Introduction

As the Bay Area enters a prolonged duration of stormy weather, the impact of this weather is routinely reported by the local media (print and broadcast) regarding its impact of operations at the three Bay Area commercial airports, in particular San Francisco International Airport (SFO). To ensure that the information provided to the general public by the media is complete, accurate, and relevant, San Francisco International Airport’s Bureau of Community Affairs has developed this reference and informational guide to SFO’s operations and the impact inclement weather has on those operations.

Background

San Francisco International Airport is open twenty-four hours a day, 365-days a year. SFO is the largest and busiest of the region’s three commercial airports. In calendar year 2009 more than 37 million passengers passed through SFO gates. This represents more than 60% of all of the Bay Area’s passenger traffic. Calendar year 2009 also saw more than 380,000 aircraft take-off or land at SFO. This equates to an average of about 1,040 operations every day.

SFO operates on two sets of parallel runways that intersect midfield at a ninety degree angle. Approximately 83% of the time aircraft depart on either Runway 01L or 01R and arrive on either Runway 28L or 28R. This operation is called the “West Plan.” (Runways are numbered based upon its approximate runway heading. Runways 28L and 28R have a magnetic heading of 283 degrees and runways 01L and 01R have a magnetic heading of 013 degrees.) Under this flow of traffic, SFO’s acceptance rate for arriving traffic is 60 aircraft per hour.

About 15% of the time, usually when a low pressure weather system brings rain to the Bay Area, arriving aircraft land on Runways 19L and 19R and departing aircraft use Runways 01L and 01R. This arrival and departure plan is known as the “Southeast Plan.” Graphics of both the “West Plan” and “Southeast Plan” are available at flysfo.com for reference and use by the media.

Weather and Operations at SFO

The primary factor in determining which runway to use for arrivals and departures is the direction and strength of the prevailing wind. All aircraft need to take off and land into the prevailing wind. The location of the San Bruno Gap creates a nearly year-round WNW wind at SFO and accounts for overwhelmingly predominant use of the West Plan. Quite often during summer afternoons, the rush of wind through the San Bruno Gap is so high aircraft must arrive and depart from Runways 28L and 28R.

In the northern hemisphere winds circulate around a low pressure system in a counterclockwise rotation (also known as “cyclonic”). As a result of this phenomenon, whenever a low pressure system brings stormy weather to the Bay Area, the prevailing wind shifts to the south-southeast and SFO (as do all other airports in the Bay Area) shifts operation to the Southeast Plan.

San Francisco International Airport’s current runway configuration was designed and built in the 1950s. Both sets of parallel runways are only separated by 750 feet from centerline to centerline. On fair weather days, known as Visual Meteorological Conditions (VMC), and with aircraft operating under Visual Flight Rules (VFR), SFO’s runway system can accommodate over sixty arrivals per hour, more than twice as many as any other airport in the Bay Area. This high arrival rate can occur because aircraft land side-by-side on Runways 28L and 28R because the pilots are able to see the other aircraft arriving on the parallel runway and can maintain visual separation.
When the visibility (measured in miles) and the height of the lowest level of significant clouds, called the “ceiling level” (measured in feet above the ground) decrease below the established minima, flight conditions have changed from VMC to Instrument Meteorological Conditions (IMC) and aircraft must operate under Instrument Flight Rules (IFR).

Most commercial airports in the world operate a navigation aid known as an Instrument Landing System (ILS) which allows aircraft to safely land under such degraded weather conditions. An ILS consists of two independent subsystems, one providing lateral guidance (the localizer), the other vertical guidance (the glideslope) to aircraft approaching a runway. SFO has ILSs on Runways 28L, 28R and 19L.

Even with the most limited visibility, aircraft can arrive safely at SFO using the ILS. In fact, one runway, Runway 28R, is equipped with a Category III ILS, which allows for properly equipped aircraft and properly trained and certified pilot, to land on the runway when both visibility and ceiling are rated as “zero.”

One aspect the ILS cannot solve for SFO is the lateral separation of aircraft. Current FAA criteria require that aircraft arriving side-by-side while under instrument conditions must be separated laterally by at least 4,300 feet. Since the runways at SFO are only 750 feet apart, aircraft cannot land side-by-side at SFO under instrument flight rules. As a result of this restriction, under instrument conditions SFO’s acceptance rate for arriving aircraft is cut in half to thirty aircraft per hour, which is the same rate as the other commercial airports in the Bay Area.

