CHAPTER 2: FORECASTS

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2.1 INTRODUCTION AND PURPOSE

The Metropolitan Airports Commission (MAC) is updating the Long Term Comprehensive Plan (LTCP) for Minneapolis-St. Paul International Airport (MSP). A critical element of this plan is to balance the long-term airfield, terminal, and landside facilities serving the airport. A re-appraisal of the forecasts is especially timely, given the acquisition of Northwest Airlines by Delta Air Lines and the impacts of recent fuel price increases and the current economic recession.

This forecast analysis contains the annual and derivative activity forecasts for the airport. Except where noted, the forecasts contained herein are unconstrained; they assume landside and airfield capacity will be available to accommodate the anticipated demand. Forecasts are presented for 2010, 2015, 2020, 2025, and 2030. Separate annual forecasts were developed for scheduled domestic and international passenger, non-scheduled passenger, air cargo, general aviation, and military activity.

This analysis first discusses historical and anticipated socioeconomic activity in the Twin Cities area, followed by a discussion of historical aviation activity and ongoing trends at MSP. Critical assumptions are then presented followed by the forecasts of domestic and international passengers, along with forecasts of non-scheduled passengers and peak activity. Forecasts of air cargo tonnage and operations, and general aviation and military activity are then discussed. The technical report concludes with a summary of forecast annual activity, estimated gate requirements, and a discussion of alternative forecast scenarios.

The assumptions in the following forecasts are based on input from airline and airport officials, previous MSP studies, relevant literature, and professional experience. Forecasting, however, is not an exact science. Departures from forecast levels in the local and national economy and in the airline business environment may have a significant effect on the projections presented herein. These uncertainties increase toward the end of the forecast period, when new technologies and business strategies and changes in work and recreational practices may have an unpredictable impact on aviation activity. For these reasons, the forecasts should be periodically compared with actual airport activity levels, and airport plans and policies adjusted accordingly. Tables 2.1 through 2.18 are included in this chapter, the rest of the tables, denoted with letters, can be found in Appendix A of this report.

2.2 ECONOMIC TRENDS

Passenger demand is determined by the strength of the economy and the cost of available services. Consequently, the development of an aviation activity forecast requires a clear understanding of local economic forecasts and trends.

The service area definition corresponds to the seven counties that comprise the Metropolitan Council (Met Council). This core area includes Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington Counties. Larger service area definitions that encompass additional counties have been tested in previous MSP forecast efforts, but in those studies, passengers proved to be most sensitive to trends in the 7-county Met Council area.

Table 2.1 presents historical and projected population, employment, income and per capita income for each county of the Met Council area. The tables in the Appendix provide more detailed information by county and also show data for the United States for comparison purposes. Two sets of forecasts are presented in the Appendix, one from the Met Council and the other from Woods & Poole Economics.

Both the Met Council and Woods & Poole socioeconomic forecasts have their strengths and weaknesses. The Met Council forecasts are prepared locally and reflect a detailed knowledge of the existing and projected growth trends within the Minneapolis-St. Paul metropolitan area. However, they do not include projections of income or projections of national activity. Income is important because an analysis of historical registered aircraft data by county indicated that registered aircraft were more closely correlated with income than with population or employment. Also, much of the analysis will be based on Federal Aviation Administration projections of national general aviation activity. For this analysis to be valid, the local and national socioeconomic projections need to be based on a consistent set of assumptions.

The Woods & Poole forecasts are more recent than the Met Council forecasts. They also include personal income and prepare metropolitan and national forecasts using a common set of assumptions. However, the Woods & Poole forecasts do not incorporate a detailed knowledge of local growth trends and development constraints.

A hybrid forecast that incorporates the strengths and minimizes the weaknesses of the two data sources was prepared for use in this study. For each county, Met Council forecast growth rates were applied to the latest base year data. These forecasts were then adjusted, on a prorated basis, to sum to the Woods & Poole forecasts for the 7-county Met Council metropolitan area.

2.2.1 POPULATION

Table A.1 of Appendix A shows historical population in the Twin Cities, Minnesota, and the United States. The historical population information was obtained from the Bureau of Economic Analysis in the US Department of Commerce. The Twin Cities have grown at a more rapid pace than the United States. The suburban areas are also growing slightly more quickly than the urban core (Hennepin and Ramsey Counties).

Table A.2 of Appendix A presents two alternative forecasts of population for Minneapolis-St. Paul. The first forecast was obtained from the Met Council's revised Regional Development Framework 2030 Forecasts and is available only for the 7-county Met Council area. The second forecast was obtained from Woods & Poole Economics, which provides forecasts for all counties and metropolitan areas in the United States. As shown, the two sources provide very similar forecasts for the 7-county area, both projecting an average annual growth rate slightly above 1.0% through 2030. The forecasts project the metropolitan area to continue to grow faster than the state, and the outer suburbs to grow faster than the inner suburbs.

TABLE 2.1: SUMMARY OF SOCIOECONOMIC DATA AND FORECASTS SEVEN-COUNTY METROPOLITAN COUNCIL AREA

Year	Population	Employment	Income (thousands of 2007 $)	Per Capita Income (2007 $)
1990	2,298,418	1,603,044	76,546,647	33,304
1991	2,332,897	1,605,181	76,567,544	32,821
1992	2,368,710	1,628,288	79,552,668	33,585
1993	2,406,000	1,662,568	80,492,172	33,455
1994	2,441,014	1,713,409	84,046,939	34,431
1995	2,474,926	1,766,851	88,005,525	35,559
1996	2,508,406	1,802,255	91,965,878	36,663
1997	2,540,725	1,834,525	96,874,609	38,129
1998	2,575,454	1,884,161	104,644,525	40,631
1999	2,613,594	1,927,990	109,008,820	41,708
2000	2,652,116	1,972,269	115,532,307	43,562
2001	2,684,454	1,982,015	116,168,728	43,275
2002	2,701,403	1,964,849	116,954,718	43,294
2003	2,714,033	1,971,415	118,465,846	43,649
2004	2,730,546	2,004,534	123,102,449	45,083
2005	2,745,769	2,045,068	124,827,612	45,462
2006	2,767,734	2,082,727	127,735,714	46,152
2010	2,924,557	2,233,505	129,480,127	47,023
2015	3,118,761	2,421,649	146,564,763	49,913
2020	3,318,224	2,609,428	165,854,464	53,087
2025	3,524,942	2,796,788	187,853,049	56,602
2030	3,744,009	2,983,675	212,841,334	60,379
		Average Annual Growth Rate		
1990-2006	1.2%	1.6%	3.3%	2.1%
2006-2030	1.3%	1.5%	2.2%	1.1%

Sources: Tables A.1 through A.8 and HNTB analysis.

2.2.2 EMPLOYMENT

Table A.3 in Appendix A presents historical employment for each of the seven Met Council counties, the service area, and the United States. The table shows the economic cycles that have occurred over the past two decades, including the boom times of the mid- to late-1980s and mid- to late-1990s, punctuated by the slowdowns and declines of the early 1980s, early 1990s, and 2001-2003. Overall, the metropolitan area has grown slightly more rapidly than the U.S. and again the outer suburbs have grown slightly faster than the inner suburbs.

Employment forecasts from the Met Council and Woods & Poole are presented in **Table A.4**. in Appendix A The Met Council uses a stricter definition of employment than is used by the US Bureau of Economic Analysis (USBEA) or Woods & Poole and therefore its historical and projected employment numbers are lower.[1] Consequently, to facilitate comparison an adjusted set of Met Council projections was developed by applying Met Council growth rates to base year USBEA numbers. The Met Council projections (0.9% per year) are more conservative than the Woods & Poole projections (1.5% per year).

2.2.3 INCOME AND PER CAPITA INCOME

Table A.5 in Appendix A shows historical income in the service area and the United States from 1980 through 2006. All numbers are provided in thousands of 2007 dollars. Total income in the metropolitan area grew at 3.3% annually through 2006, a higher rate than in the remainder of the State or the United States (2.9%). As was the case with employment, income has alternated between periods of rapid growth and periods of stagnation. No income data specific to the 7-county area are available for a more recent year than 2006. However, since the 2008-2009 recession has already had an impact on air travel demand, an effort was made to estimate income for more recent years based on State and national data. Those estimates are also presented in **Table A.5.**

Table A.6 in Appendix A shows historical per capita income in 2007 dollars. Per capita income in the Twin Cities is higher than in the rest of the State or than in the United States. Over the past 20 years, Minnesota per capita income has grown at roughly the same pace inside and outside the metropolitan area but more quickly than in the United States.

Projected per capita income is shown in **Table A.7** in Appendix A. No Met Council forecasts are presented because the Met Council does not publish income or per capita income forecasts. Woods & Poole projects per capita income to continue to grow but at a more moderate rate than it has in the past. This, in part, reflects an expectation that the growth in the economy will slow down as more members of the Baby Boom generation enter retirement. Per capita income is projected to grow at roughly 1% per annum in the Twin Cities metropolitan area, and in the United States.

Table A.8 in Appendix A presents two sets of income projections. The unadjusted Woods & Poole forecasts project real income to grow 2.4% per year in the metropolitan area. A second set of projections combines the Met Council population forecasts with the Woods & Poole per capita income forecasts to generate a hybrid income forecast for the 7-county service area. The resulting forecast was also adjusted downward to reflect lost economic growth in 2008 and

[1] The Bureau of Economic Analysis employment statistics, upon which Woods & Poole projections are based, include the self-employed in addition to wage and salary workers.

anticipated in 2009. The adjusted forecast projects income to increase at 2.2% rate over the forecast period.

2.3 HISTORICAL AVIATION ACTIVITY AND CURRENT TRENDS

This section provides a brief overview of historical passenger, cargo (freight and mail), general aviation and military activity at MSP.

2.3.1 PASSENGER ACTIVITY

Table 2.2 shows historical domestic and international originations and **Table 2.3** shows historical passenger enplanements at MSP from 1980 through 2008. In general, passenger growth has tracked economic growth. There were periods of slow growth in the early 1990s, and 2000-2003 and periods of more rapid growth in the mid- to late-1990s, as well as 2004 and 2005. Enplanements began to decline after 2005 and originations declined between 2007 and 2008. Key trends and factors at MSP over the past 24 years include:

- the reduction in traffic growth after 1987 following the Northwest/Republic merger and the economic slowdown;
- two rapid periods of regional carrier growth, first in the 1980s with the advent of code-sharing and then in the late-1990s with the widespread proliferation of regional jets;
- significant international passenger growth through the period as Northwest introduced non-stop service to Europe and Asia and the Canadian markets became liberalized;
- an extended period of passenger growth corresponding with the economic boom of the mid- and late-1990s;
- a brief slow-down in the growth in 1998 as a result of the Northwest work stoppage;
- another spurt in growth in 1999-2000 corresponding to Sun Country's introduction of scheduled service and Northwest's competitive reaction;
- a major downturn beginning in 2001 as a result of the September 11th terrorist attacks and associated security restrictions and passenger apprehensions coupled with an economic slowdown;
- rapid growth in 2004 resulting from an improving economy and relentless fare competition; and
- a decline after 2005 resulting from Northwest's Chapter 11 filing, followed by a rapid increase in jet fuel costs, and followed in turn by the financial crisis of 2008 and subsequent economic recession.

Total domestic originations have grown at a 3.0% average annual rate over the period. Total enplanements have grown at a 4.7% average annual rate over the same period indicating that international passengers and connecting enplanements have grown more rapidly than originating enplanements. International enplanements and regional carrier enplanements have grown most rapidly. Conversely, non-scheduled enplanements have grown the slowest and declined in recent years, although this is largely due to Sun Country's change in emphasis from charter to scheduled operations.

