Federal Aviation Administration

FACT3: Airport Capacity Needs in the National Airspace System

January 2015

FROM THE ADMINISTRATOR

Dear Members of the Aviation Community:

This is the third iteration of the Federal Aviation Administration's (FAA) long-term outlook for airport capacity in the United States. Like the previous studies, the primary goal is to identify airports that are likely to need more capacity to accommodate anticipated growth in demand.

Today, most hub airports in the United States operate efficiently with moderate delays. This is a significant improvement from prior editions of the Future Airport Capacity Task (FACT) reports when delays at many airports were growing and causing a ripple effect of systemwide delays. The graphic on the following page helps illustrate the substantial reductions in congestion that have been achieved during the 10 years since the first FACT report was published.

Working closely with airports, we've been able to dramatically enhance capacity at many airports. This report shows the combined effects of adding 18 new runways and seven extended runways at 21 busy hub airports since 2000. That's a tremendous amount of new capacity that allows traffic to flow more freely in and out of airports to better serve their communities and the nationwide system. At other airports, air traffic has decreased with structural changes in the airline industry. As a result of both enhanced capacity and traffic changes, congestion has been reduced and the nationwide system is more reliable. Bad weather days have less impact, and we can recover schedules faster once the weather clears.

Since the publication of the second FACT report in 2007, the aviation industry has continued to evolve, and we've sought to keep pace with ongoing trends in this report. Our data and modeling of future demand, fleet mix, throughput, air traffic control (ATC) procedures, and NextGen have all been updated. We've also included surface components to better gauge congestion that can occur on the airport surface and at gates.

What have we learned? Most (but not all) of our hub airports will be able to function well in terms of capacity through the next decade. NextGen is helping to manage delays resulting from increasing congestion at many airports, but NextGen alone cannot create sufficient additional capacity at some of the largest and busiest airports. This is not surprising, as FAA has always acknowledged that new runways and other solutions will still be necessary to address traffic growth and reduce delays.

Therefore, we still have work to do. It's vital that active airfield work continue at key hubs like Chicago O'Hare and Philadelphia International Airports if we are to keep pace with demand and stay ahead of delays. While capacity and delays have improved nationally, there are a handful of airports with consistent delays – most notably John F. Kennedy, LaGuardia, Newark, Philadelphia, and in the coming years, San Francisco. Airline scheduling is increasingly concentrated at major hubs, which has exacerbated congestion as well. While NextGen will improve performance, it's likely that significant congestion will continue to plague these airports unless additional airfield capacity enhancements can be achieved. The FAA is committed to

supporting continued work in these locations to evaluate and implement effective long-term solutions in collaboration with stakeholders.

Looking further into the future, out to 2030, this report will also show that with cumulative traffic growth, more hub airports will become congested. However, due to aviation industry consolidation and other factors, there is uncertainty with these longer-term projections. For example, the airlines may accelerate the current trend in upgauging to larger aircraft, flying more passengers on fewer flights. With these short-range fluctuations, it's challenging to determine when long-term capacity enhancements will be needed. Nonetheless, this long-term outlook warrants careful monitoring and continuing airport planning efforts in order to stay ahead of congestion and delay as the economy improves and air travel demand picks up.

Where do we go from here? Principally, the findings of this report underscore the continued need for investment in aviation infrastructure. The airports identified in this report need to continue progress on their runway projects and other airfield enhancements, while FAA and our industry partners need to continue the push forward with NextGen. Both airport development and NextGen are complementary of course. Together, they enable efficient, reliable access to the safest and most dynamic aviation system in the world.

Michael P. Huerta
FAA Administrator

Airport	FACT1			FACT2			FACT3		
	2004	2013	2020	2007	2015	2025	2011	2020	2030
ABQ		●	●						
ATL	●	◑	●			●	●	●	●
BDL			●						
BHM			●						
BOS			◑			◑			
BUR		●	●						
BWI		◑	◑						
CLT		◑	◑		◑	◑			●
CVG		◑	◑						
DCA			◑						
DEN			◑						
DFW			◑						
DTW			◑						
EWR	●	●	●	●	●	●	●	●	●
FLL		●	◑	●	◑	●			◑
HOU		●	●		◑	◑			
IAD			◑			◑			
IAH		◑	◑		◑	◑			●
ISP			●						
JFK		●	◑		◑	●	●	●	●
LAS		◑	●		◑	●			●
LAX		◑	◑			◑			
LGA	●	●	●	●	●	●	●	●	●
LGB		●	●		●	●			
MDW		◑	●		◑	●			
MEM			◑						
MIA			◑						
MSP		◑	◑			◑			
OAK		●	●		●	●			
ONT			●						
ORD	●	●	◑	●	◑	◑			◑
PBI		●	◑		◑	◑			
PHL	●	●	◑		●	●	●	●	◑
PHX		◑	◑			●			●
PVD			●		◑	◑			
SAN						●			
SAT		●	●		◑	◑			
SEA			◑			◑			
SFO						●		◑	●
SLC			◑						
SNA		●	●		●	●			
STL		◑	◑						
TUS		●	●		◑	◑			

Comparative Summary Results Across all Three FACT Reports

Legend:

◑ Constrained in reference case, but unconstrained if planned improvements are implemented

● Constrained even after all planned improvements are implemented; additional capacity enhancement is needed; or constrained in base year.

No symbol indicates not capacity constrained

Note: *This table lists only the airports that were identified as capacity-constrained in one of the FACT reports. Other airports that were analyzed in the FACT reports, but not identified as capacity-constrained, are not included.*

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SUMMARY INTRODUCTION

In 2003, FAA convened a team to assess the Nation's future airport capacity needs. This effort, which became known as the Future Airport Capacity Task (FACT), represents a strategic approach to identify the airports that have the greatest need for additional capacity in the future. The identification is based on a macro-level analysis of the factors and trends contributing to congestion and delay at the busiest airports in the Nation. By embarking on this initiative, FAA seeks to ensure that the long-term capacity of the U.S. aviation system can adequately serve future demand.

The team is led by the Office of Airports (ARP) and includes active participation from the Air Traffic Organization (ATO) Capacity Analysis Group and the MITRE Corporation's Center for Advanced Aviation System Development (CAASD). The FAA's Office of Aviation Policy and Plans (APO) and the NextGen office (ANG) are also involved in the conduct of the studies.

The first report in the series, commonly known as FACT1, was published in 2004 and identified shortfalls in the system through 2020. This study was the first top-down review of the busiest commercial service airports in the Nation. The report's findings supported the need for a substantial number of major airport capacity projects nationwide. After considering all planned improvements at the time, 18 airports were projected as needing additional capacity by 2020.

An updated report, FACT2, was published in 2007 to identify shortfalls through 2025. FACT2 included a more transparent methodology and refined analytical methods. Fourteen busy hub airports located in the Nation's most populated regions (such as the Northeast Corridor and California coast) were projected to be capacity-constrained in 2025 even with completion of all planned improvements, as then contemplated. Notably, the report also reaffirmed that key runway projects would allow several hub airports to reduce delays and continue growing; this supported the completion of five new runways that have been commissioned at hub airports since the report's publication. The report provided an initial look at capacity benefits from the Next Generation air traffic control (ATC) system, better known as NextGen. The FAA's investment in NextGen began in 2007. The graphic following the Administrator's letter provides a comparison of the FACT1, 2, and 3 report results.

All of the FACT reports have begun with a broad sampling of several hundred commercial service and busy general aviation airports nationwide. From this initial step, a smaller number of airports are identified for more detailed study. Both FACT1 and FACT2 evaluated capacity and delay at 56 airports, including the 35 airports that were part of the now completed Operational Evolution Plan (OEP). FACT3 conducted a more detailed evaluation of 48 airports, including the 30 Core airports that FAA currently tracks as a measure of system performance in the National Airspace System (NAS).

Since the publication of FACT2, the aviation industry in the United States has continued to rapidly evolve. Due to the Great Recession and volatile (often higher) fuel costs, airlines have emphasized better ticket yields, fees, and load factors, rather than improved market share as a strategy for profitability. Airlines have consolidated through mergers and have increasingly focused their connecting operations at major hubs. While the use of 50-seat regional jets (RJ) has grown substantially during the last decade, these aircraft are now leaving the fleet due to their higher fuel costs and upcoming major maintenance cycles. Airlines are replacing these smaller RJs with larger RJs and narrow-body aircraft, enabling

airlines to accommodate passenger growth but with fewer operations. Collectively, these factors have resulted in relatively flat traffic growth over the last few years. As a result, the FAA forecast estimates 32 percent fewer operations and about 23 percent fewer enplanements in 2025 at the 30 Core airports than the forecast used in FACT2.

FACT3 is scoped to incorporate many of these trends through 2020 and 2030. In addition to updated forecasts, the FACT3 analysis includes current aircraft fleet mix projections, updated NextGen planning (which has matured substantially since 2007), and modeling of gate and surface constraints on airport capacity.

The FACT3 assessment relies on a similar systemwide modeling approach as that used by FAA to estimate the midterm benefits of NextGen, as well as the same airport capacity assumptions and air traffic projections. Thus, the FACT3 results are consistent with the overall delay reduction benefits reported in the Business Case for NextGen. Where FACT3 differs is in the use of location-specific metrics (e.g., percent of congested operating hours above a delay threshold) that describe future congestion levels at airports. FACT3 also incorporates a near-term NextGen scenario that reflects only the specific capabilities that are ready and expected to be widely deployed in the NAS within the next few years. In contrast, the analytical results reported in the Business Case for NextGen reflect all of the midterm NextGen capabilities to calculate total system wide delay savings. While the Business Case quantifies total NextGen benefits for the entire NAS, FACT3 is meant to provide airport-specific results that can inform local infrastructure planning discussions.