In October 2005, San Francisco International Airport began operating a new navigation system called the Precision Runway Monitor/Simultaneous Offset Instrument Approach (PRM/SOIA). The PRM/SOIA is made up of two systems, the Precision Runway Monitor, and the offset instrument landing system. The offset instrument landing system allows aircraft approaching Runway 28R to separate themselves from aircraft on Runway 28L by flying a precise angled approach. The Precision Runway Monitor system is a high-scan rate radar system, which allows air traffic controllers to monitor and ensure separation of the two arriving aircraft. Once the aircraft on the offset instrument approach descends below a cloud layer at approximately 2100 feet, the pilot will then make a gentle turn to align the aircraft for a normal visual approach to Runway 28R. This angled approach allows the use of both runways at SFO at lower weather than that currently allowed for visual approaches. On average, PRM/SOIA can increase the acceptance rate for arriving aircraft at SFO from 30 to 38 aircraft per hour.

**Ground Delay Programs (“Flow Control”) at SFO**

The Federal Aviation Administration (FAA) is responsible for the safe and efficient movement of all aircraft operating within the United States airspace system. When weather conditions dictate the use of an ILS approach to SFO, the FAA begins to slow the arrival rate of aircraft heading for San Francisco International Airport so that the arrival rate does not exceed the acceptance rate. Formally, this is known as a Ground Delay Program. Informally, this is referred to as “flow control.”

Flow control is implemented to control air traffic volume to airports where the projected traffic demand is expected to exceed the airport’s acceptance rate for a lengthy period of time. The most common reason for a reduction in acceptance rate is adverse weather such as low ceilings and visibility.

When SFO is operating under a flow-control program, it rarely begins before 9:00 a.m. local because prior to 9:00 the average arrival rate is less than the IMC acceptance rate of 30 aircraft per hour. Normally, the first flights that are impacted are ones that are less than three hours in duration. Usually, these are flights that are bound for San Francisco from locations west of the Rockies. These “short haul” flights can often be turned around more quickly, even if they are delayed. The least impacted flights are normally cross country flights because these flights are fewer in number. International flights are not affected because they are not departing from a U.S. airport. Flow control is not unique to SFO. Many other airports in the country experience flow control because of the same two reasons San Francisco International does: an extremely full flight schedule and unpredictable and quickly changeable weather. The other two Bay Area commercial airports, Oakland International and Mineta-San Jose, rarely have flow control because their average arrival rate is considerably less than their average acceptance rate of 30 aircraft per hour under both visual and instrument conditions.
Departures are usually not directly impacted by a flow-control program at SFO. Indirectly, however, departing aircraft may be impacted because if an arriving is late in all likelihood it will be delayed for its upcoming departure as it is turned around for another destination. Departures can be, and often are directly impacted when other airports have flow control operations. The FAA has two websites for “flow control” information. One website provides a map of the U.S. with the status of major airports highlighted (http://www.fly.faa.gov/flyfaa/usmap.jsp). The other website (http://www.fly.faa.gov/ois/) has much more detailed information regarding delays. Airport management routinely uses this site’s data since it is updated every 15 minutes and uses more real-time information rather than the map which relies heavily on forecast data.

Reference Files

The following files are available at www.flysfo.com/web/page/about/news/pressres/ for your use and reference:

- SFO_layout.pdf: A map of the runway and taxiway system at SFO
- WestPlan.jpg: Graphic map of standard “West Plan” flow of air traffic
- SoutheastPlan.jpg: Graphic map of standard “South East Plan” flow of air traffic

The Key Points Regarding Delays at SFO

- Good weather arrival acceptance rate at SFO = 60 planes/hour
- Marginal weather arrival acceptance rate at SFO = 38 planes/hour
- Inclement weather/restricted visibility acceptance rate at SFO = 30 planes/hour
- FAA National Command Center will institute a Ground Delay Program (“Flow Control”) whenever an airport’s arrival rate exceeds its acceptance rate.
- SFO has no authority to institute any type of delay program.
- SFO’s average hourly arrival rate DOES NOT exceed its inclement weather/restricted visibility acceptance rate until AFTER 9:00 a.m. local. As a result, “Flow Control” rarely begins before 9:00.
- Delay programs are for arriving aircraft ONLY. Departing aircraft may be delayed as a result of a delay program if the aircraft arrives late at SFO and then cannot be turned around in time to meet its scheduled departure time.