DRAFT: DIVERSION STUDY

Winter Storm Efficiency Study

Alaska International Airport System

March 2025

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Alaska Department of Transportation

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1.0 INTRODUCTION

Significant weather events in 2024 resulted in operational disruptions at both Alaska International Airport System (AIAS) airports: Ted Stevens Anchorage International Airport (ANC) and Fairbanks International Airport (FAI). In one event, snow fell at ANC at a more intense rate and for a longer duration than forecast for the overnight hours between January 28th and 29th. An imbalance in the hourly aircraft arrival and departure rates, with arrivals outpacing departures, resulted in parking shortages, the issuance of an arrival restriction, and the unplanned diversion of 30 aircraft. Eighteen of those aircraft diverted to FAI, which can accommodate up to 23 aircraft. However, unusually cold temperatures in Fairbanks led to aircraft mechanical problems, and the influx of aircraft exceeded the capabilities of ground handlers serving carriers at FAI.

This study is designed to help inform AIAS's winter weather operating decision-making process considering, both quantitatively and qualitatively, the costs and benefits of several aircraft accommodation scenarios under operating conditions similar to those experienced at ANC in January 2024. In this study, ANC and FAI are considered to work as a system, affected differently by weather, as is normally the case, with FAI providing a capable diversion option for affected ANC flights.

2.0 ANC AIRPORT USERS

User Type	Example	Business Description	Primary Uses of ANC
Integrated Cargo Airlines (Global)	FedEx, UPS	Door-to-door worldwide cargo services.	Technical services. Cargo onloading, offloading, and transfer. Crew changes.
All-Cargo Airlines (Global)	Atlas, Kalitta, China Airlines	Worldwide cargo services generally relying on freight-forwarding services.	Technical services. Minimal cargo transfer. Crew changes.
All-Cargo Airlines (Local)	Alaska Cargo Express, Lynden Air Cargo	Cargo services generally to, from, and within Alaska.	Business base. Cargo onloading and offloading.
Network Passenger Airlines (Global)	Alaska Airlines, Delta Air Lines	Passenger services across a broad global network.	Passenger carriage to, from, and connecting at ANC.
Passenger Airlines and Air Taxis (Local)	Grant Aviation, Kenai Aviation	Passenger services (including Essential Air Service) generally to, from, and within Alaska.	Business base. Carriage of passengers to, from, and connecting at ANC. Essential air services.
Medevac Providers (Local)	LifeMed Alaska, Guardian Flight	On-demand air ambulance services with aircraft based at ANC.	Business base. Ambulance service provision to/from ANC and other locations.
Private Users	Corporate, Individuals	Independent	Various
Aircraft Not Destined for ANC (Global)	All types	All types	Flying between non-ANC points, but relying on ANC as a diversion point for flight planning.

Table 1: Descriptions of ANC Users. Source: DOWL Team.

ANC serves a broad range of users with diverse business models and needs. Table 1 shows groupings and descriptions of ANC's users. Global users of the airport generally operate longer flights, often across several time zones, and require longer lead times for flight planning adjustments. Conversely, local users generally operate shorter routes and require less advance notice of adverse conditions to adjust their operations. However, local users often operate multiple flights in and out of ANC on a given day, and delays affecting one flight segment can have downline effects on other flights served by the same aircraft.

Figure 1 presents three examples of routings operated by aircraft using ANC, reflecting inbound and outbound service to and from ANC on a representative day. Aircraft A represents an aircraft operated by a local cargo or passenger carrier which operates five flights between Kenai Municipal Airport (ENA) and ANC. Aircraft B represents an aircraft operated by a network passenger airline on a roundtrip between Seattle–Tacoma International Airport (SEA) and ANC. Aircraft C represents a transpacific flight operated by a global cargo integrator or all-cargo carrier.

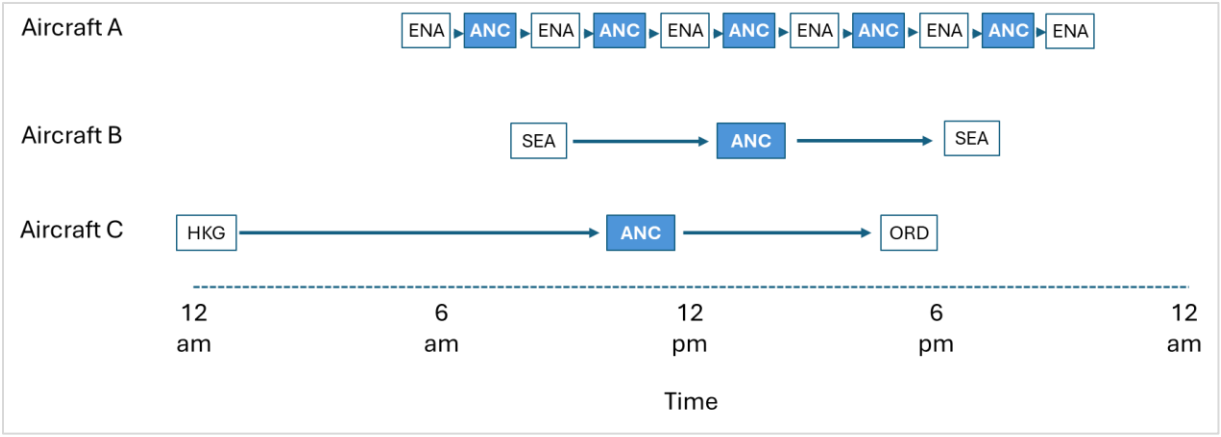

Figure 1: Example Aircraft Routings on a Single Day. Source: DOWL Team.

Global all-cargo airlines generally operate flights similar to those illustrated by Aircraft C and spend little time on the ground, often one time per day, to refuel and change crews. By contrast, local cargo and passenger aircraft (Aircraft A) generally operate multiple daily shorter flights to and from ANC. The time on the ground at ANC can be short, but cumulative ground time and overnight hours (if remaining overnight at ANC), or consolidation of flights (canceling one or more trips and consolidating passengers on those remaining flights), can provide opportunities for disruption recovery. Table 2 presents metrics for each user group on a representative day in December 2024.

User Type	Example	% of ANC Daily Arrivals	Average Flight Time (Hours)	Average Hours on Ground
Integrated Cargo Airlines (Global)	FedEx, UPS	14	7.0	4.3
All-Cargo Airlines (Global)	Atlas, Kalitta, China Airlines	30	8.0	1.7
All-Cargo Airlines (Local)	Alaska Cargo Express, Lynden Air Cargo	11	1.9	7.2
Network Passenger Airlines (Global)	Alaska Airlines, Delta Air Lines	19	2.7	3.2
Passenger Airlines and Air Taxis (Local)	Grant Aviation, Kenai Aviation	20	1.0	5.4
Medevac Providers (Local)	LifeMed Alaska, Guardian Flight	4	1.6	11.3
Private Users	Corporate, Individuals	2	2.5	9.3

Table 2: Selected Schedule Metrics of ANC Users on a Representative Winter Day in 2024. Source: DOWL Team analysis of activity on December 10, 2024.

