Chapter 3.

Airport Capacity

3.1. Introduction

The capacity of an airfield is primarily a function of the major aircraft operating surfaces that compose the facility and the configuration of those surfaces (i.e., the existing runway and taxiway system). However, it's also significantly influenced by the local environmental conditions (e.g., wind coverage and weather conditions), air traffic control requirements and airspace utilization, specific characteristics of local aviation demand, and the availability and type of navigational/landing aids. Thus, capacity refers to the number of aircraft operations that a facility can accommodate either on an hourly or yearly basis.

The FAA's methodology used for the measurement of airfield capacity is described in Advisory Circular (AC) 150/5060-5, Airport Capacity and Delay and it's defined in the following terms:

- Hourly Capacity of Runways: The maximum number of aircraft operations that can be accommodated under conditions of continuous demand during a one-hour period.
- Annual Service Volume (ASV): A reasonable estimate of an airport's annual capacity (i.e., level of annual aircraft operations that will result in an average annual aircraft delay of approximately one to four minutes).

It can be noted that the hourly capacity operational estimates provided in AC 150/5060-5 for the calculation of ASV are premised on a number of generalized operating conditions for an airport, which include: 1) arrivals equal departures, 2) the percent of touch-and-go operations is between zero and 50 percent of total operations, 3) there is a full-length parallel taxiway with ample exits and no taxiway crossing problems, 4) there are no airspace limitations, 5) the Airport has at least one runway equipped with an ILS and the necessary air traffic control facilities to carry out operations in a radar environment, 6) IFR weather conditions occur roughly 10 percent of the time, and 7) approximately 80 percent of the time the Airport is operated with the runway use configuration that produces the greatest hourly capacity. However, as a point of record, virtually none of these baseline operating conditions are applicable to SUN, given the surrounding mountainous terrain, which also requires an opposite direction operation (ODO) use configuration on the runway for the majority of aircraft operators. It should also be noted that the operational capacity of an airport can be constrained to specific categories of aircraft operators by the availability of facilities on the airfield (e.g., the number gate positions at the terminal building and/or the number of GA itinerant aircraft parking positions at the FBO) and these conditions can also be an issue a SUN.

For the purposes of this Study, the Airport requested input from Woolpert air traffic control (ATC) subject matter experts describing the variety of unique operating conditions and site constraints at SUN, including the operational demand characteristics common to mountain resort airports that are needed to generate a realistic calculation of both hourly and annual operational capacity. As an example, Woolpert consultants annually assist with the planning and execution of a July special event at SUN, which is related to a conference at a nearby resort, that generates a significant number of business jet operations at the facility. During the peak arrival day for the conference in 2025, over 300 daily operations were recorded at SUN, with many of these aircraft experiencing delays, particularly during arrival sequencing. On an annual basis, it's estimated that 12 percent of the time (i.e., 44 days per year), the Airport operates at peak demand, which either approaches or meets the hourly capacity of the Airport. The following sections describe a more customized assessment of the aircraft operational capacity for SUN.

3.2. Characteristics of Demand

The capacity of an airport is partly defined by the way demand accumulates. For instance, is it all departures in the morning and arrivals in the afternoon? Are operations perfectly balanced between arrivals and departures? Is it quiet in the morning and then very busy in the afternoon? In the example of an airport that is quiet in the morning and very busy in the afternoon, that means it’s busy half the time. So, when only annual capacity is considered, then the airport could appear to be operating at only half capacity, when in reality it may face so much pressure in the afternoons that significant afternoon delays are common. This approach to evaluating capacity is particularly challenging at airports with seasonal peaks like SUN since they may have significant variations between extensive light traffic time periods, and very complex busy time periods.

A good understanding of a specific airport’s capacity is also used dynamically to coordinate air traffic control (ATC) decisions in the air at long distances from the airport as flights are sequenced for arrival. Airport capacity is also important when developing airline schedules to increase predictability and on-time performance.