TABLE 2.2: HISTORICAL ORIGINATING PASSENGERS

Year	Domestic Originations (a)	Combined International (b)	Total Originations
1990	4,284,240	n/a	n/a
1991	4,288,090	n/a	n/a
1992	4,414,590	n/a	n/a
1993	4,511,050	n/a	n/a
1994	4,598,270	n/a	n/a
1995	5,021,830	n/a	n/a
1996	5,411,820	n/a	n/a
1997	5,750,780	n/a	n/a
1998	5,736,650	n/a	n/a
1999	6,365,610	n/a	n/a
2000	7,225,020	n/a	n/a
2001	6,603,320	709,489	7,312,809
2002	6,207,930	680,392	6,888,322
2003	6,390,140	675,401	7,065,541
2004	7,074,980	780,332	7,855,312
2005	7,609,360	840,887	8,450,247
2006	7,643,820	888,697	8,532,517
2007	7,857,050	951,196	8,808,246
2008	7,291,815 (c)	963,631 (c)	8,255,446
	Average Annual Growth Rate		
1990-2008	3.0%	n/a	n/a
2001-2008	1.4%	4.5%	1.7%

(a) USDOT, Origin-Destination Survey as compiled by DataBase Products, Inc.

(b) USDOT, Origin-Destination Survey for U.S. Flag Carriers. Originations for Foreign-Flag Carriers estimated.

(c) Extrapolated from first three quarters.

Sources: As noted and HNTB analysis.

TABLE 2.3: HISTORIC PASSENGER ORIGINATIONS AND REVENUE ENPLANEMENTS

Year	Domestic Air Carrier Enplanements	International Air Carrier Enplanements (b)	Regional Enplanements	Non-Scheduled Enplanements	TOTAL Enplanements (c)
1980	4,285,217	28,731	159,727	113,793	4,587,468
1981	4,391,802	57,871	129,497	85,869	4,665,039
1982	5,071,395	50,574	178,590	82,278	5,382,837
1983	5,702,094	49,638	256,615	149,486	6,157,833
1984	5,986,288	73,014	287,762	187,076	6,534,140
1985	7,114,367	83,533	349,281	312,186	7,859,367
1986	7,845,494	81,700	481,188	238,972	8,647,354
1987	8,171,206	85,023	509,246	205,700	8,971,175
1988	8,023,121	65,265	516,083	266,344	8,870,813
1989	8,349,920	78,910	415,910	343,418	9,188,158
1990	8,609,638	102,673	495,439	387,320	9,595,070
1991	8,683,232	124,125	492,075	353,590	9,653,022
1992	9,550,986	144,255	566,186	419,060	10,680,487
1993	9,851,910	170,544	649,104	350,918	11,022,476
1994	10,261,328	166,114	646,788	457,715	11,531,945
1995	11,288,317	256,669	617,477	501,792	12,664,255
1996	12,142,783	276,575	720,749	481,532	13,621,639
1997	12,578,587	419,048	872,377	465,628	14,335,640
1998	12,645,248	519,395	820,709	635,290	14,620,642
1999	14,020,304	575,079	1,211,306	650,350	16,457,039
2000	15,278,927	644,096	1,204,681	399,683	17,527,387
2001	14,379,588	558,276	809,019	280,609	16,027,492
2002	13,794,354	551,203	1,054,192	365,023	15,764,772
2003	14,045,747	572,691	1,250,064	233,692	16,102,194
2004	14,901,675	677,318	1,778,396	240,250	17,597,639
2005	14,849,344	790,806	2,138,186	205,975	17,984,311
2006	14,143,459	692,757	2,190,679	151,412	17,178,307
2007	13,496,662	980,460	2,406,447	85,515	16,969,084
2008	11,750,665	1,264,507	3,336,724	32,376	16,384,272
		Average Annual Growth			
1980-1990	7.2%	13.6%	12.0%	13.0%	7.7%
1990-2001	4.8%	16.6%	4.6%	-2.9%	4.8%
2001-2008	-2.8%	12.4%	22.4%	-26.5%	0.3%
1980-2008	3.7%	14.5%	11.5%	-4.4%	4.7%

Sources: MAC activity statistics and HNTB analysis.

2.3.2 AIRCRAFT OPERATIONS

Table 2.4 presents historical aircraft operations at MSP. Each aircraft takeoff and each aircraft landing counts as an operation. Total aircraft operations have grown at an average annual rate of 1.7% over the 28-year period. The fastest growing categories have been international and regional passenger carriers. Conversely, general aviation and military operations have been declining.

2.4 GENERAL BASE FORECAST ASSUMPTIONS

This section describes the general forecast assumptions that were applied in this forecast. More detailed assumptions specific to a particular activity category are described in the sections pertaining to those categories. These general assumptions also apply to the forecast scenarios except where noted (see section 2.12). The major assumptions are as described below.

2.4.1 UNCONSTRAINED FORECASTS

The revised unconstrained forecasts contained herein are physically unconstrained. For the purposes of this study, "physically unconstrained" means that there are sufficient airport airfield, terminal, and landside facilities at the airport to accommodate all commercial aviation activity dictated by demand. Although no airfield limits are assumed for general aviation (GA), it is anticipated that the development of on-airport GA facilities will follow current trends. Therefore, it is assumed that limited on-airport GA facilities will continue to divert GA to reliever airports.

It is assumed that destination airports will be developed sufficiently to accommodate demand from the Twin Cities. However, it is recognized that airfield capacity constraints at some airports, such as London Heathrow and Tokyo Narita, will force an increase in aircraft size that would not occur in a truly unconstrained case.

2.4.2 REGULATORY ASSUMPTIONS

No return to airline regulation, as occurred prior to 1979, is assumed. This means that airlines will increase service and change fares as market conditions dictate. Also, except for the demand management scenarios, the forecasts in this report assume no slot control systems for MSP or destination airports other than those already in place.

2.4.3 ECONOMIC ASSUMPTIONS

The forecasts assume no major economic downturn, such as occurred during the depression of the 1930s. The local and national economies will periodically increase and decrease the pace of growth in accordance with business cycles. However, it is assumed that, over the forecast term, the high-growth and low-growth periods will offset each other so that the economic forecasts described in Section 2.2 will be realized. As noted in Section 2.2, the socioeconomic projections used for these forecasts have been adjusted for the current economic recession.

TABLE 2.4: HISTORICAL AIRCRAFT OPERATIONS (a)

Year	Domestic Air Carrier	Regional	International Air Carrier (b)	Non-Scheduled	All-Cargo	General Aviation	Military	Total
1980	146,524	12,128	350	1,976	1,214	114,260	6,604	283,056
1981	146,338	9,904	472	2,568	1,446	97,278	5,606	263,612
1982	150,450	22,838	390	2,478	2,556	82,303	5,359	266,374
1983	170,108	33,924	388	3,752	3,192	83,548	5,100	300,012
1984	189,830	35,938	506	2,234	5,966	93,367	7,721	335,562
1985	220,190	31,460	628	3,346	5,338	106,715	14,020	381,697
1986	231,760	50,520	680	2,426	12,360	71,406	6,869	376,021
1987	213,540	56,410	644	3,002	15,434	70,050	8,676	367,756
1988	211,562	58,896	544	2,836	17,958	68,634	6,698	367,128
1989	218,168	59,338	718	3,310	17,194	71,669	4,347	374,744
1990	223,884	74,446	860	4,538	18,526	58,864	2,804	383,922
1991	225,390	75,856	1,078	5,046	20,280	55,702	2,534	385,886
1992	242,670	85,926	1,222	5,824	18,900	60,929	3,003	418,474
1993	258,374	108,237	1,285	4,855	15,198	49,216	2,825	439,990
1994	264,519	115,164	1,478	6,103	14,110	50,898	2,451	454,723
1995	281,334	106,763	1,832	6,832	15,909	49,769	2,915	465,354
1996	295,776	105,926	2,256	8,750	20,362	49,786	2,624	485,480
1997	294,220	102,038	3,821	8,350	15,011	64,209	3,624	491,273
1998	278,828	90,421	5,109	11,531	15,323	79,757	2,044	483,013
1999	314,883	109,017	6,036	10,600	17,271	49,256	3,358	510,421
2000	341,980	89,105	7,224	5,959	18,395	58,076	2,473	523,212
2001	342,122	81,661	7,449	4,090	17,077	45,943	3,180	501,522
2002	338,744	95,248	7,048	4,833	14,974	44,279	2,543	507,669
2003	336,516	104,931	8,461	4,732	16,579	39,513	1,856	512,588
2004	334,452	135,785	9,360	3,793	16,709	39,018	1,976	541,093
2005	314,833	144,293	13,351	3,879	17,182	36,472	2,230	532,240
2006	277,525	128,156	10,900	3,233	16,355	37,459	2,040	475,668
2007	253,338	135,170	14,889	1,432	15,292	30,562	2,289	452,972
2008	212,167	166,106	24,074	536	14,361	30,685	2,115	450,044
				Average Annual Growth				
1980-1990	4.3%	19.9%	9.4%	8.7%	31.3%	-6.4%	-8.2%	3.1%
1990-2001	3.9%	0.8%	21.7%	-0.9%	-0.7%	-2.2%	1.2%	2.5%
2001-2008	-6.6%	10.7%	18.2%	-25.2%	-2.4%	-5.6%	-5.7%	-1.5%
1980-2008	1.3%	9.8%	16.3%	-4.6%	9.2%	-4.6%	-4.0%	1.7%

(a) MSP Airport data as reported on the MAC website.
(b) Does not include some Canadian traffic on Northwest Airlines. Canadian traffic included in domestic numbers.

Sources: As noted, MAC Activity Statistics, and HNTB analysis.

2.4.4 INTERNATIONAL POLITICAL ENVIRONMENT

No major international conflicts that would disrupt aviation at MSP are assumed. Likewise, no major trade wars or embargoes that would restrict the international flow of commerce and travel are assumed.

2.4.5 SECURITY ENVIRONMENT

Post-September 11th security requirements are still evolving. They affect passenger demand by increasing the cost of travel, delays, and inconvenience. For the purpose of this study it is assumed that the Transportation Security Agency will meet an objective of limiting security-related delays.

2.4.6 FUEL ASSUMPTIONS

In accordance with Department of Energy forecasts, the real cost of fuel is assumed to increase from 2009 levels. However, no major disruptions, as occurred in the mid- and late-1970s, are assumed. Also, no major increases in fuel taxes are assumed. If this assumption does not hold, and fuel prices continue to remain high, airlines would have to raise air fares to remain in operation, and the higher air fares would reduce demand. The effect of fuel prices on fares is discussed in more detail in Section 2.5. Also, the sensitivity of airport activity to fuel prices is explored further in Section 2.12.

2.4.7 ENVIRONMENTAL FACTORS

No major changes in the physical environment are assumed. It is assumed that global climate changes will not be sufficient enough to force restrictions on the burning of hydrocarbons or major fuel tax increases. A strict cap and trade system for carbon dioxide would have a similar impact as an increase in fuel prices, and that is explored in Section 2.12.

2.4.8 NATIONAL AIRSPACE SYSTEM

It is assumed that the Federal Aviation Administration will successfully implement any required changes and improvements for the national airspace system to accommodate the unconstrained forecast of aviation demand.

2.4.9 AIRLINE CONSOLIDATION

It is assumed that factors, such as government regulations and labor union resistance, will prevent any major airline consolidation beyond the Delta/Northwest merger. Although some minor airline consolidation could continue to occur, no attempt is made to predict the individual airlines that would be affected. It is also assumed that major airlines that are currently in Chapter 11 will successfully re-emerge from bankruptcy.

2.4.10 NEW ENTRANTS

As they expand their national route networks, established airlines that currently do not serve MSP, such as JetBlue, are assumed to introduce service by 2015. Southwest Airlines is assumed to expand service at MSP as it has at other major connecting hubs. New airlines may

attempt to become established during the forecast period; however, it is not possible to predict the names and characteristics of these airlines.