3.0 OVERVIEW OF DISRUPTIONS AND COSTS

These users depend on access to ANC's facilities to support the safe, reliable, and efficient flow of passengers, medical patients, and cargo. Global cargo carriers traversing the Pacific Ocean between Asia and North America rely on a stop in ANC to enable en route refueling. This allows for a greater volume of cargo to be carried than would otherwise be possible if enough fuel were carried to complete the flight without a stop. Any breakdown in access to these services could have wide-reaching impacts on these users, the customers who depend on their services, and airport staff. Breakdowns can come in the form of delayed, canceled, or diverted flights. Direct impacts can include:

- *Delayed or Diverted Crews*: Delays or diversions can cause schedule and routing disruptions for aircraft crews (pilots or other required members). Global integrators and all-cargo operators change crews at ANC to support the efficient scheduling of personnel and to comply with carrier crew service rules. For example, a Cathay Pacific flight between Hong Kong International Airport (HKG) and Chicago O'Hare International Airport (ORD) has a stop and crew change at ANC. In the event of a diversion to FAI, with the aircraft then continuing its journey without a stop at ANC, a crew would have to be ferried between ANC and FAI, potentially causing delay and additional expense.

- *Disruption to the Efficient Flow of Aircraft*: Aircraft are expensive assets and, particularly for commercial operators, are scheduled to serve passengers or cargo with minimal downtime except to accommodate necessary maintenance. Delays or diversions

causing schedule disruptions can require scheduling adjustments that may include flight cancellations, or a redirection of other aircraft across route networks to substitute for the affected aircraft. Longer operating times, for example due to long ground times, decrease the efficient use of aircraft and increase the cost of service above that for a non-impacted itinerary.

- *Passenger Delays, Diversions, or Cancellations*: Five types of passenger itineraries are generally served at ANC in the winter months. These include passengers:

    - Flying between ANC and another point with no stops. For example, ANC to SEA or ANC to ENA.

    - Flying between ANC and another point with a connection. For example, ANC to ORD with a connection at SEA.

    - Flying between two points with a connection at ANC. For example, ENA to SEA with a connection at ANC.

    - Flying between two points with connections at ANC and another airport. For example, ENA to ORD with connections at ANC and SEA.

    - Flying between two points with a connection at ANC and several other airports. For example, Fort Yukon Airport to ORD with connections at FAI, ANC, and SEA.

  Passenger itineraries, especially those requiring connectivity to points in the lower 48 states which have less robust service in winter months, rely on seamless connectivity between flights that, if disrupted, could cause breaks in those itineraries. This may lead to passenger cancellations or delays.

- *Cargo Delays, Diversions, or Cancellations*: Cargo shipments follow similar itineraries to those used by passengers. In fact, a portion of cargo shipments are served by passenger aircraft in the belly-hold sections of those aircraft. Any disruption in the ability of air carriers to operate on time can lead to delayed or canceled shipments of goods.

- *Medical Patient Delays, Diversions, or Cancellations*: Any disruption in medevac services can lead to delays or cancellation of patient treatment or care.

- *Disrupted Planning for En Route Aircraft*: Airport access is important for the planning of aircraft operations not intending to depart from or land at that particular airport if it is relied upon as an alternate on another journey. This can include:

    - Routings requiring an alternate airport for mechanical or operational disruptions.

    - Routings requiring unanticipated medical services at an alternate airport.

  ANC is used for these purposes, and an inability for flight operations to select the airport for these reasons can impact airline planning, flight execution, and passenger safety.

- *Airport Staffing Disruptions*: Prolonged operational disruptions requiring staffing outside of normal schedules can lead to reduced levels of staffing and an inability to provide

services to airport users. This includes actual airport staff and non-airport staff (such as outside ground handlers).

These disruptions, while not unique to Alaska's airports, do have a disproportionately high likelihood of impact there, given the unique and diverse group of users and markets that the airports serve. Many small Alaskan communities rely on limited air service by smaller local carriers for the flow of goods and passengers. The global economy relies on the timely and cost-efficient flow of goods across a network of all-cargo carriers and integrators. These global carriers rely on the geographical advantage offered by ANC, which allows them to operate with reduced fuel loads and greater capacity for goods.

4.0 REVIEW OF JANUARY 2024 SNOW EVENT

The winter weather event that occurred on January 28th and 29th, 2024 was characterized by unusually heavy and intense periods of snow, lower than normal temperatures (in both ANC and FAI), and an inaccurate forecast of weather conditions. ANC received 17 inches of snow during those two days despite National Weather Service (NWS) forecasts of no snow three days prior to the event, and for four to six inches of snow forecast early on the morning of January 28th. Snowfall began at 1:10 pm on the 28th, and the NWS issued an additional advisory at 3:20 pm indicating between 7 and 13 inches to fall that evening and overnight. Snowfall was most intense between 3:00 pm on the 28th and 3:00 am on the 29th, but many flights, especially the longer-haul flights operated by all-cargo and integrator users, were already in flight when the severity of the event started to become clearer. As the severity of the weather event was unknown prior to departure for many flights, disruption mitigation options were limited. Figure 2 shows the actual snowfall amounts across the two days beside the NWS forecast amounts.

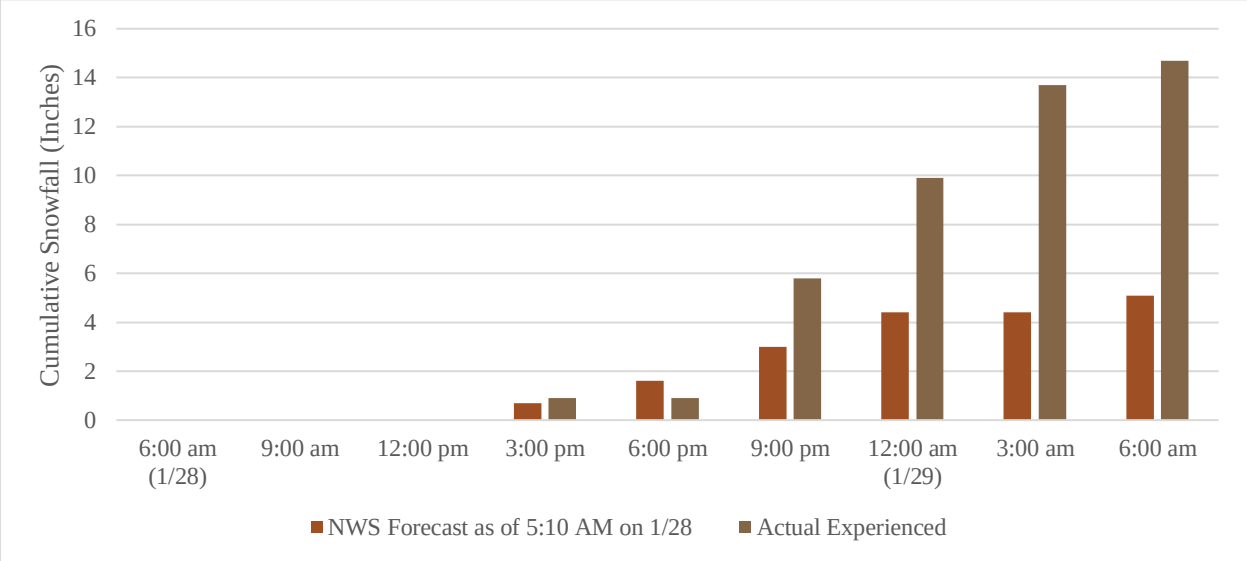

Figure 2: Forecast and Actual Cumulative Snowfall Amounts at ANC. Source: Weather Summary January 28th–29th, 2024 Storm Review, NWS, Anchorage, Alaska.