There are many variables that affect airport operational capacity. The variables of weather impacts, physical infrastructure (runways, gates and terminal capacity), and operational procedures, are some of the major considerations. While each of these is described further in the following sections, it is important to acknowledge that key factors of capacity at SUN relate to the geographic environment that causes operations to be “opposite direction,” with departures going south and arrivals coming from the south; seasonality and peak demand time periods that stress capacity; an operational environment that is heavily weighted towards daytime operations; and the different challenges of “bluebird” good visibility days as compared to winter snow events.

Another important factor to understand about SUN is the different ways private aircraft access the airport as compared to scheduled commercial flights. Because of these differences, it is useful to think of SUN as two airports operating in the same place using the same runway.

3.3. Airport Operational Capacity Components

The foundation of airport operational capacity is the number of runways and their geometry. These are discussed in the following section. In addition to runway basics, there are many other factors that influence capacity. Some affect capacity in the short term (next few hours) and others affect capacity over the long term (these are also further described in the following section).

3.4. Variables Affecting Capacity

Arrival and Departure Operational Mix

The capacity of a runway can be thought of as a quickly changing time-share operation. The runway can only be “owned” by one operator at a time. The amount of time each take-off or landing needs to safely complete the operation is called the Runway Occupancy Time (ROT). The primary components of runway capacity are the speed of the aircraft and the required safety spacing in between aircraft. The ROT for arrivals is different than the ROT for departures. This is due to the separation rules ATC must use to maintain a safe operational environment. For arrivals, the ROT is calculated from the time the pilot is told “cleared to land” until the time they have landed and turned off the runway. (An arrival cannot be told “cleared to land” when there is anyone else on the runway, so a preceding arrival has to have the tail clear the runway surface.) For departures, the ROT is calculated from the time the pilot is cleared to enter the runway until the time it has cleared the runway threshold and is airborne.

Departures require slightly more time on the runway than arrivals because they are starting at zero speed and it takes time to accelerate and become airborne. However, the separation rules are different for departures so controllers can clear a subsequent departure behind another very efficiently.

While arrivals take slightly less time to fly the last distance to the runway, slow down, and turn off of the runway, the controller has to factor this in when putting together a landing sequence; there needs to be a cushion in the separation because the front aircraft is always slowing down and the back aircraft is compressing the gap. Another factor in runway capacity is if there are multiple runways, and one can be dedicated to arrivals with another dedicated to departures, the ATC sequencing can become very efficient and timed out for maximum throughput. If the runway has to be shared between arrivals and departures, as is the case at SUN, consideration has to be given to how the timing works between arrivals and departures. For an arrival-only runway, the typical assumed maximum hourly capacity is 36 operations per hour. For a departure-only runway, the typical assumed maximum hourly capacity is 45 per hour. For a mixed-use runway, like at SUN, the gaps between arrivals must be longer in order to make enough time for a departure to take the runway in between arrivals. The hourly capacity for a mixed-use runway is usually 32 per hour, however due to additional factors, this is not the hourly capacity at SUN.

Opposite Direction Operations

Another important capacity consideration for SUN is that the runway is located in an area where local terrain limits traffic patterns, an “opposite direction operation” (ODO) may typically be required. This is the prevailing pattern at SUN, in which aircraft arrive from and depart to the south. This negatively affects the operational efficiency of Runway 13/31, because additional delay, and air traffic control coordination is needed to safely stagger operations. The tower facilitates ODO operations because it is the safest pattern based on the surrounding mountainous terrain, which prohibits instrument flight rules (IFR) arrivals from and departures to the north. ODO also supports voluntary noise abatement over the City of Hailey, although the Voluntary Noise Abatement Procedures are not the primary reason for the pattern. While the ODO pattern limits runway capacity, the safety benefits of the pattern generally take precedence over any congestion concerns. The ODO pattern represents the general policy of the Airport. In ODO operations, the controller needs to manage how close the arrival gets to the runway to preserve the time necessary for the departure to be cleared onto the runway, start the takeoff roll and accelerate to flight speed, become airborne and turn away from the inbound arrival. This synchronization between arrivals and departures means the arrival should be 6-8 miles out when the departure aircraft begins the takeoff roll. In ODO operations, because of the increased spacing, the maximum hourly capacity of the runway at SUN in good weather should be considered 12 arrivals and 12 departures per hour for balanced operations. In order to achieve that 12+12 capacity, a smooth arrival demand and a smooth departure demand must exist. As an example, if departures had an extra-high demand and 12 or more departures were lined up on the taxiway, it would be difficult and slow to move any arrivals from the runway to parking, given that there is also a single parallel taxiway at SUN.