2.4.11 AIRLINE ALLIANCES

The SkyTeam alliance is assumed to continue with its current membership through the future. Current members include Delta Air Lines, Air France, KLM Royal Dutch Airlines, Alitalia Airlines, Korean Air, Aeromexico, Aeroflot, China Southern Airlines, Air Europa, Copa Airlines, Kenya Airways and CSA Czech Airlines.

2.4.12 AIRLINE STRATEGY

Delta Air Lines is assumed to continue to operate as a hub carrier at MSP. It is not assumed to either add or delete major hubs elsewhere in the United States, and therefore the connecting percentage is assumed to remain at levels similar to those from 1992-2008.

2.5 DOMESTIC PASSENGER FORECASTS

This section describes the domestic passenger forecast for MSP. This section includes a discussion of assumptions and data sources, the methodology for the passenger originations forecast, and the assumptions used to determine potential new markets. This section also includes a discussion of the projections of enplanements and connections, load factor, and seat departures. The methodology and assumptions used to estimate the type of air service that would accommodate the projected passenger are also described. This section concludes with a forecast of domestic passenger carrier aircraft operations.

2.5.1 METHODOLOGY, ASSUMPTIONS AND DATA SOURCES

Following is a summary of the methodology used in the domestic passenger forecast:

1. Determine drivers of passenger activity in the Twin Cities area
2. Project future domestic passenger originations at MSP using regression analysis
3. Adjust originations for impact of Southwest Airlines
4. Project future domestic passenger enplanements
5. Allocate MSP passengers by market
6. Determine future non-stop markets based on airline revenue thresholds for existing non-stop markets
7. Project outbound revenue passengers for each destination market as a ratio of origination and destination (O&D) traffic
8. Project load factor for each market
9. Project seat departures for each market using the outbound revenue passenger and load factor forecasts
10. Estimate the most likely way that airlines would accommodate the seat departure forecast in terms of aircraft type and frequency of service
11. Convert the outbound passenger forecast to enplanements using MSP enplanement data
12. Convert the scheduled aircraft departure forecast to actual departures using historical departure completion data

The methodology will be described in greater detail below.

The following data sources were used in the analysis:

- Historical and projected information on population, employment, and real income were obtained from the Regional Economic Information System developed by the Bureau of Economic Analysis in the U.S. Department of Commerce (see Section 2.2).

- The US Department of Transportation OD1A domestic O&D database was used to obtain yield (airline revenue per passenger mile) and distance and historical originating traffic and on a market-by-market basis.

- The USDOT T-100 database was used to obtain outbound passengers on a market-by-market basis.

- Official Airline Guide (OAG) information on scheduled operations was used to determine existing scheduled service and historical non-stop service.

- The OAG, JP Fleet Airline-Fleets International, and individual airline websites were used to determine aircraft seat configurations for each airline.

- JP Fleet Airline-Fleets International and other industry publications were used to identify information on airline fleet orders.

2.5.2 YIELD AND FARE PROJECTIONS

Since passenger originations are local, they are sensitive to local economic factors such as population, employment, and income, and also to airline factors such as air carrier service and fares. Therefore, the critical assumptions for this analysis include the use of the growth rates in Section 2.2 for socioeconomic data and assumptions regarding future yield (revenue per passenger mile) and fare levels. The detailed yield and fare analysis is presented in the Appendix.

Table B.1 in Appendix A presents historical fares and yields at MSP. Since the price to the passenger includes taxes and fees, in addition to the base fare reported by the airlines, these taxes and fees were added to the historical data. As shown in the table, there has been a long-term decline in the real cost of air travel at MSP, with the rate of decline accelerating after the September 11, 2001 terrorist attacks.

Table B.2 in Appendix A provides the Federal Aviation Administration (FAA) forecasts of yield. An estimate of FAA fares was derived by multiplying the FAA forecasts of average yield and average trip distance. Since the FAA provides separate forecasts for mainline and regional carriers, these were weighted by FAA forecasted enplanements to generate combined mainline-regional carrier fare projections. As shown in the Table, the FAA projects yield to continue to decline but, because of increasing trip distance, national fares are projected to increase slightly.

The FAA forecasts in **Table B.2** were prepared prior to the major spike in fuel prices that occurred in 2008. The airlines need to cover the cost of fuel in their fare structure if they are to remain financially viable; therefore there was a concern that the more recent expectations about the price of fuel were not adequately reflected in the FAA projections. To compensate for this,

an adjustment was made to the FAA yield forecast to incorporate the more recent US Department of Energy (DOE) forecasts of jet fuel. In effect, the additional increase in fuel cost estimated by the DOE was allocated by revenue passenger mile and then allocated to the FAA's original yield estimate. **Table B.3** in Appendix A shows the calculations.

Real yields and fares (constant 2007 dollars) at MSP were assumed to change at the adjusted FAA national-projected rate (see **Table B.4** Appendix A). **Table B.5** in Appendix A shows projected MSP fares and yields including estimated taxes and fees.[2] Although real fares are anticipated to dip slightly between 2008 and 2010, as a result of a weak economy and reduced fuel prices, they are expected to increase thereafter.

2.5.3 PASSENGER ORIGINATION FORECAST

This section presents the forecast of domestic passenger originations. It includes a discussion of the projection of domestic MSP originations, adjustments for the introduction of Southwest Airlines service, and the market-by-market distribution of projected originations.

Base Domestic Originations

Base domestic passenger originations were projected using regression analysis. Additional originations resulting from the introduction of air service by Southwest Airlines are discussed later in this section. Regression analysis is a statistical method of generating an equation (or model) which best explains the historical relationship among selected variables, such as origination and destination (O&D) passenger data and real income. If it is assumed that the model that best explains historical activity will continue to hold into the future, this equation can be used as a forecasting equation. Using historical (1980-2006) data, several passenger origination forecasting models were tested. The potential driving factors tested included socioeconomic variables, aviation industry variables, and instrument variables (also called dummy variables). The socioeconomic variables included population, employment, income, and per capita income for the service area (see Section 2.2). The aviation industry variables included MSP fares and yields. Instrument variables representing the first Gulf War, the 1998 Northwest Airlines work stoppage, and the September 11th attacks and ensuing industry recovery were also tested. The model was tested in both linear and logarithmic formulations. The variables that were tested are shown in **Tables C.1** and **C.2** in Appendix A.

Several of the equations that were calculated showed strong correlations with passenger originations. The model that produced the best results, from both a theoretical and statistical standpoint, was a logarithmic formulation that specified MSP originations as a function of local income and average fares (including taxes and fees) as independent variables. The regression equation is presented in **Table 2.5**.

The model's projections for 2008 were compared with preliminary numbers for 2008 and the results suggested a further downward adjustment over and above that explained by the economic variables. Based on the difference between the forecast results and actual numbers, the value of this imputed dummy variable is $10^{-.0211}$. This negative impact, along with that of the post-September 11th dummy variables, was carried through the forecast period.

The metropolitan area income and employment variables represent the size of the market, and the fare variable represents the cost of the service. Since the forecasting model has a

[2] It was assumed that taxes and fees, as a proportion (%) of total fare, would remain at their 2008 levels over the forecast period.

logarithmic formulation, each of the exponents associated with the input variables is defined as an elasticity. With small changes in the input variables, the forecasting model can be interpreted as indicating that every 1.0% increase in metropolitan area income will increase originations by approximately 1.14% and that every 1.0% decrease in MSP fares will increase originations by approximately 0.34%. Therefore, the forecast equation says that domestic originations have an income elasticity of 1.14 and a fare elasticity of -0.34.

Projections of the input variables are necessary to use the forecasting equation. Specifically, income projections were obtained from **Table A.8** and fare and yield projections from **Table B.5**. Both tables are found in Appendix A of this report.

Table 2.5 shows the base forecast of scheduled domestic passenger originations prepared using the equation presented above. As shown, base domestic MSP originations are projected to rise from 7.3 million in 2008 to 12.3 million in 2030, an average annual increase of 2.4%. This growth rate is lower than that experienced since 1990 (3.0%). The reduced future growth rate is anticipated to result from slower-than-historical rates of real income growth and from a slight increase in real fares.

There are several assumptions implicit in the base passenger origination forecasts:

- The historical relationship between originations, income, and fares will continue throughout the forecast period. Forces that could disrupt this relationship, such as a return to regulation, severe congestion at destination airports, or the wide-scale use of teleconferencing as a travel alternative, could alter this relationship.

- In accordance with US Department of Energy forecasts, fuel prices will increase over the forecast period, causing fares to increase rather than continue to decline.

- Real income in the extended service area will grow at the rate projected in **Table A.8** in Appendix A.

- The population's distribution of income through the forecast period will be similar to what it is today.

- As a percentage of income, taxes and medical expenses, which are the principal budget items over which households have little control, will not increase sufficiently to affect household or business budgets devoted to air travel.

Originations Resulting from Southwest Airlines Service

Southwest Airlines began to serve MSP directly in March 2009. Many in the aviation industry have noted a phenomenon termed the "Southwest effect" in which the introduction of air service to an airport by Southwest Airlines has resulted in a substantial increase in passenger activity. The principal cause of the increase is the reduction in fares resulting from increased competition. The effect, however, often exceeds the amount that would be expected from the reduction in fares, possibly because of Southwest's high frequency of service, price transparency, and consistent level of service, and because of increases in the size of the catchment area.

TABLE 2.5: BASE FORECAST OF ANNUAL DOMESTIC ORIGINATIONS

Year	Income (thousands of 2007 dollars) (a)	Fare (b)	Originations (c)	Southwest Adjustment Factor (d)	Originations Including Southwest Factor (e)
2006	127,735,714	197.36	7,643,820	-	7,643,820
2007	131,147,791	190.64	7,857,050	-	7,857,050
2008	131,859,584	215.40	7,291,815	-	7,291,815
2009	128,299,375				
2010	129,480,127	188.98	7,468,129	1.03	7,692,173
2015	146,564,763	218.20	8,191,488	1.15	9,420,211
2020	165,854,464	221.79	9,381,527	1.15	10,788,756
2025	187,853,049	224.85	10,765,239	1.15	12,380,025
2030	212,841,334	229.12	12,336,341	1.15	14,186,792
			Average Annual Growth Rate		
2008-2030	2.2%	0.3%	2.4%	n/a	3.1%

(a) Table A.8.

(b) Table B.5.

(c) Projected using following equation:

ORIG = (10^-1.5452)*(INCOME^1.14219)*(FARE^-.34159)*(STRIKE)*(D2001)*(D2002)*(D2004)*(A2008)

where: ORIG = domestic originations

INCOME = 7-county metropolitan income in thousands of 2007 dollars)

FARE = average fare in 2007 dollars, including taxes and fees

STRIKE = instrument variable equal to (10^-.0266) in 1998 during NWA pilot job action, and equal to 1 in all other years.

D2001 = instrument variable equal to 1 prior to 2001, and to (10^-.04316) thereafter

D2002 = instrument variable equal to 1 prior to 2002, and to (10^-.02858) thereafter

D2004 = instrument variable equal to 1 prior to 2004, and to (10^.02318) thereafter

A2008 = adjustment factor of .95257, representing difference between actual 2008 originations and originations projected by the equation.

R-squared = .991

F-statistic = 307.52

Durbin-Watson = 1.93

Degrees of Freedom = 10

T-statistics

intercept = -1.73

INCOME = 16.82

FARE = -2.01

STRIKE = -2.50

D2001 = -3.82

D2002 = -2.81

D2004 = 2.13

(d) Adjustment for Southwest stimulation. Please see text for details.

(e) Originations multiplied by Southwest factor.

Sources: As noted and HNTB analysis.