ANC remained open throughout the snow event, although an arrival restriction for large aircraft, except for those operated by FedEx and UPS, was issued through a Notice to Airmen (NOTAM) at 7:30 pm on the 28th to be effective at 8:30 pm. Restrictions were issued due to parking congestion in airport-administered spaces resulting from a domino effect aggravated by snow

intensity, longer turnaround times, short holdover times, and cancellations for carriers using those spaces.

Carriers assigned to airport-administered parking experienced an imbalance in arrivals and departures that was more pronounced than usual. Figure 3 illustrates the cumulative balance of arrivals less departures for global all-cargo carriers using airport-administered parking over the period between 12:00 am on the 28th and 3:00 pm on the 29th compared to the same time frame one week earlier. The imbalance that occurred over January 28th and 29th was an anomaly, as illustrated in Figure 4, which presents the cumulative balance of arrivals less departures by day (in three-hour intervals) at ANC for this same group of cargo carriers for the entire month of January 2024.[1] This imbalance led to an unusually high number of cargo aircraft on the ground during the snow event. Figure 5 presents the estimated global all-cargo aircraft on the ground at ANC during the snow event contrasted with the number of available airport-administered parking spaces. While a portion of these aircraft may have been accommodated at other parking locations (for example, the UPS ramp), parking at ANC remained constrained for a 24-hour period starting at 3:00 pm on January 28th. Those global all-cargo aircraft that did arrive seeking airport-administered parking remained on the ground for a prolonged period. Over 30 aircraft arrived between 12:00 pm and the start of the arrival restriction on January 28th, with an average time on the ground at ANC of nearly 20 hours, compared to an average of 2.2 hours on the ground the previous day.

[1] This is similar information as that shown in Figure 3, except the cumulative measurement starts on January 1st for the depiction in Figure 4. For Figure 3, the measurement starts on January 28th. As a result of the different starting points, slight differences appear in the peak amounts between the charts without affecting the conclusions of either chart.

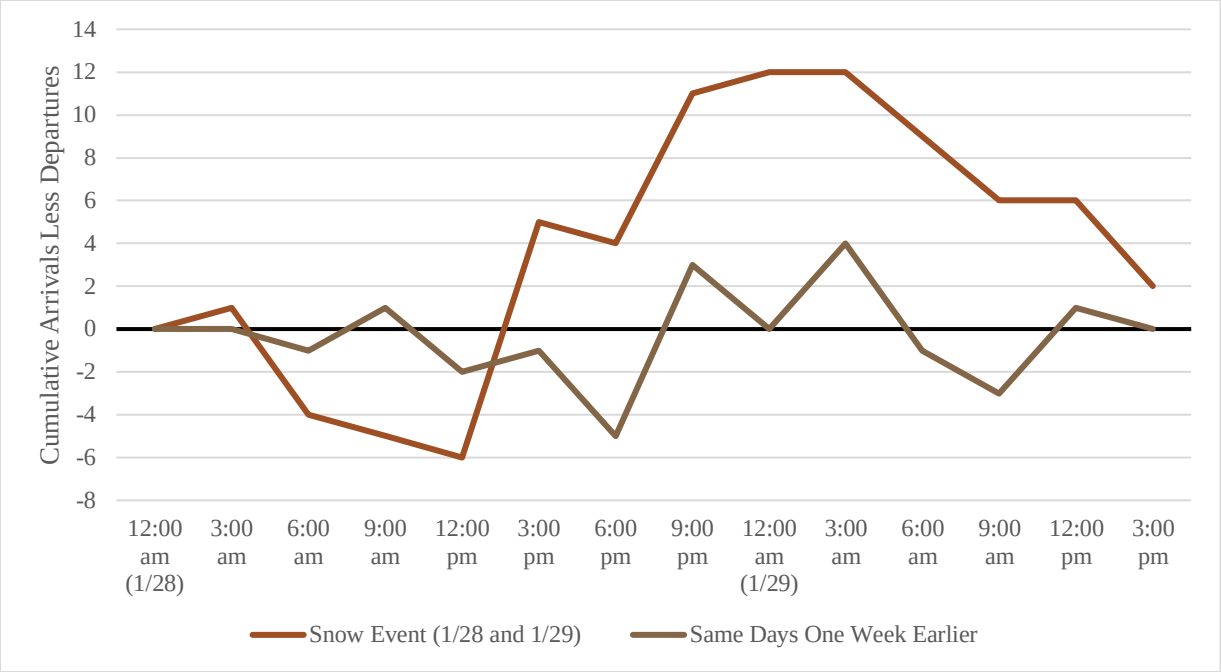

Figure 3: Cumulative Arrivals Less Departures of Global All-Cargo Aircraft on January 28th and 29th, 2024 (Excluding UPS and FedEx). Source: FAA CountOps data.

