



2017 ANNUAL REPORT
METROPOLITAN AIRPORTS COMMISSION





Dear Reader:

For 75 years, the Metropolitan Airports Commission has been working to promote safe, efficient, environmentally responsible air transportation services in the Minneapolis-St. Paul metropolitan area. In the process, our airports have become key economic drivers for the area economy, generating nearly \$16 billion in total economic output and supporting nearly 87,000 jobs.

This report is designed to update you on key activities and achievements at Minneapolis-St. Paul International (MSP) and our six general aviation, or “reliever,” airports in 2017. The report covers a broad range of topics: improvements to airport infrastructure and amenities, air service growth, economic impacts, services for airport neighbors, operational and capacity data, and plans for the future. It also satisfies our legislative reporting requirements under Minnesota Statute 473.621, Subd. 1b.

Please take a few minutes to read through the report to find out more about our record-setting year at MSP. In the process hopefully you’ll get a sense of why MSP was named the Best Airport in North America in its size category for both 2016 and 2017 by Airports Council International, the Most Efficient Airport by the Air Transport Research Society, and Best Airport Staff in North America by Skytrax.

Thank you for your interest in the Metropolitan Airports Commission and our system of airports.

Sincerely,



Dan Boivin
Chairman



Brian Ryks
Executive Director
and CEO



The Metropolitan Airports Commission

(MAC) owns and operates one of the largest airport systems in the United States, including Minneapolis-St. Paul International (MSP) – the nation’s 16th busiest commercial airport – and six general aviation airports in the Minneapolis-St. Paul metropolitan area. By law, the MAC can own and operate airports within a 35-mile radius of city halls in Minneapolis and St. Paul.

The MAC system helps connect people and businesses in the Upper Midwest to friends, family, colleagues, clients and customers around the world. It supports Minnesota’s ability to attract and retain Fortune 500 firms and small businesses alike.

Improving the MSP Experience



The MAC's vision is
"Providing your best airport experience."

The organization took significant steps in 2017 to maximize customer satisfaction.

The first phase of a massive food and retail renovation was completed in 2017, with 50 new restaurants, retail venues and service providers open for business. Many of the new venues are Minnesota-based, including local retailers and iconic area restaurants such as:

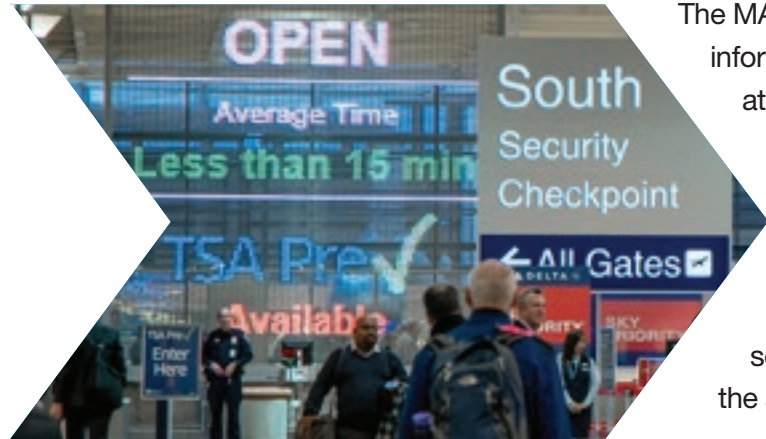


Following a competitive public process, in 2017 the MAC also selected businesses to open another 30 new restaurants in 2018 and 2019.



Other efforts:

CLEAR began providing services at MSP in 2017. Participants in the membership-based program can use fingerprint or iris scanners to verify their identity in dedicated security lines rather than wait in traditional security lines.



The MAC installed large electronic signs informing travelers of wait times at Terminal 1's primary security checkpoints, helping travelers identify and choose the quickest alternative. In addition, the MAC installed four automated security lanes at Terminal 1's south security checkpoint to speed the screening process.

Delta and American airlines both began testing new automated bag drop services, enabling travelers to tag their bags and take them to an automated bag drop area instead of waiting in line for a ticket agent.

New public seating and improvements to self-service business centers enhanced both comfort and utility for travelers awaiting flights.

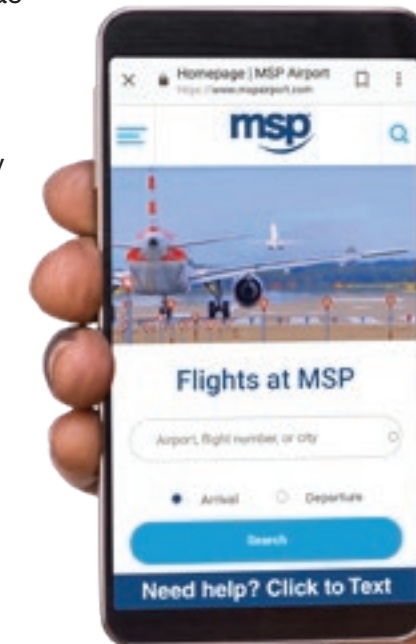


Technology upgrades such as 1,000 new antennae to increase mobile phone coverage, as well as enhancements to the free public Wi-Fi system that expanded capacity by 33 percent, helped ensure even Super Bowl-sized crowds could stay connected at the airport.

mspairport.com

An updated MSP website went public in July. The new site – available on both mobile and desktop devices – includes on the home page:

- Security wait times
- Parking availability
- Live chat with MSP information agents.





airport foundation



The Arts@MSP program, a partnership between the MAC and the non-profit Airport Foundation MSP, brought new exhibits, live performances, short films and permanent art to MSP, including:

- Rotating exhibits were featured at the Thomson Reuters Concourse C Gallery, near the See 18 short film theater and in lighted display cases in both terminals
- Installation of new mosaics continued as part of the restroom renovation program
- Permanent works of art were installed near the four new gates at Terminal 2.
- Musicians and dancers appeared in many areas of the airport, providing both soothing and exhilarating performances for travelers' enjoyment.



Investing in Infrastructure



Ensuring the MAC's airport system continues to meet the air transportation needs of the community and the region requires continuous planning, design and construction to maintain and improve the organization's seven airports.

In 2017, the MAC budgeted nearly \$447 million for capital expenditures at MSP and more than \$8.3 million for capital improvements at MAC general aviation airports.

The MAC launched a multi-year project to expand and modernize Terminal 1-Lindbergh's 55-year-old arrivals and departures lobbies. The project includes:

- Expanding the front of the terminal toward the roadway to ease congestion in the ticketing and bag claim areas
- Installing new elevators and escalators
- Developing technology infrastructure to support self-service airline check-in and bag-check processes
- Providing technology solutions to help travelers move through security faster
- Creating central, intuitive spaces in which to meet arriving travelers using food and beverages services and iconic art.

Because the arrival and departure lobbies must continue to operate during construction, the improvements are being implemented in phases, with completion expected in 2023.



Construction began on a new **5,000-space parking ramp** at Terminal 1. For years, existing ramps have frequently filled to capacity mid-week, resulting in drivers being diverted to ramps at Terminal 2-Humphrey or to the unattached Quick Ride Ramp on Northwest Drive. When completed in 2020, the new Silver Ramp will also house new auto rental counters and facilities. In addition, it will allow for more flexibility in expanding curbside passenger pickup and dropoff areas.



Graves Hospitality continued construction of a 12-story, 300-room **InterContinental hotel**, spa and conference center. Scheduled to open in the summer of 2018, the hotel will connect to Terminal 1 via a skyway the MAC began constructing in 2017.