During peak arrival events at SUN, typically arrival and departure demand is not balanced. There are times when arrivals are heavy and other times when departures are dominant. During the highest peak arrival times, the combined planning efforts of the tower and the Air Route Traffic Control Center (ARTCC) model a 16 aircraft arrival rate. That assumption depends on departures being very light. During winter season weekends, typically the arrival capacity is considered to be 8-12 an hour and the departure capacity is considered to be 8-12 as well.

Geometry/Spacing of Runways

If runways are spaced closely parallel, their combined capacity can be compromised. As an example, two parallel runways located 1 mile apart can each operate at maximum possible capacity according to FAA ATC rules. There are several intermediate values defined in ATC rules that tell controllers how much they have to stagger operations between the two runways. In the worst-case scenario, when the runways are closely parallel, the controllers must treat them like they are the same runway and there can only be one operation at a time.

Taxiways and Runway Entrances/Exits

Runway exits to taxiways can also affect capacity. At most single runway airports, including SUN, the taxiways connect to the runway via a 90 degree turn off. The alternative is an angled runway exit much like an interstate highway exit ramp. If it's angled, aircraft can turn onto the exit at a higher speed (taking less time on the runway) than if it is a 90 degree turn off that requires the aircraft to slow down more in order to exit the runway. The faster, angled version means the next aircraft can take the runway sooner.

Weather (Visibility and Wind)

Most airports are built in an area that allows the runways to be used in either direction based on the most favorable wind. Landing or taking off with a tailwind can have safety implications especially when the winds are greater than 15 mph. The canyons north of the Airport sometimes contribute to challenging crosswinds at low altitudes.

At SUN, taking off to the south allows efficient use of the runway but can lead to inefficient taxi operations due to the FBO location at the south end of the taxiway. But if the winds are too strong out of the north, the takeoff direction must occur to the north to get the headwind. Because a departure to the north utilizes different procedures, which are significantly limited by terrain, departing to the north results in a much lower capacity operation. Even more substantially for arrivals, if the wind is strong from the south and the only way to land is from the north facing south, the surrounding terrain limits the descent pilots can use, so for all practical purposes, this is not a realistic option unless visibility is excellent, and even then, some aircraft don't have the ability to make the appropriate descent.

Instrument Approach Procedures

Instrument Approach Procedures (IAPs) are used by all large jets and commercial flights all the time, even in good weather. The design of IAPs is highly regulated. Mountainous terrain within 7 miles of an airport, and especially within 3 miles of an airport, greatly influences the details of an IAP.

Prior to 2015, SUN had what should be considered "standard" approach procedures for airports located in a mountainous environment. They were significantly restricted due to surrounding terrain. For this reason, if there were clouds blocking visibility at 1,600 feet over the ground, arrival flights had to divert to another airport.

Since then, the Freidman Memorial Airport Authority (FMAA) has contracted with a procedure designer (certified by the FAA) to design more optimal arrival procedures known as Special Instrument Approach Procedures (SIAPs). These types of procedures are considered "Special" approaches because they are not automatically available to the public. Operators that wish to use these procedures must certify that their aircraft are properly equipped with advanced navigation equipment, and that their flight crews have currency in using the advanced equipment.