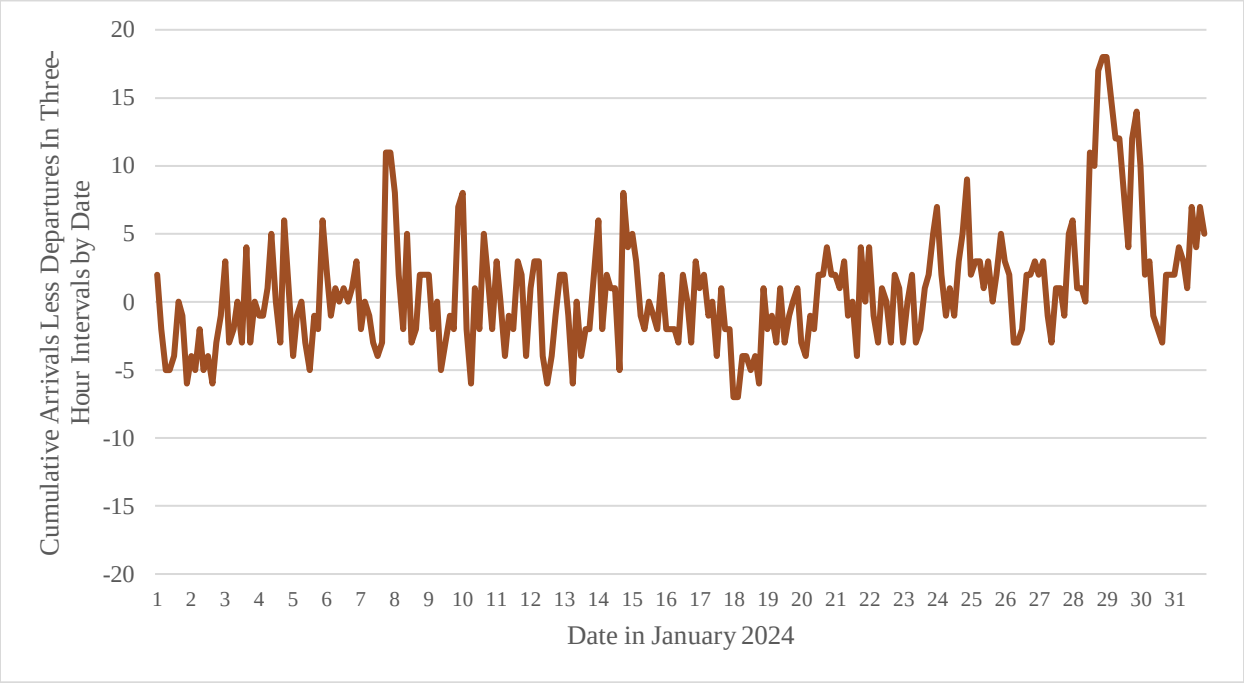

Figure 4: Cumulative Arrivals Less Departures of Global All-Cargo Aircraft in January 2024 (Three-Hour Intervals, Excluding UPS and FedEx). Source: FAA CountOps data.

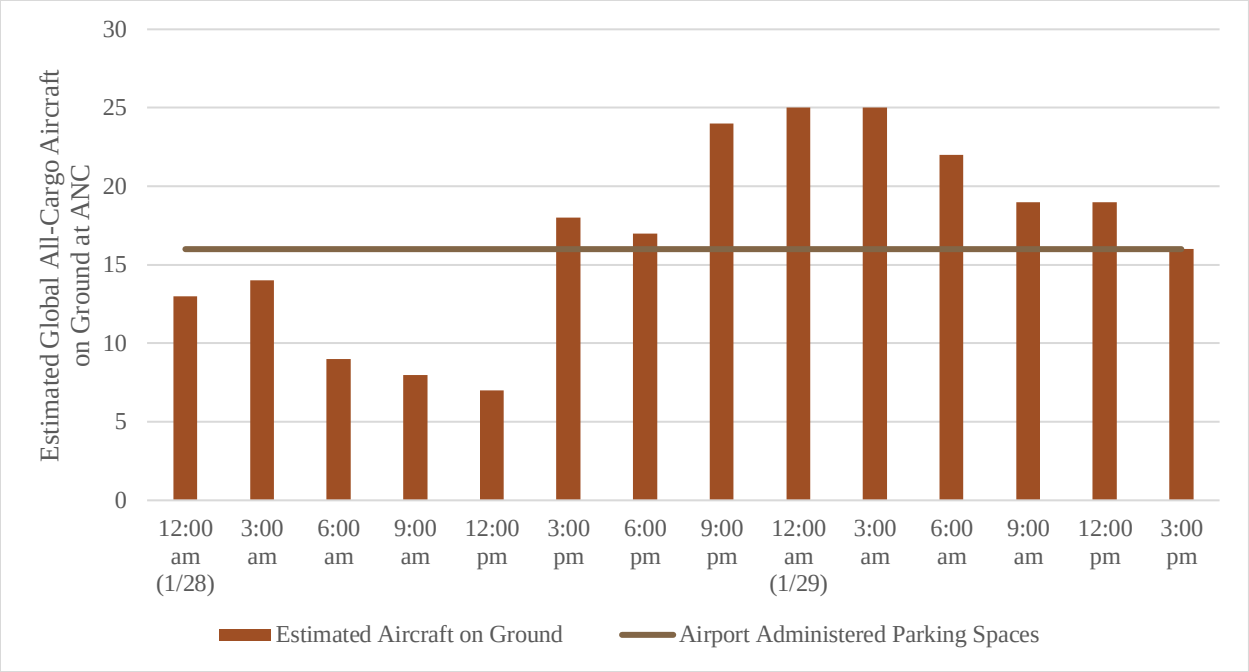

Figure 5: Estimated Global All-Cargo Aircraft on the Ground at ANC (Excluding UPS and FedEx). Note: Not all operations required airport-administered parking. Source: FAA CountOps data.

At FAI, which received 18 diversions from ANC, unusually cold weather persisted. Figure 6 shows the average weekly temperature at FAI in the last week of 2024 compared to the same week over the ten years from 2016 to 2025.

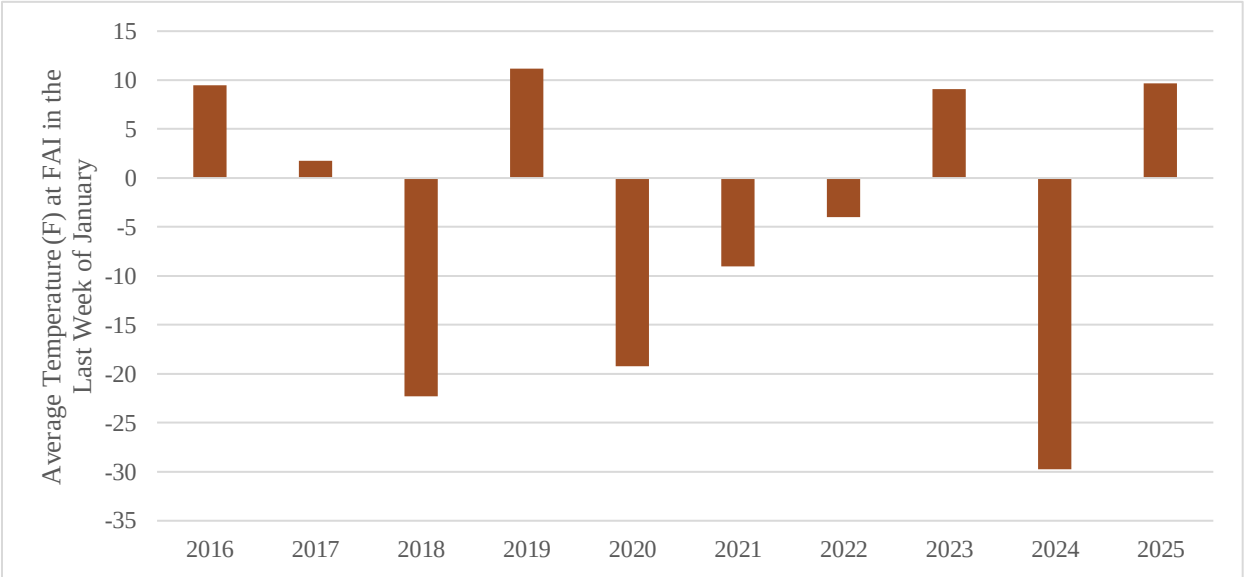

Figure 6: Average Temperature at FAI in the Last Week of January. Source: Weather Underground.

For reasons unrelated to the operation of FAI, long ground times occurred for diverted aircraft. Analysis of Federal Aviation Administration (FAA) diversions data indicates that during the January 2024 weather event, ground times for diverted global all-cargo aircraft averaged nearly two days (or 1.3 days if two likely mechanical events are excluded). This compares to several other transpacific journeys in the January and February 2024 time frame that diverted from ANC to FAI due to weather to spend approximately three hours on the ground before departing to their intended destinations in the lower 48 states.