Table D.1 in Appendix A shows the historical impact of Southwest service on originations at large United States airports. The airports listed include large and medium hub airports where Southwest initiated service after 1990. Detroit is included for comparison, although Southwest began serving the market in the 1980s. Originations in the table are expressed as a share of national originations to net out the impact of changes in the general economy and industry trends. To facilitate comparison, the shares are indexed so that in the two years prior to the introduction of Southwest service, the relative share is set equal to 1.00. In each case, the data series begins the first full year after the introduction of Southwest service. Therefore, all other things being equal, the relative share of United States originations would remain at 1.00 if Southwest service had no impact on originations. The relative share would be greater than 1.00 if Southwest had a positive impact and less than 1.00 if Southwest had a negative impact.

In all cases, the addition of Southwest service caused an airport's share of national originations to increase. In one instance – Cleveland Hopkins International Airport – the relative share eventually dipped below 1.00 again, most likely because of Cleveland's poor record of economic growth relative to the remainder of the country. The increase in share was exceptional in the case of Baltimore Washington International Airport and Fort Lauderdale/Hollywood International Airport, mainly because Southwest was able to capture traffic from other markets – Washington and Miami.

To better evaluate the potential effect on MSP, the analysis was refined to include only airports similar to MSP, i.e., airports that host major connecting operations and whose catchment areas do not substantially overlap that of another major airport. Three airports met those criteria – Denver, Philadelphia, and Cleveland. **Table D.2** in Appendix A shows the results of the analysis, indicating that for the airports most similar to MSP, the average impact of Southwest service was to increase originations by 15% over what they would otherwise have been.

The domestic originations forecasts in **Table 2.5** were adjusted to reflect the anticipated impact of Southwest Airlines service. It was assumed that the effects would be fully realized by 2015. As shown, with the effect of Southwest Airlines included, originations are projected to increase from 7.3 million in 2008 to 14.2 million by 2030, an average annual increase of 3.1%.

2.5.4 DOMESTIC ENPLANEMENT FORECASTS

The forecast of domestic passenger enplanements is a function of the originating passenger forecast and the ratio of enplanements to originations (hubbing ratio). When queried, Delta Air Lines indicated that it did not anticipate a significant change in the ratio between enplanements and connections for its operation at MSP in the short-term. In the longer term, there are a number of national industry factors that are affecting the relationship between enplanements and originations. These include:

- The loss of service at small communities, where the vast majority of passengers connect to their final destination;
- The increase in regional jets, which facilitate point-to-point service for market pairs that had previously been too small to justify non-stop service;
- The proliferation of low-cost carriers that typically provide more point-to-point service than legacy carriers; and
- Faster economic growth in communities served by large and medium hub airports as opposed to small hub airports.

In combination, these forces have caused connections to grow at a slightly lower rate than originations nationally, as shown in **Table E.1** in Appendix A. If this trend is carried forward, the ratio of enplanements to originations will continue to decline, albeit at a slow rate. **Table E.2** in Appendix A shows the projected future hubbing ratio at MSP, assuming that it will decline at the same rate as the national hubbing ratio.

Table 2.6 provides the forecast of domestic enplanements at MSP. The hubbing ratio in **Table E.2** was applied to base originations rather than total originations, since it is not anticipated that the additional originations stimulated by Southwest will lead to additional connecting passengers. As shown in **Table 2.6**, total domestic enplanements at MSP are projected to increase from 15.1 million in 2008 to 25.6 million in 2030, an average annual increase of 2.4%.

2.5.5 DOMESTIC PROJECTIONS BY MARKET

Since one of the end products of this forecast is a detailed fleet mix for use in gate requirements analyses and noise simulation, domestic passenger forecasts were disaggregated by individual market.

Originations by Market

MSP originations in each market were projected to increase from 2007 at the same rate as total domestic MSP originations, adjusted by the relative difference in income growth in the destination markets. As seen in the forecasting equation, there is a strong relationship between income and originations. Therefore, it is reasonable to assume that the relative growth rate in each region's originations to the Twin Cities area will vary in relation to each region's growth in personal income relative to the United States. Woods & Poole Economics was used as the source of income forecasts by market. The individual market originations forecasts were proportionately adjusted as necessary so that they would sum to the forecast of total domestic originations.

The detailed calculations of the market-by-market originations forecast are presented in **Table E.3** in Appendix A**.**

Forecast Of Outbound Passengers by Market

Data for outbound passengers on a market-by-market basis were obtained from the US Department of Transportation's T-100 database, which provides data on total revenue passengers (enplaned plus on-board) for each segment. Outbound passengers include both originating and connecting passengers. This section first discusses assumptions regarding new non-stop markets, and then discusses the methodology for estimating future non-stop outbound passengers.

TABLE 2.6: BASE CASE FORECAST OF DOMESTIC ENPLANEMENTS

Year	Base Originations (a)	Hubbing Ratio (b)	Base Enplanements w/o Southwest (c)	Total Originations (d)	Total Enplanements including Southwest (e)
2006	7,643,820	2.137	16,334,138	7,643,820	16,334,138
2007	7,857,050	2.024	15,903,109	7,857,050	15,903,109
2008	7,291,815	2.069	15,087,389	7,291,815	15,087,389
2010	7,468,129	2.021	15,092,264	7,692,173	15,316,308
2015	8,191,488	1.999	16,377,788	9,420,211	17,606,511
2020	9,381,527	1.978	18,555,194	10,788,756	19,962,423
2025	10,765,239	1.956	21,060,262	12,380,025	22,675,048
2030	12,336,341	1.924	23,729,505	14,186,792	25,579,956
			Average Annual Growth Rate		
2008-2030	2.4%	-0.3%	2.1%	3.1%	2.4%

(a) Table 5. Originations without Southwest Factor.

(b) Table E.2.

(c) Base originations multiplied by Southwest factor.

(d) Table 5. Total originations including Southwest factor.

(e) Base enplanements plus originations resulting from Southwest factor.

Sources: As noted and HNTB analysis.

A critical element of the forecasts is the determination of new non-stop markets. The number of new non-stop markets will affect the number of enplaned passengers and aircraft operations.

Candidate markets for non-stop domestic air carrier service were determined by identifying the current thresholds of total revenue (passengers multiplied by average fare) that justified non-stop service to MSP. A market's total revenue includes revenue from both originating and potential connecting passengers and is therefore a better measure of the market's value to the airline than just originating revenue to MSP. These thresholds are presented in **Table E.4** in Appendix A. Thresholds are lower for nearby markets than for more distant markets because service can be offered with smaller aircraft and because there is less competition from connecting hubs between the two markets. Thresholds of revenue necessary to justify non-stop service were estimated using the average of revenue in the smallest market with non-stop service and the largest market without non-stop service in each mileage band (0-300 miles, 301-500 miles, 501-700 miles, etc.). These thresholds are in large part determined by aircraft capabilities. For example, there is a big jump in the threshold above 1300 miles because that is beyond the capability of most regional jets. Therefore, these more distant markets would need to be large enough to justify mainline aircraft.

In markets to the west of MSP, specifically the rest of Minnesota, the Dakotas, and Montana, MSP is the most realistic connecting hub to most destinations. Since these are essentially "captive" markets, the ratio of connections to originations tends to be very high and the revenue threshold required for non-stop service tends to be lower. This is reflected in **Table E.4** which shows lower thresholds for markets to the west of MSP.

It was assumed that revenue in each market would increase at the same rate as the forecast of MSP originating passengers in that market. New markets that are projected to grow sufficiently to justify non-stop service to MSP are shown in **Table E.4**.

No service stimulation was assumed for originations at new non-stop markets. Experience at other airports indicates that the stimulation effect is less than 10% and often less than 5%. In addition, the historical growth in Twin Cities area originations has been caused, in part, by new non-stop service. Therefore, the forecasting equation implicitly includes the effect of new service stimulation. Including additional service stimulation would result in double counting.

Markets that were most likely to attract non-stop service by Southwest Airlines were identified based on the experience of other Midwest airports with Southwest service. The additional originations resulting from the Southwest effect were distributed proportionately to these markets. These are also identified in **Table E.3** in Appendix A.

The forecasts of outbound domestic passengers by market area are presented in **Table E.3**. Outbound passengers in most markets were estimated by assuming that the ratio of outbound passengers to originating passengers declines at the same rate as the hubbing ratio. Data for outbound passengers were adjusted proportionately where necessary so that the resulting sum of enplanements would equal the total in **Table 2.6**.

The ratio of outbound passengers to originating passengers in new non-stop markets (markets that have had non-stop service for fewer than two years or are projected to obtain non-stop service in the future) was assumed to be the same as in the most similar existing non-hub originating market in the same mileage band.

Load Factor and Seat Departure Forecast

This section discusses the assumptions used to estimate load factor in each market and the calculation of projected annual and daily seat departures in each market.

Over the past several years, the airline industry has experienced a significant increase in the average boarding load factor on both domestic and international flights. The load factor average has increased dramatically, from an average in the mid- to upper-50% range in the early 1980s to close to 80% nationally in 2007. This growth was fueled by a strong economy, coupled with strong travel demand and actions by the airlines to remove capacity from their systems and to use sophisticated yield management procedures. Since national load factors have recently been at historically high levels, the Federal Aviation Administration (FAA) does not project them to go significantly higher.

In existing non-stop markets, load factors were assumed to increase at the projected FAA rate for domestic operations. Load factors in new non-stop markets were assumed to be same as in the most similar existing market in the same mileage band.

Annual scheduled seat departures in each market were estimated by dividing the projections of outbound passengers by the load factor projections. Average annual day (AAD) seat departures were estimated by dividing annual seat departures by 365 days. Detailed calculations of annual and AAD seat departures by market are presented in **Table E.3** in Appendix A.

2.5.6 AIR SERVICE PROJECTIONS

The AAD seat departure projections were translated into projections of scheduled aircraft flights for each market using a set of assumptions regarding airline strategies and available equipment. The service projections are guided by the general assumptions outlined in Section 2.4. Based on previous surveys and discussions with the major airlines operating at MSP, industry publications, and professional experience, additional, more-detailed air service assumptions were developed, as listed below:

- No radical changes in airline strategy for how to serve and compete in markets are assumed.
- The current pattern of airline dominance at other airport hubs and non-hubs is assumed to remain substantially in place.
- Delta Air Lines (including its SkyTeam partners) is assumed to continue to maintain a constant share of the MSP market, after allowance for the expansion of Southwest Airlines.
- As projected by the FAA and Boeing, airlines will continue to emphasize frequency when adding service to meet demand. This means that domestic service will be provided principally by narrow-body air carrier aircraft and regional jets.
- Relaxation of legacy carrier scope clauses will allow their code-sharing regional partners to add regional jets, as necessary, to meet demand.

- Carriers that do not currently provide service to MSP, such as Jet Blue, are assumed to gradually introduce service from their main focus cities.

- Delta Air Lines is assumed to continue Northwest's current directional connecting bank structure.

- The existing relationship between aircraft size and frequency for each distance category was assumed to remain stable through the forecast period unless the frequency exceeded the number of connecting banks.

- The existing connecting bank structure limits the number of Delta Air Lines daily frequencies to medium- and long-haul markets to six, or seven at most. It is assumed that once the frequency limit is reached, Delta will accommodate increases in demand with larger aircraft rather than with increases in frequency.

- Full integration of the Delta and Northwest fleets is assumed by 2015.

- Delta Air Lines is assumed to continue to gradually remove the hush-kitted DC9 aircraft from its fleet, and completely remove them by 2015.

- It is assumed that Delta will phase-out the 757 and MD80 aircraft by 2025.

- It is assumed that the Saab 340 aircraft will be phased out by 2030.

- In the short-term, major growth is expected to occur in the 76-seat CRJ-900 and EMB 175 aircraft fleet.

- Next generation replacement aircraft for the 757 and 737/320 categories are assumed to be available by 2025.

- It is assumed that 50-seat turboprop aircraft will replace the Saab 340 in small short-haul markets.

- Southwest Airlines is assumed to fly Boeing 737-700 aircraft through the forecast period.

- Future schedule information provided by Sun Country was reviewed in estimating future Sun Country markets. Sun Country is assumed to continue to fly Boeing 737-800 aircraft.