In brief, the FACT3 report findings support the following:

Airport Capacity Constraints and Congestion through 2020

- Today delays are concentrated at a few major hub airports, which reflect ongoing trends towards airline consolidation at their hubs. The New York City (NYC) area airports, Philadelphia International Airport (PHL), and Hartsfield-Jackson Atlanta International Airport (ATL) have significant congestion.[1]

- The NYC area airports (Newark Liberty International (EWR), John F. Kennedy International (JFK), and La Guardia (LGA)) will continue to have significant capacity constraints through 2020; LGA and JFK delays are expected to worsen such that congestion will become severe.[2]

- At ATL, the new runway that opened in 2006 and area navigation (RNAV) flight procedures have improved the airport's capacity; however, the airport remains prone to delays due to demand growth and arrival/departure banks in the schedule of the airport's primary airlines. Delays at ATL are projected to continue to grow through 2020. However, the use of larger aircraft by the airport's primary airlines and/or a more balanced flight schedule could mitigate these delay projections.

[1]This report identifies airports with their three-letter FAA location identifiers. For a complete list, see Appendix A.

[2]At the NYC area airports, the FAA forecast assumes unconstrained operations demand growth at JFK and EWR and constrained growth at LGA. Since FACT3 uses the Terminal Area Forecast (TAF), the additional congestion projected is a reflection of demand growth above the existing schedule limits. Should the schedule limits continue (due to future regulatory action), there will be less congestion than this report projects.

- When implemented at San Francisco International Airport (SFO), midterm NextGen capabilities will be sufficient to reduce delays below the significance criteria due to more efficient flight procedures. Without midterm NextGen, SFO is projected to be capacity-constrained in 2020.[3]

- The planned runway extensions at PHL will serve to reduce average arrival delays, although the airport is projected to remain significantly congested if the planned new parallel river runway is not constructed.

What is expected by 2030?

- The 2030 scenarios show that with steady traffic growth as forecasted, delays will continue to grow. Without planned improvements beyond near-term NextGen, 12 airports will have significant congestion, including 11 that will have severe congestion as shown in Table 3 and Figure 5.

- The implementation of midterm NextGen capabilities is expected to reduce growth in delays at the capacity-constrained airports by about 26 percent, with a slight increase in total throughput of up to 2 percent. This is as compared to the 2030 Reference Scenario (i.e., no further improvements beyond near-term NextGen). Although this is a worthwhile improvement, the congestion reduction is not sufficient to keep these airports below the FACT3 significance criteria.

- Of particular note, the runway development projects (both ongoing and future phases) at Fort Lauderdale/Hollywood International Airport (FLL), Chicago O'Hare International Airport (ORD), and PHL provide sufficient capacity to keep these airports from becoming severely congested by 2030.

NAS Modernization: NextGen and New Runways

- Many of the NextGen capabilities provide incremental benefits – a moderate throughput increase, or the ability to fly more efficient routes, or optimized descents that save fuel. Time-based metering can optimize traffic flow into an airport. Surface metering methods and decision support tools allow for improved data sharing and coordination. This reduces capacity losses that would otherwise occur during certain adverse conditions. These capabilities are important as they improve the efficiency, predictability, and reliability of the entire NAS. Still, if an airport is facing a substantial shortfall in capacity, the best answer is often new pavement. The optimal combination of solutions in each particular location depends on the scale of the capacity/demand imbalance and the specific operational issues that need to be addressed. Often, at congested airports, both are necessary to foster improved operational performance. For example, NextGen improvements may be needed to maximize the capacity benefits of a new runway.

[3]Currently, SFO is designated by FAA as Level 2 under the International Air Transport Association Worldwide Slot Guidelines. Level 2 indicates that there is a potential for congestion that could be managed by voluntary means. This designation is necessary due to runway capacity, existing congestion and delays, and expected increased congestion with multiyear airport construction projects. The FAA is working with airlines serving SFO to voluntarily adjust schedules to reduce delays.

- NextGen has benefits that may prove to be as important as outright capacity enhancement. Significant improvements in the reliability and predictability of operations across the NAS will help airlines better maintain and recover flight schedules during inclement weather. However, these predictability and reliability benefits will not be readily apparent in the high-level systemwide capacity benefits presented in the FACT3 report.

- Gates and taxiway infrastructure do not constrain capacity at most airports, now or in the future. In general, the largest and busiest airports have been able to build gates when they are needed—and many airports are making better and more efficient use of their gates through more flexible leasing arrangements.

Recommendations

- While NextGen capabilities will mitigate delays at the capacity-constrained airports, congestion will continue to impede efficiency and growth. The remaining gap shows why additional solutions such as new runways, regional emphasis, congestion management, multimodal transportation, and further NextGen development are so important.

- Given the evolving trends and shifts in the aviation industry, along with a much higher level of volatility, there is considerable uncertainty surrounding any projection that is nearly two decades into the future (i.e., the 2030 scenarios). Sources of uncertainty include traffic growth, how quickly the airlines add larger aircraft to their fleet to replace smaller aircraft, demographic and socioeconomic shifts, and the realization of capacity improvements from NAS modernization initiatives. However, with several consecutive years of sustained operations growth at any of the Core airports, the long-term delay concerns will become much more tangible. As a result, it remains crucial for these airports to continue their efforts to devise long-term planning solutions to address capacity constraints.

- The immediate focus should be on identifying solutions for airports identified as capacity-constrained in any of the 2020 scenarios. These airports are likely to be capacity-constrained under a variety of scenarios. Airports such as SFO and the NYC area airports cannot easily be expanded to meet unconstrained demand. At the NYC area airports, FAA limits on operations are currently in effect. If the schedule limits continue due to future regulatory action, this will not diminish the need for capacity enhancement at the NYC area airports. A focused effort will be needed to identify viable solutions that can be implemented during this decade.

METHODOLOGY AND INPUTS – WHAT HAS CHANGED SINCE FACT2?

The FAA has undertaken this third FACT analysis in order to identify airports that are expected to have capacity needs in the future, given several possible scenarios for demand growth and capacity expansion.

Much has changed since the publication of FACT2 in 2007. The aviation industry in the United States has continued to evolve. Due to the Great Recession and volatile (often higher) fuel costs, airlines have emphasized better ticket yields and fees, rather than improved market share, as a strategy for profitability. Airlines have consolidated through mergers and have increasingly focused their connecting operations at major hubs. While the use of 50-seat RJs has increased substantially during the last decade, these aircraft are now leaving the fleet due to their higher fuel costs and upcoming major maintenance cycles. Collectively, these factors have resulted in relatively flat operations and enplanement growth over the last few years. As a result, FAA forecast estimates 32 percent fewer operations in 2025 at the 30 Core airports than the forecast used in FACT2.

FACT3 is scoped to incorporate many of these trends. In addition to updated forecasts, the FACT3 analysis includes current aircraft fleet mix projections, updated NextGen planning (which has matured substantially since 2007), and modeling of gate and surface constraints on airport capacity. FACT3 also contains refined modeling and selection criteria.

This section identifies several changes made to the FACT process since the publication of the FACT2 report. Appendix B provides more detail on the methodology. Appendix C provides a summary of the FACT input changes through the various iterations of this report. Appendix D provides a sensitivity analysis of the FACT3 findings, given the changes in forecasted demand with the FAA's annual forecast update.

Updated Forecast and Fleet Mix Data

The FACT3 analysis uses the 2012 version of the FAA's TAF, as published in January 2013.[4] At the 30 Core airports, the TAF forecasts 14.2 million total operations and 606.5 million enplanements in 2020. In 2030, 16.7 million total operations and 769.0 million enplanements are forecast. This reflects annualized operational growth of 1.1 percent through 2020 and then 1.6 percent through 2030. Enplanements are forecast to grow at a faster rate of 2.1 percent through 2020 and then 2.7 percent to 2030. The average seat per aircraft in the fleet is expected to increase over this period, as enplanements are forecast to grow faster than operations.

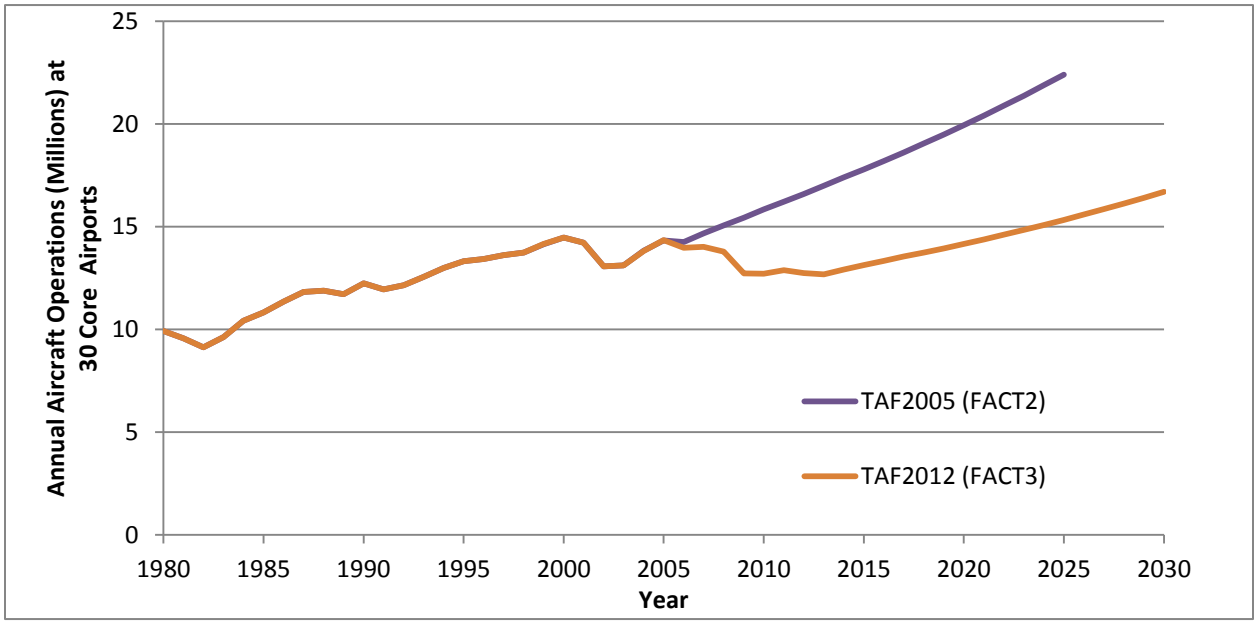
The original FACT1 report was based on the TAF released in 2003, while the FACT2 report used the 2005 release of the TAF, as well as MITRE CAASD's Future Air Traffic Estimator[5] (FATE) forecast. The 2003 and 2005 TAFs were reflective of a period in which the aviation industry was recovering from the September 11, 2001, terrorist attacks and the economy

[4]The FAA updates the TAF every year.

