arrivals to JBER Runway 6. Straight-in arrivals to JBER cross the departure path of Runway 33 approximately 3 miles north of the Airport; therefore when a JBER arrival comes into the vicinity of the Airport, departures from Runway 33 are held until the JBER arrival clears the departure path. PDARS data shows this to be a delay to Airport departures of approximately 5 to 7 minutes per incident.

<u>**Configuration 2 Airfield**</u>

Configuration 2 is the next most used configuration, accounting for 20% of the time in VFR and 2% in IFR, annually. The airspace and runway utilization assumptions can be found in **Section 2.2.2**.

Upon landing, runway exit utilization is dependent upon aircraft performance, destination terminal, and congestion on the airfield. Aircraft parking at cargo aprons to the north prefer runway exits at Taxiway M or Taxiway W, turning northbound to taxi along Taxiways R and Y, respectively. Runway exits at Taxiway L and Taxiway K are utilized if there is congestion along Taxiway R. Runway exits at Taxiway M, Taxiway L, and Taxiway K are used, in that order of preference, for all other aircraft arriving on Runway 15. Arrivals to Runway 25R are exclusively props and turboprops and utilize runway exits at Taxiway E or Taxiway D. Runway exits as well as arrival taxi flow during Configuration 2 are shown in **Figure 25**.

Figure 25
Configuration 2 Arrival Taxi Flow

Source: ATAC, 2013.

Runway 15 and Runway 25R operations are dependent. Arrivals to Runway 15 block all operations on Runway 25R until landing is confirmed; likewise, when Runway 25R departures or arrivals are on the runway, the Runway 25R aircraft must be past the runway intersection or exited off the runway prior to the Runway 15 arrival crossing the threshold. Runway 15 and Runway 25L are independent and can operate without restriction.

Airport arrivals to Runway 15 are dependent with arrivals to JBER Runway 6. Straight-in arrivals to JBER interact with arrivals to the Airport and are sequenced in with Airport traffic approximately 6 miles north of the airport. This causes a slight delay to Airport arrivals due to the increased spacing requirements when a JBER arrival is on approach.

The majority of jets and turboprop aircraft depart full length on Runway 25L, entering at Taxiway C. Turboprop aircraft parked at SAP utilize the intersection departure from Taxiway F on the south side of the runway.

Approximately 3% of jets and 5% of turboprops depart Runway 25R, and those flights normally depart either to the west or north. The Runway 25R jet departures queue at Taxiway A, and turboprops will use either Taxiway A or Taxiway B. Runway 25L is the longer of the two runways and also requires less taxi time to the departure queue; therefore it is the preferred runway in this configuration.

Figure 26 depicts the departure taxi flow and the departure queue locations are illustrated by green circles.

Figure 26
Configuration 2 Departure Taxi Flow

Source: ATAC, 2013.

Configuration 3 Airfield

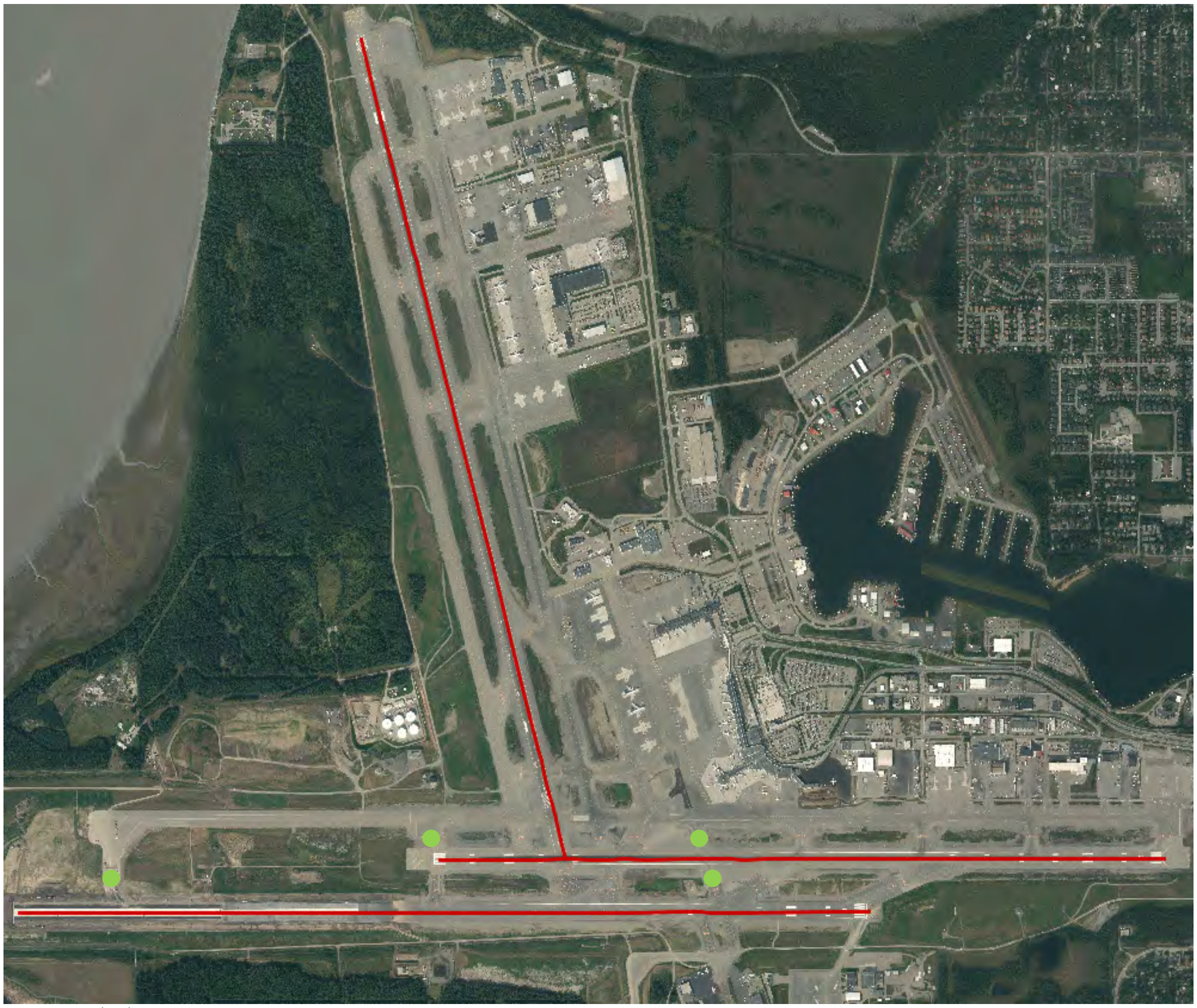
Configuration 3 is utilized approximately 3% of the time annually in VFR conditions. Arrivals are handled similarly to Configuration 1, utilizing Runway 7R and Runway 7L. Departures also utilize Runway 7R and Runway 7L. The primary departure runway in Configuration 3 is Runway 7L, thus fewer arrivals utilize this runway in comparison with Configuration 1. Runway 7L is occasionally used for arrivals, but only during times of low departure demand and there are few aircraft queuing for departure. Exit utilization and arrival taxi flow procedures are illustrated in **Figure 23**.

Jets depart full length Runway 7L from Taxiway H while turboprop aircraft may depart full length or, when feasible, via the intersection at Taxiway E. Runway 7R is used by departures during times of low arrival demand or when the Runway 7L departure queue becomes saturated. All aircraft depart Runway 7L full length from Taxiway J in the simulation models.

Figure 27 depicts the departure taxi flows with the departure queues depicted as green circles.

JBER operations do not impact Airport operations in Configuration 3.

Figure 27
Configuration 3 Departure Taxi Flow



Source: ATAC, 2013.

Configuration 4 Airfield

Configuration 4 is also utilized only about 3% of the time annually in VFR. Runway 15 is the only runway in use for all traffic. Arrivals are handled similarly to Configuration 2, and the exit utilization and taxi flow procedures for Runway 15 arrivals are the same as those shown in **Figure 25**.

Airport arrivals to Runway 15 are dependent with arrivals to JBER Runway 6. Straight-in arrivals to JBER interact with arrivals to the Airport and are sequenced in with Airport traffic approximately 6 miles north of the airport. This causes a slight delay to Airport arrivals due to the increased spacing requirements when a JBER arrival is on approach.

All Runway 15 departures depart full length from Taxiway Q and queue along Taxiway R.

2.3 SIMULATION EVENT FILES

In order to accurately portray the anticipated increase in demand at the Airport, three airport schedules were developed. The first demand schedule represents operations in 2012, and the other two represent demand projected for Future 1 and Future 2 scenarios. These were provided to the Ted Stevens Anchorage International Airport Master Plan Update (Master Plan Update) team by the 2013 AIAS Planning Study team, who simultaneously conducted the 2013 AIAS Planning Study using the same schedules. In the demand files, all scheduled aircraft were assigned specific gates. However, due to randomness in the early / late distributions entered into the simulation model, a flight's assigned gate may not be available at the actual arrival time. When this occurs, the model will assign the aircraft an alternate gate appropriate to the aircraft's airline and aircraft size.

The demand schedules were converted into simulation event files. The conversion process includes applying schedule delay distributions, calculating simulation injection times, assigning airspace routes, and verifying proper aircraft group assignments. The simulation event files are representative of the peak month average day (PMAD) at the Airport.

Turnaround, Tows, and Remain Overnight (RON) activities were all modeled as defined below:

- **Turnarounds** – Aircraft that arrive and then depart within the 24-hour day schedule.
- **Tows** – Arrival aircraft that are required to move off the gate due to future activity expected at the gate. They are towed via a tug to another open gate, a tow area used by their airline, or to a maintenance area on the airfield. Tows can also be departure aircraft that are towed on to gates from the same areas in order to prepare for departure. Towed aircraft in the model operate at a slower speed than taxiing aircraft.
- **RONs** – Aircraft that, upon arrival, will remain at the gate for the remainder of the simulation day. The gate is not scheduled to be used by any other flights and therefore the aircraft are allowed to remain at the gate overnight. Because the start of the simulation day is at midnight, some aircraft are at gates already, representing aircraft that came in the day before and "remained overnight" as described above; some of these may in fact be aircraft that landed just prior to midnight and are in the turnaround phase. Other RONs may represent aircraft that came in the night before and rather than be towed off to a run up area, remained at the gate to depart at some point the next morning.

Table 7 provides the operational counts for a PMAD at the Airport by ground operation as described above for each demand level. General aviation is a fourth ground operation group and is split between those aircraft parked at LHD and those parking at SAP. The demand schedules represent the Baseline year 2012, Future 1, and Future 2.

Table 7
Daily Operation Totals by Ground Operations

	Baseline Operations		Future 1 Operations		Future 2 Operations	
Annual Operations	211,409		242,275 15% increase from base operations		281,942 33% increase from base operations	
Peak Month Average Day	VFR 742	IFR 706	VFR 860	IFR 830	VFR 1,004	IFR 968
Arrivals	371	353	430	415	502	484
RON	43	43	56	56	53	53
Tow-off	29	29	39	39	47	47
Turnaround	218	218	254	254	306	306
General Aviation (LHD/SAP)	81 (63/18)	63 (45/18)	81 (56/25)	66 (41/25)	96 (65/31)	78 (47/31)
Departures	371	353	430	415	502	484
RON	51	51	56	56	53	53
Tow-off	21	21	39	39	47	47
Turnaround	218	218	254	254	306	306
General Aviation (LHD/SAP)	81 (63/18)	63 (45/18)	81 (56/25)	66 (41/25)	96 (65/31)	78 (47/31)

Source: ATAC, 2013.
Notes: VFR = Visual Flight Rules; IFR = Instrument Flight Rules; GA = general aviation; RON = Remain Overnight

Aircraft in these demand schedules are grouped into one of nine groups as defined in **Table 3**.