To make room for the new parking ramp and hotel, Glumack Drive leading to and from Terminal 1 was modified and **new parking entrance and exit plazas constructed**. The outbound roadway now is positioned south of the hotel and new parking ramp, with the exit plaza located further east, near Delta Air Lines' existing aircraft maintenance facilities.



At the reliever airports, the MAC continued long-term planning processes for Crystal (MIC) and Lake Elmo (21D) airports and initiated the process for Airlake Airport (LVN) in Lakeville and Eureka Township.

Key capital improvements at the reliever airports in 2017 involved:

- Renovating the terminal at St. Paul Downtown Airport (STP), including infrastructure to support a new full-service restaurant and a public outdoor viewing space
- Modernizing the STP terminal parking lot to provide adequate space not only for airport operational uses but also to accommodate community visits to the facility
- Rehabilitating runway, taxiway and apron pavements at STP
- Procuring a new equipment storage building and improving alleyway pavement at Flying Cloud Airport (FCM)
- Installing new runway and obstruction lighting systems at LVN
- Improving storage for airfield maintenance products at MIC and ANE
- Creating aircraft viewing areas at MIC, LVN and FCM so that all MAC reliever airports now have attractive areas for community members to watch flight activities

In addition there were more than \$8 million in private investment at MAC reliever airports in 2016, with three corporate hangars constructed at FCM and one at ANE. Site work for a new commercial hangar at STP was completed in 2017, with construction slated for 2018.

Air Service



AIRFRANCE KLM

MSP is Delta Air Lines' second largest hub, base for Sun Country, and an operations site for nearly every major domestic carrier and a growing number of international airlines.

In 2017, airlines offered non-stop service to nearly 160 destinations from MSP: 131 domestic and 28 international.

Multiple airlines served 58 of those routes – a record for MSP – helping keep fares competitive. Alaska, Delta, Frontier, KLM, Southwest, Spirit and Sun Country airlines launched a total of 16 new routes from MSP in 2017.

Added airline routes included:

Amsterdam	New Orleans
Aruba (two airlines)	San Francisco
Austin	San Diego
Cincinnati	Santa Rosa/Sonoma
Cleveland	Sault Ste. Marie
Fort Myers	Tampa
Marquette	Tucson
Nashville	

KLM launched scheduled service to MSP in March 2017, the first time the airline has served the Twin Cities since 2001. The airline offers three roundtrips a week between Amsterdam and MSP. In October 2017, KLM became the first airline to offer MSP travelers service on the new Boeing 787 Dreamliner. That same month, **JetBlue Airways** announced it will launch service at MSP in May 2018, with three daily roundtrip flights between MSP and Boston.



New service, larger planes and higher demand pushed passenger levels to a record high in 2017, with 38,034,341 total travelers flying to or from MSP – 1.4 percent more than in 2016.

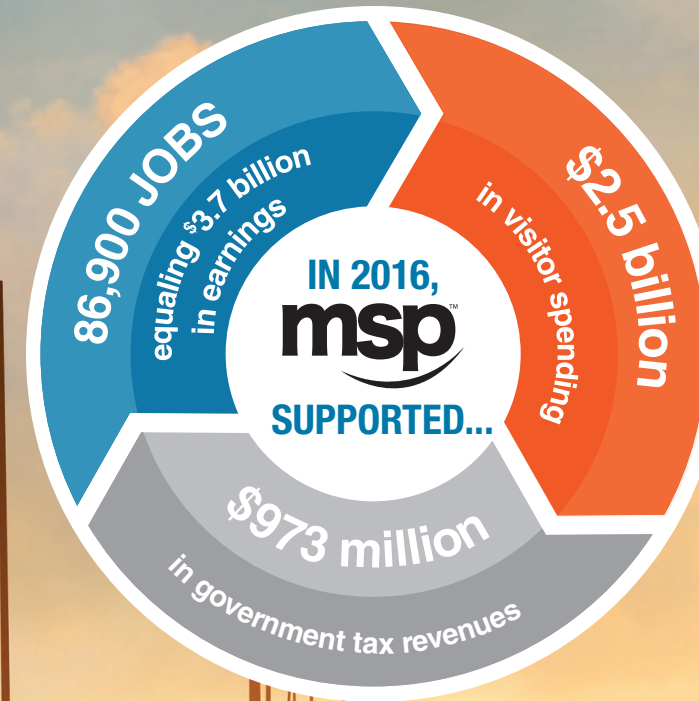
Aircraft landings and takeoffs grew less than 1 percent, as major airlines continued to shift more flight activity to mainline jets and away from smaller regional aircraft. Even with the increased activity, British air travel consulting firm OAG named MSP best in the world in its size category for on-time flights in 2017, with 85.7 percent of flights departing and arriving on time. That top world ranking is particularly impressive considering MSP's location in the snow belt – a credit to the world-class MAC snow removal team, local air traffic controllers and the airlines operating at the airport.

Delta Air Lines brought its history of scheduled service on Boeing 747s to a close in December, with a farewell flight from Atlanta to MSP. That month, hometown carrier Sun Country Airlines was sold to New York investment firm Apollo Global Management. The sale came as Sun Country was beginning to transform its business model to one more aligned with ultra-low-cost carriers.

The new owner has indicated Sun Country's headquarters will remain in Minnesota.

To ensure air service at MSP continues to meet area business demand, the MAC partnered with Greater MSP to create the MSP Regional Air Services Partnership. Greater MSP is a cooperative business venture designed to grow the local economy by creating a regional approach to economic development. The MSP Regional Air Services Partnership recognizes that competitive air service is a top priority for businesses in determining where to locate facilities and employees. To find and attract new air service, it is important to have a robust fact base and complete understanding of market conditions. Toward that end, Greater MSP will research current and future air service needs in cooperation with its members, airlines and the MAC.

Economic Impact



Air transportation is a key economic driver in cities across the nation. In 2017, InterVISTAS Consulting, LLC published a study of MSP's economic impact on the Twin Cities metropolitan area in 2016.

The findings:

MSP created more than \$15.9 billion in annual economic output and supported 86,900 jobs, making it one of the most important economic generators in the entire Upper Midwest.

More than 5.2 million visitors to the Twin Cities traveled through MSP, spending more than \$2.5 billion in the community. The airport generated \$3.7 billion in employment earnings and nearly \$1 billion in taxes to support federal, state and local programs.

The study did not measure the number of Twin Cities businesses and jobs that are unrelated to the aviation and visitors industries that would probably not be located there if not for ample air service. However, it is likely no coincidence that Minnesota has both some of the best air service and most Fortune 500 companies per capita in the nation.



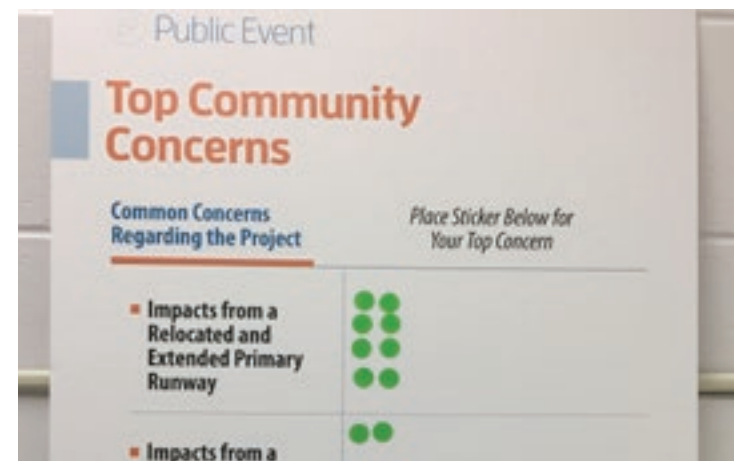
Services for MSP's Neighbors



The MAC administers the most extensive noise mitigation program in the nation, providing residential noise abatement improvements well beyond the federal standard for mitigation. In 2017, the MAC provided mitigation to 79 homes at a cost of more than \$1.5 million and introduced an additional 48 homes to the first phase of construction.