- United Airlines is expected to replace its older Boeing 737 aircraft with Airbus 319s and 320s.

- American Airlines is expected to gradually replace its MD-80 aircraft with newer Boeing aircraft, specifically the 737-800.

- Continental is anticipated to replace its older Boeing 737 aircraft with next generation Boeing 737 aircraft.

- Future fleet additions beyond those presently announced by the airlines are assumed to be consistent with current announced fleet expansion plans and existing acquisitions.

- No supersonic, hypersonic, or tilt-rotor aircraft are projected because of poor operating economies and potential noise impacts.

Using the above assumptions for guidance, air service scenarios were developed for each market in each forecast year. The scenarios were developed so that the selected aircraft types and frequencies in combination matched the average annual day (AAD) seat departure projections for that market. Factors considered in each market included historical service patterns, current dominant carriers, aircraft in place and on order, length of haul, and announced plans of current carriers and new entrants. Individual market scenarios are presented in **Table E.5** in Appendix A.

2.5.7 DOMESTIC PASSENGET FORECAST SUMMARY

Table 2.7 summarizes the forecast of domestic passenger enplanements and aircraft operations for MSP. It should be noted that some of the domestic enplanements are international originations departing through another gateway and therefore do not appear as originations in this table.

Table 2.7 also shows the forecast of scheduled domestic aircraft operations. Completed aircraft departures are slightly less than the scheduled aircraft departures identified in **Table E.5**, because, typically, approximately 2-3% of scheduled flights are cancelled for weather, mechanical, or miscellaneous other reasons. As shown, scheduled domestic passenger aircraft departures are projected to increase at 1.5% per year through 2030. **Table E.6** in Appendix A presents the forecast of AAD scheduled aircraft departures by aircraft type.

2.6 INTERNATIONAL PASSENGER FORECASTS

This section discusses the international passenger forecasts, including assumptions, methodologies, and results.

2.6.1 METHODDOLGY, ASSUMPTIONS, AND DATA SOURCES

The methodology used to develop the international passenger forecasts was essentially a top-down approach. The type of bottom-up approach that was used to estimate domestic passenger traffic was not suitable for the international passenger forecast for several reasons. First, origination and destination (O&D) data for passengers flying their entire itinerary on foreign-flag carriers are not available; therefore, the historical record is incomplete. Second, many of the international markets are still being developed, so insufficient historical data exist from which to establish trends. Finally, past international service has been constrained by physical factors, such as distance, and political factors, such as bilateral agreements. These constraints tend to obscure the relationship between traditional drivers of demand, such as income and yield, and international passenger traffic.

TABLE 2.7: FORECAST OF DOMESTIC SCHEDULED PASSENGER AIRCRAFT OPERATIONS AND SEAT DEPARTURES

	2007	2008	2010	2015	2020	2025	2030
Scheduled Aircraft Departures							
Daily (a)	533.3	536.0	547.5	604.4	652.8	706.8	749.8
Annual (b)	194,662	195,655	199,819	220,591	238,272	257,982	273,688
Completed Aircraft Departures							
Annual (c)	194,254	189,304	193,333	213,431	230,538	249,608	264,804
Ratio (Completed to Scheduled) (d)	0.998	0.968	0.968	0.968	0.968	0.968	0.968
Completed Aircraft Operations (e)	388,508	378,273	386,666	426,862	461,076	499,216	529,608
Scheduled Aircraft Seat Departures							
Daily (a)	56,442	54,204	54,901	62,677	70,595	79,356	89,061
Annual (b)	20,601,474	19,784,490	20,038,792	22,877,112	25,767,073	28,964,772	32,507,126
Seats per Departure (f)	105.8	101.1	100.3	103.7	108.1	112.3	118.8
Enplanements (g)	15,903,109	15,087,389	15,316,308	17,606,511	19,962,423	22,675,048	25,579,956
Enplanements per Departure (h)	81.9	79.7	79.2	82.5	86.6	90.8	96.6

(a)Table E.6

(b) Daily activity multiplied by 365 days.

(c) Existing departures from MSP Monthly Summary Reports. Future completed departures estimated by multiplying scheduled departures by completion ratio.

(d) Assumed to remain constant at 2008 levels.

(e) Completed aircraft departures multiplied by 2.

(f) Scheduled seat departures divided by scheduled aircraft departures.

(g) Table 6.

(h) Enplanements divided by completed aircraft departures.

Sources: As noted and HNTB analysis.

A top-down approach provides an opportunity to exploit the research and analysis into international travel conducted by the Federal Aviation Administration (FAA), and major aircraft manufacturers, such as Boeing and Airbus. These organizations have resources available to investigate the factors driving international demand, and are able to incorporate the findings into their forecasts. The selected top-down approach can be summarized as follows:

1. Develop forecasts of United States international passenger traffic by major region.
2. Estimate future Twin Cities share of United States international passenger originations in each region.
3. Estimate future Twin Cities international passenger enplanements from originations forecast.
4. Disaggregate regional forecasts into individual markets.
5. Identify potential new non-stop markets.
6. Develop passenger forecasts by market.
7. Estimate future load factor.
8. Project future seat departures by market using the passenger and load factor forecasts.
9. Estimate the most probable way that airlines would accommodate the seat departure forecast in terms of aircraft type and scheduled frequency.
10. Convert the passenger forecast to enplanements using local airport enplanement data.
11. Convert the scheduled aircraft departure forecast to actual departures using historical departure completion data.

The methodology will be described in greater detail in subsequent sections of this report.

The following data sources were used in the analysis:

- FAA, Boeing, and Airbus international projections.
- US Department of Transportation (USDOT) International Schedule T-100 database.
- USDOT International O&D Survey.
- OAG information on scheduled operations, which was used to determine current scheduled service.
- The Official Airline Guide (OAG), and JP Airline-Fleets International guide, which were used to determine aircraft seat configurations for each airline.
- JP Airline-Fleets International and other industry publications, which were used to gather information on airline fleet orders.

2.6.2 FORECASTS BY INTERNATIONAL REGION

Table F.1 in Appendix A presents a comparison of international forecast growth rates developed by the FAA, Boeing, and Airbus. The projections show agreement in some areas, such as Europe, but vary in other regions. For example, Airbus is more optimistic about Middle East travel than Boeing, while Boeing is more optimistic about South America and Oceania.

A consensus forecast was developed for each region using the average of the forecast indexes from the three organizations. Based on the consensus forecast, Oceania and the Middle East are expected to grow most rapidly, followed by Asia, South America, and Africa. More mature markets, such as Europe, Canada and Mexico and Central America, are expected to grow more slowly.

2.6.3 MSP FORECASTS BY REGION

The estimated existing breakout of international originations from MSP by world region is provided in **Table F.2** in Appendix A. The estimate is complicated by two factors. First, foreign-flag carriers are not required to submit originating data to the USDOT. Secondly, international originating data submitted by the United States-flag carriers are restricted, and cannot be published publicly. The estimates in **Table F.2** were prepared by adding estimated foreign-flag originations (based on a percentage of enplanements) to the USDOT originating passenger numbers. The two largest international markets are Europe and Mexico and Central America, followed by Asia, Canada, and the Caribbean.

Table F.3 in Appendix A shows projected MSP international originations. The basis for the projections is the regional growth rates from **Table F.1** with two adjustments. First, the 2009 projections were adjusted downward to reflect Delta Air Lines' planned international capacity reductions in response to the recession. Secondly, the growth rates in **Table F.1** were adjusted to reflect the difference in estimated Twin Cities income growth and United States income growth. As shown, total international originations at MSP are projected to rise from slightly less than 1.0 million in 2008 to 2.4 million by 2030.

2.6.4 MSP INTERNATIONAL ENPLANEMENT FORECASTS

Similar to the domestic forecast approach, future international passenger enplanements were estimated by applying a hubbing ratio to the forecast of international originations. The international hubbing ratio has been increasing in recent years. However, there is a question as to whether this increase can be sustained given Delta's acquisition of Northwest, because of its heavy investment in international facilities at Atlanta and New York JFK. In addition, international enplanements are heavily dependent on domestic connecting passengers and will be sensitive to trends in that segment. For these reasons, it was assumed that the future international hubbing ratio would change at the same rate as the domestic hubbing ratio, and therefore decline slightly in the future. **Table E.4** of Appendix A shows the estimated future international ratio of enplanements to originations and **Table 2.8** shows the future forecast of international enplanements at MSP. Total international enplanements are projected to increase from about 1.3 million in 2008 to 2.8 million in 2030, an average annual increase of 3.7%.

TABLE 2.8: FORECAST OF INTERNATIONAL ENPLANEMENTS BASE CASE

Year	International Originations (a)	International Hubbing Ratio (b)	International Enplanements (c)
2006	888,697	0.780	692,757
2007	951,196	1.031	980,460
2008	963,631	1.312	1,264,507
2010	959,808	1.230	1,180,400
2015	1,210,171	1.217	1,472,452
2020	1,525,839	1.204	1,836,550
2025	1,923,847	1.191	2,290,408
2030	2,425,675	1.171	2,839,469
	Average Annual Growth Rate		
2008-2030	4.3%	-0.5%	3.7%

(a) Table F.3.

(b) Table F.4.

(c) Originations multiplied by international hubbing ratio.

Sources: As noted and HNTB analysis.

2.6.5 INTERNATIONAL PASSENGER PROJECTIONS BY MARKET

This section discusses the forecasts of MSP international passengers, first in markets with existing non-stop service, then in potential new markets.

Existing Markets

International originations in existing and potential non-stop markets were projected to increase at the same rate as the consensus growth indexes for each region developed in **Table F.1**. Details of the calculations are presented in **Table F.5**. Both of these tables are found in Appendix A of this report.

New Markets

Similar to the methodology used for domestic markets, passenger thresholds were used to identify potential new international non-stop markets. The process was more difficult because international originating passenger data are not available for foreign-flag carriers. Therefore, several threshold criteria were used to estimate new markets. The methodology involved the following steps:

1. *Identify originating passenger thresholds for non-stop service in each region*. Thresholds will vary by region because: a) shorter-haul markets require smaller aircraft and thus reduce the required threshold; and b) the direction of the market will determine how much connecting traffic can logically be funneled through the MSP gateway, thereby reducing the required originating passenger percentage. For example, most East Coast United States passengers can fly to Asia or western Canada via MSP with relatively little increase in circuity. However, those same passengers would incur much greater circuity if they were to use MSP as a gateway to Europe. Originations in each potential market were assumed to grow at the rates in **Table F.3** to determine if and when they would exceed the threshold.

2. *Identify seat departure thresholds for non-stop service to each region*. As a crosscheck on the passenger data, seat departures from all United States gateways to international markets were identified. Similar to Step 1, the threshold for new service in each region was assumed to be the average of the smallest market (measured in terms of seat departures) with non-stop MSP service and the largest market without non-stop MSP service. Scheduled seat departures in each potential market were assumed to grow at the rates in **Table F.3** to determine if and when they would exceed the threshold. **Table F.6** in Appendix A shows the seat departure thresholds by region.

3. *Identify thresholds for regions with no existing service.* Some regions, such as Africa or China, have insufficient service history from which to identify originating passenger thresholds. In these instances, thresholds were adopted from other regions based on similar distance and circuity characteristics. For example, European thresholds were used for Africa.

4. *Estimate new non-stop markets*. Information from the two sets of threshold criteria was integrated to estimate new non-stop markets. In general, any market that satisfied both threshold criteria was assumed to gain new non-stop service in the year in which those criteria were reached.

The new non-stop markets that were estimated using the above approach are listed in **Table F.5**. These projections are the best estimate of new market potential given available information. It is acknowledged that additional factors such as local economic trends, political circumstances, airline strategies, and market development initiatives may serve to either accelerate or delay the introduction of non-stop service to the markets listed in the Appendix.