The benefit of designing a SIAP is that the procedure designer can include instructions that take advantage of equipment that is above the baseline. This means flight paths can be designed more precisely and altitude instructions can assume highly accurate aircraft positioning relative to the terrain. The SAIPs now in use at SUN allow commercial flights and certain jet aircraft that are suitably equipped to successfully continue an approach in much lower visibility conditions. This translates into higher schedule predictability and less diversions.

While these new procedures are critically important enhancements at SUN, they do not technically add to SUN's capacity; instead, they improve predictability and reliability. An aircraft using these procedures still requires the same amount of ATC separation and time on the runway.

Daylight

An airport's capacity is usually diminished at night. This is because mostly, night operations are affected as if there is low visibility due to clouds in the daytime. At an airport with significant nearby mountainous terrain, such as SUN, airport capacity is reduced by 50-60 percent at night as compared to the daytime.

Runway Surface Conditions

If a runway has conditions that are worse when wet, it reduces operational capacity. Since aircraft braking can take longer if there is any ice or snow on the runway, ATC has to account for the longer time period it takes for a flight to slow down on the runway and put more space in between operations.

Commercial Gates

Commercial gates available at an airport can limit the capacity of commercial operations. Airlines typically plan for 5-7 departures per day per gate at an airport with enough demand. The current gate capacity at SUN is a constraint during peak periods.

Aircraft Parking

A limitation at airports, typically in mountainous areas that have limited space to park aircraft is the space to store and service aircraft. This challenge can be amplified due to seasonal/peak event activity levels. It can be difficult to have enough aircraft parking, enough ground crews to tug and park aircraft, and enough tugs and fuel equipment to serve a beyond-full aircraft ramp during holiday weeks and festivals or special events.

SUN has ample aircraft parking for routine weeks, but it can become constrained during peak holiday weeks and special events. When parking is near-full or beyond, it can restrict inbound flights, and it can cause flights to have to drop off passengers and then depart to store an aircraft at another airport (thereby doubling the flight's time on the runway and increasing operations).

During peak arrival events, parking at SUN can fill up to the point that the Airport has to put out a notice through the FAA telling inbound pilots that long-term parking is not available, and arrivals are restricted to "drop and go only". This means arriving flights can land, taxi to the FBO, unload and potentially refuel, and then leave within about 45 minutes. If the "drop and go" restriction was not used, aircraft parking would fill to capacity and the Airport would have to close for arrivals until some departures left. The "drop and go" operations also impact runway capacity as these generate both an arrival and departure operation in a short window.

Airspace

The airspace around an airport can impact airport capacity, and it can be structured to support airport capacity. Mountainous airports tend to have more challenges as the terrain limits the flight paths and the options available to air traffic controllers to either sequence arrivals or fan out departures. It should also be noted that SUN is one of six Rocky Mountain airports identified in FAA's *Instrument Procedures Handbook* regarding "Special Airport Qualification" that requires special pilot and/or navigation qualifications for commercial passenger carriers that serve the Airport.

Another facet of airspace characteristics are the procedures used between the SUN airport traffic control tower (ATCT) and the Salt Lake City Air Route Traffic Control Center (ARTCC). The arrival procedures at Friedman were not ideal 7 years ago, prior to the implementation of the SIAPs. Since then, airport management has worked closely with procedure designers to optimize the inbound flight procedures to ensure they work well in low visibility conditions and support the synchronization of arrivals and departures.

SUN's departure procedures have been studied as well, and two new departure procedures were published in early 2025 to help improve the control tower's ability to manage arrivals and departures.

The collaboration and interactions between the SUN ATCT and the Salt Lake City ARTCC have improved in recent years to add to the Airport's capacity. Previously, the interactions between the radar-environment ARTCC and the tower were limited, and when inbound demand was heavy, a holding pattern would be established approximately 20 miles south of the airport. One arrival would be cleared in, and once that aircraft was off the runway, the next arrival would be cleared out of the holding pattern and could proceed to the airport. This type of operation can happen in mountainous areas where radar coverage is limited.