To date, the MAC has provided mitigation to more than 15,000 homes, nearly 3,300 multi-family units and 19 schools at a total cost approaching \$500 million.





In addition, the MAC transformed its quarterly MSP Noise Oversight Committee public information meetings into listening sessions, with a greater focus on providing a forum for airport neighbors to express concerns and get their questions answered. The MAC also created a Noise Basics video and fact sheet series to help explain various aspects of aircraft noise. Additionally, the MAC launched a new interactive reports site, with graphics to help simplify noise-related data and avenues to dig deeply into the data if desired. For more information, visit macnoise.com.

The MAC was recognized nationally for developing an innovative way for the industry to measure impacts of optimized profile descents at a local airport level. Endorsed by the Noise Oversight Committee and the MAC, optimized profile descents occur when pilots keep the throttle pulled back for a continuous descent rather than using more traditional procedures that involve power adjustments and descending in steps. The MAC estimates that airlines burn 2.9 million fewer gallons of fuel per year using optimized profile descents, emitting 28,465 fewer metric tons of carbon dioxide into the atmosphere.

In addition, the MAC achieved Level 2 Carbon Accreditation from an industry program that recognizes airports that commit to reducing their emissions by making investments in technologies, incentives and stakeholder engagement.

As part of the environmental analysis of improvements at Lake Elmo Airport, the MAC expanded opportunities for community members and airport users to gain information and engage in the process. The enhanced public process will serve as a template for similar efforts in the future.

Recognizing Excellence



The MAC and MSP were recognized with a number of prestigious awards in 2017, with accolades for customer experience, environmental leadership, affordable fares and innovation. Chief among the awards:

- ▶ Airports Council International named MSP **Best Airport in North America** in its size category based on surveys of travelers throughout the continent.
- ▶ Skytrax presented MSP with the **Best Airport Staff in North America**, again based on traveler surveys.
- ▶ The Airport Transportation Research Society determined MSP to be the **Most Efficiently Managed Airport in North America**.



Planning for the Future



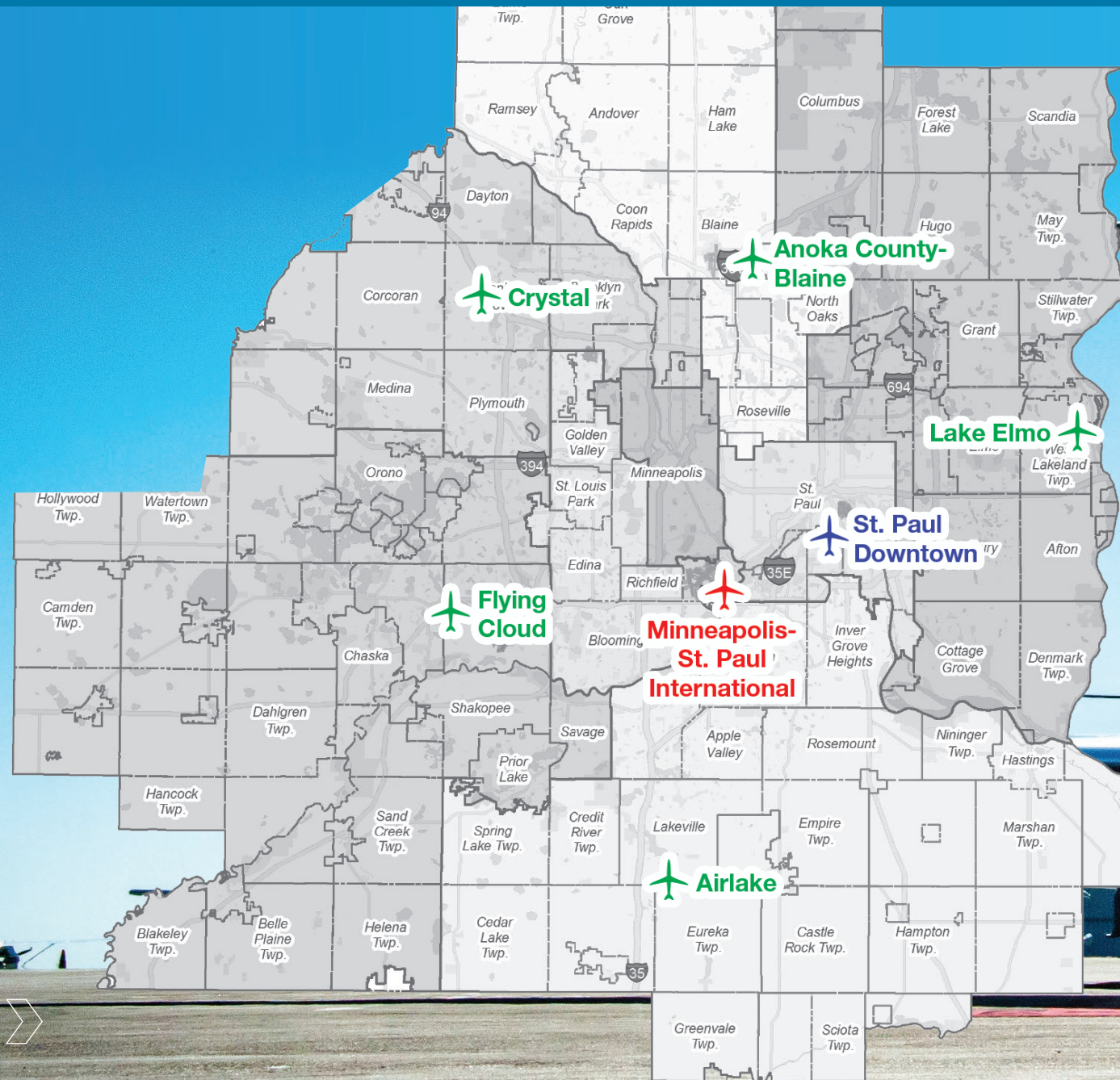
Work on a number of major improvements at MSP will continue or reach completion in 2018.

- The InterContinental Hotel and connected skyway will open to the public in the summer.
- Construction will continue on the new Silver parking ramp scheduled to open in 2020.
- The second phase of improvements to expand and modernize arrivals and departures lobbies and streamline movement between levels will commence.

Development will begin on the first of 30 new restaurants, including a significant expansion of the main food court in Terminal 1.



Reliever Airports

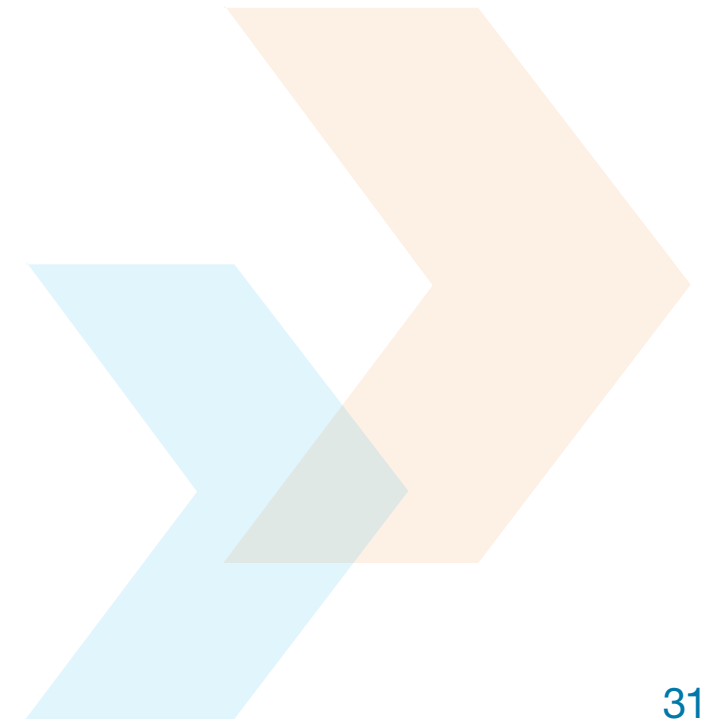


The MAC's six general aviation reliever airports continue to play a vital role both in providing easy access to businesses and communities throughout the metropolitan area and in providing an attractive alternative to MSP for private pilots.