Table 8 provides the operational counts for a PMAD at the Airport by the above defined aircraft groups in the Baseline, Future 1, and Future 2 demand schedules.

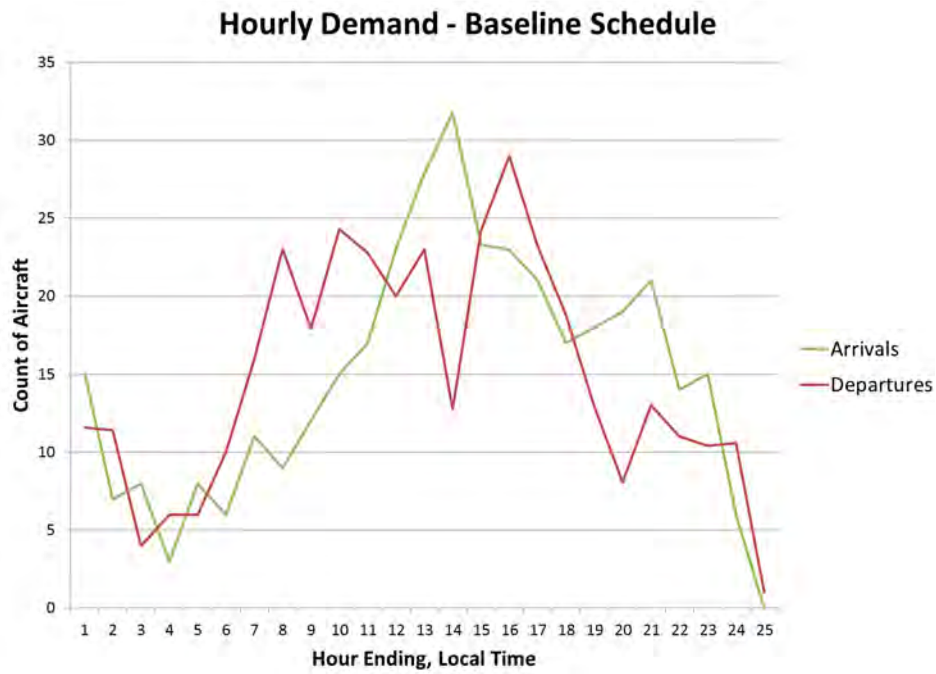
Figure 28, **Figure 29**, and **Figure 30** present the hourly airport runway demands for all aircraft in the baseline, Future 1, and Future 2 demand schedule year, respectively.

Table 8
Daily Operation Totals by Aircraft Group

		Baseline Operations		Future 1 Operations		Future 2 Operations	
Annual Operations		211,409		242,275 15% increase from base operations		281,942 33% increase from base operations	
Peak Month Average Day		VFR	IFR	VFR	IFR	VFR	IFR
		742	706	860	830	1,004	968
Arrivals		371	353	430	415	502	484
	SUPER	0	0	0	0	3	3
	H_757	11	11	4	4	2	2
	H_JET	87	87	118	118	147	147
	L_JET	77	77	95	95	115	115
	L_TRB	29	29	32	32	26	26
	S_JET	14	14	16	16	20	20
	S_SNG	26	17	8	0	10	0
	S_TRB	115	115	147	147	167	167
	S_TWN	12	3	10	3	12	4
Departures		371	353	430	415	502	484
	SUPER	0	0	0	0	3	3
	H_757	11	11	4	4	2	2
	H_JET	87	87	118	118	147	147
	L_JET	77	77	95	95	115	115
	L_TRB	29	29	32	32	26	26
	S_JET	14	14	16	16	20	20
	S_SNG	26	17	8	0	10	0
	S_TRB	115	115	147	147	167	167
	S_TWN	12	3	10	3	12	4

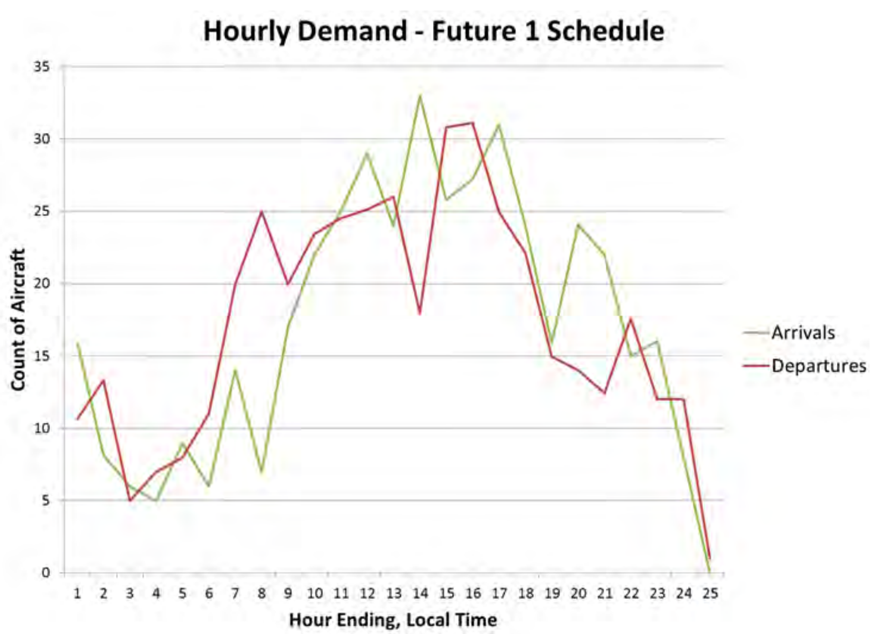
Source: ATAC, 2013.
Notes: See Table 3 for lead aircraft definitions. VFR = Visual Flight Rules; IFR = Instrument Flight Rules

Figure 28
Hourly Demand in Baseline Year



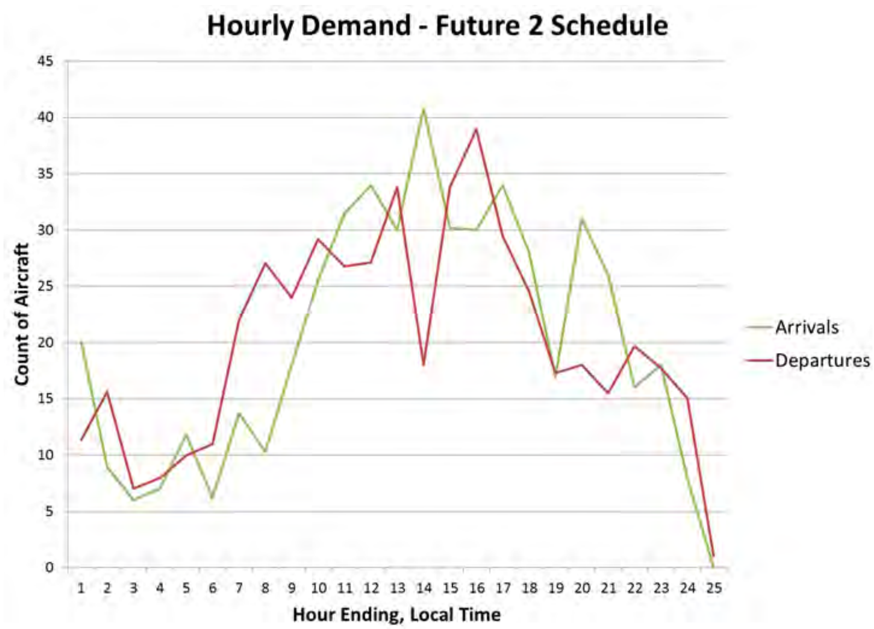
Source: ATAC, 2013.

Figure 29
Hourly Demand in Future 1



Source: ATAC, 2013.

Figure 30
Hourly Demand in Future 2



Source: ATAC, 2013.

2.4 EXISTING AIRFIELD SIMULATION RESULTS

The existing airfield models represent gated forecasts for the Airport in the Baseline year, and Future 1 and Future 2 demand levels. The Future 1 and 2 demand forecast represent a 15% and 33% increase respectively from the baseline schedule. For each demand forecast, the six major airport operational configurations at the Airport were modeled to reflect operations throughout the course of the year. This section discusses various output statistics from the 18 Simmod *PRO!* models that were developed: three demand forecast schedules per six operational configurations. **Table 9** lists all of the simulation models for reference.

The primary metrics used in this study to determine capacity constraints at the Airport include Average Daily Delay, Peak Hour Delay, and Average Annual Delay. Each metric is discussed in detail below.

Table 9
Simulation Model Runs

Run Number	Alternative	Configuration	Weather	Arrivals	Departures	Demand Level
Calibration	Existing Airfield	1	VFR	7L and 7R	33 and 7L	Baseline
1	Existing – No Action	1	VFR	7L and 7R	33 and 7L	Baseline
2	Existing – No Action	1	VFR	7L and 7R	33 and 7L	Future 1
3	Existing – No Action	1	VFR	7L and 7R	33 and 7L	Future 2
4	Existing – No Action	1	IFR	7R	33 and 7L	Baseline
5	Existing – No Action	1	IFR	7R	33 and 7L	Future 1
6	Existing – No Action	1	IFR	7R	33 and 7L	Future 2
7	Existing – No Action	2	VFR	15 and 25R	25R and 25L	Baseline
8	Existing – No Action	2	VFR	15 and 25R	25R and 25L	Future 1
9	Existing – No Action	2	VFR	15 and 25R	25R and 25L	Future 2
10	Existing – No Action	2	IFR	15	25R and 25L	Baseline
11	Existing – No Action	2	IFR	15	25R and 25L	Future 1
12	Existing – No Action	2	IFR	15	25R and 25L	Future 2
13	Existing – No Action	3	VFR	7L and 7R	7L and 7R	Baseline
14	Existing – No Action	3	VFR	7L and 7R	7L and 7R	Future 1
15	Existing – No Action	3	VFR	7L and 7R	7L and 7R	Future 2
16	Existing – No Action	4	VFR	15	15	Baseline
17	Existing – No Action	4	VFR	15	15	Future 1
18	Existing – No Action	4	VFR	15	15	Future 2

Source: ATAC, 2013
Note: VFR = Visual Flight Rules; IFR = Instrument Flight Rules.

2.4.1 AVERAGE DAILY DELAY

Delay in the simulation model is defined as the amount of time above the nominal flight time experienced by each flight due to congestion and required air traffic control spacing within the model. The Average Daily Delay is the average delay for a group of flights across an entire 24 hour schedule. Each of the simulation exercises is run independent of one another for an entire 24 hour period, and the average delay per aircraft is calculated per simulation run. Most U.S. airports consider capacity to be an issue when the Average Daily Delay per aircraft exceeds 8-10 minutes per aircraft across the entire 24 hour day. The delay values are presented in **Table 10**. The red highlighted values in the table indicate times when average daily delay exceeds 10 minutes per aircraft. Ten minutes of delay is exceeded in Configuration 4 at the Future 1 and Future 2 activity levels in VFR conditions. Configurations 1 and 2 both exceed the 10 minute threshold at the Future 2 activity level in IFR conditions.

Table 10
Existing Airfield - No Action Case Average Daily Delay, Simmod Results Overview

	Annual Usage											
	Configuration 1			Configuration 2			Configuration 3			Configuration 4		
VFR	62%			20%			3%			3%		
IFR	10%			2%								
	Average Minutes of Delay Per Aircraft – Full Day											
	Configuration 1			Configuration 2			Configuration 3			Configuration 4		
	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2
VFR	1.9	3.4	8.5	1.3	1.9	3.2	1.6	2.2	5.4	5.4	11.8	41.2
IFR	2.8	5.8	21.6	2.4	5.2	19.6						

Source: ATAC, 2013.
Note: Red highlighted values indicate times when average daily delay exceeds 10 minutes per aircraft.