Load Factor and Seat Departure Forecast

The load factor projections vary by market. Load factors in each region were projected to increase at the same rate as the Federal Aviation Administration forecast load factor for that region. Projected seat departures in each market were estimated by dividing the passenger projections by the load factor. Annual scheduled international seat departures at MSP are presented in **Table F.5**. As shown, total scheduled international seat departures are projected to increase from 1.65 million in 2008 to 3.75 million by 2030. Average annual day (AAD) seat departures were estimated by dividing by 365 days.

2.6.6 AIR SERVICE PROJECTIONS

The procedure used to allocate international passenger activity to airlines and aircraft equipment was similar to that used for the domestic air service projections. The following assumptions were used to guide the process:

- Annual aircraft departures and aircraft types were projected to be consistent with the AAD seat departure forecast for each market, as presented in **Table F.5**.
- The trend toward more Open Skies agreements is assumed to continue.
- No radical changes in airline strategy for how to serve and compete in markets is assumed.
- The current pattern of airline dominance at other airport hubs and gateways is assumed to remain in place.
- The current airline alliance structure is assumed to remain intact. Thus, SkyTeam members and code-sharing partners are expected to be more likely to provide service at MSP than other foreign-flag carriers.
- Except where noted, sufficient airport expansion in Europe and the Far East is anticipated to accommodate market demand.
- Delta Air Lines is assumed to serve its overseas international markets with A-330s, Boeing 777s and Boeing 787s.
- Next generation replacement aircraft for the 757 and 737/320 categories are assumed to be available by 2025.
- Future fleet additions beyond those presently announced by the airlines are assumed to be consistent with current announced fleet expansion plans and existing acquisitions.

- No supersonic, hypersonic, or tilt-rotor aircraft are projected because of poor operating economies and potential noise impacts.

The air service projections for each international market are outlined in detail in **Table F.7** in Appendix A. Projecting individual flights over an 11-year forecast horizon is an ambitious undertaking. The air service scenarios presented in **Table F.7** are considered reasonable and plausible, given the available information. However, it is acknowledged that actual service patterns may deviate from those projected, and that these deviations could be material.

2.6.7 SUMMARY

Table 2.9 summarizes the unconstrained international scheduled passenger and aircraft operation forecasts. Total international enplanements are projected to increase from 1.3 million in 2008 to 2.8 million in 2030. Completed international aircraft operations are projected to increase from 24,074 in 2008 to 47,074 in 2030, an average annual increase of 3.1%.

Table F.8 in Appendix A shows the scheduled international passenger fleet mix forecast. Although an increase in wide-body operations is anticipated, narrow-body aircraft operations to Canadian, Mexican and Caribbean markets are projected to account for the majority of the total.

2.7 CHARTER ENPLANEMENTS AND AIRCRAFT OPERATIONS

The forecast of charter (non-scheduled) passenger enplanements and aircraft operations is discussed in this section.

2.7.1 CHARTER PASSENGERS

Good historical data on charter activity are difficult to obtain and, therefore, it is not possible to develop a forecast using regression analysis or trend analysis. The Federal Aviation Administration does not publish forecasts of national charter activity so a share analysis is not possible either. Typically, charter operators cater to tour groups traveling to leisure destinations or to sports teams traveling to road games. Airport counts of charter passengers have declined significantly in recent years at MSP. This can be attributed to several factors:

- Sun Country, which has accounted for the majority of past charter operations at MSP, has placed more of an emphasis on scheduled operations, although in many instances to the same markets where it offered charter service.
- Some major charter operators, such as Champion, have ceased operations.
- Northwest's (now Delta) Amigo flights to Mexico have cut into traditional charter markets. These are assumed to continue under Delta in the future.
- Continued price reductions by legacy carriers have diminished the price advantage that charter carriers can offer.

There is little indication that any of the above factors will be reversed. The entry of low-fare service by Southwest Airlines will place additional pressure on charter operators. For these reasons, the historical decline in charter passengers is projected to continue. The rate of decline is assumed to be moderate, however, given that the effect of most of the above factors has been realized already.

TABLE 2.9: FORECAST OF INTERNATIONAL SCHEDULED PASSENGER AIRCRAFT OPERATIONS AND SEAT DEPARTURES

	2008	2010	2015	2020	2025	2030
Scheduled Aircraft Departures						
Daily (a)	34.1	33.5	40.6	45.9	56.3	66.5
Annual (b)	12,429	12,224	14,826	16,764	20,531	24,265
Completed Aircraft Departures						
Annual (c)	12,056	11,857	14,381	16,261	19,915	23,537
Ratio (Completed to Scheduled) (d)	0.970	0.970	0.970	0.970	0.970	0.970
Completed Aircraft Operations (e)	24,074	23,714	28,762	32,522	39,830	47,074
Scheduled Aircraft Seat Departures						
Daily (a)	4,530	4,398	5,403	6,738	8,384	10,248
Annual (b)	1,653,480	1,605,168	1,971,971	2,459,202	3,059,985	3,740,418
Seats per Departure (f)	133.0	131.3	133.0	146.7	149.0	154.1
Enplanements (g)	1,264,507	1,180,400	1,472,452	1,836,550	2,290,408	2,839,469
Enplanements per Departure (h)	104.9	99.6	102.4	112.9	115.0	120.6

(a) Table F.8.
(b) Daily activity multiplied by 365 days.
(c) Existing departures from MSP Monthly Summary Reports. Future completed departures estimated by multiplying scheduled departures by completion ratio.
(d) Assumed to remain constant at 2008 levels.
(e) Completed aircraft departures multiplied by 2.
(f) Scheduled seat departures divided by scheduled aircraft departures.
(g) Table 8.
(h) Enplanements divided by completed aircraft departures.

Sources: As noted and HNTB analysis.

Table G.1 in Appendix A shows the forecast of charter enplanements. The forecast assumes that Sun Country continues operating principally as a scheduled carrier. Total charter enplanements are projected to decline from about 32,000 in 2008 to about 12,000 in 2030. The current split between domestic and international passengers is projected to continue.

2.7.2 CHARTER AIRCRAFT OPERATIONS

Tables G.2 and **G.3** in Appendix A show the derivations of domestic and international charter aircraft operations from the passenger forecast. The tables also show the forecast fleet mix. Passenger aircraft departures for charter carriers were estimated as follows:

1. Assume constant load factors since they are already at very high levels.

2. Project total charter seat departures by dividing forecast enplanements by the projected load factor.

3. Estimate future fleet mix based on existing carrier fleets and available information on aircraft acquisition plans.

4. Calculate average seats per aircraft from the future fleet mix.

5. Divide forecast seat departures by projected seats per aircraft to generate projected charter aircraft departures and operations.

No attempt was made to forecast charter activity by market. **Table G.4** in Appendix A summarizes the forecast of charter aircraft operations. As shown, total passenger charter aircraft operations are projected to decline from 536 in 2008 to 218 in 2030. Narrow-body aircraft are forecast to continue to account for the vast majority of charter operations.

2.8 SUMMARY OF PASSENGER FORECASTS

Table 2.10 summarizes the scheduled and non-scheduled domestic and international passenger enplanement forecasts. Total enplanements at MSP are projected to increase from 16.4 million in 2008 to 28.4 million in 2030, an average annual increase of 2.5%.

Many facility requirements are dependent on peak hour activity. **Tables H.1** through **H.6** in Appendix A provide domestic and international peak month, average weekday peak month, and peak hour estimates of enplaning, deplaning, originating and terminating passengers. These estimates were organized by SkyTeam, Southwest, and other airline categories.

The distribution of passengers by airline was in accordance with the distribution of scheduled seat departures that resulted from the market projections in **Tables E.5** and **F.7**. The peak month shares of passengers in the domestic and international categories were assumed to remain constant. However, since the categories are projected to grow at different rates, the combined peak month percentage changes slightly. Because international activity, which peaks in March, is expected to grow more quickly than domestic activity, which peaks in July, the peak month for overall airport activity is expected to eventually shift from July to March.

Because the connecting bank structure for Delta Air Lines is expected to remain the same, the percent of daily passenger activity occurring during the peak hour was assumed to remain

TABLE 2.10: FORECAST OF ANNUAL DOMESTIC AND INTERNATIONAL DEPARTURES

Year	Domestic (a)	International (b)	Charter (c)	Total
2006	16,334,138	692,757	151,412	17,178,307
2007	15,903,109	980,460	85,515	16,969,084
2008	15,087,389	1,264,507	32,376	16,384,272
2010	15,316,308	1,180,400	29,677	16,526,385
2015	17,606,511	1,472,452	23,872	19,102,835
2020	19,962,423	1,836,550	19,203	21,818,176
2025	22,675,048	2,290,408	15,447	24,980,903
2030	25,579,956	2,839,469	12,425	28,431,850
		Average Annual Growth Rate		
2008-2030	2.4%	3.7%	-4.3%	2.5%

(a) Table 6.
(b) Table 8.
(c) Table G.1.

Sources: As noted and HNTB analysis.

constant for the SkyTeam airlines. As of this writing, Southwest Airlines is just beginning its operation at MSP, so there are no historical data upon which to base peak hour percentage. A 10% peak percentage was assumed for Southwest, suggesting an operation that is fairly evenly spread throughout the day, which is typical of the way Southwest operates at most airports. The peak hour percentage for other airlines was also assumed to remain constant. However, in the case of non-SkyTeam international passengers, the seasonal distribution of activity was assumed to become more evenly distributed than is currently the case. It is not expected that other new entry international carriers will have the same pronounced spike of activity in March that Sun Country currently experiences.

2.9 AIR CARGO TONNAGE AND AIRCRAFT OPERATIONS

The forecasts of air cargo tonnage and related all-cargo aircraft operations are discussed in this section.

Table I.1 in Appendix A shows historical enplaned air cargo, including both freight and mail, at MSP from 1990 through 2008. In the early part of the decade FedEx won a major postal service contract to carry mail and includes mail with cargo when reporting statistics. Hence, the apparent recent downturn in air mail at MSP is mostly an artifact of changes in reporting practices. Air cargo tonnage at MSP grew rapidly in the 1980s and then at a slower rate through 1997. It has since declined, in part because of the stricter security restrictions imposed after the September 11, 2001 terrorist attacks. The stricter security restrictions have led to an especially sharp downturn in air cargo carried on passenger carriers. Cargo carried on all-cargo carriers continued to increase through 2004 but has since declined.

2.9.1 AIR CARGO TONNAGE

As noted earlier, some carriers have ceased distinguishing between air mail and air freight when reporting their statistics. Consequently, the forecast contained herein combines freight and mail into a single air cargo category. All statistics are presented in short tons (2000 pounds per ton).

Table I.1 shows the forecasts of air cargo at MSP. There are two main categories of air cargo tonnage: 1) cargo carried on passenger aircraft (belly cargo); and 2) cargo carried on dedicated all-cargo aircraft. Separate approaches were developed to forecast each category.

Forecasts of belly cargo activity are based in part on Federal Aviation Administration (FAA) forecasts of revenue ton miles (RTMs) of air cargo traveling on domestic passenger carriers. An index was developed which related the FAA forecast of RTMs on domestic passenger carriers to the forecast of Available Seat Miles (ASM) for domestic air carriers. This ratio provided the expected future relationship of cargo to available seats. This index was then applied to the forecasts of scheduled seat departures prepared in Sections 2.5 and 2.6 to produce a belly cargo forecast for MSP.

As shown in **Table I.1**, enplaned belly cargo is projected to increase from 24,179 tons in 2008 to 35,701 tons in 2030, an average annual increase of 1.8%. Although this represents an increase from base year levels, it is still well below the belly cargo tonnages experienced in the 1990s. Increased security restrictions and strong competition from the dedicated all-cargo carriers will make it difficult for passenger carriers to recapture market share.