Each airport is unique both in its design and layout and in the role it plays within the MAC's system.

The MAC's three primary reliever airports are Anoka County-Blaine (ANE), Flying Cloud (FCM) and St. Paul Downtown (STP), and the three complementary reliever airports are Airlake (LVN), Crystal (MIC) and Lake Elmo (21D).

For complete information on long term comprehensive plans for MAC reliever airports, visit metroairports.org.



Airlake Airport

Located south of the Twin Cities in Lakeville and Eureka Township, Airlake Airport (LVN) has a single 4,099' x 75' runway and a full-length parallel taxiway.

The MAC completed a 2035 Long Term Comprehensive Plan for Airlake Airport and submitted it for Metropolitan Council review and approval in 2017.

The plan envisions:

- ▶ Displacing the Runway 12 threshold to provide airspace clearance over railroad tracks
- ▶ Extending Runway 12-30 with declared distances to maximize overall airfield utility for existing users
- ▶ Reconfiguring the taxiway and expanding the apron area

Any required environmental review for the planned improvements at Airlake Airport will be completed prior to construction.



Anoka County-Blaine Airport

Situated in the north metro near the National Sports Center, Anoka County-Blaine Airport (ANE) serves the most diverse aircraft mix in the MAC's reliever airport system. The airport has two runways, the longest of which measures 5,000' x 100'. It is served by a non-federal air traffic control tower. Prior to initiating the long-term planning update for ANE, the MAC is conducting a broader system-level assessment of the three primary reliever airports (ANE, FCM and STP) and the general aviation activity at MSP.



Crystal Airport

Crystal Airport (MIC) lies within the cities of Crystal, Brooklyn Park and Brooklyn Center in the northwest metro. The airport has three paved and one turf runway – the most runways of any MAC reliever airport as well as the only turf runway in the system. Runway 14R-32L is the longest, measuring 3,267' x 75'. An FAA-operated air traffic control tower is located on site.

Highlights of the adopted 2035 Long Term Comprehensive Plan for MIC include:

- ▶ Converting portions of paved blast pads on Runway 14L-32R to useable runway for a published length of 3,750' with declared distances, and extending taxiways to new runway ends
- ▶ Shifting Runway 14L-32R 115' to the northwest to locate the entire runway protection zone on MAC property
- ▶ Converting existing Runway 14R-32L into a full-length parallel taxiway
- ▶ Updating the runway designation to Utility, reducing runway protection zone dimensions
- ▶ Retaining a portion of the turf runway while reducing crossing points and airfield complexity



Flying Cloud Airport

Flying Cloud Airport (FCM) is situated in Eden Prairie and serves the southwest metro. The busiest general aviation airport in the MAC system, FCM is a popular home base for corporate business jets and turboprops. The airport has three runways, the longest of which is 5,000' x 100', and an FAA-operated air traffic control tower. Prior to initiating the long-term planning update for FCM, the MAC is conducting a broader system-level assessment of the three primary reliever airports (ANE, FCM and STP) and the general aviation activity at MSP.



Lake Elmo Airport

Located in the east metro, Lake Elmo Airport (21D) ranks third amongst MAC reliever airports for the number of based aircraft. However, it is the least busy from an aircraft operations standpoint. The airport has two runways, the longest of which is 2,849' x 75'.

Planned improvements documented in the 2035 Long Term Comprehensive Plan and draft Environmental Assessment/ Environmental Assessment Worksheet include:

- Relocating primary runway 14-32 to the northeast by 615 feet and extending it to 3,500'
- Converting existing Runway 14-32 into a partial parallel taxiway
- Constructing other taxiways and engine run-up pads as needed to support the new runway ends
- Realigning 30th St. North around the new Runway 32 end runway protection zone and reconnecting the street to the existing intersection with Neal Avenue
- Reconstructing existing crosswind Runway 4-22 and extending it to 2,750'
- Pursuing creation of Rust Patch Bumble Bee/pollinator habitat

An environmental assessment of the airfield improvements at Lake Elmo Airport was initiated in early 2017 and included robust stakeholder engagement to inform, educate and engage the public and airport users throughout the environmental process. The environmental review is planned to be completed in mid-2018.



St. Paul Downtown Airport

St. Paul Downtown Airport (STP) is the only airport in the MAC reliever system with a runway longer than 5,000'. As such, the airport is a popular draw for larger corporate jet aircraft. Of the airport's three runways, Runway 14-32, is the longest, measuring 6,491' x 150'. Nestled along the Mississippi River, with scenic limestone bluffs on one side and downtown St. Paul on the other, and served by an FAA-operated air traffic control tower, the airport offers easy access to many local businesses and

amenities. In 2017 the MAC completed significant renovations of the historic airport terminal, creating infrastructure to house a restaurant and catering service. STP has the fewest based aircraft in the MAC system but ranks third for aircraft operations. Prior to initiating the long-term planning update for STP the MAC is conducting a broader system-level assessment of the three primary reliever airports (ANE, FCM and STP) and the general aviation activity at MSP.



Connecting Minnesota to the World



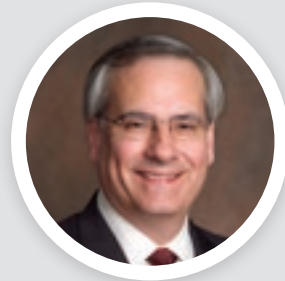
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The Minnesota Legislature created the Metropolitan Airports Commission (MAC) in 1943 to promote the efficient, safe, economical handling of air commerce and to develop the full potentialities of the Minneapolis-St. Paul metropolitan area as an aviation center. A public corporation of the state, the MAC generates the revenues it needs to operate through rents and user fees, not general tax appropriations. Bonding and financing authority – along with MAC-generated cash and state and federal aviation grants and fees – fund capital investments in the MAC’s seven-airport system. The MAC maintains a AA- senior bond rating – among the highest of any U.S. airport operator.

The organization is governed by a 15-member policy board. The board chairman and 12 commissioners are appointed by Minnesota’s governor, and the mayors of Minneapolis and St. Paul each appoint a commissioner.

The chairman and mayoral appointees serve at the will of the elected officials who appoint them. All other commissioners serve four year, staggered terms, providing continuity when administrations change. Eight commissioners are appointed by the governor to metropolitan districts, and four represent greater Minnesota.

Topics typically are first discussed at monthly public meetings of the board’s three committees:

- Finance and Administration (F&A)
- Management and Operations (M&O)
- Planning, Development and Environment (P,D&E)

Those committees discuss published agenda items and make recommendations for consideration by the full board. Members of the public can come to the meetings in person or watch them streamed live or via video-on-demand on the MAC website. Each meeting offers opportunities for public comment, both on agenda items and on other MAC-related topics.