5.0 OBJECTIVES OF THE ANALYSIS

The January 2024 snow event was notable for the storm's unpredictability, intensity, and duration, nearly no holdover time for deiced aircraft, and the longer turnaround times for many global all-cargo airlines leading to extensive parking congestion, arrival and departure delays, and diversions for these carriers at ANC. Other airport users were generally unaffected beyond what would be expected in severe weather, since ANC's runways remained open, including Runway 33 for departures and both 7L and 7R for arrivals.

AIAS is considering a range of options for accommodating all-cargo aircraft with the intention of helping to ease congestion and operational disruptions during future winter weather events. The objective for this analysis is to identify the tradeoffs for AIAS and airport users of options to accommodate various levels of arrivals, under different parking availability scenarios. Of particular interest is the incremental impact that could occur under situations requiring the closure of Runway 7L, as it is assumed that, similar to the January 2024 event, other airport users would be unaffected by AIAS parking decisions if Runways 33, 7R, and 7L remained open and taxi routings remained available to gates and tenant leaseholds.

Assumptions of airport-administered parking spaces made available by ANC were derived generally considering several options presented by AIAS in its *Draft ANC Winter Contingency Parking Concepts for Airport-Administered Parking Spaces* document.

It is important to stress that decisions and outcomes can take many forms depending on a range of variables including:

- Parking space availability and configuration.
- Arrival and departure demand throughout the day.
- Airline decisions to adjust operations themselves rather than being fully directed by AIAS decisions regarding parking availability.
- The duration and intensity of the winter snow event.

This study modeled a fraction of the possible scenarios. However, the scenarios that were modeled yielded insights into the possible effects of various combinations, and a framework for evaluating future events.

6.0 APPROACH TO THE ANALYSIS

Scenario development and modeling started with an assessment of the current daily winter demand at ANC. A representative daily schedule of operations at ANC was assembled through multiple data sources indicating the arrivals and departures on December 10, 2024. That day was selected to show a current schedule of winter operations on a relatively normal weather day. Arrival and departure times were captured for each user along with other pertinent information including:

- Specific airline or user.
- Originating airport of arrivals and destination airport of departures.
- Aircraft type.

From this information, a complete journey profile, including arrival and departure times at upline and downline airports, was developed for each flight to and from ANC. Flight operations were designated by user type as defined in Table 1, then identified by parking area used at ANC. This schedule served as the baseline case of aircraft operations for the analysis.

Assumptions on the number of airport-administered parking spaces, specifically those capable of accommodating large cargo aircraft, were developed through information provided by AIAS, including the *Draft ANC Winter Contingency Parking Concepts for Airport-Administered Parking Spaces* document. For the purposes of this analysis, it was assumed that, as was the case during the January 2024 event, flights operated by UPS and FedEx would not use airport-administered spaces and could all be accommodated in their leased areas. Scenarios were considered in two groupings using separate assumptions regarding Atlas's operations:

1. The majority of flights operated by Atlas would be accommodated in preferentially-leased spaces or in spaces leased from UPS. The proportion of Atlas's operations using airport-administered spaces was guided by airport-provided data reflecting flight operations in October 2024, the first month of Atlas's seasonal preferential hardstand lease.
2. A larger percentage of Atlas's flights would require airport-administered spaces, potentially due to the unavailability of spaces leased from UPS.

The number of airport-administered parking spaces capable of accommodating large cargo aircraft accounted for spaces set aside to accommodate irregular or special operations, such as international diversions, passenger flights requiring Customs and Border Protection services, or to accommodate snow removal. The primary assumptions related to ANC parking include:

- After accounting for seasonal preferential uses, prioritization for irregular and special use operations, and snow removal planning, ANC has 15 ramp parking spaces available to accommodate large cargo aircraft.
- AIAS can also accommodate parking for up to 11 additional large cargo aircraft on taxiways without runway disruption.

- Any additional aircraft parking accommodation would be on Runway 7L, resulting in its closure.

- Aircraft would only park in contingency parking locations if the departure flow slowed to the point that arriving aircraft could no longer hold on taxiways without interference with taxi routes to and from gates and tenant leaseholds.

The baseline daily schedule specific to the global all-cargo aircraft operations generating demand for these airport-administered spaces was isolated, and operations were modeled across the representative day reflecting various stages: before departure for ANC, in flight to ANC, arriving at ANC, parked, departing ANC, and in flight outbound from ANC under normal operating circumstances. To model scenarios illustrating the effects of a severe weather event on the baseline flow of these aircraft, a reduction in the hourly departure rate was estimated based on the experience of the January 2024 event. These reduced rates were applied to the baseline schedule of departures, creating an imbalance between arrivals and departures resulting in an increased demand for parking space during the weather event. Departure rates were modeled to immediately improve after the weather event, thus clearing the parking backlog, unlike in January 2024 when aircraft remained at ANC for extended periods.

Specific scenarios were developed to reflect different options and availability for parking:

- 15 spaces, all located on ramp space.

- 23 spaces, including eight on taxiways, similar to AIAS Phase 0 in the draft contingency parking concepts.

- 26 spaces, including 11 on taxiways, similar to AIAS Phase 2. It was assumed that because of the low departure flow modeled, no additional aircraft would hold on taxiways.

- 34 spaces, requiring closure of Runway 7L. It was also assumed that a reopening of Runway 7L would require an additional 12 hours beyond the period needed for parking.

In addition to the assumptions on available parking spaces and parking configurations, two assumptions of Atlas's use of airport-administered spaces were tested:

- 5 of 28 operations (comprised of an arrival and a departure) require airport-administered spaces, selected as a meaningful volume of operations for modeling and similar to its use in October 2024.

- Approximately two-thirds of Atlas's flights require airport-administered spaces, assumed to be due to the unavailability of other spaces.

Scenario	Parking Spaces	Atlas Assumption	Comment
Scenario 1	15	Lower Use	
Scenario 2	23	Lower Use	
Scenario 3	26	Lower Use	
Scenario 4	34	Lower Use	Runway 7L Closed
Scenario 5	15	Higher Use	
Scenario 6	23	Higher Use	
Scenario 7	26	Higher Use	
Scenario 8	34	Higher Use	Runway 7L Closed

Table 3: Scenarios Modeled. Source: DOWL Team.

Eight scenarios were modeled, as shown in Table 3. For each scenario, the start time of the most intense snowfall was modeled to occur at approximately 3:00 pm and last for 12 hours, similar to the January 2024 event. This time period included 40 scheduled arrivals of all-cargo flights seeking airport-administered parking spaces (47 with the higher Atlas use assumption). This is among the busier 12-hour periods across the day, as shown in Figure 7. The volume of arriving flights peaked at 10:00 pm (not shown).