2.4.2 AVERAGE PEAK HOUR DELAY

Most U.S. airports do not focus on Peak Hour Delay in capacity studies. The Airport, however, is unique due to its cargo turnaround time windows. In order for cargo carriers to meet deadlines in other markets, delay cannot exceed a specific threshold during any given hour. Due to this nature of the Airport's schedule, the amount of delay on average in any given hour is of major concern. Previous planning studies for the Airport, along with airport personnel, have recommended that 30 minutes be set as the threshold of unacceptable delay during the peak hour. This study applied the same threshold.

The Peak Hour Delay metric reports the highest average hourly delay over the 24 hour period for flights that operated in that hour. In other words, it represents the average amount of delay experienced by each flight within the peak hour of delay. **Table 11** below presents the peak hour delay per configuration with values over 30 minutes highlighted in red. Configuration 4 under VFR conditions already exceeds the 30 minute threshold at the Baseline activity level. Configurations 1 and 3 under VFR conditions exceed the 30 minute threshold at the Future 2 activity level. Configurations 1 and 2 exceed the 30 minute threshold at the Future 2 activity level under IFR conditions.

Table 11
Existing Airfield - No Action Case Average Peak Hour Delay, Simmod Results Overview

	Annual Usage											
	Configuration 1			Configuration 2			Configuration 3			Configuration 4		
VFR	62%			20%			3%			3%		
IFR	10%			2%								
	Average Minutes of Delay Per Aircraft – Full Day											
	Configuration 1			Configuration 2			Configuration 3			Configuration 4		
	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2
VFR	10.9	17.2	50.4	4.7	7.1	17.0	6.1	8.7	30.9	30.1	60.9	150.6
IFR	16.1	29.2	99.6	15.8	28.3	76.3						

Source: ATAC, 2013.
Note: Red highlighted values indicate times when average delay exceeds 30 minutes.
VFR = Visual Flight Rules; IFR = Instrument Flight Rules

2.4.3 AVERAGE ANNUAL DELAY

The most common metric used for airport capacity analysis is the Average Annual Delay. This is a composite number consisting of the various annual delay values from each configuration as a factor of how often they occur each year. The annual usage percentages shown in both **Table 10** and **Table 11** are applied to the daily delay values presented in **Table 10** to calculate the Average Annual Delay at the Baseline, Future 1, and Future 2 activity levels. **Table 12** below presents the Average Annual Delay for each activity level.

Average Annual Delay values generally have a large influence on decisions related to airport infrastructure improvements. Most U.S. airports consider Average Annual Delay values in excess of 8-10 minutes per aircraft to be disruptive to the efficient operation of flights. Based on this general assumption, the Airport would begin to experience delay issues somewhere between the Future 1 and Future 2 demand levels under today's airport layout and operating environment.

Table 12
Existing Airfield - No Action Case Average Annual Delay, Simmod Results Overview

Average Minutes of Delay (Annualized using Annual %)			
	Baseline	Future 1	Future 2
Annual Operations	211,409	242,275	281,942
Existing Airfield	2.0	3.6	9.9

Source: ATAC, 2013.

SECTION 3 ALTERNATIVES - SIMULATION ASSUMPTIONS AND RESULTS

3.1 ALTERNATIVE 1 – MINIMIZE DEVELOPMENT

Alternative 1 consists of a number of safety enhancements to the airfield and was expected to have minimal impact on capacity and delay. Regardless of any future improvements to Ted Stevens Anchorage International Airport (Airport), the modifications modeled in Alternative 1 will be necessary in order to comply with safety design standards that are currently recommended and will likely be required by the Federal Aviation Administration (FAA) in the future. **Figure 31** is a graphic of the airport with the Alternative 1 safety modifications shown in black.

Changes to the airfield and Simmod *PRO!* model for Alternative 1 include:

- Angled Taxiways R, G, F, E, D, and C are removed and replaced with four taxiways oriented at 90-degrees to the parallel runways.
  - All exits between the runways will be perpendicular, eliminating high-speed angled exits.
- Taxiway Z is extended, providing access between the South Airpark and Kulis Business Park apron, as well as access to all four of the new perpendicular exits.
- Runway 15-33 shortened to eliminate intersection with Runway 7L-25R; the end of the runway will be at the intersection of Taxiway K.
  - Aircraft depart from Taxiway K, as they do under current operations. Shortening the runway will not remove the jet blast dependency or alleviate any associated delay.
- Taxiway R extended north to provide access to the Runway 15 end via a new connecting taxiway.
- Taxiways U and P extended east to accommodate four additional pull-through parking positions, for aircraft up to Airplane Design Group (ADG)-IV (e.g. Airbus A380).
- Diagonal Taxiway G between Taxiway G1 and Taxiway E removed in order to eliminate 4-node intersection Hot Spot.

Figure 31
Alternative 1 Proposed Modifications to Airfield

Source: HDR, 2014.

3.1.1 ALTERNATIVE 1 - CONFIGURATION 1

Airspace procedures described in **Section 2.2.2** do not change in Alternative 1, Configuration 1. The only changes to the model in this configuration is the elimination of the few Boeing 747-200 and Boeing 747-300 aircraft that depart full length at the intersection of the original runways, and the departure queues for intersection departures on Runway 7L are moved to the west slightly. Additionally, all high speed exits are removed.

3.1.2 ALTERNATIVE 1 - CONFIGURATION 2

Airspace procedures described in **Section 2.2.2** do not change in Alternative 1, Configuration 2. The airfield changes will affect the location

of the departure queue for aircraft parked at South Airpark (SAP). The queue is moved to the east and is no longer an intersection departure, but rather full length of the runway for all departures. For aircraft not parked at SAP, the location of the Runway 25L departure queue remains the same; however, aircraft will taxi across Runway 25R slightly to the east. No heavy or super aircraft will be able to hold between the runways and must wait along Taxiway K until cleared for departure.

3.1.3 ALTERNATIVE 1 - CONFIGURATION 3

Airspace procedures described in **Section 2.2.2** do not change in Alternative 1, Configuration 3. The only modifications to the model are the departure queue locations for intersection departures on Runway 7L, which are moved slightly west due to the removal of the high speed exits.

3.1.4 ALTERNATIVE 1 - CONFIGURATION 4

Alternative 1 airfield modifications will have no effect on operations in Configuration 4. This Alternative / Configuration combination would be identical to the current airfield, so an additional simulation model was not required. Any delay information for Configuration 4 will be identical to the delay information reported earlier in the Existing Airfield – No Action case.

3.2 ALTERNATIVE 2 – OPTIMIZE AIAS

The *2013 Alaska International Airport System (AIAS) Planning Study* (AIAS Planning Study) concurrently studied Alternative 2, in which 50% of all tech stops (fights landing at the Airport simply to refuel and then depart) will utilize Fairbanks International Airport rather than the Airport. Alternative 2 was not included in this analysis.

3.3 ALTERNATIVE 3 –OPTIMIZE ANC

With no infrastructure change at the Airport, Alternative 3 is simply a modification of the current operational procedures used at the Airport during times when the Airport is operating in Configuration 1. Alternative 3 (or Modified Configuration 1) utilizes the Alternative 1 airfield model with slight changes to the airspace.

The primary goal of Alternative 3 is to optimize the runway utilization at the Airport during peak arrival and departure pushes in the demand schedule. This was done without regards to noise abatement procedures during the daytime hours between 7 a.m. and 10 p.m. Normally, during these hours preferential runway use is in effect, which does not allow for large and heavy jets to depart via Runway 7L to the east. During the noise abatement hours, the airfield reverts back to the current runway usage for Configuration 1.

The Alternative 3 scenario consists of three parts as described below depicted in **Figure 32**. The Simmod *PRO!* simulation model for Alternative 3 dynamically switches between the various runway use schemes at the time periods depicted in **Figure 32**.

Configuration 1 – During the noise abatement night hours between 10 p.m. and 7 a.m., Configuration 1 runs as it does today. Arrivals utilize Runway 7R and Runway 7L, large jets and turboprops depart from Runway 33, and some small jets and turboprops depart from Runway 7L. The operational procedures that restrict Runway 33 departures due to Runway 7R and Runway 7L operations due to jet blast are unchanged as discussed in **Section 2.2.4**.

Configuration X – Starting at 7 a.m., and ending at 10 p.m., a modified Configuration 1 goes into effect. To alleviate the jet blast runway dependency seen in normal Configuration 1 operations, all jets will depart Runway 7L and the majority of turboprops via Runway 33.

Configuration Y – Configuration X is in effect during the majority of daytime hours. However, during peak arrival hours, Configuration Y will be used. During these periods of peak arrival operations, the turboprops utilizing Runway 33 for departure in Configuration X will switch to Runway 7L, which becomes the sole departure runway. Arrivals will continue to use Runway 7R and Runway 7L, and in addition, Runway 15 will be utilized as a third arrival runway.

The demand schedules were analyzed to determine times when arrivals were abundant and departures were low in order to take advantage of the three-runway arrival system. Hourly demand for the Baseline, Future 1, and Future 2 flight schedules is discussed and graphically depicted in **Section 2.3**. After analysis, two peak arrival periods were chosen in which to use Configuration Y: between 12:30 p.m. and 2 p.m., and between 7:30 p.m. and 9 p.m. Alternative 3 was not modeled during Instrument Flight Rules (IFR) as simultaneous arrivals to Runway 15 and the parallel east / west runways are not permitted in Instrument Meteorological Conditions (IMC) weather conditions.

Figure 32
Alternative 3 - Modified Configuration 1 Description

Source: ATAC, 2013.

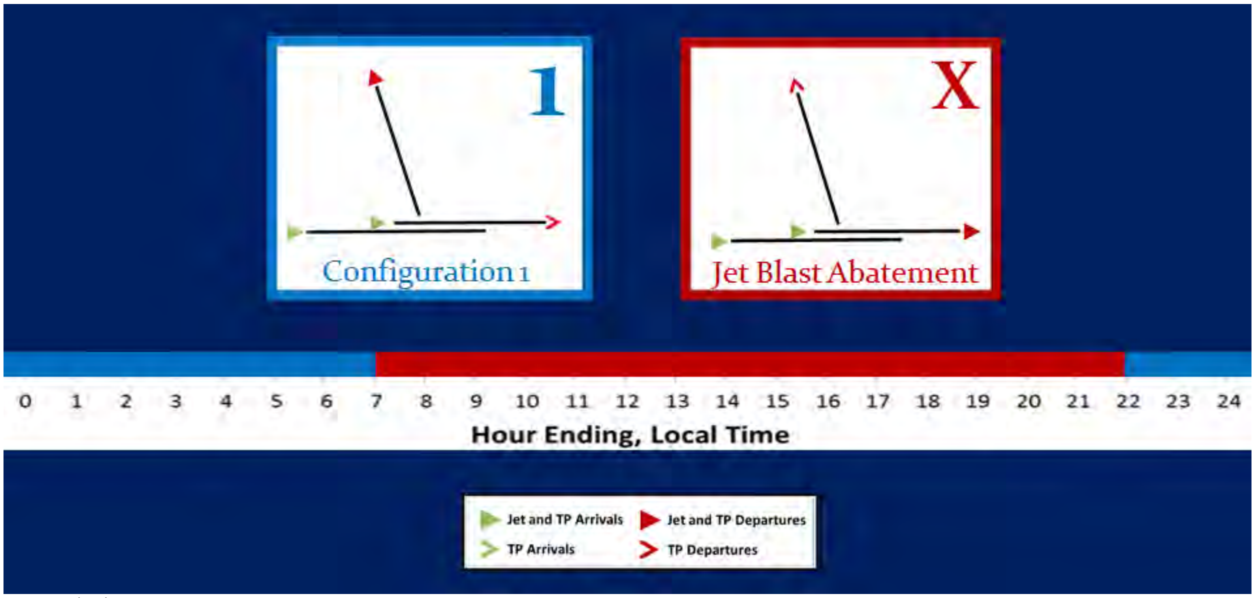
3.3.1 ALTERNATIVE 3A - ELIMINATE THE JET BLAST EFFECT

An additional alternative was studied that tries to minimize the effect of the jet blast constraint that occurs in Configuration 1. It was determined that an alternative utilizing the conditions specified in Alternative 3 with Configuration 1 and X would be tested. This Modified Configuration 1 blended scenario consists of two, rather than three parts, as described below and visually depicted in **Figure 33**.