The MAC operates much like a city, with its own police, fire, emergency dispatch and maintenance departments. The MAC board acts like a city council, establishing policies, ordinances and budgets. Executive Director and Chief Executive Officer Brian Ryks functions much like a city manager, overseeing day-to-day operations and administration of the organization. With only 600 employees, the MAC is among the most efficient airport operators in the nation, keeping the cost to airlines low and encouraging growth in air service and airline competition.



Appendix



This report and appendix is prepared in accordance with the requirements of Minnesota Statutes Section 473.621. It presents MSP passenger and aircraft operations activity, current airport capacity in terms of operations and passenger enplanements, average length of delay statistics, and technological developments affecting aviation and their effect on operations and capacity at the airport. To satisfy the MAC's statutory obligations, this appendix includes MSP airfield capacity and delay information and technological developments and capacity enhancements at MSP.

MSP Revenue Passenger Summary

Rank	Airline	2015	2016	2017	Gain/Loss 2015-2017	% Change 2015-2017
1	Delta	25,844,791	25,843,245	25,995,533	150,742	0.58%
2	Sun Country	2,051,647	2,197,819	2,411,903	360,256	17.56%
3	American/US Airways	2,244,409	2,403,295	2,363,226	118,817	5.29%
4	Southwest/AirTran	1,884,704	2,109,637	2,058,405	173,701	9.22%
5	United	1,567,854	1,736,055	1,696,922	129,068	8.23%
6	Spirit	1,029,510	1,200,623	1,232,433	202,923	19.71%
7	Frontier	453,762	327,798	346,053	(107,709)	-23.74%
8	Alaska Airlines	193,548	276,412	321,768	128,220	66.25%
9	Air Canada	82,726	89,282	103,146	20,420	24.68%
10	Icelandair	56,795	74,564	99,406	42,611	75.03%
11	Air France	60,100	52,845	63,570	3,470	5.77%
12	KLM			52,356	52,356	---
13	Condor	10,581	18,861	28,112	17,531	165.68%
14	Boutique Air		6,458	11,334	11,334	---
15	Air Choice One		3,113	10,128	10,128	---
16	Great Lakes	8,765	1,557	0	(8,765)	-100.00%
	Total	35,489,192	36,341,564	36,794,295	1,305,103	3.68%

Source: MAC Year End Operations Reports 01-30-2018. Note, this chart reflects numbers of paying passengers only. Each year's totals are greater if you also count non-revenue passengers such as airline employees with flight benefits.

MSP Revenue Passenger Market Share

Rank	Airline	2015	2016	2017	Gain/Loss 2015-2017	% Change 2015-2017
1	Delta	72.82%	71.09%	70.65%	-2.17%	-2.98%
2	Sun Country	5.78%	6.05%	6.56%	0.77%	13.39%
3	American/US Airways	6.32%	6.65%	6.42%	0.10%	1.56%
4	Southwest/AirTran	5.31%	5.80%	5.59%	0.28%	5.34%
5	United	4.42%	4.78%	4.61%	0.19%	4.39%
6	Spirit	2.90%	3.30%	3.35%	0.45%	15.46%
7	Frontier	1.28%	0.90%	0.94%	-0.34%	-26.44%
8	Alaska Airlines	0.55%	0.76%	0.87%	0.33%	60.35%
9	Air Canada	0.23%	0.25%	0.28%	0.05%	20.26%
10	Icelandair	0.16%	0.21%	0.27%	0.11%	68.82%
11	Air France	0.17%	0.15%	0.17%	0.00%	2.02%
12	KLM			0.14%	0.14%	---
13	Condor	0.03%	0.05%	0.08%	0.05%	156.26%
14	Boutique Air		0.02%	0.03%	0.03%	---
15	Air Choice One		0.01%	0.03%	0.03%	---
16	Great Lakes	0.03%	0.00%	0.00%	-0.03%	-100.00%

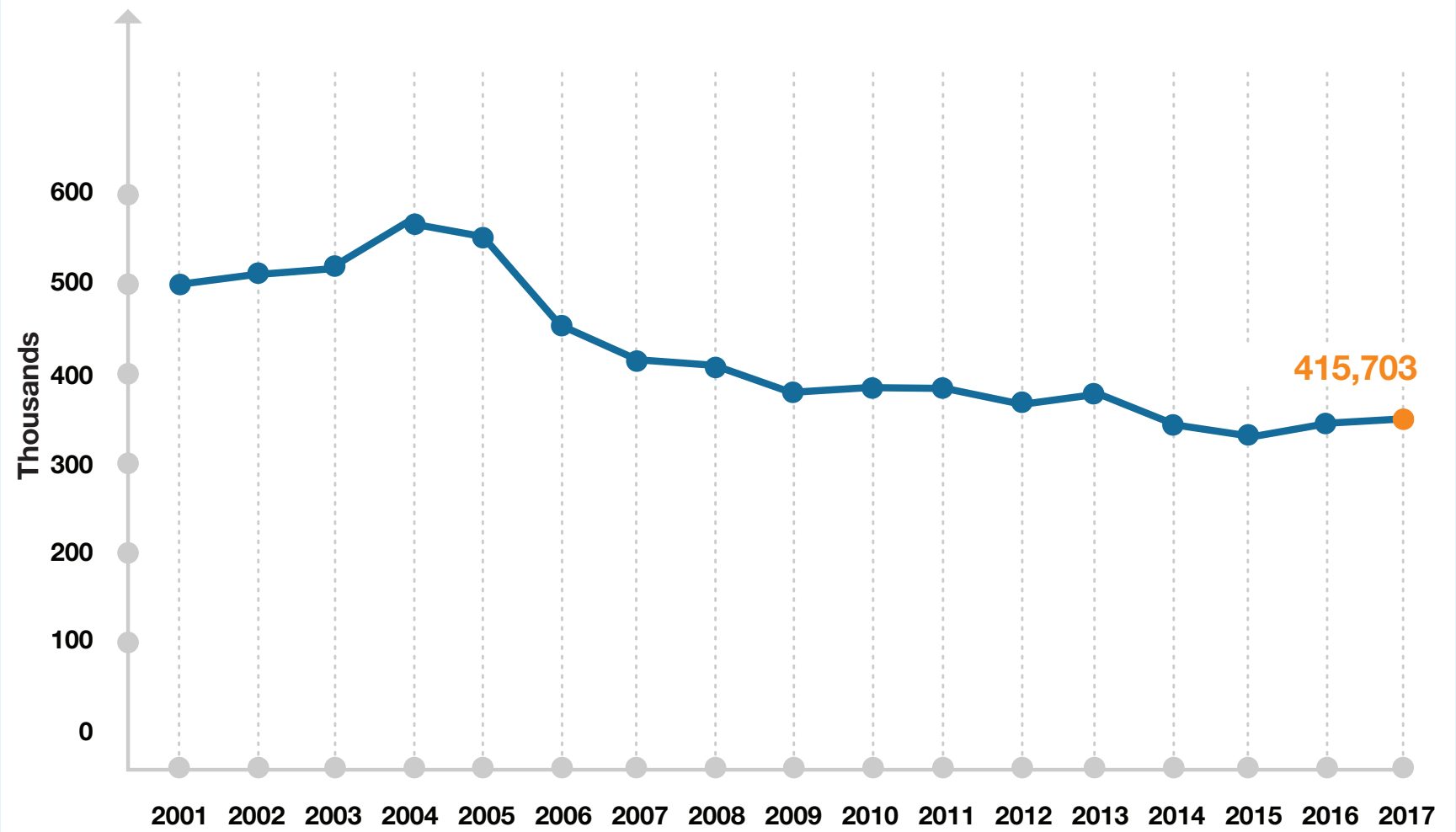
Source: MAC Year End Operations Reports 01-30-2018