[5]The FATE forecast methodology is being transferred into the FAA's modernized TAF, known as TAF-M.

was growing steadily. In contrast, the 2013 TAF used in the FACT3 report shows the effects of the economic contraction in 2008 and 2009 on the aviation industry and the stabilization of the industry through 2012. Figure 1 provides a comparison of the TAF operational levels at the 30 Core airports from FACT2 to FACT3.

Figure 1. Actual and Forecasted Annual Operations at 30 Core Airports



Because the TAF is a forecast of unconstrained demand, FACT3 seeks to evaluate long-term capacity needs of the airport system as needed to meet demand growth without constraints. However, at a few very congested airports, a trimming algorithm is used to smooth schedule peaks and limit operations in the FACT3 analysis.[6] Even with trimming, these airports remain highly delayed.

Fleet mix is a particularly important factor in assessing future airport congestion. For a given number of passengers who want to travel by air, a fleet with a smaller average seat count will result in more aircraft operations. This trend was evident in the last decade with the increasing use of 50-seat RJs. However, the current trend is towards somewhat larger aircraft, which are more fuel efficient as reflected in the current TAF. For the same amount of growth in passengers, this results in a lower rate of growth in aircraft operations. The amount of benefit with some NextGen improvements, such as Wake Recategorization, is also dependent on fleet mix. The NAS-wide simulation used in FACT3 includes a dynamic fleet mix that evolves over time using the FAA Fleet Forecast. FACT3 also uses an annual service volume (ASV) model with a static fleet mix based on the current fleet at an airport. The separate fleet mix assumptions provide useful variation in the estimates of future delays at an airport.

[6]The trimming algorithm is meant to mimic historical airline and FAA actions at ORD, LGA, JFK, and EWR to reduce delays. However, the trimming algorithm does allow some growth in future years, including growth above the current FAA schedule limits at the NYC area airports.

Planned Improvements: Runways, NextGen, and NAS Modernization

The FACT3 analysis includes planned improvements affecting runway capacity for two future planning periods, 2020 and 2030. The FACT estimates of future capacity needs incorporate the best available information about planned improvements to the ATC system, as well as runway and airport infrastructure improvements.

FACT3 is aligned with the FAA's overall NextGen implementation strategy in order to incorporate relevant NextGen assumptions into the study. NextGen is a portfolio of capabilities that will improve the capacity, efficiency, safety, and environmental performance of the NAS. NextGen planning has matured greatly since the publication of FACT2 with the formation of the FAA's NextGen office. The FAA published the NextGen Implementation Plan (NGIP), which provides an overview of NextGen capabilities and implementation timeframes. The NextGen assumptions used in FACT3 are derived from the Agency's overall NextGen planning, including the NGIP as well as internal planning documents,[7] which describe NAS modernization efforts extending to the year 2020.

FACT3 assesses the capacity benefits of NextGen concepts at airports and estimates how they will help reduce growth in delays through enhanced ATC techniques, technologies, and procedures. While capacity is a NextGen benefit, it is important to note that many of the capabilities are more focused on efficiency, shared situational awareness, and flexibility.[8] These will improve the predictability and reliability of the NAS in ways that are perhaps more important than capacity, by allowing more nimble reroutes of air traffic around lines of thunderstorms; or allowing a faster recovery of normal operations when a weather event impacts a metropolitan area (such as a snowstorm in the Mid-Atlantic region). While these types of benefits are not assessed in the FACT3 models and metrics, the overall benefit to the NAS should not be underestimated.

Two primary scenarios are used in FACT3 to assess airport capacity and congestion in 2020 and 2030 as shown in Figure 2. The improvements included in each scenario are described on the following pages.

[7] FAA NAS Segment Implementation Plan (NSIP), version 4. The FACT3 assumptions reflect elements of Segment A for near-term NextGen and the remainder of Segment A plus Segment B for midterm NextGen.

[8] When used in the context of NextGen benefits, efficiency is often used to describe fuel savings that result from optimized flight procedures. Efficiency in this context does not necessarily indicate delay savings related to capacity enhancement.

Figure 2. FACT3 Scenarios in 2020 and 2030

Improvements	**Reference Scenario:** *No further improvements beyond near-term NextGen*	**Improvements Scenario:** *After planned improvements with mid-term NextGen and runways*
Existing airport infrastructure as of 2011	✓	✓
New or extended runways at FLL, ORD, and PHL		✓
Near-term NextGen	✓	✓
Mid-term NextGen		✓
New or revised ATC flight procedures, including airspace redesign		✓
Existing noise abatement procedures	✓	✓
Gate development plans		✓

The **Reference Scenario**, which encompasses *no further improvements beyond near-term NextGen,* includes existing airport infrastructure (as of 2011), as well as existing ATC procedures and airspace design. Also included are new or extended runways that have opened at ORD, Seattle-Tacoma International Airport (SEA), Washington Dulles International Airport (IAD), PHL, and Charlotte/Douglas International Airport (CLT), since FACT2 was published. This scenario includes mature NextGen capabilities that are expected to be widely deployed in the NAS within the next few years:

- **Near-term NextGen:** From an implementation perspective, NextGen is a long-term, incremental program. The initial building blocks establish the foundation for future segments of NextGen to be implemented. FACT3 evaluates two segments of NextGen and their effects on airport capacity. The first segment, known as near-term NextGen, includes the capabilities in the NGIP that are mature, funded and are either being deployed today or will achieve initial deployment in the NAS by the end of 2015. ATC capacity improvements include the initial phase of Wake Recategorization, an increased use of Traffic Management Advisor and Converging Runway Display Aids, and a demonstration of Wake Turbulence Mitigation for Departures. Several improvements to dependent and independent closely spaced parallel operations are also included. The implementation, use, and benefit of these tools and procedures vary, given the unique configurations and operational needs of an airport.

The **Improvements Scenario** includes the following additional planned improvements:

- **New or Extended Runways.** New runways are included in FACT3 at FLL, ORD, and PHL as planned improvements. At FLL, the extended and widened Runway 10R/28L

opened in September 2014. At ORD, the completion phase of the O'Hare Modernization Program is planned by 2020.[9] Two runway extensions are planned at PHL by 2020 as part of its Capacity Enhancement Program (CEP). All of these runway projects are included in the 2020 Improvements Scenario.[10]

The completion of the new parallel river runway at PHL, which is planned for early in the next decade, is incorporated into the 2030 scenario with planned improvements at PHL. Runway improvements are being considered at other airports as well, and several site-specific studies are underway at Denver International Airport (DEN), George Bush Intercontinental/Houston Airport (IAH), CLT, and ATL. However, these projects have not reached sufficient maturity to be included in FACT3.

- **Midterm NextGen.** The second segment of NextGen capacity improvements builds on the capabilities achieved in the near-term segment. ATC capacity improvements include use of Wake Turbulence Mitigation for Departures at additional airports; enhanced closely spaced parallel runway operations, including Wake Turbulence Mitigation for Arrivals; and improved metering of traffic within congested terminal airspace. Improved departure fanning enabled by RNAV routes is also expected at several airports. The integration of NextGen communications, navigation, and surveillance capabilities is also estimated to improve the precision and reduce the separation buffer of arrivals coming into congested airspace and airports. Overall, the midterm segment includes capabilities that are expected to be achieved in the NAS by 2020.

- **New or Revised ATC Procedures.** If a new or revised ATC procedure is planned at an airport by FAA, with either NextGen or a complementary NAS modernization initiative, it was modeled as an improvement in this report. Examples include increased use of simultaneous offset approaches at SFO and improved departure throughput with RNAV-based departures at ATL.

- **Airspace Redesign.** Improvements derived from the redesign of the airspace surrounding an airport were reflected in the 2020 scenarios based on the best information available. This includes longer-term airspace projects such as the Las Vegas and New York/New Jersey/Philadelphia airspace redesigns, as well as completion of the first phase of the FAA's Metroplex[11] initiative to streamline Performance Based Navigation (PBN) routes and procedures. Airspace redesign efforts are primarily focused on efficiency (including fuel burn and route mileage reductions) and flexibility improvements, rather than capacity. Detailed airspace redesign itself was not performed as part of this analysis.

[9]Completion of the O'Hare Modernization Program includes Runways 10C/28C in 2013 and 10R/28L in 2015. The Runway 9C/27C and 9R/27L extensions are assumed to be completed by 2020.

[10]PHL CEP includes extension of Runways 8/26 and 9R/27L by 2020 and then construction of a new south parallel runway along the Delaware River a few years later. As such, this runway is included in the 2030 improvement scenarios.

[11]Also known as Optimization of Airspace and Procedures in the Metroplex (OAPM).