Between 10 p.m. and 7 a.m., Configuration 1 procedures are in effect; arrivals land Runway 7R and Runway 7L, large jets and turboprops depart from Runway 33, and some small jets and turboprops depart from Runway 7L.

During daytime hours of 7 a.m. until 10 p.m., Configuration X runway assignment preferences are used. As previously described, all jets depart Runway 7L and the majority of turboprops depart Runway 33. Arrivals would continue to utilize Runway 7R and Runway 7L.

Figure 33
Alternative 3A - Modified Configuration 1 Description



Source: ATAC, 2013.

3.4 ALTERNATIVE 4 – CLOSELY SPACED RUNWAY

Alternative 4 introduces a fourth runway to the airfield. This new runway would be oriented north / south directly to the west of the existing Runway 15-33. The existing Runway 15-33 is renamed Runway 15L-33R within this alternative. This runway would be closely spaced with a separation of 908 feet between centerlines, preventing independent IFR operations on the two runways. The Alternative 1 models were was used as the basis for this alternative with airspace and ground structure added as needed.

Figure 34 is a graphic with the proposed airfield modifications shown in black. In addition to the modifications to the Airport airfield as specified in Alternative 1, the following changes will be made in Alternative 4:

- A closely spaced parallel runway to the existing Runway 15-33 will be added, Runway 15R-33L. The runway will be 10,000 feet in length, ADG-V capable, and will have 908 foot separation between centerlines; assumes a Modification of Standards (MOS) for Boeing 747-8 use, but not ADG-VI (e.g. Airbus A380).
- Taxiway Y will be extended north to the runway end of Runway 15L-33R and assumes an MOS for ADG-VI use.
- A taxiway will be added west of the new Runway 15R-33L with high-speed exits, all ADG-V capable, and with an MOS to allow Boeing 747-8 aircraft use.
- A West Airpark (WAP) will be created with new Boeing 747-8-capable tech stop positions to the west of the new runway.

These will be utilized by non-integrated cargo carriers for refueling.

Figure 34
Alternative 4 Proposed Modifications to Airfield

Source: HDR, 2014.

3.4.1 ALTERNATIVE 4 - CONFIGURATION 1

The addition of a new parallel north / south runway does not impact arrival operations in this configuration. Staggered arrivals will continue to Runway 7R and Runway 7L. **Section 2.2.2** discusses these procedures in detail.

All jets will depart either Runway 33R or Runway 33L. For modeling purposes, departure runway assignment was determined by direction of flight. Southbound aircraft will depart from Runway 33L and all others from Runway 33R. This prevents flights from crossing once airborne and promotes improved capacity by avoiding the larger separation standards required between crossing departures. Turboprops will utilize either of the parallel north / south runways or Runway 7L. Turboprop runway assignment will be determined by gate location, direction of flight, and avoidance of congestion areas.

In order to conduct simultaneous departures off the parallel runways, the departure headings need to diverge by 45 degrees. Alternative 4 assumes Runway 33R operations will depart runway heading with Runway 33L departures immediately turning 45 degrees to the west. Super, heavy, and Boeing 757 aircraft departing as the lead aircraft require standard wake turbulence separations for other aircraft on either the same or parallel runway.

There is no exception to runway dependencies between the parallel east / west runways and the new Runway 33L. Because of the proximity of Runway 7L and Runway 7R, jet departures on either Runway 33R or Runway 33L are required to wait for arrivals to pass the intersection of the two runways due to the jet blast. Departures from both north / south runways are required to be abeam Taxiway M prior to arrivals crossing the Runway 7R threshold and to be abeam Taxiway U prior to Runway 7L arrivals crossing the threshold. Flights departing full length on Runway 7L are blocked until Runway 33L and Runway 33R departures are abeam Taxiway U. Small jets and turboprops departing full length from Runway 33L and Runway 33R do not create sufficient jet blast / prop wash and are not included in the dependencies of the runways.

Runway 33L departures are also dependent on arrivals to JBER Runway 6. Straight-in arrivals to JBER cross directly in the path of these departures. Therefore, when a JBER arrival commences its approach, departures are held until the arrival clears the departure paths for Runway 33L and Runway 33R. Runway 33L departures can be released just prior to Runway 33R departures as the JBER arrival clears the Airport runways from west to east.

Departures from Runway 33L queue and depart from the east side of the runway along Taxiway K. Configuration 1 does not utilize the additional tech stop locations in the WAP as it would create unnecessary delay for those tech stop arrivals to taxi on Taxiway K and wait to cross the north / south runways while departures are queuing along the same taxiway.

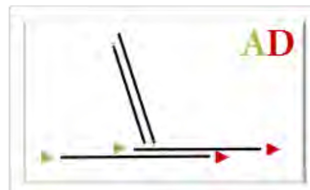
3.4.2 ALTERNATIVE 4 - CONFIGURATION 2

The addition of a new north / south parallel runway adds an arrival runway in Configuration 2. However, arriving aircraft must be staggered for approach to the two parallel runways. Jets and the majority of turboprops arrive on either Runway 15L or Runway 15R. In Visual Flight Rules (VFR) some turboprops arrive on Runway 25R, while in the IFR simulation model all arrivals use Runway 15L. For modeling purposes, runway selection choice between Runway 15R and Runway 15L was given a balanced 50/50 random probability distribution. Runway 15R also blocks all operations on Runway 25L until landing is confirmed, but does not conflict with Runway 25R operations.

Arrivals to Runway 15R and Runway 15L are dependent with arrivals to JBER Runway 6. Straight-in arrivals to JBER interact with arrivals to the Airport and are sequenced in with Airport traffic approximately 6 miles north of the airport. This causes a slight delay to Airport arrivals due to the increased spacing requirements when a JBER arrival is on approach.

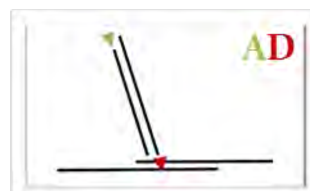
Non-integrated cargo tech stop traffic arriving on Runway 15R will utilize the new refueling positions located on the west side of the runway. In the event all of the new positions are occupied, overflow arrivals will taxi to the R or P positions.

3.4.3 ALTERNATIVE 4 - CONFIGURATION 3



The addition of a fourth runway parallel to the existing Runway 15-33 will have no effect on operations in Configuration 3. All operations occur on Runway 7L and Runway 7R as they do in Alternative 1. Therefore, Alternative 4 / Configuration 3 was not modeled. Delay values for Configuration 3 will be identical to the delay values reported for Alternative 1 / Configuration 3.

3.4.4 ALTERNATIVE 4 - CONFIGURATION 4



In Alternative 1, Configuration 4 was limited to one runway sharing both arrivals and departures. In Alternative 4, the addition of the new runway will allow aircraft to arrive on the outboard Runway 15R, while departures will continue to utilize Runway 15L. As in Configuration 2, non-integrated cargo tech stop traffic arriving via Runway 15R will utilize the new refueling positions located on the west side of the runway. In the event all of the new positions are occupied, overflow arrivals will taxi to the R or P positions.

Arrivals to Runway 15 are dependent with arrivals to JBER Runway 6. Straight-in arrivals to JBER interact with arrivals to the Airport and are sequenced in with Airport traffic approximately 6 miles north of the airport. This causes a slight delay to Airport arrivals due to the increased spacing requirements when an JBER arrival is on approach.

3.5 ALTERNATIVE 5 – WIDELY SPACED RUNWAY

Alternative 5 also introduces a fourth runway to the airfield. This runway would be a north / south parallel runway widely spaced to the west of the existing Runway 15-33 with the centerlines separated by 3,300 feet allowing for independent operations. The existing Runway 15-33 is renamed Runway 15L-33R within this alternative. The Alternative 1 models were used as the basis for this alternative with airspace and ground structure added as needed.

Figure 35 is an airfield graphic with the airfield modifications shown in black. **Figure 36** depicts the link-node structure used in the Simmod *PRO!* model.

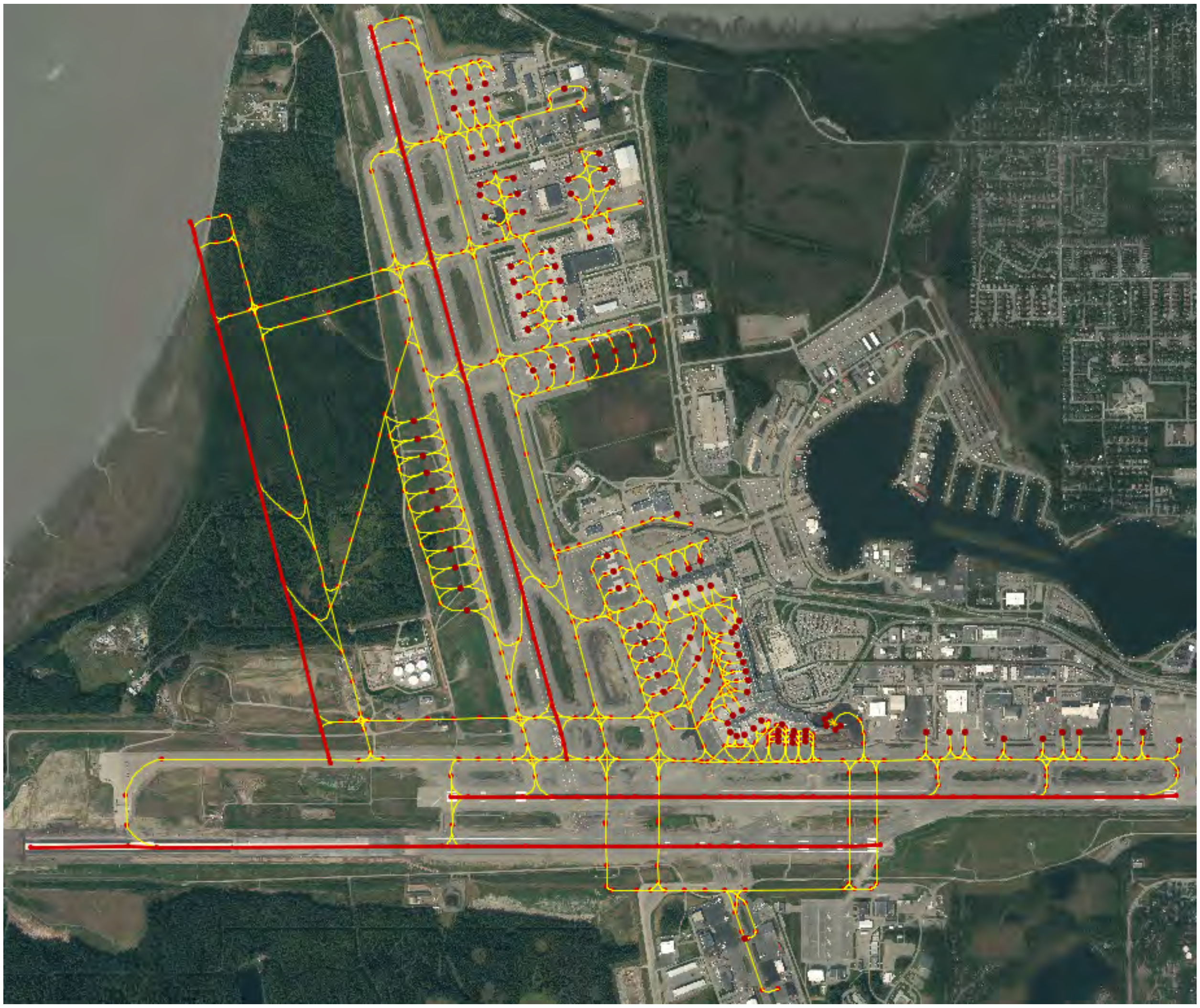
In addition to the modifications to the Airport airfield as specified in Alternative 1, the following changes will be made in Alternative 5:

- A widely-spaced parallel runway to Runway 15-33 added, Runway 15R-33L, with 3,300 feet between runway centerlines, 8,000 feet in length, and Airplane Design Group VI or ADG-VI capable
- A new taxiway east of the new Runway 15R-33L added with high-speed exits; ADG-VI capable
- Diagonal ADG-VI taxiway for use by NAP cargo aircraft for reduced taxi time
- A West Airpark (WAP) created with new Boeing 747-8-capable tech stop positions between the two runways, to be utilized by non-integrated cargo carriers for refueling
- Connector taxiways between the runways on both the north and south sides. The south side connector taxiway is the extension of the existing Taxiway L just north of Taxiway K

Figure 35
Alternative 5 Proposed Modifications to Airfield

Source: HDR, 2014.