MSP Airport Operations

Calendar Year	Air Carrier	Air Taxi	Itinerant General Aviation	Military	Total Operations
2010	278,102	140,858	13,784	2,839	435,583
2011	279,567	139,172	13,413	2,924	435,076
2012	282,186	128,267	12,030	2,445	424,928
2013	285,278	132,241	11,510	2,544	431,573
2014	292,445	105,606	11,272	2,437	411,760
2015	303,357	86,497	11,691	2,829	404,374
2016	311,271	87,198	11,489	2,940	412,898
2017	319,278	82,861	11,521	2,043	415,703

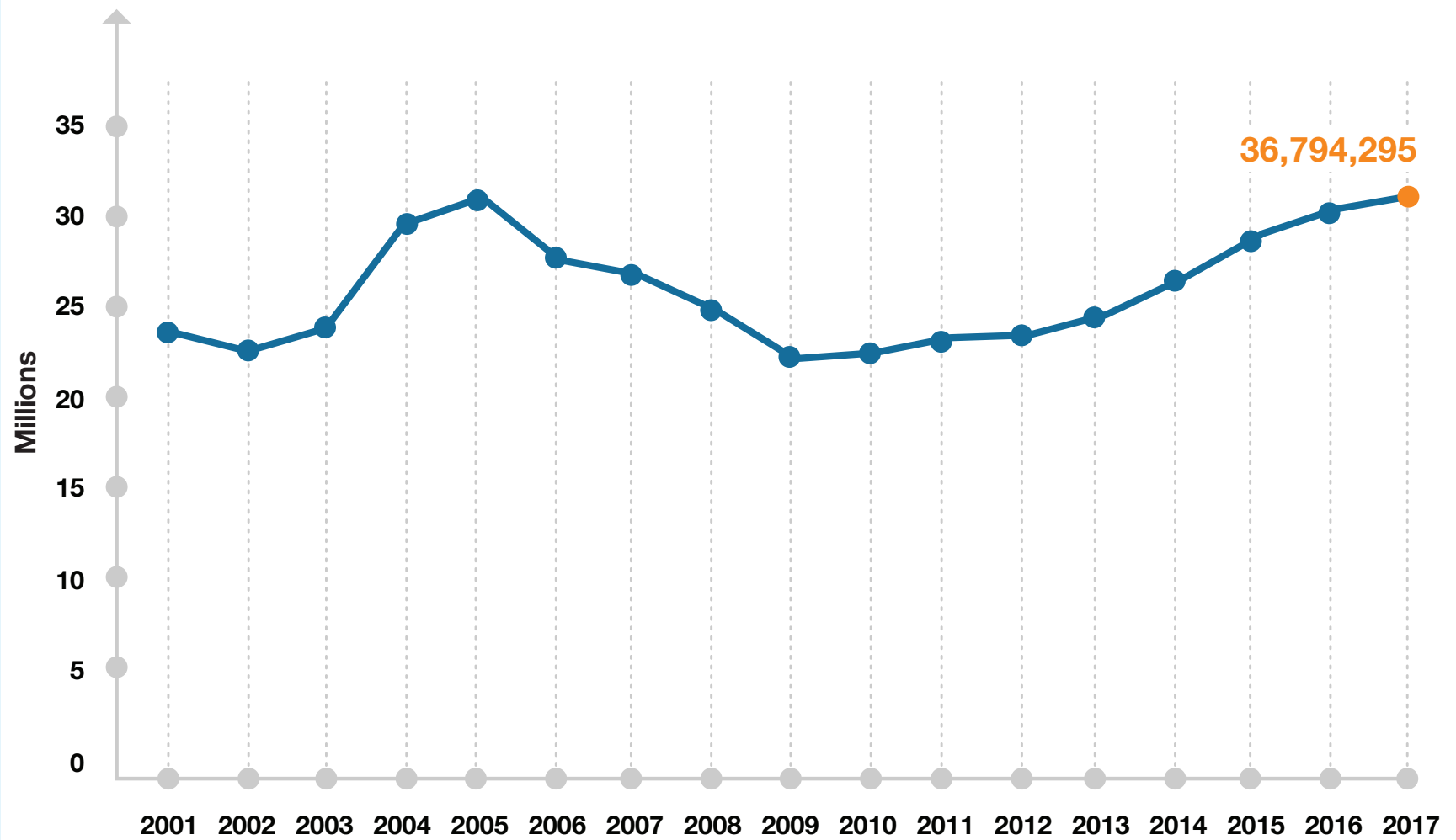
Source: The Operations Network (OPSNET)

MSP Aircraft Operations



Source: FAA Tower Counts

MSP Revenue Passengers



Source: MAC Monthly Statistics. Note, this graph reflects numbers of paying passengers only. Each year's totals are greater if you also count non-revenue passengers such as airline employees with flight benefits.

Airfield Capacity

Airfield capacity is typically described in terms of hourly capacity and annual capacity under good and poor weather conditions.

Table A-1 below reflects the hourly capacity for MSP in optimum, marginal and poor weather conditions.

MSP Airfield Capacity Table A-1

Weather Conditions	Operations per hour
Optimal Rate (1)	141
Marginal Rate (2)	126
IFT Rate (3)	114

Notes:
 (1) Ceiling and visibility above minima for visual approaches.
 (2) Below visual approach minima but better than instrument conditions.
 (3) Instrument conditions (cloud ceiling less than 1,000 feet or visibility less than 3 miles).

Source: Federal Aviation Administration Air Traffic Control Tower Analysis

MSP’s current airfield capacity is about 141 aircraft operations in optimum conditions and 114 operations in poor weather, when instrument flight rules are being used due to low-level, heavy cloud cover and/or low visibility. Since 2015 when new Converging Runway Operations (CRO) measures were put in place, the Federal Aviation Administration (FAA) has worked to refine the procedures at MSP to regain capacity and reduce environmental impacts as much as feasible.

A CRO exists when runways that do not physically intersect have flight paths that could intersect within one mile of the runway ends. At MSP, the extended centerline of Runway 35 intersects within one mile with the extended centerlines of both Runway 30L and 30R. Since arrivals on Runway 35 are only from the south, potential convergence in flight paths only would occur if an aircraft executes an aborted landing (go-around) on Runway 35. CRO procedures at MSP prevent an aircraft that aborts its landing on Runway 35 from conflicting with aircraft departing from Runways 30L or 30R, as shown in **Figure A-1**.



Figure A1: CRO Rules protect Circled Area of Convergence at MSP

The new CRO rules caused a change in runway use trends and slowed arrival rates down from the 90 arrivals per hour during north flow at MSP. Throughout 2016 and 2017, the MSP Noise Oversight Committee (NOC), MAC board, surrounding city councils and neighborhood groups received regular updates from the FAA on its efforts related to the new CRO. In September 2016, the NOC unanimously passed a resolution requesting the FAA evaluate the current and future environmental and capacity impacts from the new CRO rules and to communicate the findings back to the NOC. The MAC board of commissioners took unanimous action supporting the NOC resolution and forwarded it to the FAA.