All-cargo carrier air cargo tonnage was estimated as a share of the FAA forecast of domestic all-cargo RTMs. All-cargo carrier tonnage at MSP roughly paralleled United States all-cargo carrier RTMs in the 1990s but has declined since 2003. The MSP share was assumed to continue to decline but at half the rate of the recent past, reflecting a combination of long-term and short-term historical rates. Enplaned all-cargo tonnage is forecast to increase from 102,508 tons in 2008 to 143,943 tons in 2030, an average annual increase of 1.6%.

Table 2.11 summarizes the cargo tonnage forecast. The ratio of deplaned to enplaned cargo tonnage was assumed to equal the 2007-2008 average in the future. Combined belly and all-cargo carrier enplaned tonnage is forecast to increase at an average annual rate of 1.6% from 126,687 tons in 2008 to 179,643 tons in 2030.

2.9.2 ALL-CARGO AIRCRAFT OPERATIONS

Table I.2 in Appendix A presents the forecast of all-cargo aircraft operations and fleet mix.

The future all-cargo carrier fleet mix was estimated based on available information on future aircraft acquisition plans by the carriers serving MSP. The average lift capacity per aircraft operation was estimated from the projected fleet mix and future all-cargo carrier aircraft departures were estimated by dividing total all-cargo carrier lift capacity by the capacity per aircraft. No attempt was made to forecast cargo activity by market.

Total all-cargo aircraft operations are projected to rise from 14,361 in 2008 to 18,834 in 2030, an average annual rate of 1.2%.

2.10 GENERAL AVIATION AND MILITARY OPERATIONS

This section discusses the forecast of general aviation and military operations.

2.10.1 GENERAL AVIATION

In contrast to commercial activity at MSP, general aviation (GA) activity has been declining in the long-term. This mirrors the experience at many other major airports, where many GA operators have relocated to reliever airports to avoid the congestion generated by scheduled commercial operations.

The Minneapolis-St. Paul Reliever Airports: Activity Forecasts – Technical Report for the MAC Reliever Airport System provides much of the basis of the GA forecast for MSP. The report was selected because it was performed on a system basis, and therefore takes into account the interactions resulting from the differing growth rates among the Twin Cities counties and the differing capabilities and capacities of the airports in the system.

Table 2.12 shows the based aircraft forecast for MSP, which comes from the Reliever Airport forecasts. Based on available hangar facilities, the maximum capacity was estimated at 30. Based aircraft in each category were projected to grow at national trends, adjusted for local factors, until the capacity limit was achieved. As shown, all based aircraft are anticipated to be jets, as is the case currently.

TABLE 2.11: ENPLANED AND DEPLANED AIR CARGO (SHORT TONS)

	Passenger Carrier (a)			Cargo Carrier (a)			Total		
Year	Enplaned	Deplaned	Total	Enplaned	Deplaned	Total	Enplaned	Deplaned	Total
2007	25,124	28,745	53,870	116,058	113,849	229,908	141,182	142,595	283,777
2008	24,179	27,412	51,591	102,508	103,018	205,526	126,687	130,430	257,116
2010	23,298	26,537	49,834	108,379	107,537	215,915	131,677	134,073	265,750
2015	25,603	29,162	54,765	118,759	117,836	236,595	144,362	146,998	291,360
2020	31,627	36,023	67,650	127,749	126,756	254,506	159,376	162,780	322,156
2025	43,274	49,290	92,565	135,617	134,563	270,180	178,891	183,853	362,745
2030	66,129	75,322	141,451	143,943	142,824	286,767	210,071	218,146	428,217
				Average Annual Growth Rate					
	4.7%	4.7%	4.7%	1.6%	1.5%	1.5%	2.3%	2.4%	2.3%

(a) Table I.1 and MSP Monthly Summary Reports. Deplaned cargo assumed to increase at same rate as enplaned cargo.

Sources: As noted and HNTB analysis.

TABLE 2.12: SUMMARY OF BASED AIRCRAFT FORECAST

Year	Single Engine Piston	Multi-Engine Piston	Turboprop	Microjets	Other Jets	Helicopter	Other (b)	Total
2008	0	0	0	0	24	0	0	24
2010	0	0	0	1	26	0	0	27
2015	0	0	0	1	29	0	0	30
2020	0	0	0	1	29	0	0	30
2025	0	0	0	1	29	0	0	30
2030	0	0	0	1	29	0	0	30
Average Annual Growth Rate								
2008-2030	-	-	-	-	0.9%	-	-	1.0%

Source: Table G.6 in Minneapolis-St. Paul Reliever Airports: Activity Forecasts - Technical Report.

Table J.1 in Appendix A shows the MSP forecast of GA operations based on the methodology in the Reliever Airport forecast. As shown, even with the constraint on based aircraft, the anticipated increase in jet aircraft utilization results in growing forecast of GA aircraft operations. The Reliever Airport methodology addresses hangar capacity but does not address airfield capacity and delay.

Table 2.13 shows the recent history of GA operations at MSP and compares it to the FAA count of itinerant GA operations in the United States. As shown, MSP GA activity, as a share of the United States, has been consistently declining. GA activity in the United States rose in the late 1990s but then declined as a result of the recession and the September 11th attacks. Since 2001, United States GA activity (itinerant operations) has been relatively constant. The FAA predicts that GA will begin to grow again in the near future based on the following assumptions:

- Moderate sustained economic growth;
- No dramatic changes in the GA regulatory environment; and
- Increased growth in the fractional ownership market, which brings new owners and operators into business aviation.

Table 2.13 shows the MSP GA forecast if the airport share of United States GA activity accounted for by the airport is assumed to continue to decline at historical rates.

As shown, under this assumption, GA operations would decline at a -1.7% annual rate to slightly over 21,000 by 2030.

The Reliever Airport methodology accounts for the anticipated stimulation resulting from the higher utilization of jet aircraft while the United States share methodology captures the ongoing trend of GA operators diverting their aircraft from MSP to one of the regional reliever airports. The recommended forecast incorporates both trends by taking the average of the two methodologies. As shown in **Table 2.13**, based on the average, total GA operations are projected to increase slightly from 30,685 in 2008 to 32,988 in 2030, an average annual increase of 0.3% per year.

Forecast operations by aircraft type are shown in **Table J.1**. Based on current practices at MSP, all these operations are projected to be itinerant operations. Operations in each GA aircraft category were assumed to grow at the same rate as the FAA's forecast of hours flown in that category. The results were then adjusted on a prorated basis to sum to the original forecast of GA aircraft operations. The result, as shown in the table, is a slight increase in jet operations through 2030, while turboprop and piston operations decrease.

2.10.2 MILITARY

Military operations are related to national and international political and institutional factors rather than local economic conditions. The number of military operations at MSP decreased during most of the 1980s and early 1990s and then leveled off after a spike in activity in 2001. Due to the uncertainties enumerated above and consistent with the principal trend occurring since 1990, military operations are assumed to remain constant at 2008 levels throughout the forecast period. This assumption is consistent with FAA forecasts of national military activity. However, future national defense actions could increase or decrease future military operations.

TABLE 2.13: FORECAST OF ANNUAL GENERAL AVIATION OPERATIONS

Year	FAA Itinerant GA Ops (000's) (a)	Ratio of MSP Operations to US Operations (b)	MSP Operations from Ratio Method (c)	MSP Operations from Reliever LTCP	Average (e)
1995	20,860	2.39	49,769		
1996	20,823	2.39	49,786		
1997	21,669	2.96	64,209		
1998	22,086	3.61	79,757		
1999	23,019	2.14	49,256		
2000	22,844	2.54	58,076		
2001	21,433	2.14	45,943		
2002	21,451	2.06	44,279		
2003	20,231	1.95	39,513		
2004	20,007	1.95	39,018		
2005	19,315	1.89	36,472		
2006	18,741	2.00	37,459		
2007	18,577	1.65	30,562		
2008	18,637	1.65	30,685	30,685	30,685
2010	19,298	1.57	30,291	32,793	31,542
2015	20,928	1.32	27,569	39,140	33,354
2020	22,839	1.11	25,250	41,413	33,331
2025	24,951	0.93	23,150	43,289	33,220
2030	27,063	0.78	21,073	44,903	32,988
			Average Annual Growth Rate		
2008-2030	1.7%	-3.3%	-1.7%	1.7%	0.3%

(a) FAA Aerospace Forecasts: Fiscal Years 2008-2025.

(b) Ratio of MSP GA operations to thousands of US operations. Assumed to change at historical rate in the future.

(c) Historical from Table 4. Future estimated by multiplying FAA forecast by ratio of MSP operations to US operations.

(d) Unconstrained GA forecasts estimated using methodology in Minneapolis-St. Paul Reliever Airports: Activity Forecasts - Technical Report.

(e) Average of Ratio and LTCP methods.

Sources: As noted and HNTB analysis.

Table 2.14 shows the forecast of military operations. As shown, annual operations are projected to remain constant at 2,115.

2.11 SUMMARY OF ANNUAL FORECASTS

This section summarizes the passenger and aircraft operation forecasts.

Table 2.15 provides a summary of the passenger forecasts. Total revenue enplanements are forecast to increase from 16.4 million in 2008 to 28.4 million in 2030, an average annual increase of 2.5%. Originating passengers are projected to increase from 8.3 million to 16.6 million over the same period. As a percentage of enplanements, originations are projected to increase, but with the majority of the increase occurring in the early part of the period as a result of Southwest's entry into the market. The percentage of enplanements accounted for by originations is expected to increase from 51% in 2008 to 58% by 2030.

Table 2.16 summarizes the unconstrained forecast of aircraft operations at MSP. Total aircraft operations are estimated to increase from 450,044 in 2008 to 630,837 in 2030, an average annual increase of 1.5%. The scheduled passenger operation categories are projected to grow the most rapidly, and air cargo, general aviation, and military aircraft operations are projected to grow slowly.

2.12 FORECAST SCENARIOS

The assumptions used in developing the forecasts are likely to vary over the forecast period, and the variations could be material. One way to explore the impact of these variations is to develop alternative scenarios in which the impact on the forecast of a variation in a critical assumption is evaluated. The base case forecast provides the basis for determining what additional facilities will be required at the airport through 2030. The airport must be able to respond to a range of contingencies that could occur, taking into account political and economic changes, technological changes, and changes in individual airline policies. The recommended development program must be flexible enough to accommodate these contingencies.

To address these potential changes, four alternative forecast scenarios were selected with the assistance of airport staff. Much of the background information used to develop the scenarios is provided in previous chapters; except where noted, the assumptions are the same as those presented in section 2.4. The four scenarios are:

Scenario 1 – High Fuel Cost. This scenario assumes that jet fuel costs to the airlines increase significantly, either as a result of increased demand/supply imbalances, or stringent environmental restrictions, such as a cap and trade program or a carbon tax. The cost of jet fuel is assumed to increase to $4.50 per gallon after the recession ends and then continue to increase at 2% per year thereafter. This would cause air fares to rise and passenger demand to fall. As detailed in **Table K.2**, in Appendix A, total enplanements would rise slowly to 21.4 million by 2030, an average annual increase of 1.2%. Total operations would increase to 514,042 in 2030, an average annual rate of 0.6% per year. Because of the low growth, it is assumed that under this scenario Delta Air Lines would consolidate its connecting activity among fewer hubs and, therefore, the connecting percentage at MSP would decline more than in the base case.

TABLE 2.14: FORECAST OF ANNUAL MILITARY AIRCRAFT

Year	Total (a)
1990	2,804
1991	2,534
1992	3,003
1993	2,825
1994	2,451
1995	2,915
1996	2,624
1997	3,624
1998	2,044
1999	3,358
2000	2,473
2001	3,180
2002	2,543
2003	1,856
2004	1,976
2005	2,230
2006	2,040
2007	2,289
2008	2,115
2010	2,115
2015	2,115
2020	2,115
2025	2,115
2030	2,115
Average Annual Growth Rate	
2008-2030	0.0%

(a) Table 4 for historical data. Assumed to remain constant in future.