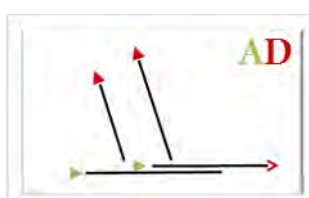
Figure 36
Alternative 5 SIMMOD Link-Node Structure



Source: ATAC, 2013.

3.5.1 ALTERNATIVE 5 - CONFIGURATION 1

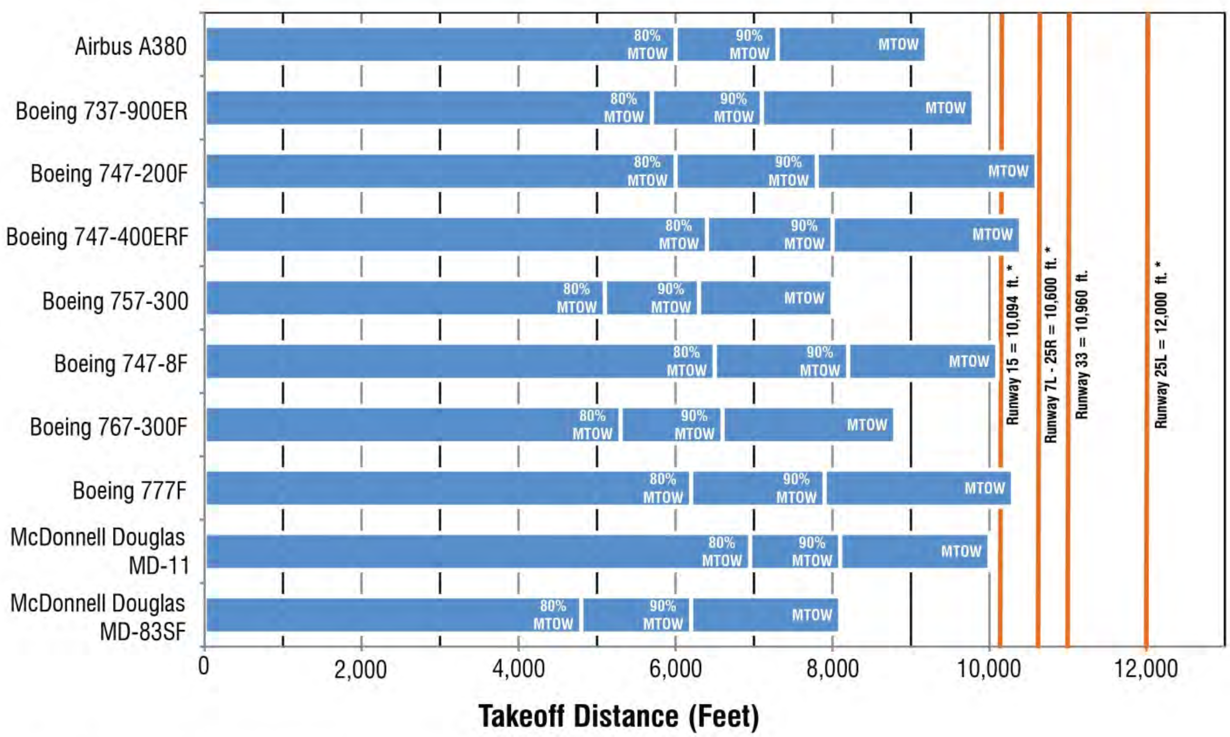
A new parallel north / south runway does not affect arrival operations while in Configuration 1. Arrivals continue as staggered to Runway 7R and Runway 7L. **Section 2.2.2** describes these procedures in detail.



Departure procedures are adjusted to incorporate the additional north / south runway. All jets will depart either Runway 33R or Runway 33L. Southbound jets are assigned Runway 33L and all others to Runway 33R. In order to reduce congestion in the departure queue area for Runway 33R during peak departure periods, jets are allowed to depart Runway 33L regardless of direction of flight. In some instances, heavy jets from the North Airpark (NAP) are able to avoid the Runway 33R congestion area by utilizing the diagonal crossfield taxiway in order to taxi for departure from Runway 33L. However, some heavy jets are unable to utilize the shorter, 8,000 foot runway for departure and must depart on Runway 33R.

Figure 37 presents the runway length requirements for a representative day at the Airport, as presented in the *Ted Stevens Anchorage International Airport 2014 Master Plan Update* report. Based on this graph, and assuming all aircraft do not depart at maximum take-off weight (MTOW), a percentage of use per aircraft model was utilized in the simulation models. If a jet initially assigned Runway 33L was unable to use it based on the percentages shown in **Table 13**, the runway assignment would be changed to Runway 33R. Turboprops utilize either of the parallel north / south runways or Runway 7L as determined by gate location, direction of flight, and avoidance of congestion areas.

Figure 37
Runway Takeoff Distance Requirements



*Accelerate-Stop Distance Available from 5010 Airport Master Record

Source: RS&H, 2014; Airbus and Boeing aircraft planning manuals, 2013.

Table 13
Proposed Percentage of Aircraft able to Utilize 8,000-Foot Runway for Departures

Aircraft Model	Percentage of Use in Model
A380	0
B732	100
B733	100
B734	100
B737	100
B738	100
B739	75
B739ER	75
B742	0
B743	0
B744	50
B748	50
B752	100
B753	100
B763	75
B777	50
MD11	50
MD83	100

Source: ATAC, 2013.

There are several benefits derived from the introduction of the widely spaced second north / south parallel runway in Configuration 1. The most prominent benefit comes with the ability to have simultaneous departures. The placement of the runway in relationship to Runway 7L and Runway 7R also provides benefits with the elimination of departure jet blast dependencies when departures are on Runway 33L and arrivals are utilizing Runway 7L. Arrivals to Runway 7L will be above jet blast created by jets departing from Runway 33L and will cross the threshold beyond the jet blast's range. The Runway 7L and Runway 7R arrival dependencies with Runway 33R remain. However, since a portion of the departure traffic is moved to Runway 33L, the overall delay effect is diminished.

Runway 33L departures are also dependent on arrivals to JBER Runway 6. Straight-in arrivals to JBER cross directly in the path of these departures. Therefore, when a JBER arrival commences its approach, departures are held until the arrival clears the departure paths for Runway 33L and Runway 33R. Runway 33L departures can be released just prior to Runway 33R departures as the JBER arrival clears the Airport runways from west to east.

Runway 33L departures queue along Taxiway K on the east side of the runway. Similar to Alternative 4, in Configuration 1 aircraft do not utilize the additional tech stop locations in the WAP as it would create unnecessary delay for arrivals going to the WAP to refuel. These aircraft would have to taxi on Taxiway K then wait to cross Runway 33R with departures queuing along the same taxiway. Congestion and delay taxi time would also occur with aircraft taxiing south along Taxiway Y and queuing on the west side of Runway 33R.

3.5.2 ALTERNATIVE 5 - CONFIGURATION 2

In Configuration 2, jets and the majority of turboprops arrive either Runway 15L or Runway 15R for Alternative 5. In VFR conditions some turboprop aircraft will arrive to Runway 25R, while in IFR these arrivals are directed to Runway 15L. In all weather conditions, arriving aircraft form two streams. The initial runway assignments would have aircraft arriving from the south or west utilizing Runway 15R and Runway 15L for all others. Depending on the arrival demand, aircraft have the ability to change runway assignment approximately 6 miles from the Airport which would allow for a greater frequency of simultaneous arrivals. Both Runway 15R and Runway 15L block operations on Runway 25R until landing is confirmed, but neither conflict with Runway 25L.

Arrivals to Runway 15R and Runway 15L are dependent with arrivals to JBER Runway 6. Straight-in arrivals to JBER interact with arrivals to the Airport and are sequenced in with Airport traffic approximately 6 miles north of the airport. This causes a slight delay to Airport arrivals due to the increased spacing requirements when a JBER arrival is on approach.

Non-integrated cargo tech stop traffic arriving on Runway 15R will utilize the new refueling positions located on the west side of the runway. In the event all of the new positions are occupied, overflow arrivals will taxi to the R or P positions.

Departures in Alternative 5 / Configuration 2 remain the same as Alternative 1 / Configuration 2, as discussed in **Section 2.2.2** and **Section 3.1.2.**

3.5.3 ALTERNATIVE 5 - CONFIGURATION 3

The addition of a fourth runway parallel to the existing Runway 15-33 will have no effect on operations in Configuration 3. All operations occur on Runway 7L and Runway 7R as they do in Alternative 1. Therefore, Alternative 5 / Configuration 3 was not modeled. Delay values for Configuration 3 will be identical to the delay values reported for Alternative 1 / Configuration 3.

3.5.4 ALTERNATIVE 5 - CONFIGURATION 4

With the addition of a new widely spaced runway, aircraft will be able to better utilize both runways depending on demand in Configuration 4. The primary arrival runway will be Runway 15R, but because simultaneous operations are allowed, during peak arrival periods the parallel runway will be available for arrivals to help reduce delay. Likewise, during peak departure demand, departures will be able to be split between the two runways depending upon direction of flight as well as whether a specific aircraft model is capable of departing from an 8,000 foot runway, as discussed in **Section 3.5.1**.

Non-integrated cargo tech stop traffic arriving on Runway 15R will utilize the new refueling positions located on the west side of the runway. In the event all of the new positions are occupied, overflow arrivals will taxi to the R or P positions.

Arrivals to Runway 15R and Runway 15L are dependent with arrivals to JBER Runway 6. Straight-in arrivals to JBER interact with arrivals to the Airport and are sequenced in with Airport traffic approximately 6 miles north of the airport. This causes a slight delay to Airport arrivals due to the increased spacing requirements when a JBER arrival is on approach.

3.6 ALTERNATIVES - SIMULATION RESULTS

This section is a summary of the delay results for the capacity and demand study at the Airport for the alternatives performed. The metrics used in this study include Average Daily Delay, Peak Hour Delay, and Average Annual Delay.

In order to analyze the impact of an increase in operations, several simulation models were developed for each alternative and configuration at the Airport. However not all operational configurations were modeled for each alternative. **Table 14** shows the various alternatives and configurations considered for analysis. The cells marked with airplanes were modeled; those cells that are grayed out were not. **Table 15** further delineates the models performed for this analysis. Brief descriptions of each alternative follow.