- **Other Assumptions.** The FACT3 analysis assumed that existing noise abatement procedures, which can affect runway capacity, would continue as is into the future planning periods. Terminal gate development plans were also included. Detailed taxiway or ground access improvements were not included in this analysis because they were outside the scope of the models used.

Airport Selection

The goal of FACT is to identify those airports that are expected to be capacity-constrained in the future; however, it is impractical to analyze all of the existing 3,330 airports in the FAA's National Plan of Integrated Airport Systems (NPIAS) to the required level of detail. Therefore, a screening method was used to select candidate airports where excessive delays could potentially have a significant impact on the efficiency of the NAS, including:

- Core airports: 30 commercial service airports that have been identified by FAA as having a significant role in the NAS due to their level of operations or passengers;

- Potentially constrained commercial airports: commercial service airports with projected traffic growth that may stress their current capacity; and

- General aviation airports: other airports with a substantial level of traffic, even if primarily general aviation, which can affect airspace and air traffic in multi airport areas like New York and Southern California.

In all, 48 airports were included in the FACT3 analysis as shown in Appendix A.

Models and Identification Criteria

As in FACT2, the FACT3 analysis was based on both ASV and NAS-wide modeling tools. The use of two modeling techniques is a strength of the FACT approach as the synthesized results can incorporate a comprehensive set of operational parameters.

ASV calculates the yearly demand that results in a given level of average delay in simulated operations. ASV studies are conducted by the Capacity Analysis Group (AJR-G5) at the FAA's William J. Hughes Technical Center. ASV analysis considers multiple runway configurations, weighted by the annual frequency of occurrence, and utilizes an annual estimation of weather conditions for each configuration in its calculation. The resulting demand-delay curve can be used to estimate the average annual delay that results at a given level of annual demand.

As the name implies, NAS-wide simulations allow for the assessment of aircraft operations across the entire system. MITRE CAASD conducts NAS-wide studies for the FACT reports. Calculated capacity curves are used for each airport with adjustments over time for future fleet mixes. With faster processing capability, 16 demand days, with a mix of weather conditions, are simulated for each scenario (versus only two traffic scenarios, "good weather" and "bad weather" for FACT2). NAS-wide modeling was expanded from runways and airspace to include taxiway and gate constraints.

Both the ASV and the NAS-wide models were used to define whether an airport would be considered "congested" or "capacity-constrained" in a scenario.[12] [13]

- **Caution:** this status identifies airports that are not capacity constrained but have delays approaching the capacity-constrained criteria. An airport falls into this caution designation if the ASV delay was 5 minutes or greater or the percentage of congested hours[14] was 20 percent or greater for either arrivals or departures.

- **Congested:** to be designated as capacity constrained or congested, an ASV delay of 7 minutes per flight or greater was needed, as well as an NAS-wide estimate of 30 percent or more of the arrival or departure hours at the airport being congested.

- **Severe:** as a subset of the capacity-constrained airports, some airports have estimated delay and congestion that are an order of magnitude higher than the initial criteria for identification. An ASV delay of 15 minutes or greater and a percentage of congested hours at or above 50 percent is considered to be severely capacity constrained.

Given the consolidation of airline operations at fewer airports and the general challenges of applying a macro-level approach to regional system planning, the identification of congested metropolitan areas is less significant today than when done in the FACT2 report. Accordingly, the designation of metro areas as congested is not included in the FACT3 report. Nonetheless, this report recognizes that certain key metro areas with multiple airports, such as the NYC area, are effectively congested under almost any measure due to airport delays and airspace complexity. Where possible, encouraging traffic growth to unconstrained airports in a metro area is worthwhile but often has practical constraints. Effectively, the analysis of metro area airport systems is better conducted with a more regionally focused methodology than is possible with FACT.

Airport Capacity Profiles and ASV Studies

As a companion publication to the FACT3 report, capacity curves similar to those used in the NAS-wide modeling are available for selected airports on the FAA Web site. The airport capacity profiles provide a range of model-estimated and facility called rates for both existing and future conditions. The profiles replace the benchmarks that were last published in 2004. In addition, the ASV studies are available to airport sponsors upon request.

[12] FACT3 criteria must not be considered as an FAA definition of acceptable delay for the purpose of justifying proposed airport development without prior consultation with the FAA's Office of Airport Planning and Programming, Airport Planning and Environmental Division (APP-400).

[13] Due to the complexity of operations at LGA, only the NAS-wide model was used to assess future congestion at the airport.

[14] A congested hour is defined by having a high level of delay for either arrivals or departures. A congested delay level is defined as the 90th percentile value seen at the 30 Core airports in the 2011 NAS-wide baseline simulation. The hours between 0700 and 2259 local time on the 16 representative days were considered in the determination and application of this metric. See Appendix B for additional information.

COORDINATION WITH AFFECTED AIRPORTS

During May, June, and July 2014, the FACT3 analysis was briefed to each of the airports identified as being capacity constrained in future years. Each airport operator was briefed on the assumptions used in the analysis, as well as the draft results. Often, the airport operator agreed with the FACT3 analysis. Others thought the analysis may have over- or under-estimated airport capacity. Several airports noted changes in gate assignments or terminal development plans, as well as the ongoing effects of airline mergers.

Ongoing changes at airports are expected of course. Given the medium-level fidelity of the models used in this report, the primary value of the simulation modeling is for trend analysis. New gate assignments and similar smaller-scale changes do not substantively affect the long-term trends projected by FACT3. This is because the trend projections for future delays are more relevant and telling than a single-point, deterministic value that can vary with small changes.

FINDINGS OF THE FACT3 REPORT

Consistent with FACT2, this report also finds that several of the Nation's busiest hub airports are and will be capacity constrained in future years.

As would be expected, the findings from the various iterations of FACT have evolved over time. Effectively, while aggregate future demand is lower than in previous FACT reports, the ability of the NAS to handle demand is also greater. Ten of the 30 Core airports have been successful in adding new runway capacity with either new runways or extensions, since the first FACT report was published in 2004. The ATC has also enhanced efficiency with airspace redesigns, including improved flight routes and procedures. Many large hub airports have seen steady traffic growth as airlines have sought to increasingly focus connecting traffic at their established hubs. Other airports have seen significant and sustained reductions in operations. As a result, some airports are no longer designated as congested by FACT. A full comparison of the FACT findings by airport is provided following the Administrator's introductory letter.

As a macro-level assessment of the airport system, FACT3 is not intended to evaluate all aspects of an operation at each individual airport. For example, some airports may have taxiway limitations that cause significant operational delays on the surface. While FACT3 does reflect consideration of general surface and gate constraints, it does not use a detailed taxiway layout. Airports have many different runway configurations used throughout the year. Most airport configurations are captured in the ASV model; however, the NAS-wide modeling is limited to the three most common runway configurations during visual, marginal, and instrument conditions. As such, the performance of an individual airport may not be fully represented, and some future problems may not be captured or identified. While FAA considers the FACT3 findings to be representative of the future performance of the airport system, the limitations discussed above do influence the overall results.

The FACT3 analysis should be considered in combination with studies being prepared for specific airports. These studies are focused specifically at the airports of interest and may be more detailed and take into consideration additional constraints not accounted for in the FACT3 methodologies. Furthermore, inclusion of capacity enhancement for which there is an ongoing National Environmental Policy Act evaluation should not be construed as predetermination of approval by FAA, but rather as a "what-if" assessment of potential benefit. Similarly, inclusion of an NAS modernization initiative that has not yet been

approved through the FAA's acquisition and safety processes should not be construed as an FAA commitment to implement a given ATC improvement at a specific airport. Noise abatement restrictions, where they presently exist, were assumed to continue unchanged.

When interpreting the results of FACT3 as compared to site-specific studies, it is important to keep in context the purpose of the FACT process and the changes made since FACT1 and FACT2. As a systemwide analysis, FACT is intended to provide FAA with macro-level insights about the timing, need, and magnitude for both infrastructure and NAS modernization improvements. This is meant to inform the FAA's strategic planning. While the FACT analysis is also meant to provide airport sponsors with insights about NAS modernization plans, it cannot replace site-specific studies that examine capacity issues in detail and are thus more accurate reflections of the situation at a particular airport.

The following sections identify airports that FACT considers to be capacity constrained or congested in the applicable scenario and timeframe. This designation is based on the airport meeting both the FACT3 delay and congestion criteria. Some airports are designated as having a caution status, which means they experience some level of delay but do not yet meet the FACT3 criteria to be considered congested. A few airports are considered to have severe congestion as they exceed the FACT3 criteria by a significant margin.

Congested Airports in 2011

The FACT3 analysis identified five airports that are currently congested and would benefit from additional capacity as shown in Figure 3.