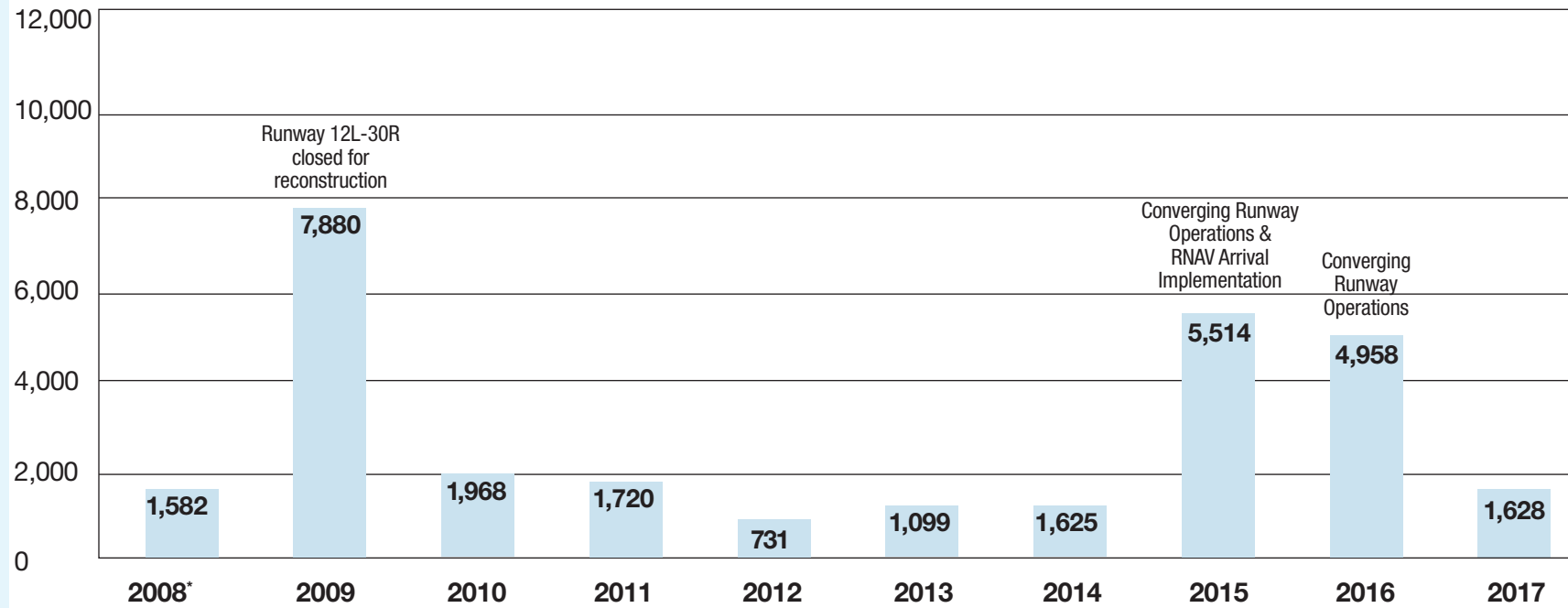
During 2017, the FAA made substantial progress in designing and employing technological tools within its air traffic control system to revert changes in runway use, regain some capacity loss, and reduce air traffic controller work load at MSP during CRO. In January 2017, the FAA began using two Arrival Departure Windows (ADWs) for each of the parallel runways. In order to use

two ADWs at the same time, a thorough risk assessment and approval process was required. These windows help alternate flights departing Runways 30L and 30R with flights arriving to Runway 35. Use of the two ADWs increased MSP’s northerly arrival rate from 64 to 75 aircraft per hour. Further, in June 2017, the FAA implemented a Converging Runway Display Aid (CRDA) which aligns aircraft arriving to Runways 30L with 35 to offer efficiency gains in sequencing departures to the northwest. The CRDA tool helps arrivals on Runway 35 line up with arrivals on Runway 30L to create a predictable departure gap for Runway 30L. This has allowed the FAA to flex arrival rates up to 84 aircraft per hour during three peak arrival demand periods throughout the day, reducing arrival delays. Similarly, in August 2017 the FAA began flexing departure rates up during periods of peak departure demand by routing Runway 35 arrivals to either parallel runway (30L or 30R), thus eliminating the dependency on ADWs for aircraft departing to the northwest. The FAA’s implementation of this suite of tools has largely reverted runway use trends to pre-CRO conditions.

While the FAA’s efforts related to CRO were taking place, the MAC was in the process of updating the Long Term Comprehensive Plan (LTCP) for MSP. The LTCP is a forward-looking document that acts as a roadmap for possible facility improvements needed for the next 20 years to meet deficiencies identified through the process. A component of the LTCP document is a 20-year forecast noise contour to provide an estimated depiction of the future noise impacts at the airport. At the request of elected officials and community members, and as recommended by the NOC, the MAC deferred its LTCP efforts to ensure the FAA’s CRO efforts and any resulting changes to ground and air operations are taken into account in the MAC’s long term planning efforts.

The MAC plans to initiate the MSP LTCP update in 2018 and complete the document in 2020.

MSP Flights Delayed by ATC* 2008 - 2017 *Figure A-2*



*This total is reported differently in 2008 due to FAA adjusting the way air traffic control calculates delays for arriving and departing flights. Source: Federal Aviation Administration Opsnet.

Airfield Delay

Even in the midst of complications related to Converging Runway Operations, MSP's location in the snow belt and a small increase in operations in 2017, British air travel consulting firm OAG named MSP the best in the world in its size category for on-time flights, with 85.7 percent of flights operating on time (within 15 minutes of their scheduled flight times). Airport delay can be measured in several ways. This section reviews MSP delay metrics as they are reported by the FAA.

The FAA Air Traffic Operations Network (OPSNET) database counts flights that were reported by Air Traffic Control (ATC) to be delayed for more than 15 minutes. **Figure A-2** on the following page, depicts the annual number of MSP flights delayed by ATC from 2008 through 2017.

In 2008, the FAA made significant modifications to its reporting rules that affect historical data comparisons. The FAA now combines arrival and enroute delays into one category and reports delays for aircraft that accumulate 15 minutes or more holding delay at each facility throughout the entire route of flight. Delays of fewer than 15 minutes are not counted; nor are delays not initiated by ATC. In addition, since delays are reported by each airport facility, a flight that was delayed by 13 minutes at one airport facility and 12 minutes by another airport facility (for a total delay of 25 minutes) was not included in the OPSNET database prior to October 1, 2008. These data limitations should be kept in mind when reviewing OPSNET delay.

In 2017, there were 1,628 delayed flights at MSP, a reduction of 3,330 from the number of flights delayed in 2016. In 2015 and

2016 delays at MSP largely were attributed to the implementation of new RNAV/RNP arrival procedures in March and April 2015 and implementation of new CRO requirements beginning in August 2015.

Average Delay per Aircraft Operation

When calculating the average delay per aircraft operation, airport-attributable delay is estimated by comparing a flight's actual air

and taxi times with estimated unconstrained times. The total cumulative amount of delay experienced by all scheduled flights in the database is then divided by the total number of flights in the database for the same time period. The output is usually expressed in minutes of delay per operation.