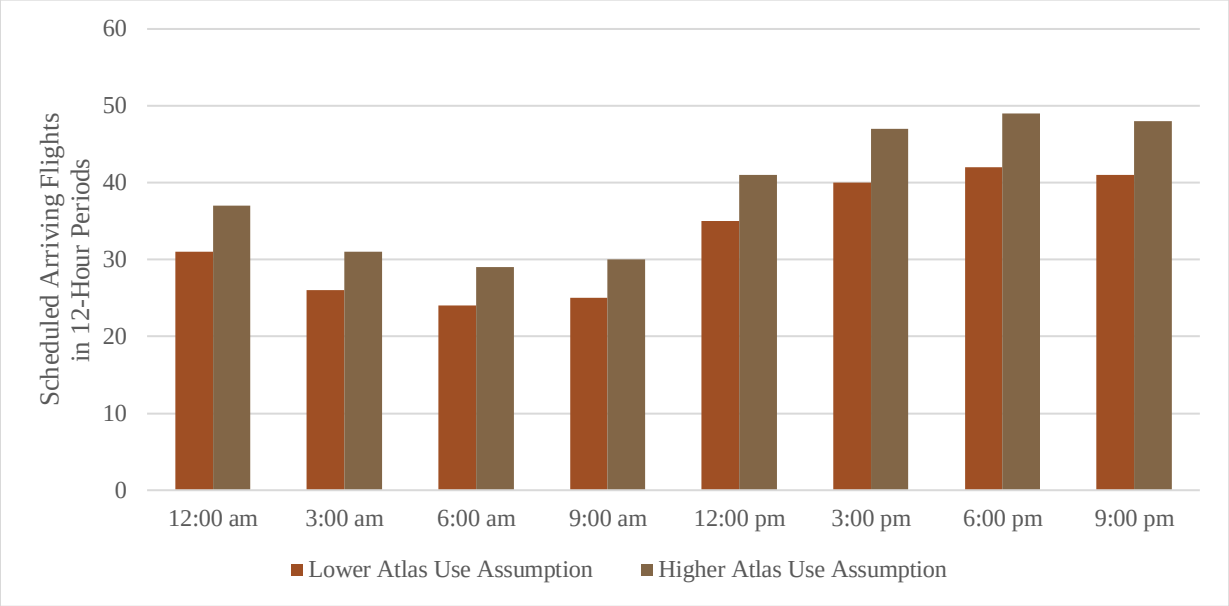

Figure 7: Scheduled Arriving All-Cargo Flights Requiring Airport-Administered Parking Spaces in a 12-Hour Period at Starting Times Across the Representative Day. Sources: Schedule derived from FlightAware, FlightRadar24, and FAA CountOps data.

Holdover/turnaround times and weather unpredictability (and thus short windows for advance carrier notification) were assumed to be similar to the January 2024 snow event in all scenarios. It was therefore assumed that all scheduled aircraft would depart for ANC and not remain on the ground at their upline airport or elect to cancel. Instead, aircraft were modeled as being accommodated at ANC with varying levels of delay due to slowed departure rates, or as diverted if inbound parking was unavailable after, if necessary, a period of in-flight holding (modeled not to exceed 45 minutes). Those aircraft accommodated at ANC were assumed to depart on a first-in, first-out basis.

For each scenario, estimates of several metrics pertaining to large cargo aircraft requiring airport-administered parking spaces were developed:

- Incremental delays measured as additional time spent on the ground for those arriving aircraft due to departure backlogs.
- The number of flights that might divert throughout the event due to a shortage of parking capacity at ANC, to understand the possible demand for FAI parking capacity.
- The number of disrupted flights that may have sought alternative options prior to departure (potentially through ground delays or cancellations), indicated by flights scheduled to depart after the weather event started.

Arrival delays associated with in-flight holding or speed reductions were not considered due to the variability of circumstances that could entail. Instead, all delays were estimated on the ground at ANC.

In scenarios requiring Runway 7L closure to accommodate large cargo aircraft parking, metrics were also generated to illustrate the possible other user flight operations at ANC that may be adversely affected. These include:

- The estimated time and duration of Runway 7L's closure.
- The scheduled number of arrivals by user type.

It was assumed in the modeling that, after the snow event, departures for the affected aircraft would increase to the maximum rate observed in the original schedule for any period of the day until the delay backlog was cleared, at which time departures would match rates as scheduled. This, again, is unlike the January 2024 experience, where aircraft remained on the ground at ANC for extended periods of time.

7.0 FINDINGS

Table 4 presents selected results for each scenario. These include arrival demand of all-cargo aircraft seeking airport-administered parking spaces over the 12-hour weather event (although the effects of delays are accounted for on other similar operations beyond the 12-hour period). Accommodated landings, diversions, cumulative aircraft delay hours at ANC, and the number of flights that departed for ANC after the snow event commenced (shown as "Pre-Departure") are also shown.

Scenario	Note	Comment	Arrival Demand	Pre-Departure	Landings	Diversions	Delay Hours
Scenario 1	15 Spaces Lower Atlas Demand		40	12	22	18	104
Scenario 2	23 Spaces Lower Atlas Demand		40	12	30	10	146
Scenario 3	26 Spaces Lower Atlas Demand		40	12	33	7	161
Scenario 4	34 Spaces Lower Atlas Demand	Runway 7L Closed	40	12	40	0	175
Scenario 5	15 Spaces Higher Atlas Demand		47	15	21	26	121
Scenario 6	23 Spaces Higher Atlas Demand		47	15	29	18	169
Scenario 7	26 Spaces Higher Atlas Demand		47	15	32	15	184
Scenario 8	34 Spaces Higher Atlas Demand	Runway 7L Closed	47	15	40	7	231

Table 4: Metrics for All-Cargo Aircraft Seeking Airport-Administered Parking Spaces Under Modeled Scenarios. Source: DOWL Team analysis.

A significant portion of demand—12 out of 40 in the lower Atlas demand cases, and 15 out of 47 in the higher Atlas demand cases—would have departed for ANC after 3:00 pm local time and may have adjusted their plans if informed before departure. Diversions decreased with greater availability of parking spaces, while delay hours increased with more parked aircraft. In scenarios with higher demand, greater numbers of diversions were experienced.

Beyond these more predictable relationships, other results, as illustrated in Table 5, are worth noting. Specifically, the average delay hours per landed aircraft are greater for the higher demand scenarios. In addition, the incremental delay hours per landed aircraft are generally higher in the higher demand scenarios. This is due to the timing of arrival demand throughout the day. The higher Atlas demand cases add to the pool of arriving demand earlier in the snow event than in the lower Atlas demand cases. As a result, a similar number of arrivals can be accommodated in both cases, but those accommodated in the higher demand scenarios land earlier and experience longer ground delays as a result. Figure 8 illustrates that by comparing the timing of landings in two similar scenarios with different arrival demand assumptions.

Scenario	Arrival Demand	Landings	Delay Hours	Delay Hours Per Landing	Incremental Change		
					Landings	Delay Hours	Delay Hours Per Landing
Scenario 1	40	22	104	4.7			
Scenario 2	40	30	146	4.9	8	42	5.3
Scenario 3	40	33	161	4.9	3	15	5.0
Scenario 4	40	40	175	4.4	7	14	2.0
Scenario 5	47	21	121	5.8			
Scenario 6	47	29	169	5.8	8	48	6.0
Scenario 7	47	32	184	5.8	3	15	5.0
Scenario 8	47	40	231	5.8	8	47	5.9

Table 5: Incremental Changes by Scenario. Source: DOWL Team Analysis.