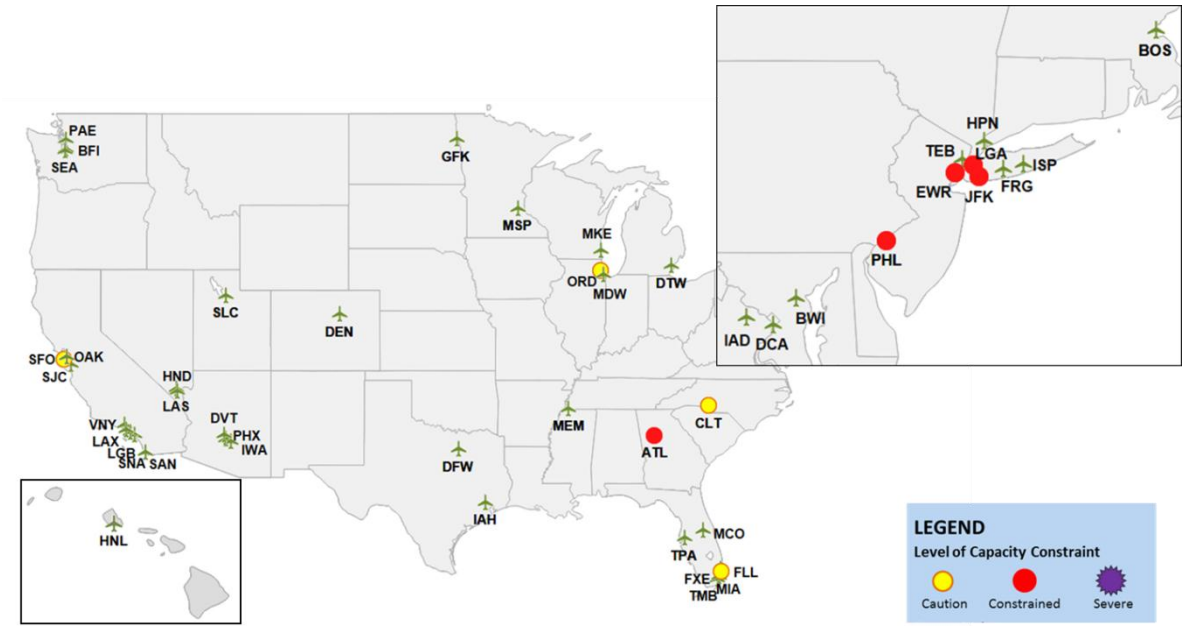
Not surprisingly, the three major NYC area airports, EWR, JFK, and LGA, are congested. All three airports regularly experience delays. As a result, all three airports are currently subject to FAA limits on operations. While the ongoing airspace redesign effort and NextGen enhancements will help to improve efficiency and flexibility, FAA sees strong evidence that additional runways may be the best long-term solution to meet future demand for intercity travel to and from the NYC area.

PHL continues to regularly experience significant delays. As a result, the airport is pursuing its CEP to mitigate delays and meet future growth. The CEP includes two runway extensions and a new parallel runway, as well as terminal area and other airport improvements.

ATL also meets the FACT3 criteria to be considered congested, although the airport has seen significant delay reduction with the opening of its fifth parallel runway in 2006. ATL can be congested during certain periods of the day because of the extensive connecting hub activity at the airport.

Figure 3. Airports Needing Capacity Today (2011)

Five airports today are considered congested by the FACT3 criteria (as shown in red), with four others having caution status (as shown in yellow). The airports shown in green were evaluated in FACT3 but generally are not congested.



Interim Capacity Needs in 2020

The capacity needs in the 2020 midterm planning period were evaluated with two scenarios:

1. **Reference Scenario**: this scenario includes the 2011 baseline conditions (runways and airspace), with the implementation of mature, high-confidence, near-term NextGen improvements.

2. **Improvements Scenario:** this scenario assumes completion by 2020 of all planned runway development projects at ORD and FLL; two runway extensions at PHL; enhanced ATC procedures and airspace redesign; and NAS modernization initiatives included in midterm NextGen. Both scenarios assume forecasted demand growth through 2020 at a rate of about 1.1 percent annually for Core airports consistent with the 2012 TAF.

Figure 4 shows both scenarios; results are also shown in Table 1. Comparison of the scenarios reveal where additional capacity will be needed in the future; what effect the improvements that are currently underway or in the planning process will have on future capacity needs; and where new initiatives will be needed to provide even greater capacity beyond what is currently in the construction or planning process.

Table 1. Airports Needing Additional Capacity in 2020

Airports Needing Additional Capacity	Reference: *No further improvements beyond near-term NextGen*	Improvements: *After planned improvements with midterm NextGen and runways*
ATL Hartsfield-Jackson Atlanta Int'l	♦	♦
EWR Newark Liberty Int'l	♦	♦
JFK John F. Kennedy Int'l	♦	♦
LGA New York LaGuardia	♦	♦
PHL Philadelphia Int'l	♦	♦
SFO San Francisco Int'l	♦	
Total	**6**	**5**

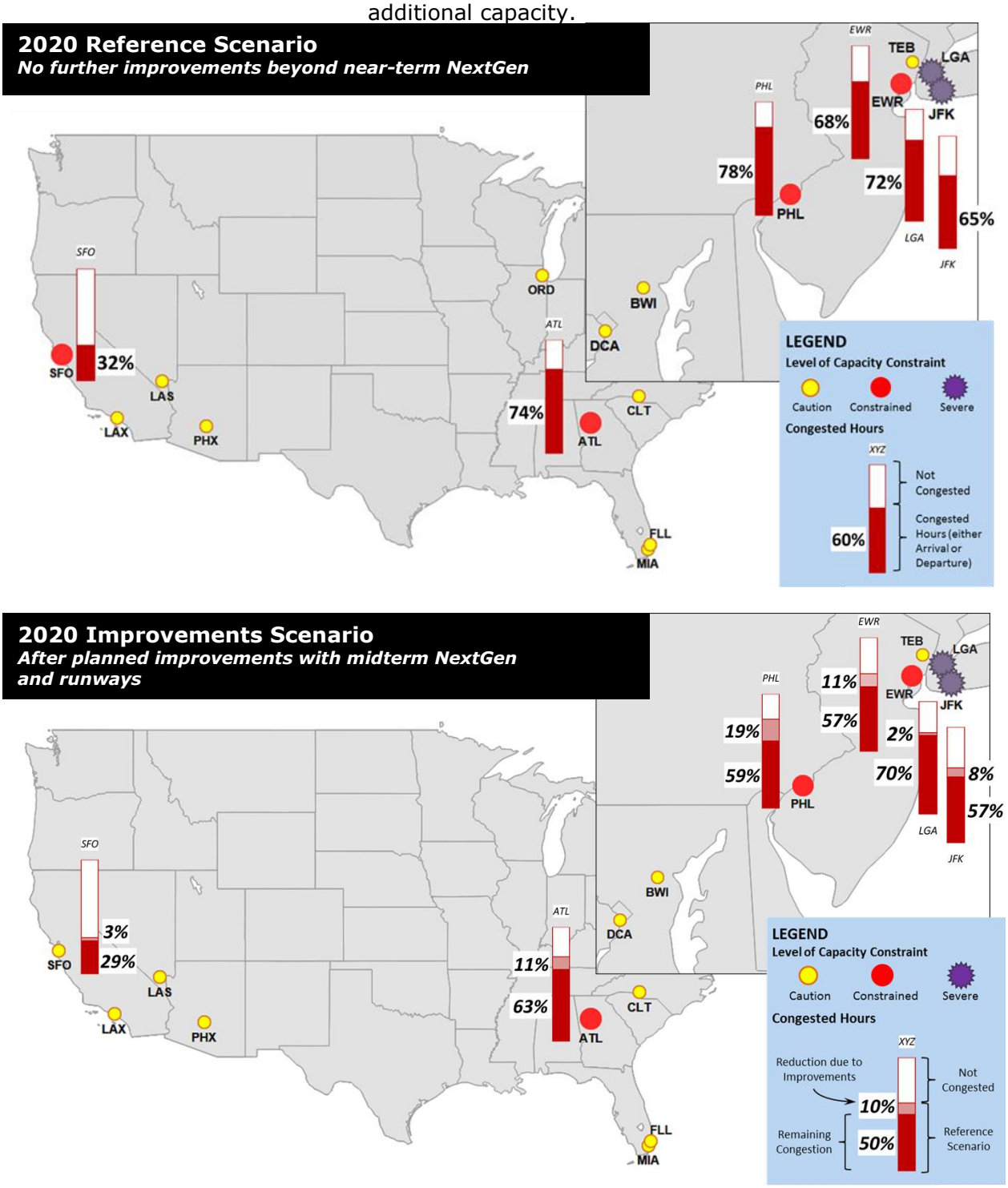
A comparison of the two scenarios allows for consideration of several possible outcomes affecting airport system performance. In both scenarios, ATL, EWR, JFK, LGA, and PHL will be capacity constrained. Delays at LGA and JFK are expected to increase to severe levels, exceeding the FACT3 criteria significantly.[15] While midterm NextGen improvements are not sufficient to bring these airports below FACT3 criteria, the airports will nonetheless experience significant reductions in delay and congested hours with NextGen. SFO will become capacity constrained if expected midterm NextGen improvements are not achieved.

If NextGen implementation is delayed due to budgetary constraints or technical readiness, then the reference scenario provides a conservative estimate of airport capacity and delay.

[15]The baseline modeling is representative of operational conditions as they occurred in 2011, which includes the existing schedule limits for the NYC area airports. For 2020 and 2030, the trimming algorithm is used by the NAS-wide model to constrain future demand at these airports. However, the trimming algorithm does allow moderate operations growth beyond the current schedule limits. As a result, the future congestion status of the NYC area airports is indicative of higher traffic levels than currently allowed by the FAA schedule limits.

Figure 4.
Airports Needing Additional Capacity in 2020

Midterm NextGen improvements reduce the percentage of congested hours at airports, as shown in the lower map. However, even with additional capacity gained from the planned improvements expected by 2020, the FACT3 analysis identifies five airports that will still need additional capacity.



Needed Capacity Beyond What is Currently Planned for 2020

By incorporating the additional capacity gained from the planned improvements expected by 2020 to the 2011 baseline capacities, and measuring this against the forecasted demand for 2020, the FACT3 analysis identified five airports that will need additional capacity beyond what is already planned (see Figure 4 and Table 1).[16]

- EWR, LGA, and JFK: The Port Authority of New York and New Jersey has embarked on a long-term planning study to assess the feasibility of adding new runways to these congested hub airports. While it is too early to determine the outcome of this initiative, the FACT3 findings make clear the need for additional capacity enhancements within the NYC area.

- ATL: The city of Atlanta is developing an update to its master plan to assess future facility requirements, including assessment of the need for further runway development. ATL's fifth runway opened in 2006 providing significant capacity benefit. If demand grows as expected, delays will also increase. With its master plan, ATL is expected to identify needed further capacity improvements and their timeframe for implementation.