In recent years, through combined efforts on the part of the SUN ATCT and the ARTCC, collaboration has vastly improved, airspace utilization has been improved, and the airspace is less of a constraint. The ARTCC is required to have controllers do simulation training every year for proficiency, and they now use a SUN-oriented set of traffic to practice. The SUN air traffic manager has gone to the ARTCC and collaborated on ways to optimize coordination between the two facilities during some of these practice sessions.

Currently, the airspace does not significantly restrict the capacity of the Airport. The ARTCC can deliver as many aircraft as the airport's runway can handle. There are some limits for departures, but if visibility is good, the tower can keep up with the departure demand.

Fleet mix

The term "fleet mix" means the aircraft types that operate at the airport. Examples of different fleet mixes are San Diego that operates a relatively homogenous fleet of commercial single-aisle twin engine jets, compared to an airport like Anchorage that has a large component of heavy 4-engine cargo flights of mostly Boeing 747's along with small jets, commercial single-aisle twin engine, and very old propellor aircraft. At SUN, the fleet mix is mostly a blend of propellor single-engine aircraft and private jet traffic, with a component of commercial service single-aisle, twin engine aircraft.

The fleet mix can impact the available hourly capacity due to the different speeds and the different types of ATC separation that is required. The advantage of the small propellor aircraft is they move slowly and are very maneuverable, so they can take up small spaces and are only on the runway for a short period of time when they land. The bigger, faster moving jet aircraft require more room to slow down meaning that more separation has to be applied between operations.

ATC also has a significant effect on the capacity of an airport depending on whether there are small aircraft that will mostly be operating using visual rules, or large jets that must be spaced according to instrument rules (even when the weather is good). For these reasons, defining an absolute capacity number for an airport is a complex process and the accuracy of it relies upon defining an accurate fleet mix and demand profile for the airport. If we were to define the capacity of SUN and assumed 100 percent of operations consisted of single-engine propellor aircraft, the capacity number would be much higher than if we assumed all operations consisted of jet traffic. Of course, the traffic at SUN isn't at either extreme; it is a mix. The jet traffic may dominate on a Saturday during ski season, while it may be quite different on an early Fall Saturday.

The hourly capacity estimates for a single runway with all small propellor aircraft might be as high as 40 per hour, while a mix of propellor aircraft and jets would be at capacity at 32 per hour. Typical hourly capacity assumptions for a single runway based on the type of operations are identified in **Table 3.1**.

Table 3.1 SUN Hourly Capacity (Single Runway)

Number of Runways	Type of Operations	Weather	Hourly Capacity
Single runway	Arrivals only	VFR	36
Single runway	Arrivals only	IFR	32
Single runway	Departures only	VFR	42
Single runway	Departures only	IFR	36
Single runway	Arrivals and departures (same direction)	VFR	32
Single runway	Arrivals and departures (same direction)	IFR	24
Single runway	Arrivals and departures (opposite direction)	VFR	16
Single runway	Arrivals and departures (opposite direction)	IFR	12

Source: Woolpert

3.5. Airfield Capacity Analysis

As described in the introduction to this chapter, the legacy method for determining airport operational capacity is contained in FAA Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*. This AC was published in 1983 and continues to be the industry standard for generalized airport capacity planning. The ASV calculation is used by the FAA as an indicator of relative operating capacity that accounts for differences in runway use, aircraft mix, weather conditions, etc. that would be encountered over a year's time. ASV also assumes an acceptable level of aircraft delay as described in the Advisory Circular. It's acknowledged that this legacy FAA document does not effectively address all of the existing capacity constraint variables for SUN, particularly the guidance regarding single runway ODO configurations and restricted nighttime operations due to the surrounding terrain.