Table 14
Alternatives and Configurations Modeled

Graphic	Alternative	Weather	Schedule	Configuration 1	2	3	4
	Alternative 1 Safety Enhancement	VFR	Baseline	✈	✈	✈	
			Future 1	✈	✈	✈	
			Future 2	✈	✈	✈	
		IFR	Baseline	✈	✈		
			Future 1	✈	✈		
			Future 2	✈	✈		
	Alternative 2 Fairbanks Utilized for Tech Stops	VFR	Baseline				
			Future 1				
			Future 2				
		IFR	Baseline				
			Future 1				
			Future 2				
	Alternative 3 Optimize ANC Procedural Changes	VFR	Baseline				
			Future 1	✈			
			Future 2	✈			
		IFR	Baseline				
			Future 1				
			Future 2				
	Alternative 3A Optimize ANC Eliminate Jet Blast Constraint	VFR	Baseline				
			Future 1	✈			
			Future 2	✈			
		IFR	Baseline				
			Future 1				
			Future 2				
	Alternative 4 New Closely Spaced Runway	VFR	Baseline				
			Future 1	✈	✈		✈
			Future 2	✈	✈		✈
		IFR	Baseline				
			Future 1	✈	✈		
			Future 2	✈	✈		
	Alternative 5 New Widely Spaced Runway	VFR	Baseline				
			Future 1	✈	✈		✈
			Future 2	✈	✈		✈
		IFR	Baseline				
			Future 1	✈	✈		
			Future 2	✈	✈		

Source: ATAC, 2013.
Note: The cells marked with airplanes were modeled; those cells that are grayed out were not.
VFR = Visual Flight Rules , IFR = Instrument Flight Rules

Alternative 1 – 15 models

Configurations 1 (VFR / IFR), 2 (VFR / IFR), and 3 (VFR) were modeled for all three forecast years. Alternative 1 airfield modifications will have no effect on operations in Configuration 4, and therefore was not modeled. Any delay information for Configuration 4 will be identical to the delay information reported earlier in the Existing Airfield – No Action casein **Section 2.4**.

Alternative 2 – 0 models

The AIAS Planning Study concurrently studied Alternative 2, in which 50% of all tech stops, those flights landing at the Airport simply to refuel and then depart, utilize Fairbanks International Airport rather than the Airport. Results from that research will be used and no Simmod *PRO!* models were developed for this study.

Alternative 3 – 2 models

Other than incorporating Alternative 1, Alternative 3 consists of procedural changes rather than physical changes. Modifications to Configuration 1 throughout the daytime hours were done to elevate delay. During peak arrival periods, Runway 15-33 would be used for arrivals in the Runway 15 direction. During peak departure periods, Runway 15-33 would be used for departures in the Runway 33 direction. Since the airport functions with little delay today, the Baseline schedule was not modeled.

Alternative 3A – 2 models

Other than incorporating Alternative 1, Alternative 3A consists of only procedural changes rather than physical changes. Modifications to Configuration 1 throughout the daytime hours were done to elevate delay. Since the airport functions with little delay today, the Baseline schedule was not modeled.

Alternative 4 – 10 models

Incorporating Alternative 1, Configurations 1 (VFR / IFR), 2 (VFR / IFR), and 4 (VFR) were modeled for the two future forecast years. Alternative 4 airfield modifications will have no effect on operations in Configuration 3, and was not modeled. Any delay information for Configuration 3 will be identical to the delay information reported earlier in Alternative 1. Since the Airport functions with little delay today, the Baseline schedule was not modeled.

Alternative 5 – 10 models

Incorporating Alternative 1, Configurations 1 (VFR / IFR), 2 (VFR / IFR), and 4 (VFR) were modeled for the two future forecast years.

Alternative 5 airfield modifications will have no effect on operations in Configuration 3, and therefore was not modeled. Any delay information for Configuration 3 will be identical to the delay information reported earlier in Alternative 1. Since the airport functions with little delay today, the Baseline schedule was not modeled.

Table 15
Simulation Model Runs

Run Number	Alternative	Configuration	Weather	Arrivals	Departures	Demand Level
Calibration	Existing Airfield	1	VFR	7L and 7R	33 and 7L	Baseline
1	Existing – No Action	1	VFR	7L and 7R	33 and 7L	Baseline
2	Existing – No Action	1	VFR	7L and 7R	33 and 7L	Future 1
3	Existing – No Action	1	VFR	7L and 7R	33 and 7L	Future 2
4	Existing – No Action	1	IFR	7R	33 and 7L	Baseline
5	Existing – No Action	1	IFR	7R	33 and 7L	Future 1
6	Existing – No Action	1	IFR	7R	33 and 7L	Future 2
7	Existing – No Action	2	VFR	15 and 25R	25R and 25L	Baseline
8	Existing – No Action	2	VFR	15 and 25R	25R and 25L	Future 1
9	Existing – No Action	2	VFR	15 and 25R	25R and 25L	Future 2
10	Existing – No Action	2	IFR	15	25R and 25L	Baseline
11	Existing – No Action	2	IFR	15	25R and 25L	Future 1
12	Existing – No Action	2	IFR	15	25R and 25L	Future 2
13	Existing – No Action	3	VFR	7L and 7R	7L and 7R	Baseline
14	Existing – No Action	3	VFR	7L and 7R	7L and 7R	Future 1
15	Existing – No Action	3	VFR	7L and 7R	7L and 7R	Future 2
16	Existing – No Action	4	VFR	15	15	Baseline
17	Existing – No Action	4	VFR	15	15	Future 1
18	Existing – No Action	4	VFR	15	15	Future 2
19	Alternative 1	1	VFR	7L and 7R	33 and 7L	Baseline
20	Alternative 1	1	VFR	7L and 7R	33 and 7L	Future 1
21	Alternative 1	1	VFR	7L and 7R	33 and 7L	Future 2
22	Alternative 1	1	IFR	7R	33 and 7L	Baseline
23	Alternative 1	1	IFR	7R	33 and 7L	Future 1
24	Alternative 1	1	IFR	7R	33 and 7L	Future 2
25	Alternative 1	2	VFR	15 and 25R	25R and 25L	Baseline
26	Alternative 1	2	VFR	15 and 25R	25R and 25L	Future 1
27	Alternative 1	2	VFR	15 and 25R	25R and 25L	Future 2
28	Alternative 1	2	IFR	15	25R and 25L	Baseline
29	Alternative 1	2	IFR	15	25R and 25L	Future 1
30	Alternative 1	2	IFR	15	25R and 25L	Future 2
31	Alternative 1	4	VFR	15	15	Baseline
32	Alternative 1	4	VFR	15	15	Future 1
33	Alternative 1	4	VFR	15	15	Future 2
34	Alternative 3	Modified 1	VFR	7L, 7R, and 15	33 and 7L	Future 1

Run Number	Alternative	Configuration	Weather	Arrivals	Departures	Demand Level
35	Alternative 3	Modified 1	VFR	7L, 7R, and 15	33 and 7L	Future 2
36	Alternative 3A	Modified 1	VFR	7L and 7R	33 and 7L	Future 1
37	Alternative 3A	Modified 1	VFR	7L and 7R	33 and 7L	Future 2
38	Alternative 4	1	VFR	7L and 7R	33L, 33R, and 7L	Future 1
39	Alternative 4	1	VFR	7L and 7R	33L, 33R, and 7L	Future 2
40	Alternative 4	1	IFR	7R	33L, 33R, and 7L	Future 1
41	Alternative 4	1	IFR	7R	33L, 33R, and 7L	Future 2
42	Alternative 4	2	VFR	15L, 15R, and 25R	25R and 25L	Future 1
43	Alternative 4	2	VFR	15L, 15R, and 25R	25R and 25L	Future 2
44	Alternative 4	2	IFR	15L	25R and 25L	Future 1
45	Alternative 4	2	IFR	15L	25R and 25L	Future 2
46	Alternative 4	4	VFR	15R	15L	Future 1
47	Alternative 4	4	VFR	15R	15L	Future 2
48	Alternative 5	1	VFR	7L and 7R	33L, 33R, and 7L	Future 1
49	Alternative 5	1	VFR	7L and 7R	33L, 33R, and 7L	Future 2
50	Alternative 5	1	IFR	7R	33L, 33R, and 7L	Future 1
51	Alternative 5	1	IFR	7R	33L, 33R, and 7L	Future 2
52	Alternative 5	2	VFR	15L, 15R, and 25R	25R and 25L	Future 1
53	Alternative 5	2	VFR	15L, 15R, and 25R	25R and 25L	Future 2
54	Alternative 5	2	IFR	15L and 15R	25R and 25L	Future 1
55	Alternative 5	2	IFR	15L and 15R	25R and 25L	Future 2
56	Alternative 5	4	VFR	15L and 15R	15L and 15R	Future 1
57	Alternative 5	4	VFR	15L and 15R	15L and 15R	Future 2

Source: ATAC, 2013.
VFR = Visual Flight Rules , IFR = Instrument Flight Rules

3.6.1 ALTERNATIVE 1 AND EXISTING AIRFIELD RESULTS COMPARISON

The recommend airfield safety changes contained in Alternative 1 were not anticipated to decrease or increase delay for the Airport. To confirm this assumption, Alternative 1 incorporated into the simulation models and compared against the existing airfield. The main concern centered on the removal of the high-speed exits from Runway 7R and Runway 7L, which are utilized 75% of the time annually during Configurations 1 and 3.

Average Daily Delay

Delay is defined as the amount of time above the nominal flight time experienced by each flight due to congestion and required air traffic control spacing. The average daily delay is calculated as the average delay for a group of flights across a 24 hour period. Each of the simulation exercises is run independent of one another for an entire 24 hour period, and the average delay per aircraft is calculated per simulation run. These values are presented in **Table 16**.

The Average Daily Delay is minimal between the existing airfield and Alternative 1. Delay values remain relatively similar in all configurations with only slight variations in delay. Most airports consider capacity to be constrained at 10 minutes of Average Daily Delay. The red highlighted values in **Table 16** indicate times when average daily delay exceeds 10 minutes per aircraft.

Table 16
Average Daily Delay - Existing Airfield versus Alternative 1 Airfield, Simmod Results Overview

Annual Usage												
	Configuration 1			Configuration 2			Configuration 3			Configuration 4		
VFR	62%			20%			3%			3%		
IFR	10%			2%								
Existing Airfield – Average Minutes of Delay Per Aircraft – Full Day												
	Configuration 1			Configuration 2			Configuration 3			Configuration 4		
	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2
VFR	1.9	3.4	8.5	1.3	1.9	3.2	1.6	2.2	5.4	5.4	11.8	41.2
IFR	2.8	5.8	21.6	2.4	5.2	19.6						
Alternative 1 Airfield – Average Minutes of Delay – Full Day												
	Configuration 1			Configuration 2			Configuration 3			Configuration 4		
	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2
VFR	1.8	3.4	9.0	1.4	2.0	4.2	1.6	2.1	4.9	5.4	11.8	41.2
IFR	2.7	5.8	21.4	2.7	5.4	20.1						

Source: ATAC, 2013.
Note: Red highlighted cells indicate average daily delay exceeds 10 minutes per aircraft.

Comparatively, both airfield configurations exceeded the Average Daily Delay metric during the same demand schedule and weather condition with little variation in the delay values. The values in Alternative 1 / Configuration 4 are identical to the values in Existing Airfield / Configuration 4. This is because the required safety changes to the airfield would not affect operations in Configuration 4. Therefore, the delay values from the Existing Airfield simulations were carried down to Alternative 1 in order to calculate Average Annual Delay discussed in a later section.

Average Peak Hour Delay

The peak hour delay metric reports the highest average hourly delay over the 24 hour period for flights that operated in that hour. It represents the average amount of delay experienced by any given flight within the peak hour of delay. **Table 17** compares the peak hour delay per configuration between Existing and Alternative 1 airfields. As mentioned in **Section 2.4.2**, this analysis assumes that peak hour delay exceeding 30 minutes as excessive. In **Table 17**, delay values over 30 minutes are highlighted in red.