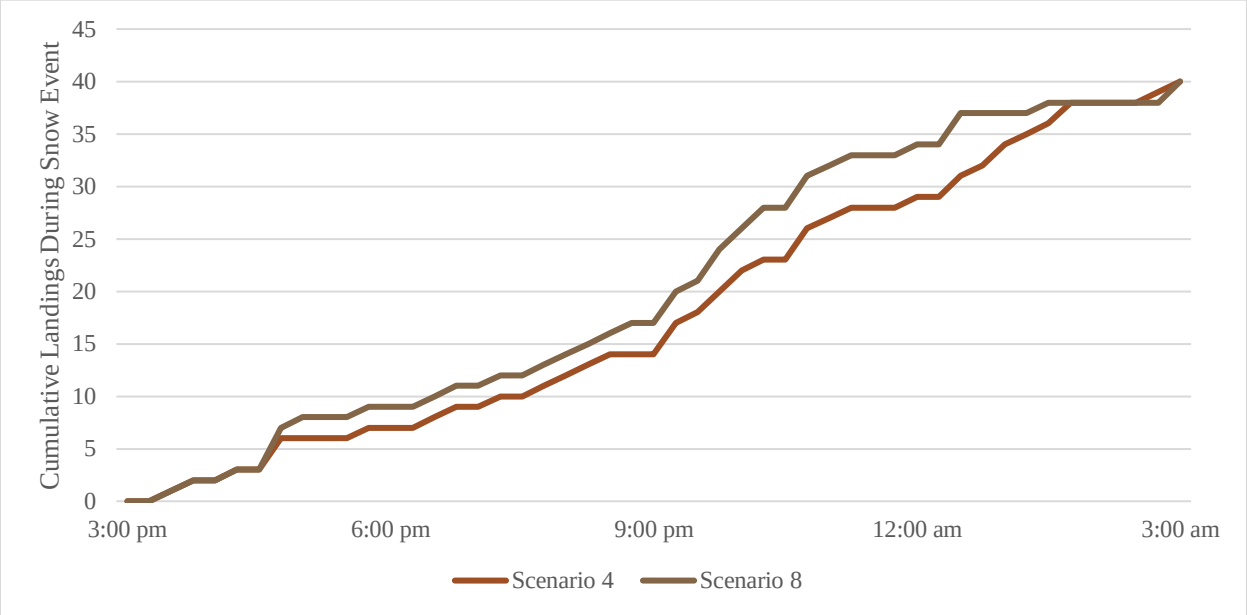

Figure 8: Comparison of Cumulative Landings by Time of Day and Scenario. Source: DOWL Team analysis.

Arrivals in the higher arriving demand Scenario 8 occur earlier than those in the lower demand Scenario 4. However, departures of these aircraft occur at the same time in both scenarios (not shown). As a result, arrivals in Scenario 8 remain on the ground for longer. These observations reinforce the idea that impacts vary under different assumptions of arrival demand and timing. In general, higher arrival demand earlier in the event leads to higher delay costs per landed aircraft.

For each scenario, diversions were also examined for their impact on the resources available at FAI to accommodate those diversions. Table 6 shows the highest rolling two-hour peak of diversions, selected in consideration of the metric in Table *2* indicating average ground times for all-cargo aircraft of 1.7 hours at ANC. Assuming a similar ground time at FAI, all scenarios reflect a number of aircraft on the ground that is far lower than the 23 available parking spaces.

Scenario	Note	Comment	Diversions	Peak Two-Hour Diversions to FAI
Scenario 1	15 Spaces Lower Atlas Demand		18	9
Scenario 2	23 Spaces Lower Atlas Demand		10	9
Scenario 3	26 Spaces Lower Atlas Demand		7	7
Scenario 4	34 Spaces Lower Atlas Demand	Runway 7L Closed	0	0
Scenario 5	15 Spaces Higher Atlas Demand		26	14
Scenario 6	23 Spaces Higher Atlas Demand		18	11
Scenario 7	26 Spaces Higher Atlas Demand		15	11
Scenario 8	34 Spaces Higher Atlas Demand	Runway 7L Closed	7	7

Table 6: Rolling Two-Hour Peak of Diversions to FAI by Scenario. Source: DOWL Team analysis.

A critical inflection occurs in the transition to either Scenario 4 or 8, where it is assumed that the growth to 34 spaces at ANC requires the use of Runway 7L, meaning that runway would be closed for arrivals. At that point, two additional operational disruptions would arise:

- Runway capacity would be halved (at least) for arriving flights.
- Complete closure of Runway 7R (and thus all landing capacity) would occur periodically for snow removal.

Table 7 shows the estimated time and duration of the Runway 7L closure, as modeled for Scenarios 4 and 8, and the scheduled arrivals of other airport users during that time (other than the all-cargo aircraft requiring airport-administered parking). Of particular note is the potential effect that reduced arrival capacity could have on network passenger and integrated cargo carriers (approximately 69 percent and 63 percent of daily arrivals, respectively, in Scenario 8). In the event of reduced arrival capacity, some or all of these arrivals could be affected by delays or diversions, impacting passenger and package/freight connectivity at ANC and downline airports.

Scenario	Note	Time and Duration of Parking/7L Closure	Arrivals Scheduled During Runway 7L Closure Time					
			Intgr. Cargo[2]	Local All Cargo	Network Psgr.	Local Psgr.	Medevac	Private
Scenario 4	34 Spaces Lower Atlas Demand	2 Hours 1:00am-3:30am / 7L Closed 1:00am-3:30pm	36 (56%)	20 (59%)	30 (55%)	36 (62%)	6 (55%)	3 (50%)
Scenario 8	34 Spaces Higher Atlas Demand	5 Hours 11:00pm-4:00am / 7L Closed 11:00pm-4:00pm	33 (63%)	22 (65%)	38 (69%)	38 (66%)	9 (82%)	3 (50%)

Table 7: Estimated Duration of Runway 7L Closure and Other User Arrival Demand by Scenario (Including Percentage of Daily Flights). Source: DOWL Team analysis.

In addition to the impact on other ANC users, closure of arriving runways would limit the ability of other aircraft to use ANC as an alternate airport. This includes:

- Extended Operations (ETOPS) flights: Safety standards require that flights remain within a certain flight time of suitable alternate airports along their journey in case of mechanical disruption. ANC serves as an alternate for many flights across the Pacific

[2] For the lower Atlas demand scenario (Scenario 4), Atlas's arrivals not modeled as requiring airport-administered parking were treated as integrated cargo operations.

Ocean and on polar routings. In the event that ANC is not available as an alternate airport, a portion of these flights may be delayed or canceled, or diverted along the journey if already in flight.

- Aircraft on transpacific routings for medical emergencies: For aircraft on transpacific or polar routings, ANC serves as an important resource for flights unexpectedly seeking medical facilities while en route.

Finally, airport safety must be considered in any decision to accommodate aircraft during difficult weather events. Any option that increases congestion across the aircraft movement areas and limits movement of aircraft and airport vehicles would reduce the ability of, for example, snow removal, firefighting, or other critical equipment and personnel to act when needed. In addition, options that incorporate runway parking increase the chances of mishaps that may occur due to pilot error (even if the runway is fully closed).