In 2012, the Airport Cooperative Research Program (ACRP) published new/supplemental capacity analysis guidelines in ACRP Report 79, *Evaluating Airfield Capacity.* While this methodology contains a more complete consideration of airport variables, and emphasizes the need for advanced simulation tools to truly capture an airport's capacity, it does not offer an explicit way to account for the type of ODO procedures in place at SUN. Thus, it does not provide a significantly better analysis tool for runway capacity calculations for SUN, and for that reason, a comparative capacity analysis using the ACRP Report 79 methodology was not conducted. Also, while there are some excellent runway capacity simulation tools available for use, in most cases, the expense of running the simulations exceeds the value of the increased precision. However, a thorough understanding and consideration of the capacity constraint variables noted above can provide a comprehensive understanding of an airport's operational characteristics.

The FAA Advisory Circular approach to calculating an annual service volume is a top-down approach in that it establishes an annual number of aircraft operations, which can then be divided into months or days to compare the assumption of what the airport can handle versus the projected operational demand.

Based on current operational statistics for SUN, the busiest day of the year is typically near 300 operations per day, but busy days typically record approximately 100 operations. A breakdown of typical high volume aircraft operation days that have been recorded at SUN for the 2023 and 2024 calendar years is presented in **Table 3.2**.

Table 3.2 – High Volume Operation Days at SUN, 2023 and 2024

Operational Volume	2023	2024
Days over 100 operations	51	43
Days over 150 operations	6	3
Days over 200 operations	2	1
Total annual operations	**24,760**	**24,130**

Source: SUN Airport Traffic Control Tower.

Using the data in the table above to compute the annual capacity for the 90th percentile day of 105 aircraft operations, would result in 38,325 total operations. That level of activity would be well within the annual capacity of the Airport based on previous analysis in the 2018 Master Plan. Section 2.2 (of Chapter C) and Appendix B of the 2018 Master Plan provide details on the calculated ASV at SUN, which was estimated to be 62,150 annual operations. If we base an annual capacity on the relatively high-pressure day of 250 operations per day, the ASV would total 91,250 operations. Consequently, the 2018 Master Plan ASV calculation of 62,150 operations is likely fairly conservative and remains appropriate for long-range planning purposes at SUN. Certainly, SUN has the ability to accommodate additional growth in operations; however, those increases would likely have to be allocated through a normalized spreading of the peak hour activity beyond the typical busy summer and winter day operations.

3.6. Capacity Conclusions

As noted from the information provided in this chapter, the existing operational capacity constraints at SUN are not currently associated with the facility's existing ASV. It's estimated that the ASV calculated previously for the 2018 Master Plan (i.e., 62,150 operations) is still an appropriate metric for this updated planning effort, and can be used by the FAA for capital improvement planning and funding decisions. However, the capacity constraints are instead related to peak-hour activity that occurs approximately 44 days of year (i.e., 12% of time annually), which is distributed across holidays, typical busy summer and winter tourism days, and special event conferences. The typical maximum hourly capacity of operations that are used for planning by ATC personnel for SUN is 16 operations per hour for VFR operating conditions, which is reduced to approximately 12 hourly operations during IFR conditions. Yet, experience shows that the Airport can temporarily accommodate higher volumes of traffic (up to approximately 300 operations per day) which are typically recorded during the top 2 percent of the busy days of the year.

For the purposes of this analysis, the capacity for SUN is sufficient for all but the 44 days of the year (i.e., 12 percent annually) when operational demand peaks. It's estimated that a small number of flights can potentially be added during these busiest days, but most of the increase in activity would have to be accommodated during the balance of the year. In addition, the peak activity days at SUN require advance planning and preparation as demonstrated by ATC staff and airport management over the past ten years. On balance, the aircraft operational demand for the rest of the year is below the operational capacity of the runway with some room for growth if demand increases at the projected rates anticipated for U.S. airports.

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