Table 17
Average Peak Hour Delay - Existing Airfield versus Alternative 1 Airfield, Simmod Results Overview

	Annual Usage											
	Configuration 1			Configuration 2			Configuration 3			Configuration 4		
VFR	62%			20%			3%			3%		
IFR	10%			2%								
	Existing Airfield – Average Minutes of Delay Per Aircraft – Peak Hour											
	Configuration 1			Configuration 2			Configuration 3			Configuration 4		
	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2
VFR	10.9	17.2	50.4	4.7	7.1	17.0	6.1	8.7	30.9	30.1	60.9	150.6
IFR	16.1	29.2	99.6	15.8	28.3	76.3						
	Alternative 1 Airfield – Average Minutes of Delay Per Aircraft – Peak Hour											
	Configuration 1			Configuration 2			Configuration 3			Configuration 4		
	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2
VFR	9.6	15.5	48.8	6.0	7.9	23.6	5.9	8.9	28.3	30.1	60.9	150.6
IFR	15.4	28.7	99.6	16.7	29.9	79.8						

Source: ATAC, 2013.
Note: Red highlighted cells indicate delay values over 30 minutes.

Both airfield configuration simulations show that during Configuration 4 in VFR, the delay already exceeds the 30 minute threshold at the Baseline activity level, and continues to significantly increase at the Future 1 and Future 2 levels. In VFR, Configuration 1 exceeds the 30 minute threshold at the Future 2 activity level for both airfields. Configuration 3 exceeds the threshold in the Future 2 Existing Airfield simulation and approaches the threshold in the Alternative 1 Future 2 simulation at 28.3 minutes of delay. In IFR, Configurations 1 and 2 exceed the 30 minute threshold at the Future 2 activity level, and both airfield models approach the threshold at the Future 1 activity level. The values in Alternative 1 / Configuration 4 are identical to the values in Existing Airfield / Configuration 4. This is because the required safety changes to the airfield would not affect operations in Configuration 4. Therefore, the delay values from the Existing Airfield simulations carried down to Alternative 1 in order to calculate Average Annual Delay discussed below.

Average Annual Delay

The annual usage percentages shown in **Table 16** are applied to the daily delay values presented in the table to calculate annual delay at the Baseline, Future 1, and Future 2 activity levels. **Table 18** presents the average annual delay for each activity level.

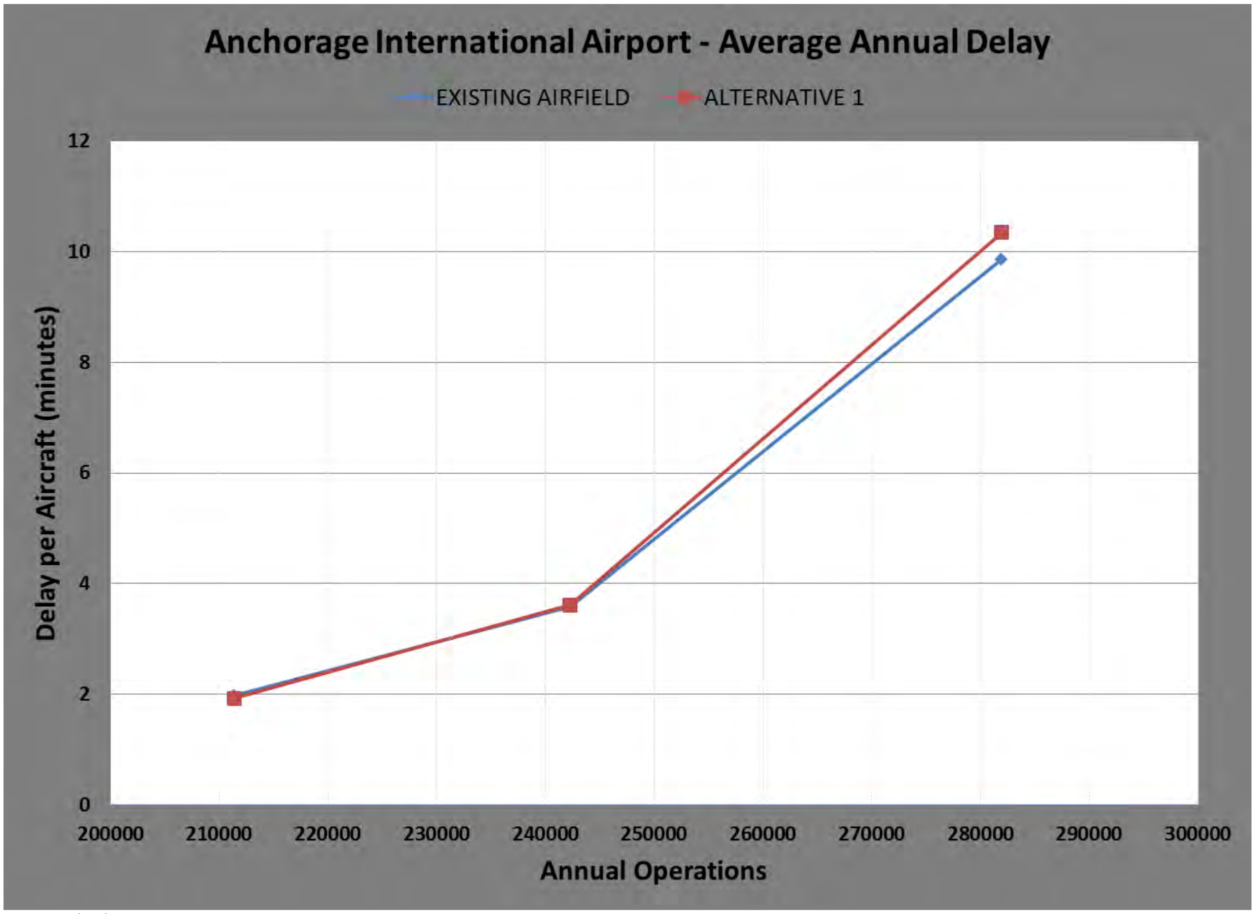
Table 18
Average Annual Delay - Existing Airfield versus Alternative 1 Airfield, Simmod Results Overview

	Average Minutes of Delay (Annualized using Annual %)		
	Baseline	Future 1	Future 2
Annual Operations	211,409	242,275	281,942
Existing Airfield	2.0	3.6	9.9
Alternative 1	1.9	3.6	10.3

Source: ATAC, 2013.

Based on the general assumptions outlined in **Section 2.4.3**, the Airport would begin to experience a delay issue somewhere between the Future 1 and Future 2 demand levels for both airfields, graphically depicted in **Figure 38**.

Figure 38
Average Annual Delay - Existing Airfield versus Alternative 1 Airfield



Source: ATAC, 2013.

3.6.2 ALTERNATIVES RESULTS COMPARISONS

<u>Average Daily Delay</u>

Average Daily Delay alternatives comparisons are presented in **Table 19**.

The values signify the average minutes of daily delay per aircraft over a 24-hour period, and represent the delay results from models that were created per alternative as shown in **Table 14**. Most airports consider capacity to be constrained at 10 minutes of Average Daily Delay. The red highlighted values in **Table 19** indicate times when average delay exceeds 10 minutes of delay per aircraft.

Table 19
Average Daily Delay – All Alternatives, Simmod Results Overview

Annual Usage

	Configuration 1	Configuration 2	Configuration 3	Configuration 4
VFR	62%	20%	3%	3%
IFR	10%	2%		

Average Minutes of Delay Per Aircraft – Full Day

		Configuration 1			Configuration 2			Configuration 3			Configuration 4		
		Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2
Alternative 1	VFR	1.8	3.4	9.0	1.4	2.0	4.2	1.6	2.1	4.9	5.4	11.8	41.2
	IFR	2.7	5.8	21.4	2.7	5.4	20.1						
Alternative 3	VFR		1.7	2.5									
	IFR												
Alternative 3A	VFR		2.1	4.0									
	IFR												
Alternative 4	VFR		2.8	7.2		2.1	4.0					3.3	9.1
	IFR		5.9	21.2		5.4	19.6						
Alternative 5	VFR		2.0	4.7		1.5	2.8					2.1	4.1
	IFR		4.7	18.9		1.6	2.7						

Source: ATAC, 2013.
Note: Red highlighted cells indicate average delay exceeds 10 minutes per aircraft.

Blank cells in **Table 19** represent values that would carry down from Alternative 1 for the same Configuration / Demand Forecast Schedule. Because Alternatives 3, 3A, 4, and 5 would not be implemented until some point in the future, all Baseline Schedule values for these alternatives would be identical to Alternative 1 values. For example, the Alternative 4 / Configuration 2 / Baseline value would be 1.4 average minutes of delay per aircraft, just as it is in Alternative 1 / Configuration 2 / Baseline.

Alternative 1 shows significant daily delay in Configuration 1 IFR Future 2, Configuration 2 IFR Future 2, and Configuration 4 VFR for Future 1 and 2.

Alternative 3 and **3A** would only be applied when the Airport is normally operating in Alternative 1 / Configuration 1. The average daily delay during these times would be significantly reduced in the Future 1 and Future 2 schedules. Alternative 3 and 3A would not have an impact on Configurations 2, 3, or 4.

Alternative 4 shows a significant benefit in Configuration 4. The addition of a second closely spaced parallel north / south runway adds capacity to the Airport in Configuration 4. However, because Configuration 4 is only used 3% of the time annually, the overall impact of the new closely spaced runway is minimized. Alternative 4 / Configuration 1 VFR values drop in both Future 1 and Future 2, but IFR values remain roughly the same, as do the VFR and IFR values in Configuration 2. In Configuration 1 and Configuration 2, IFR values remain roughly the same as in Alternative 1 which would mean the airport would still operate with significant delays 12% of the time annually. In Configuration 1, the addition of a closely spaced parallel runway does not help in IFR. Arrivals are limited to Runway 7R and departures cannot operate simultaneously on Runway 33L and Runway 33R with the jet blast constraints. In Configuration 2, the addition of a closely spaced parallel runway does not help in IFR. Departure operations remain unchanged while arrivals are limited to one runway, Runway 15L.

Alternative 5 provides significant benefit, with decreased daily delay, in all Configuration / Demand Schedule pairs except in Configuration 1 IFR Future 2, which occurs 10% annually. Delay does decrease by 2.5 minutes per aircraft in Configuration 1 IFR Future 2 when compared to Alternative 1. However, the delay still remains over the 10 minute threshold at 18.9 minutes. In Configuration 1, IFR arrivals are still limited to one runway, Runway 7R, and departures, although able to run simultaneously on Runway 33L and Runway 33R, still must abide with jet blast constraints and JBER operations.

Average Annual Delay

Average Annual Delay is the standard metric used to analyze airport capacity analysis. It is a composite number made up of the various daily delay values in each configuration as a factor of how often they occur each year. The annual usage percentages shown in **Table 19** are applied to the daily delay values presented in the table to calculate average annual delay at the Baseline, Future 1, and Future 2 activity levels. **Table 20** presents the average annual delay for each activity level per alternative.