Sources: As noted and HNTB analysis.

TABLE 2.15: SUMMARY OF BASE CASE PASSENGER FORECAST

	2007	2008	2010	2015	2020	2025	2030	Average Annual Growth Rate
Enplanements								
Domestic Scheduled Air Carrier (a)	15,903,109	15,087,389	15,316,308	17,606,511	19,962,423	22,675,048	25,579,956	2.4%
International Scheduled Air Carrier (b)	980,460	1,264,507	1,180,400	1,472,452	1,836,550	2,290,408	2,839,469	3.7%
Subtotal Scheduled	16,883,569	16,351,896	16,496,708	19,078,963	21,798,973	24,965,456	28,419,425	2.5%
Domestic Charter (c)	41,874	16,990	15,574	12,527	10,077	8,106	6,520	-4.3%
International Charter(c)	43,641	15,386	14,103	11,345	9,126	7,341	5,905	-4.3%
Subtotal charter	85,515	32,376	29,677	23,872	19,203	15,447	12,425	-4.3%
Total	16,969,084	16,384,272	16,526,385	19,102,835	21,818,176	24,980,903	28,431,850	2.5%
Originations								
Domestic Scheduled Air Carrier (a)	7,857,050	7,291,815	7,692,173	9,420,211	10,788,756	12,380,025	14,186,792	3.1%
International Scheduled Air Carrier (b)	951,196	963,631	959,808	1,210,171	1,525,839	1,923,847	2,425,675	4.3%
Subtotal Scheduled	8,808,246	8,255,446	8,651,981	10,630,382	12,314,594	14,303,872	16,612,467	3.2%
Domestic Charter (d)	41,874	16,990	15,574	12,527	10,077	8,106	6,520	-4.3%
International Charter(d)	43,641	15,386	14,103	11,345	9,126	7,341	5,905	-4.3%
Subtotal charter	85,515	32,376	29,677	23,872	19,203	15,447	12,425	-4.3%
Total	8,893,761	8,287,822	8,681,658	10,654,254	12,333,797	14,319,319	16,624,892	3.2%

(a) Table 6.
(b) Table 8.
(c) Table G.1.
(d) Assumed to be the same as enplanements.

Sources: As noted and HNTB analysis.

TABLE 2.16: SUMMARY OF FORECAST AIRCRAFT OPERATIONS

	2007	2008	2010	2015	2020	2025	2030	Average Annual Growth Rate
Domestic Scheduled Air Carrier (a)	388,508	378,273	386,666	426,862	461,076	499,216	529,608	1.5%
International Scheduled Air Carrier (b)	14,889	24,074	23,714	28,762	32,522	39,830	47,074	3.1%
Charter (c)	1,432	536	542	440	352	276	218	-4.0%
All-Cargo Carrier (d)	15,292	14,361	14,902	16,136	17,540	18,192	18,834	1.2%
General Aviation and Air Taxi (e)	30,562	30,685	31,542	33,354	33,331	33,220	32,988	0.3%
Military (f)	2,289	2,115	2,115	2,115	2,115	2,115	2,115	0.0%
Total	452,972	450,044	459,481	507,669	546,936	592,849	630,837	1.5%

(a) Table 7.
(b) Table 9.
(c) Table G.4.
(d) Table I.2.
(e) Table 13.
(f) Table 14.

Sources: As noted and HNTB analysis.

Scenario 2 – Low Fuel Cost. This scenario assumes that jet fuel costs to the airlines decrease in real terms, either as a result of increased supply or the accelerated availability of alternative fuels such as biofuels. The real cost of jet fuel is assumed to decrease by 2% per year from early 2009 levels. This would cause air fares to fall and passenger demand to increase. As detailed in **Table K.3**, in Appendix A, total enplanements would rise slowly to 31.1 million by 2030, an average annual increase of 3.0%. Total operations would increase more slowly to 697,815 in 2030, an average annual rate of 2.0% per year.

***Scenario 3 – High Economic Growth*.** This scenario assumes a full recovery from the current economic recession, to the extent that post-recession growth is sufficient to offset the losses of the recession and restore income levels to where they would be absent the recession. **Table K.4** in Appendix A shows that in this scenario, passenger enplanement would increase to 30.7 million by 2030, an average annual increase of 2.9%. Total operations are projected to increase 2.0% per year to 688,431 by 2030.

Scenario 4 – Declining Connecting Ratio. This scenario assumes the same originating passenger forecast as the base case, but also assumes that Delta Air Lines reduces the size of the MSP connecting operation. The connecting ratio is assumed to decline at the average rate of the last five years. Under this scenario, the percentage of enplanements accounted for by originations is expected to rise from 51% in 2008 to 70% in 2030. As shown in **Table K.5**, in Appendix A, total enplanements are projected to increase at an average annual rate of 1.6% to 23.7 million by 2030 and total operations are projected to increase at an annual 1.1% rate to 571,934 by 2030.

Table 2.17 summarizes the alternative scenarios and provides a comparison with the base case.

2.13 GATE REQUIREMENTS

Table 2.18 summarizes the estimated gate requirements resulting from the above forecasts and **Tables L.1** through **L.3** in Appendix A provide more detailed information organized by the SkyTeam Alliance members (Delta Air Lines and its partners), Southwest, and all other carriers.

Gate requirements are a function of passenger aircraft operations and average gate utilization. Base year gate requirements were calculated using the summer 2008 schedule from the Official Airline Guide (OAG) and assuming a 20-minute buffer between a departing aircraft and the next arriving aircraft at any given gate. Note that the existing number of gates that are required, based on schedule, is less than the available number of gates, indicating that there is excess gate capacity at this time. Since airlines cannot always operate according to their schedules, additional spare gate capacity was included to allow for off-schedule flights. This additional spare gate capacity was assumed to be 8% of the requirements calculated based solely on schedule.

Future average gate utilization was assumed to remain at existing levels for Delta Air Lines and the SkyTeam Alliance based on input provided by Delta Air Lines. Southwest Airlines is typically able to use its gates more intensively than other carriers. Southwest was assumed to average 8.5 departures per gate based on its experience at other airports. Average gate utilization for other carriers (non-SkyTeam and non-Southwest) was assumed to remain at existing levels, approximately 4.7 turns per gate.

TABLE 2.17: SCENARIO SUMMARY

	2007	2008	2010	2015	2020	2025	2030
Total Originations							
Base Case	8,893,761	8,287,822	8,681,658	10,654,254	12,333,797	14,319,319	16,624,892
Scenario 1: High Fuel Cost	8,893,761	8,287,822	8,662,834	9,904,026	11,280,808	12,867,215	14,707,543
Scenario 2: Low Fuel Cost	8,893,761	8,287,822	8,696,250	11,114,205	13,054,856	15,402,032	18,256,782
Scenario 3: High Economic Growth	8,893,761	8,287,822	8,693,849	11,377,997	13,217,186	15,408,919	17,979,093
Scenario 4: Low Connecting Ratio	8,893,761	8,287,822	8,681,658	10,654,254	12,333,797	14,319,319	16,624,892
Total Enplanements							
Base Case	16,969,084	16,384,272	16,526,385	19,102,835	21,818,176	24,980,903	28,431,850
Scenario 1: High Fuel Cost	16,969,084	16,384,272	16,039,649	16,651,548	18,068,039	19,643,363	21,401,089
Scenario 2: Low Fuel Cost	16,969,084	16,384,272	16,544,330	19,921,290	23,063,023	26,803,327	31,111,241
Scenario 3: High Economic Growth	16,969,084	16,384,272	16,541,378	20,421,185	23,378,479	26,843,490	30,656,311
Scenario 4: Low Connecting Ratio	16,969,084	16,384,272	16,074,766	17,868,992	19,601,262	21,559,813	23,708,077
Total Air Cargo Tonnage							
Base Case	283,777	257,116	265,750	291,360	322,156	362,745	428,217
Scenario 1: High Fuel Cost	283,777	257,116	265,172	270,798	294,609	325,919	378,794
Scenario 2: Low Fuel Cost	283,777	257,116	266,198	303,967	341,019	390,202	470,282
Scenario 3: High Economic Growth	283,777	257,116	266,124	311,197	345,266	390,377	463,124
Scenario 4: Low Connecting Ratio	283,777	257,116	265,750	291,360	322,156	362,745	428,217
Total Operations							
Base Case	452,972	450,044	459,481	507,669	546,936	592,849	630,837
Scenario 1: High Fuel Cost	452,972	450,044	443,941	449,443	469,455	492,352	514,042
Scenario 2: Low Fuel Cost	452,972	450,044	463,938	534,013	583,925	643,175	697,815
Scenario 3: High Economic Growth	452,972	450,044	463,875	546,593	591,594	644,305	688,431
Scenario 4: Low Connecting Ratio	452,972	450,044	448,018	484,668	512,041	542,975	571,934

Sources: Tables K.1 through K.5.

TABLE 2.18: SUMMARY OF FORECAST GATE REQUIREMENTS - TOTAL

	2008		2010	2015	2020	2025	2030
Daily Departures	569.4		580.2	644.3	698.0	762.4	815.6
		Gate Requirements					
Total	w/o Spares	w/ Spares					
Widebody (a)	3	5	5	7	11	13	15
757 Class (b)	10	11	9	6	4	9	16
Narrow Body (c)	42	45	45	48	54	56	57
Large Regional (d)	13	15	18	26	29	33	36
Medium Regional (e)	22	23	24	25	25	26	31
Small Regional (f)	12	12	11	11	10	8	-
Subtotal	102	111	112	123	133	145	155
International							
Widebody (a)	3	5	5	6	7	9	11
757 Class (b)	1	1	1	1	1	-	1
Narrow Body (c)	6	6	5	7	9	12	12
Large Regional (d)	-	-	-	-	-	-	-
Medium Regional (e)	-	-	1	1	1	1	1
Small Regional (f)	-	-	-	-	-	-	-
Subtotal	10	12	12	15	18	22	25
Domestic							
Widebody (a)	-	-	-	1	4	4	4
757 Class (b)	9	10	8	5	3	9	15
Narrow Body (c)	36	39	40	41	45	44	45
Large Regional (d)	13	15	18	26	29	33	36
Medium Regional (e)	22	23	23	24	24	25	30
Small Regional (f)	12	12	11	11	10	8	-
Subtotal	92	99	100	108	115	123	130
Average Utilization (g)		5.1	5.2	5.2	5.2	5.3	5.3

(a) Includes all multiple aisle aircraft.
(b) Includes 757-200, 757-300 and anticipated replacement aircraft.
(c) Includes all mainline narrow-body aircraft except for 757 class.
(d) Includes Embraer 175 and Canadair 900 aircraft.
(e) Includes all regional aircraft between 44 and 70 seats.
(f) Includes all regional aircraft less than 44 seats.
(g) Total aircraft operations divided by gate requirements.

Sources: As noted, Tables L.1, L.2, and L.3, and HNTB analysis.

Gate requirements in each category (wide-body, 757-class, etc.) were assumed to increase at the same rate as aircraft departures in that category. For the purpose of calculating gate requirements, however, it was assumed that aircraft would be able to use any gate sized to accommodate aircraft larger than their class. Therefore, a new 757-class gate requirement was not assumed if there was available wide-body gate capacity.

As shown in **Table 2.18**, a requirement of 155 total contact gates is anticipated by 2030, of which 25 would need to be capable of accommodating non-pre-cleared international flights. SkyTeam would account for 119 of the required gates (see **Table L.1**). Factors that could change future gate requirements at MSP include the following:

- Changes in forecast activity
- Adjustments in the spare gate percentage
- Increased future gate utilization among the carriers
- Changes from preferential use to common-use gate lease arrangements
- Use of hardstands
- Shuttling of international arrival passengers from domestic gates to Customs and Border Protection facilities. (This would not reduce the total number of gates but would reduce the number of international gates.)