- PHL: The Environmental Impact Statement (EIS) for the complete reconfiguration of its airfield was completed in 2010. In 2020, FACT3 included two runway extensions that are part of the CEP in the planned improvements scenario. While these extensions provide delay benefits, the long-term analysis also shows that the planned parallel river runway is needed to further enhance capacity.

Airport Capacity Improvements by 2020

A comparison of the airports needing additional capacity with and without planned improvements in 2020 reveals that a single airport, SFO, will come off the list of capacity constrained airports if the planned improvements are completed. This is due to improved metering of arrivals to the runways with midterm NextGen capabilities. These improvements will also benefit other airports. Table 2 shows the model-estimated hourly capacity improvement by airport. Of course, airfield capacity at ORD, PHL, and FLL also improves with new or extended runways.

[16]Capacity and delay estimates are specific to the planning years identified (i.e., 2011, 2020, and 2030). Intermediate years were not analyzed.

Table 2. Capacity Enhancement and Congestion Reduction in 2020

Airport	Reference Scenario *No further improvements beyond near-term NextGen*			Change with Improvements Scenario *After planned improvements with midterm NextGen and runways***		
	Weighted, Balanced Hourly Capacity	Arrival Congestion (% hours)	Departure Congestion (% hours)	Weighted, Balanced Hourly Capacity	Arrival Congestion (% hours)	Departure Congestion (% hours)
ATL	212	73%	48%	+6	-14%	-2%
CLT	166	65%	68%	+16	-25%	-3%
EWR	82	55%	60%	+3	-19%	-10%
FLL	79	20%	26%	+41	-18%	-2%
IAH	171	9%	5%	+16	-5%	0%
JFK	85	52%	63%	+5	-12%	-8%
LAS	106	9%	27%	+1	-5%	0%
LGA	81	67%	62%	+3	-13%	0%
ORD	231	28%	8%	+41	-18%	-7%
PHL	115	72%	47%	+13	-38%	+1%
PHX	142	10%	18%	+1	-3%	+4%
SFO	91	21%	30%	+2	-3%	-2%

**Change is arithmetic difference between two percentages, not the percent difference.

Long-Term Capacity Needs in 2030

The capacity needs in the 2030 long-term planning period were evaluated with the same two scenarios as evaluated in 2020, but with completion of the PHL CEP, including a new parallel runway in the improvements scenario. Both scenarios assume forecasted demand growth from 2020 to 2030 at a rate of about 1.6 percent annually for Core airports as projected in the 2012 TAF.

While there are additional NextGen capacity improvements in the FAA's Mid-Term Concept of Operations, these concepts are not yet sufficiently mature to include in the FACT3 modeling. This includes paired approaches to closely-spaced parallel runways in instrument meteorological conditions (IMC), and interval management with Automatic Dependent Surveillance-Broadcast (ADS-B) In for precise metering and spacing. Nonetheless, the capacity benefits of the ultimate NextGen capabilities are considered to be significant.

Figure 5 shows both long-term scenarios; results are also shown in Table 3. Comparison of the scenarios reveal where additional capacity will be needed in the future; the effect of improvements that are currently underway or in the planning process on future capacity needs; and where new planning efforts will be needed to provide even greater capacity beyond what is currently in the construction or planning process.

Table 3. Airports Needing Additional Capacity in 2030

Airports Needing Additional Capacity	Reference: No further improvements beyond near-term NextGen	Improvements: After planned improvements with midterm NextGen and runways
ATL Hartsfield-Jackson Atlanta Int'l	♦	♦
CLT Charlotte Douglas Int'l	♦	♦
EWR Newark Liberty Int'l	♦	♦
FLL Fort Lauderdale/Hollywood Int'l	♦	
IAH George Bush Intercontinental/Houston	♦	♦
JFK John F. Kennedy Int'l	♦	♦
LAS McCarran Int'l	♦	♦
LGA LaGuardia	♦	♦
ORD O'Hare Int'l	♦	
PHL Philadelphia Int'l	♦	
PHX Phoenix Sky Harbor Int'l	♦	♦
SFO San Francisco Int'l	♦	♦
Total	**12**	**9**

Needed Capacity Beyond What is Currently Planned for 2030

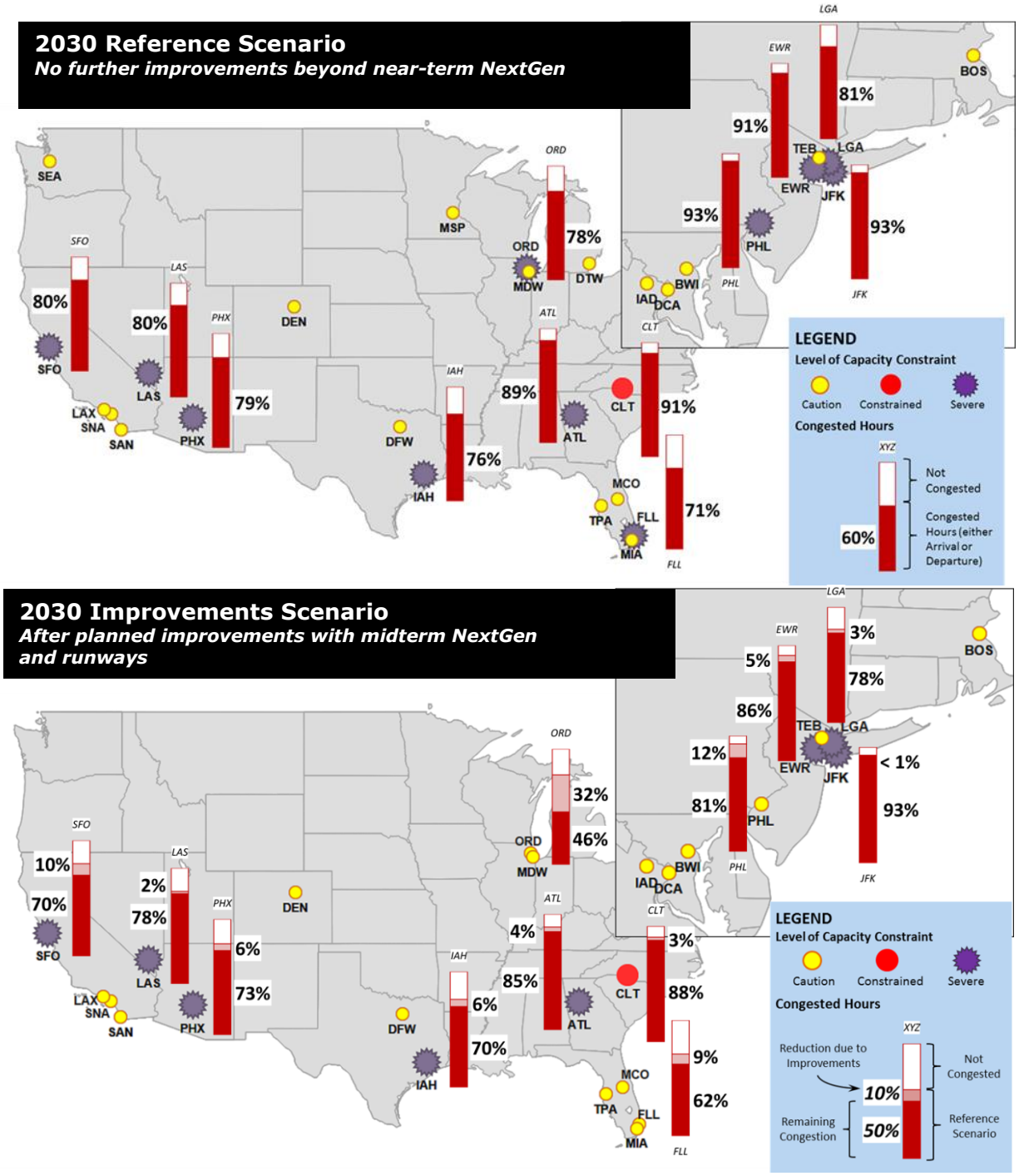
The FACT3 analysis identified nine airports that will need additional capacity beyond what is already planned (see Figure 6 and Table 4).[17] Four of these airports are a continuation of the additional capacity needs identified in the 2020 scenarios. The remaining five airports that will need additional capacity beyond what is currently planned for 2030 include:

- CLT: Planning is underway to evaluate the capacity benefits for a fourth parallel runway.
- IAH: The Houston Airport System had begun an EIS for two additional runways; however, this initiative was stopped due to reductions in traffic. With resumptions in traffic growth, IAH has options to develop additional runways.
- LAS: LAS has suspended the immediate efforts for a new secondary commercial airport for the Las Vegas region to supplement LAS. However, the option for a supplemental airport remains a future possibility if needed to meet long-term traffic growth.
- PHX: Additional runway capacity will be needed if demand continues to grow as forecasted. The city of Phoenix Aviation Department is working with Phoenix-Mesa Gateway Airport (IWA), in nearby Mesa to increase the use of this airport for scheduled commercial service.
- SFO: Given its physical constraints, SFO has been participating in a regional planning effort to address capacity needs within the San Francisco Bay area.

[17]Capacity and delay estimates are specific to the planning years identified (i.e., 2011, 2020, and 2030). Intermediate years were not analyzed.

Figure 5. Airports Needing Additional Capacity in 2030

With forecasted growth in demand, the FACT3 analysis identifies nine airports that will need additional capacity beyond what is currently planned in 2030 as shown on the lower map. *This analysis shows why additional solutions such as new runways, regional emphasis, congestion management, multimodal transportation, and NextGen are so important.*



Airports Capacity Improvements by 2030

A key finding of FACT3 is that runway development continues to be critical to meet future growth in demand. Three airports, ORD, FLL, and PHL, come off the list of capacity-constrained airports due to planned runway development. This demonstrates the effectiveness of adding new runway capacity, where needed, to meet long-term aviation growth. Table 4 shows the capacity and congestion reduction benefits of these runway development projects.