Table 20
Average Annual Delay - All Alternatives, Simmod Results Overview

Average Minutes of Delay (Annualized using Annual %)			
	Baseline	Future 1	Future 2
Annual Operations	211,409	242,275	281,942
Alternative 1	1.9	3.6	10.3
Alternative 3	1.9	2.6	6.3
Alternative 3A	1.9	2.8	7.2
Alternative 4	1.9	3.0	8.2
Alternative 5	1.9	2.2	5.7

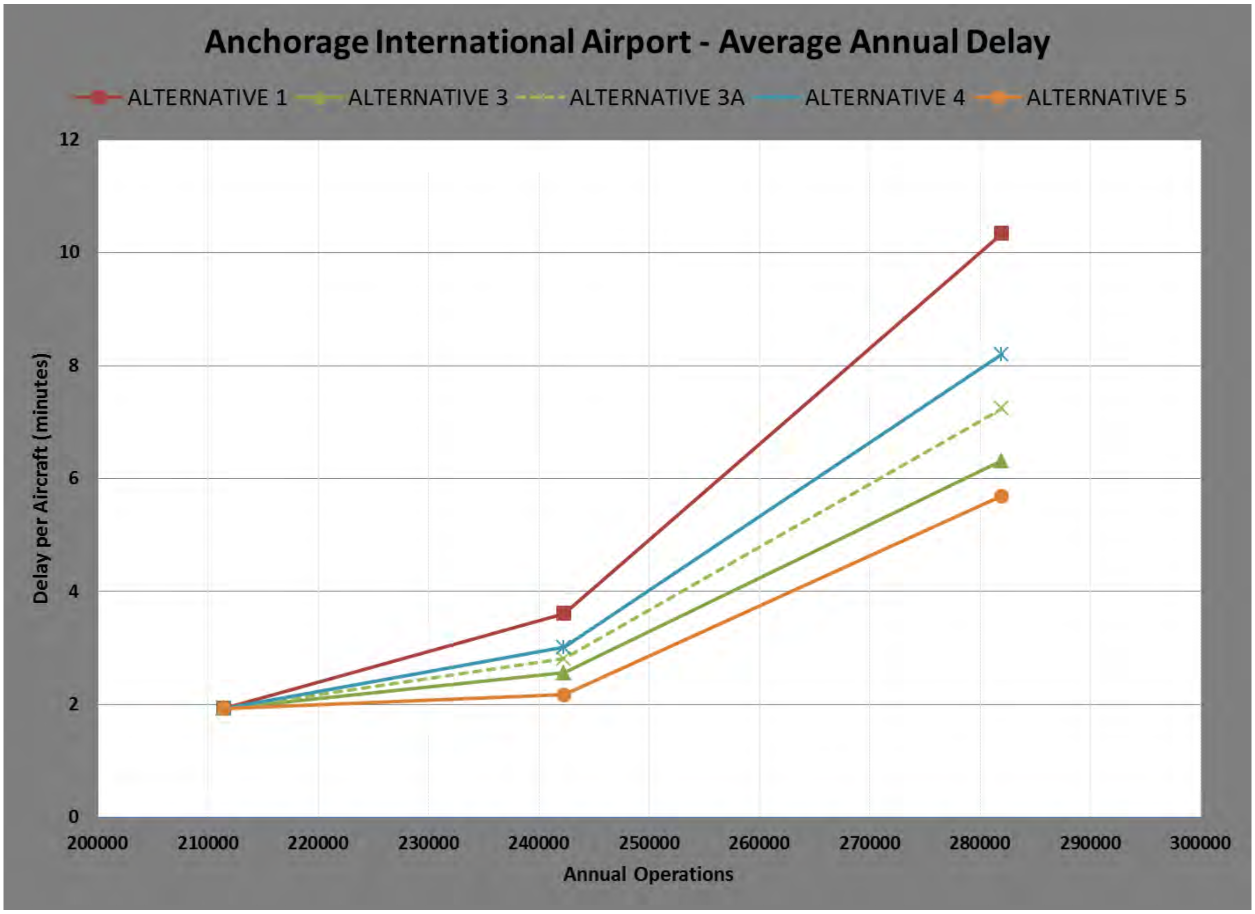
Source: ATAC, 2013.

All blank cells in **Table 19** represent the same values found in Alternative 1 for the individual Configuration / Demand Forecast Schedules. As an example, when calculating Average Annual Delay for Alternative 4, Configuration 3 delays continue to be a factor 3% of the time annually even though the configuration is not affected by the infrastructure changes made in Alternative 4. Therefore, the values applied in Alternative 4 / Configuration 3 are taken from the values produced from the Alternative 1 analysis. Taking this a step further, in the Future 1 schedule, 3% of the time there is an average daily delay of 2.1 minutes per aircraft. This value is then added to the other values from the configuration delay and percentage use calculations comprising Alternative 4, resulting in 3 minutes of Average Annual Delay for the Future 1 demand year.

Average Annual Delay values generally have a significant influence on decisions related to airport infrastructure improvements. Most U.S. airports consider average annual delay values in excess of 8 to 10 minutes per aircraft to be disruptive to the efficient operation of flights. Based on this general assumption, the Airport would begin to experience a delay issue between the Future 1 and Future 2 demand levels under Alternative 1. Alternative 4 would be approaching the threshold at the Future 2 demand level.

Figure 39 projects that Alternative 1 would support the Airport for some time past the Future 1 demand level. To maintain efficiency, either changes to procedures or to infrastructure would likely need to occur somewhere between 260,000 and 270,000 annual operations. At that point Average Annual Delay would begin to exceed the 8-10 minute delay threshold. Infrastructure changes would not necessarily be required at this point as the results of the simulation modeling indicate that Alternatives 3 and 3A would help relieve the airport traffic delays out past the Future 2 demand level.

Figure 39
Average Annual Delay - All Alternatives



Source: ATAC, 2013.

Average Peak Hour Delay

Most airports do not focus on peak hour delay in capacity studies. The Airport, however, is unique due to the critical cargo turnaround time windows. In order for cargo carriers to meet deadlines in other markets, delay values cannot exceed a specific threshold during any given hour. Previous studies have concluded, and local airport personnel have confirmed, that 30 minutes is the threshold of unacceptable delay during the peak hour. This analysis assumes the same threshold for unacceptable delay.

The peak hour delay metric reports the highest average hourly delay over the 24 hour period for flights that operated in that hour. It represents the average amount of delay experienced by any given flight within the peak hour of delay. **Table 21** presents the peak hour delay per configuration per alternative with values over the 30 minute threshold highlighted in red. The data in **Table 21** represents the worst hour of delay within the simulated day. It is also important to identify how many hours exceed the 30 minute threshold throughout the 24 hour period. That data is presented in **Table 22**.

Table 21
Average Peak Hour Delay - All Alternatives, Simmod Results Overview

Annual Usage					
		Configuration 1	Configuration 2	Configuration 3	Configuration 4
	VFR	62%	20%	3%	3%
	IFR	10%	2%		

Average Minutes of Delay Per Aircraft – Peak Hour													
		Configuration 1			Configuration 2			Configuration 3			Configuration 4		
		Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2
Alternative 1	VFR	9.6	15.5	48.8	6.0	7.9	23.6	5.9	8.9	28.3	30.1	60.9	150.6
	IFR	15.4	28.7	99.6	16.7	29.9	79.8						
Alternative 3	VFR		6.4	10.3									
	IFR												
Alternative 3A	VFR		8.4	21.3									
	IFR												
Alternative 4	VFR		12.6	40.5		8.4	23.7					13.9	51.0
	IFR		30.7	95.7		29.8	75.8						
Alternative 5	VFR		8.4	25.1		7.4	22.3					10.7	24.4
	IFR		26.7	92.3		7.7	18.6						

Source: ATAC, 2013.
Note: Red highlighted cells indicate delay values over 30 minutes.

Alternative 1 contains delays over the 30 minute threshold at the Baseline activity level in Configuration 4 only for a single hour period. However, when operations are increased 15%, represented by the Future 1 schedule, delay significantly increases in Configuration 4. There is a peak hour delay of 60.9 minutes and a total of 5 hours during the day that exceed the 30 minute threshold. The Future 1 demand in Alternative 1 for Configurations 1 and 2 in IFR nearly meet the delay threshold at 28.7 and 29.9 minutes respectively. At the Future 2 demand, delay is over the 30 minute threshold in almost every configuration: Configuration 1 (VFR and IFR), Configuration 2 (IFR) and Configuration 4 (VFR). The total number of hours exceeding the threshold in each of these configurations is 5 hours or greater. Alternative 1 / Configuration 4 at the Future 2 demand level is above 30 minutes of hourly delay for 15 of the possible 24 hours.

Both **Alternative 3** and **Alternative 3A** would cut peak hour delay in half while operating in Configuration 1 VFR at the Future 1 demand level. It would also eliminate peak hour delay above the 30 minute threshold at the Future 2 demand level in VFR conditions. However, Alternatives 3 and 3A do not provide relief to the other configurations at any demand level.

Alternative 4 significantly reduces the peak hour delay in Configuration 4 at the Future 2 demand level. Delay decreases from 150.6 minutes in the peak hour in Alternative 1 down to 51.0 minutes in the peak hour in Alternative 4. The total number of hours that exceed the 30 minute threshold also decreases significantly from 15 hours a day down to just 3 hours. However, as described in the discussion on Average Daily Delay, Alternative 4 is only utilized 3% of the time annually. With the operational constraints related to closely spaced parallel runways in IFR, there was no delay improvements observed in Configurations 1 or 2.

Alternative 5 produces significant savings in all configurations at all demand levels except Configuration 1 IFR. The jet blast operational constraints required in Configuration 1 continue even with an additional widely spaced runway.

Table 22
Total Number of Hours Operating Above 30 Minute Delay Threshold - All Alternatives, Simmod Results Overview

		Number of Hours Above 30 Minute Hourly Delay Threshold											
		Configuration 1			Configuration 2			Configuration 3			Configuration 4		
		Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2	Baseline	Future 1	Future 2
Alternative 1	VFR	0	0	5	0	0	0	0	0	0	1	5	15
	IFR	0	0	9	0	0	9						
Alternative 3	VFR		0	0									
	IFR												
Alternative 3A	VFR		0	0									
	IFR												
Alternative 4	VFR		0	3		0	0					0	3
	IFR		2	9		0	9						
Alternative 5	VFR		0	0		0	0					0	0
	IFR		0	9		0	0						

Source: ATAC, 2013.
Note: Red highlighted cells indicate delay values over 30 minutes.

SECTION 4
ALTERNATIVES - SUMMARY OF FINDINGS

4.1 ALTERNATIVE 1

Comparing to the Existing Airfield, Alternative 1 showed no significant changes in any of the metrics studied. Delay values remain roughly equivalent in all configurations with only slight variations between values.

The Existing Airfield and Alternative 1 results indicate that Ted Stevens Anchorage International Airport (Airport) will begin to operate less efficiently and will reach significant levels of delay at some point between the Future 1 and Future 2 demand levels. This equates to approximately 260,000 to 270,000 annual operations. Peak Hour Delay results indicate that in Configuration 4 Visual Flight Rules (VFR) delay levels exceed 30 minutes of delay at the Baseline traffic demand. This peak hour delay becomes exponentially worse as future operation levels increase. Additionally, the peak hour delay threshold in Configuration 1 (VFR and Instrument Flight Rules [IFR]) and Configuration 2 IFR is surpassed at the Future 2 demand level. The results indicate that approximately 75% annually at the Future 2 demand level, the airfield will operate beyond the acceptable delay threshold value.

4.2 ALTERNATIVE 2

The *2013 Alaska International Airport System Planning Study*, concurrently examined, has effectively concluded that there would be reduced delay resulting from the transfer of 50% of non-integrated tech-stop operations from the Airport to Fairbanks International Airport.

4.3 ALTERNATIVE 3 AND 3A

Alternatives 3 and 3A have demonstrated that prior to infrastructural changes made to the Airport airfield, changes to operational procedures would benefit the airport for some time. This assumes that Configuration 1 remains the preferred operating configuration while operating with the Alternative 3 assumptions 62% of the time.

Alternative 3 and 3A are modifications to Configuration 1 and can only operate in VFR conditions. Due to this Alternative 3 and 3A have no impact on any other configuration.

4.4 ALTERNATIVE 4

Alternative 4 has the greatest impact when operating in Configuration 4. However, this configuration accounts for only 3% of the time, annually. Alternative 4 realizes a slight decrease in delay in Configuration 1 VFR, but no noticeable improvement to IFR delays in either Configuration 1 or Configuration 2.

4.5 ALTERNATIVE 5

Alternative 5 demonstrates the largest delay decrease of all the alternatives. The addition of a widely spaced parallel north / south runway at the Airport results in efficient operations for most configurations at the Airport. Peak Hour Delay decreases below the 30 minute threshold 90% of the time with only Future 2 Configuration 1 IFR values unchanged from Alternative 1 values. However, in the event that the annual percent usage could be modified allowing for a higher usage of Configuration 2 in future years, the Airport could operate below all delay thresholds well into the future.