The current industry standard for estimating delay relies on the FAA's ASPM data, which provide a comprehensive analysis of

Top 25 Large Hub Airports with Highest Average Total Delay Per Operation *Table A-2*

Rank	Airport	2017 Total Airports Operations	2017 Average Minutes of Delay per Operation	2016 Average Minutes of Delay per Operation	2016 Rank	Change from 2016 to 2017
1	LGA	366,018	12.3	11.9	1	0.4
2	CLT	553,817	9.8	9.1	2	0.7
3	JFK	453,335	9.7	8.9	4	0.9
4	ORD	867,049	9.4	9.0	3	0.4
5	EWR	443,649	9.1	7.7	7	1.4
6	PHL	369,928	9.0	7.4	9	1.6
7	LAX	700,362	8.9	7.8	6	1.1
8	SFO	460,346	8.8	6.5	11	2.2
9	DCA	299,360	7.9	7.8	5	0.1
10	DFW	654,344	7.8	7.6	8	0.2
11	SEA	416,136	7.4	5.9	13	1.5
12	MIA	413,287	6.4	6.6	10	-0.2
13	IAH	450,323	6.1	6.2	12	-0.1
14	BOS	405,822	5.9	5.4	17	0.4
15	IAD	294,066	5.7	5.4	16	0.3
16	RDU	202,348	5.6	5.2	19	0.5
17	PHX	430,968	5.5	5.7	14	-0.2
18	DEN	582,486	5.4	5.3	18	0.1
19	MSP	415,703	5.4	5.5	15	-0.1
20	ATL	879,498	5.2	4.8	22	0.4
21	MCO	338,278	5.2	5.1	20	0.1
22	DTW	395,357	5.1	5.1	21	0.0
23	FLL	312,763	5.0	4.1	31	0.9
24	DAL	227,533	4.8	4.6	24	0.1
25	MEM	223,357	4.8	4.4	26	0.3

¹Prior to 2005, the industry standard was the FAA's Consolidated Operations and Delay Analysis System (CODAS); the U.S. Department of Transportation (DOT) Airline Service Quality Performance (ASQP) data were used to compare optimal versus actual taxi and flight times for MSP.

airport delay and capacity. The FAA uses ASPM results to create performance benchmarks for airports each year. Since 2005, use of ASPM data has been a well-supported methodology to calculate aircraft delays, accepted by both government and industry as the most valid, accurate and reliable metric.

Other than during January 2017, the average delay per operation for MSP was below the national average throughout 2017, averaging about 5.4 minutes of delay from January–November. Data for December were not available at the time of this analysis.

When compared to other large hub U.S. airports as shown in **Table A-2**, MSP ranked 19th overall in 2017 in terms of highest average delay per operation, down from its 2016 ranking at 15th.

TECHNOLOGICAL DEVELOPMENTS AND CAPACITY ENHANCEMENTS AT MSP

The FAA continuously explores potential capacity-enhancing development/technology in an effort to increase airport efficiency and reduce delay. When advances are identified, efforts are made to implement the technology at the busiest airports. This section describes these efforts as they apply to MSP.

Installation of ASDE-X at MSP was completed in 2009 and provides seamless coverage for complete aircraft identification information. This equipment also allows for future implementation and upgrade to Next Generation (NextGen) navigation technology (Automatic Dependence Surveillance – Broadcast, “ADS-B”); ADS-B uses a Global Navigation Satellite System to broadcast critical information.

Federal policy requires aircraft operating in capacity-constrained airspace, at capacity-constrained airports or in any other airspace deemed appropriate by the FAA, to be equipped with ADS-B/Cockpit Display of Traffic Information (ADS-B/CDTI) technology by 2020. This includes MSP.

Performance-based Navigation/Area Navigation (PBN/RNAV)

As part of the FAA’s NextGen initiative to modernize the national airspace system, in 2011 the agency began to pursue

advanced aircraft navigation technology at MSP in the form of PBN flight procedures. By 2015 the FAA focused these efforts on implementing RNAV and Required Navigation Performance (RNP) arrival procedures at MSP. On November 19, 2012, after extensive public involvement led by the MSP Noise Oversight Committee (NOC), the MAC supported implementation of MSP RNAV arrival procedures and partial implementation of MSP RNAV departure procedures. The MAC withheld its support for RNAV departure procedures for MSP Runways 30L and 30R due to a large volume of residents and elected officials expressing concern about concentrating departure flights over certain residential areas in Minneapolis and Edina. As a result, the FAA indicated it would need to conduct a safety risk management evaluation for partial implementation of RNAV at MSP.

On February 19, 2014, the results of the FAA’s safety risk management evaluation concluded partial implementation of RNAV departures introduces unsafe risk factors. Specifically, moving forward with implementation of RNAV departure procedures for Runways 12L, 12R and 17 without implementation of RNAV departure procedures on Runways 30L and 30R was determined unsafe. Therefore, the FAA concluded that RNAV departure procedures would not be implemented at MSP at this time.

In response to the FAA’s safety risk management findings, on March 6, 2014 the NOC passed a resolution regarding future RNAV standard departure procedure design and implementation efforts at MSP. The resolution specified that further consideration of RNAV departure procedures at MSP must be structured in a way that takes into account proven successes at other similarly-situated airports and incorporates community outreach efforts. The resolution also specifically expressed support for the implementation of the RNAV and RNP arrival procedures at MSP. On March 17, 2014 the MAC board of commissioners took unanimous action supporting the NOC resolution and forwarded it to the FAA.

The FAA moved forward with the approved RNAV and RNP arrival procedures incorporating Optimized Profile Descents (OPD); publication of the RNAV and RNP arrival flight procedures and air traffic control implementation began in March 2015 and was fully implemented by April 2015. OPDs occur when pilots reduce aircraft power settings and maintain a continuous descent into the airport rather than using more traditional procedures that involve power adjustments and descending in steps, reducing fuel and carbon emissions. In 2017, MAC staff completed an evaluation to quantify the benefits of OPDs. The findings were endorsed by the FAA and showed that the OPDs provide the largest carbon emission reduction in documented history at MSP with a savings of approximately 2.9 million gallons of fuel per year resulting in 28,465 fewer metric tons of carbon dioxide.

Ongoing Precision Instrument Approach Capabilities

In addition to runway separation and configuration, airfield capacity can be affected greatly by how the runways are equipped for inclement weather. A number of precision instrument approaches continue to be available at MSP as summarized in **Table A-3**.

Precision Instrument Approaches *Table A-3*

MSP	CAT 1	CAT 2	CAT 3
Runways	30R	30L	12L
			12R
			35

Notes: The term decision height is defined as the height at which a decision must be made during a precision approach to either continue the landing maneuver or execute a missed approach.

Precision approaches are categorized based on decision height and the horizontal visibility that a pilot has along the runway. Visibility values are expressed in statute miles or in terms of runway visual range (RVR) if RVR measuring equipment is installed at an airport. The different classes of precision instrument approaches are:

- i. Category I (CAT I) – provides approaches to a decision height down to 200 feet and a basic visibility of ¼ statute miles or as low as 1,800 feet runway visual range (RVR).
- ii. Category II (CAT II) – provides approaches to a decision height down to 100 feet and an RVR down to 1,200 feet.
- iii. Category IIIa (CAT IIIa) – provides approaches without a decision height (down to the ground) or a decision height below 100 feet and an RVR down to 700 feet.
- iv. Category IIIb (CAT IIIb) – provides approaches without a decision height or a decision height below 50 feet and an RVR down to 150 feet.
- v. Category IIIc (CAT IIIc) – provides approaches without a decision height and RVR. This will permit landings in “0/0 conditions,” that is, weather conditions with no ceiling and visibility as during periods of heavy fog.

Source: MSP Airfield Operations, FAA

Reliever Aircraft Operations							
Airport	LVN	21D	MIC	STP	FCM	ANE	ANNUAL TOTAL
2016	38,618	27,275	36,967	54,548	84,038	80,845	322,291
2017	36,670	28,337	34,223	40,489	90,835	74,943	305,497
“YY Comparison 2017-2016”	(1,948)	1,062	(2,744)	(14,059)	6,797	(5,902)	(16,794)

Source: MAC Airport Development and FAA

Based Aircraft							
Airport	LVN	21D	MIC	STP	FCM	ANE	ANNUAL TOTAL
2016	139	194	164	82	361	389	1,329
2017	135	193	168	87	373	377	1,333
“YY Comparison 2017-2016”	(4)	(1)	4	5	12	(12)	4

Source: MAC Airport Development and FAA

LVN = Airlake | 21D = Lake Elmo | MIC = Crystal | STP = St. Paul Downtown | FCM = Flying Cloud | ANE = Anoka County-Blaine





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