Table 4. Capacity Enhancement and Congestion Reduction in 2030

Airport	**Reference** *No further improvements beyond near-term NextGen*			**Improvements** Change after planned improvements with midterm NextGen and runways		
	Weighted, Balanced Hourly Capacity	Arrival Congestion (% hours)	Departure Congestion (% hours)	Weighted, Balanced Hourly Capacity	Arrival Congestion (% hours)	Departure Congestion (% hours)
ATL	212	89%	70%	+5	-7%	+2%
CLT	164	88%	86%	+16	-6%	-2%
EWR	82	76%	84%	+8	-13%	-3%
FLL	79	62%	62%	+42	-30%	-3%
IAH	169	65%	58%	+16	-20%	+1%
JFK	84	80%	92%	+5	-11%	-2%
LAS	107	70%	79%	+1	-6%	-3%
LGA	81	71%	70%	+3	-10%	+3%
ORD	235	73%	39%	+41	-29%	-18%
PHL	113	92%	80%	+50	-32%	-8%
PHX	148	66%	63%	+7	-13%	+2%
SFO	91	72%	62%	+3	-12%	-6%

**Change is arithmetic difference between two percentages, not the percent difference.

Airports With Some Congestion to be Monitored

The FAA believes the criteria used in this report have appropriately identified locations where additional capacity enhancements will be required. However, any report that attempts to identify future capacity constraints may not capture all the dynamics associated with the aviation industry and growth in demand. While the criteria provide a useful filter for determining the most significant capacity needs, the FACT methodology is not intended to identify and assess *all* airport capacity needs.

Therefore, the findings in this report should not be considered a substitute for more detailed regional and airport-specific capacity studies. The FAA strongly encourages individual airport sponsors and regional planning organizations to undertake detailed studies to refine and build on the FACT3 findings and to provide a more thorough understanding of issues existing at particular airports. The FAA acknowledges that airports not identified in this report may still face capacity or other operational issues that will require future airport enhancements or that listed airports may become capacity constrained earlier or later than this analysis indicates.

Because the aviation industry is constantly changing and some changes can be significant and swift, those airports that met the caution criteria used in this analysis (but not both criteria needed to be identified as capacity constrained) should be monitored to gauge the effects of potential changes on future delay. Considering the long lead time required for implementing capacity enhancements, it is important to monitor delays at airports within the interim period (through 2020) as changes could expedite the need for additional capacity. Table 5 shows airports that meet the FACT3 criteria for caution status (i.e., ASV delay was 5 minutes or greater or the percentage of congested hours was 20 percent or greater for either arrivals or departures) in either 2020 or 2030 and thus should be monitored for increasing congestion.

Table 5. Airports With Some Congestion to be Monitored

Airports Meeting Caution Criteria	2020	2030
BOS Boston Logan Int'l		♦
BWI Baltimore/Washington Thurgood	♦	♦
DCA Washington Reagan National	♦	♦
DEN Denver Int'l		♦
DFW Dallas Fort Worth Int'l		♦
DTW Detroit Int'l		♦
IAD Washington Dulles Int'l		♦
LAX Los Angeles Int'l	♦	♦
MCO Orlando Int'l		♦
MDW Chicago Midway International		♦
MIA Miami Int'l	♦	♦
MSP Minneapolis-St. Paul Int'l		♦
SAN San Diego Int'l		♦
SEA Seattle-Tacoma Int'l		♦
SNA John Wayne Orange County		♦
TEB Teterboro	♦	♦
TPA Tampa Int'l		♦
Total	**6**	**17**

*This table does not include airports identified as capacity-constrained in Tables 1 and 3.

As part of its responsibilities to maintain the safety and efficiency of the NAS, FAA continuously tracks the performance of the NAS. The FAA monitors planned airline schedules in consideration of airport capacity and delay. The FAA analyzes current trends and their potential effects on future performance. If demand or delays grow more quickly than anticipated at an airport, FAA can then work with airport operators, their users and airlines, and their local communities to address their capacity enhancement needs.

CONCLUSIONS AND RECOMMENDATIONS

The FACT3 analysis identified airports that are expected to need additional capacity in two future time periods, 2020 and 2030. This assessment is based on current demand forecasts, plans for new or extended runways, and plans for ATC system improvements, including NextGen.

Based on these assumptions, five airports will be significantly capacity constrained by 2020 and nine by 2030, even after all currently planned improvements are implemented. The improvements that are already planned or underway are crucial to complete, but even so they will not be sufficient to address all of the shortfalls by 2020, let alone 2030. If

planned improvements are not implemented as scheduled, one additional airport in 2020 and three additional airports in 2030 are expected to be capacity constrained. *This analysis shows why continued efforts to identify solutions, such as new runways, regional emphasis, congestion management, multimodal transportation, and NextGen are essential.*

Notably, all of the airports identified in FACT3 as capacity constrained are large hub, Core airports. No smaller commercial service or general aviation airports that were evaluated in the report were identified as capacity constrained, although a few are in the caution category. This reflects the continued concentration of air traffic growth at major hubs. While NextGen will reduce growth in average delays by about 26 percent,[18] steady traffic growth as forecasted will nonetheless result in eight of the nine capacity-constrained airports in 2030 having severe congestion levels, affecting air travel nationwide.

Recognizing the evolving trends and shifts in the aviation industry, there is considerable uncertainty about any projection that is nearly two decades into the future (i.e., the long-term forecasts used in the 2030 scenarios from a 2011 projection). Sources of uncertainty include:

- traffic growth;
- how quickly the airlines add larger aircraft to their fleet to replace smaller aircraft;
- demographic and socioeconomic shifts; and
- the realization of capacity improvements from NAS modernization initiatives.

However, with several consecutive years of sustained traffic growth at any of the Core airports, the long-term delay concerns will become much more tangible. As a result, it remains crucial for these airports to continue their efforts to devise long-term planning solutions to address capacity constraints.

Given future uncertainties, the focus for the remainder of this decade should be on identifying solutions for airports identified as capacity constrained in the 2020 scenarios. These airports are likely to be capacity constrained under a variety of scenarios.[19] Airports such as SFO and the NYC area airports cannot be easily expanded to meet unconstrained demand. At the NYC area airports, the FAA limits on operations are expected to continue. A focused effort will be needed to identify viable solutions that can begin implementation.

Meeting the future capacity needs of the Nation's airports will require innovative approaches, as well as continued emphasis on airport expansion and technological improvements. The following are some of the approaches that warrant further investigation:

- **New Runways and New Airports.** The most direct response to an expected capacity limitation is the expansion of existing airports to meet forecasted demand. New

[18] Reduced growth in delay is by comparison to the 2030 Reference Scenario.

[19] Appendix D provides a sensitivity analysis of the FACT3 findings, given the changes in forecasted demand with the FAA's annual forecast update. Even with changes in demand in the 2013 TAF, as compared to the 2012 TAF used in FACT3, the identification of constrained airports in 2020 remains substantively unchanged.

runways almost always provide the most significant capacity improvements. New runways can also be part of a new airport, as has been considered in Las Vegas. Large-scale airport development is rarely a straightforward process, especially near major population centers. Considerable lead time is necessary to implement planned airport capacity improvements. Master planning, site selection, financial planning, airspace, environmental studies, and land acquisition need to be conducted in a steadfast, collaborative manner to move a project through the development process.

- **Gates and Taxiways.** Gate and taxiway infrastructure are not the primary constraints to capacity at most airports, now or in the future. Gates and taxiways can usually be built where and when needed.

- **Regional Solutions.** Studies of regional traffic and development alternatives have been used to analyze specific air travel behavior within defined regions that experience significant congestion, such as the San Francisco Bay area, NYC, and the Boston/New England region. Several of these regions have ongoing study efforts and intergovernmental collaboration in place. These initiatives should continue.

- **Congestion Management.** Fortunately, we can add capacity to solve most of our problems. However, in some cases runway construction may not be a viable alternative. Today, LGA is a good example. In the next 10 years, the San Francisco Bay area may serve as an additional example of a capacity-constrained airport where runway construction may not be a feasible option. In these cases, demand management, regulatory or economic solutions, and other market mechanisms may need to be investigated.

- **High-Density Multimodal Transportation Modes.** The majority of the U.S. population is located along the coastlines in densely populated mega regions. Not surprisingly, the FACT3 analysis has identified significant and consistent capacity problems at airports in some of these areas. The demand for travel in these high-density intercity corridors requires the continued development of high-speed rail and bus modes to provide additional options along with short-haul air travel. In these dense mega regions, an "all of the above" approach is needed to advance the development of multiple transportation options. Often, the high-speed surface modes will complement air service and, where appropriate, can provide convenient and reliable access to airports for connections to long-haul markets.

- **NextGen.** These findings indicate that FAA and its industry partners, including airports, should continue to advance the development and deployment of NextGen. NextGen concepts produced quantifiable delay reductions at nearly all airports included in this report, either directly or by reducing delays at the airport that flights are going to or coming from. The improvements may often be incremental, such as a moderate throughput increase that may be the best option at airports that cannot easily add new runways. Overall, NextGen capabilities are relevant to airports with planned runway improvements, as well as for airports where geographic and other constraints prevent easy physical expansion of the airfield.

  NextGen has benefits that may prove to be more important than outright capacity growth. Significant improvements in the reliability and predictability of operations across the NAS will help airlines better maintain and recover flight schedules during inclement weather. These predictability and reliability benefits are not captured in the

high-level systemwide capacity benefits estimated with FACT3, but they are nonetheless vital to NAS modernization.