8.0 FRAMEWORK FOR COMPARING SCENARIOS

This analysis provides a framework that can be adapted for various inputs to compare the impacts between options for accommodating arriving flights. Examples of such comparisons are provided in this section, building on the scenarios presented earlier. Comparisons are illustrated between Scenarios 7 and 8, and between 3 and 4, as summarized in Table 8. Numerous potential scenario combinations could be considered based on the prevailing conditions. These comparisons were selected because they represent an approximation of the situation and decision framework during the January 2024 weather event with several differences, namely:

- The underlying demand is based on a December 2024 schedule.
- Departure flows were modeled to recover immediately after the snow event, unlike in January 2024, when several aircraft remained on the ground for prolonged periods.

	Scenario			
	3	4	7	8
Arrival Demand	40	40	47	47
Accommodated Landings	33	40	32	40
Diversions	7	0	15	7
Exceeds FAI Parking Capability?	No	No	No	No
Delay Hours	161	175	184	231
Runway 7L Closed?	No	Yes	No	Yes
Other Arrivals Affected	None	36 Integrator 20 Local Cargo 30 Network Psgr. 36 Local Psgr. 6 Medevac 3 Private	None	33 Integrator 23 Local Cargo 38 Network Psgr. 38 Local Psgr. 9 Medevac 3 Private
Other Operations Affected? (Medical Diversions and ETOPS Operations)	No	Yes	No	Yes

Table 8: Summary of Example Scenarios. Source: DOWL Team analysis.

The comparison of Scenarios 7 and 8 models the differences between maintaining 26 airport-administered spaces or increasing the number of spaces by 8 to 34, resulting in the closure of Runway 7L. The comparison of Scenarios 3 and 4 is similar, but it assumes a lower demand for parking spaces by Atlas. In both comparisons, the option to accommodate more parking at ANC results in the avoidance of several diverted global all-cargo aircraft (seven in the lower demand comparison and eight in the higher demand comparison). However, in both comparisons, overall aircraft delay hours at ANC increase as more aircraft are accommodated there (an increase of 14 hours in the lower demand comparison, and 47 hours in the higher demand comparison). It should be noted that it is very likely that a diversion to FAI could be an attractive alternative to significant delays at ANC if a stop is not required at ANC and advance planning enables the accommodation of any necessary crew changes.

More important, however, is the potential impact on other users (both at ANC and for those that rely on it as a possible diversion or alternate airport) that arises with the closure of Runway 7L, from delays, diversions, or cancellations that would result from reduced arrival capacity and periods of complete airport closure. In addition, the use of Runway 7L for aircraft parking would increase the safety risk inherent in the possibility of pilot error leading to an inadvertent landing on that surface.

9.0 RECOMMENDATIONS

A review of the January 2024 snow event and subsequent analysis of various combinations of parking demand and accommodation scenarios yielded several key findings and observations:

- The impact of weather events at ANC is not necessarily uniform across all airport users. Long turnaround times experienced by all-cargo aircraft, not related to snow clearance on airport runway and taxiway surfaces, resulted in departure delays and congestion in airport-administered parking spaces.

- Assuming these problems continue for all-cargo aircraft in the future, the level of disruption (delays or diversions) that may occur during future weather events is dependent on a combination of variables, including timing, duration, and intensity of the storm event, the level of demand (i.e., arriving flights) for airport-administered parking spaces during the event, and the timing of those arriving flights.

- Robust communication between the airports and air carriers is critical, and the sooner notification can be given about a weather event, the more options will be available for carriers to adjust their plans (such as to delay or cancel a departure, or amend a routing).

- Airport users have different operating characteristics and uses of airport resources. A high proportion of global all-cargo operations use ANC strictly for refueling and crew exchange on transpacific journeys. Aircraft that can continue directly to their ultimate destination after a diversion to FAI will incur less cost from a diversion than a diverted aircraft that must subsequently progress to ANC (to transfer cargo, for example) before departing for its ultimate destination. Any aircraft requiring a stop at ANC after a diversion would also incur delay costs while at the diversion airport as if it were on the ground at ANC, in addition to the incremental flight time to operate to and from the diversion airport.

- Options that result in multiple diversions would not strain FAI's parking capacity. However, external ground handling capacity may require augmentation (increased staffing, available equipment, etc.). In addition, internal carrier crew coordination improvements, to ensure crews can be transferred to FAI from ANC, should be explored.

- Parking options that require the closure of Runway 7L at ANC significantly reduce arriving runway capacity and cause periodic cessation of arrivals, impacting passenger connectivity, cargo services to many smaller communities, and medical patient transportation. Flights holding over the airport awaiting the clearing of the one arrival runway (7R) may experience low fuel and have to divert. Runway closures also affect flights not destined for ANC, requiring ANC as a critical alternate airport option for their transpacific and polar journeys.

Winter events like those that occurred in January 2024 are rare. Nevertheless, these events can result in significant disruption, and climate change may increase those occurrences, potentially with no improvements in weather forecast reliability. AIAS and airport users can take steps to mitigate the impacts of these events. These include:

- **Continue to improve communications between airports and users**: Opportunities to improve the timeliness of weather event and operational disruption updates should be explored to help preserve the options available for users to adjust plans and prepare for possible diversions. Users should also provide as much notice to airports regarding their plans so that there is more advance knowledge of arrival demand and timing at ANC, or diversion volumes at FAI (to provide as much advance notice to FAI and ground handlers there for planning purposes).

- Working with users and ground handlers to **improve turnaround times** during winter weather events. To the extent AIAS can affect change, improvements, such as staffing and equipment availability, along with more effective deicing processes and procedures, should be explored to improve departure rates.

- In addition to improving communications between airports and users, **data, processes, or systems that improve the accuracy and visibility of arrival demand and timing should be explored** to better understand the magnitude of potential parking space constraints throughout the day. Improvements to this information, along with improvements in airport–user communications, can facilitate improved decision-making and increase the chances of an improved outcome.

- In addition to improving communications between users and airports to maximize diversion preparedness at FAI, **AIAS should coordinate with carriers and ground handlers to ensure that additional resources are available to service higher volumes of diversions at FAI**. This includes equipment such as air stairs, ground power units, and, although outside FAI's control, additional staffing for the airport's ground handlers.

- AIAS and users should **consider processes to prioritize diversions of flights that do not require a stop at ANC** (essentially requiring only refueling and crew changes). This would maximize parking availability for users requiring a stop at ANC during winter weather events, when airport-administered parking demand would be high. A diversion, if coordinated well with air carrier crew positioning and sufficient ground resources, could present a more cost-effective option for flights, potentially helping to avoid long ground delays that could be incurred at ANC.

- **For aircraft requiring a stop at ANC, parking should be maximized. However, options that require the closure of Runway 7L should be avoided to lessen the impact of additional ground delays, avoid the adverse operational impact on other airport users, and reduce the safety risks inherent in the periodic closure of the airport and the use of runway surfaces for aircraft parking.**