- **Runways and NextGen are Complementary**. Capacity improvements from NextGen are not as significant as those from new runways, but are applicable to many airports across the NAS. Still, if an airport is facing a substantial shortfall in capacity, the best answer is often new pavement. The optimal combination of solutions in each particular location depends on the scale of the capacity/demand imbalance and the specific operational issues that need to be addressed. Often, at congested airports, both are necessary to foster improved airport performance; e.g., NextGen improvements such as PBN may be needed to maximize the capacity benefits of a new runway.

This report has identified a number of airports where additional capacity is expected to be needed to handle expected future demand. By updating the FACT analysis, FAA has a strategic understanding of future airport capacity needs in the coming years. We can then work with airports, their users, and their local communities to address capacity enhancement needs. The solution at each airport will be different and can only be identified through consideration of local factors and concerns. The FAA is prepared to work with airports to address their capacity and demand challenges and to seek innovative approaches to their needs.

APPENDIX A: STUDY AIRPORTS

The following 48 airports are included in this FACT3 analysis:

ID	Airport Name	Core
ATL	Hartsfield-Jackson Atlanta International	☐
BFI	Boeing Field/King County International	
BOS	General Edward Lawrence Logan International	☐
BWI	Baltimore/Washington International Thurgood Marshall	☐
CLT	Charlotte/Douglas International	☐
DCA	Ronald Reagan Washington National	☐
DEN	Denver International	☐
DFW	Dallas/Fort Worth International	☐
DTW	Detroit Metropolitan Wayne County	☐
DVT	Phoenix Deer Valley	
EWR	Newark Liberty International	☐
FLL	Fort Lauderdale/Hollywood International	☐
FRG	Republic	
FXE	Fort Lauderdale Executive	
GFK	Grand Forks International	
HND	Henderson Executive	
HNL	Honolulu International	☐
HPN	Westchester County	
IAD	Washington Dulles International	☐
IAH	George Bush Intercontinental/Houston	☐
ISP	Long Island MacArthur	
IWA	Phoenix-Mesa Gateway	
JFK	John F. Kennedy International	☐
LAS	McCarran International	☐
LAX	Los Angeles International	☐
LGA	LaGuardia	☐
LGB	Long Beach/Daugherty Field	
MCO	Orlando International	☐
MDW	Chicago Midway International	☐
MEM	Memphis International	☐
MIA	Miami International	☐
MKE	General Mitchell International	
MSP	Minneapolis-St. Paul International/Wold-Chamberlain	☐
OAK	Metropolitan Oakland International	
ORD	Chicago O'Hare International	☐
PAE	Shonomish County (Paine Field)	
PHL	Philadelphia International	☐
PHX	Phoenix Sky Harbor International	☐
SAN	San Diego International	☐
SEA	Seattle-Tacoma International	☐
SFO	San Francisco International	☐
SJC	Norman Y. Mineta San José International	
SLC	Salt Lake City International	☐
SNA	John Wayne Airport-Orange County	
TEB	Teterboro	
TMB	Kendall-Tamiami Executive	
TPA	Tampa International	
VNY	Van Nuys	

APPENDIX B: METHODOLOGY

Introduction

The objective of the FACT analyses is not to predict future ATC scenarios, nor to perform a benefits analysis of any improvements to the ATC system or to airports. Instead, FACT is intended to provide information about which airports are expected to be capacity constrained in the future even with reasonably optimistic assumptions about future system performance. This information can then be used to scope additional efforts for systemwide analysis or airport-specific improvements.

Study Scope and Scenarios

The baseline for the FACT3 analysis is the year 2011. Two future periods were also studied: 2020 and 2030. Multiple scenarios were analyzed for FACT3, representing alternative combinations of time period, ATC improvements, and infrastructure improvements.

Current FAA plans for NextGen (such as the NextGen Implementation Plan) show many NextGen operational improvements implemented through the end of the decade. For FACT3, the 2020 scenarios in the analysis reflect different levels of NextGen implementation:

- "Near-term" NextGen, which includes those operational improvements which have been implemented or are expected to be implemented in the next 2 or 3 years; and
- **"**Midterm" NextGen, which includes all other operational improvements expected to be implemented before 2020.

The 2030 time period represents the "far term" in the analysis, allowing more time for demand to increase and stress planned airport capacity. Such a long look ahead is helpful, given the time required to plan, study, approve, and build new runways and implement large-scale NAS modernization efforts.

The effect of these ATC improvements was evaluated with and without separate runway and gate improvements. For 2020, these runway improvements consisted of new and extended runways at FLL, ORD, and PHL that have been approved by FAA. The 2030 scenarios with runway improvements included a new runway at PHL consistent with the approved EIS. New runways would have been considered at other airports in 2030 if planning was sufficiently advanced and the need existed, but no other runway projects were identified.

Airport Selection

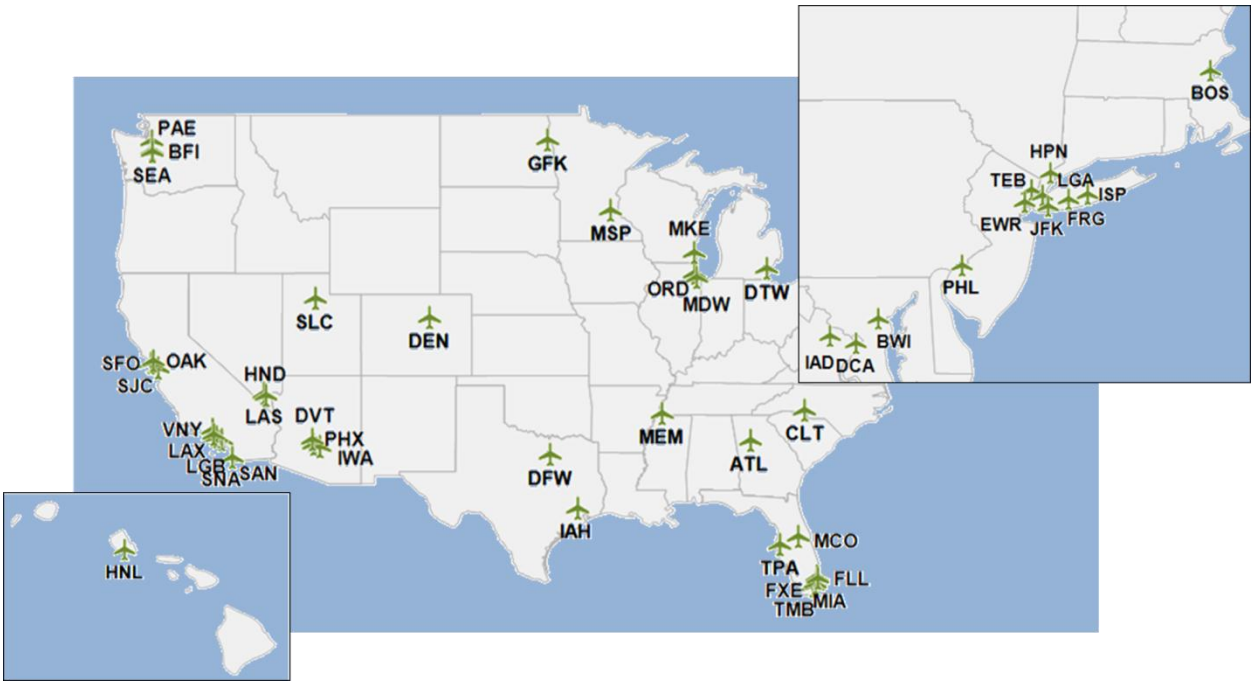
There are 3,330 existing airports in the United States that are open to public use according to the FAA's NPIAS report for 2011-2015. The goal of FACT is to identify those airports that are expected to be capacity constrained in the future; however, it is impractical to analyze all these airports to the required level of detail. Therefore, a screening method was used to select candidate airports prior to performing the detailed analysis.

Candidates for detailed analysis were those public-access airports where excessive delays could potentially have a significant impact on the NAS. The following major categories of airports were considered:

- **Core Airports**: 30 commercial service airports that have been identified by FAA as having a significant role in the NAS due to their level of operations or passengers.
- **Potentially Constrained Commercial Airports**: commercial service airports with projected traffic growth that may stress their current capacity.
- **General Aviation Airports**: other airports with a substantial level of traffic, even if primarily general aviation, that affect airspace and air traffic in multi airport areas like the NYC area and southern California.

In all, 48 airports were included in the FACT3 analysis as shown in Figure B-1.

Figure B-1. Airports Included in the FACT3 Analysis



The list of potentially constrained commercial service airports was determined using a multistep process. If the annualized capacity at an airport was more than 125 percent of the forecasted demand (in other words, the demand/capacity ratio was 0.8 or below), then delays were not expected to be significant and the airport was eliminated from consideration. The initial filter used the most conservative assumptions for fleet mix and operating procedures to underestimate capacity. Successive filters used more accurate capacity estimates, reducing the initial list of 301 airports to 7 candidates for analysis.

A separate analysis focused on general aviation airports and emerging commercial service airports in major metropolitan airports to identify additional airports for analysis. Airports

with a substantial level of traffic, even if primarily general aviation, can affect airspace and air traffic in multi airport areas like NYC and southern California.

Demand

The forecast of aviation demand in 2020 and 2030 came from the FAA's TAF that was published in February 2013, which included annual traffic counts by airport for Fiscal Years (FY) 2012-2040.

The ASV analysis was based on annual demand, while the NAS-wide analysis required daily traffic schedules. For the daily analysis, 16 days in FY 2011 were selected to represent the entire year. The daily schedules on these days were obtained from Traffic Flow Management System data. These schedules were then increased to reflect future traffic levels while attempting to preserve airline scheduling patterns. General aviation flights were also included. The resulting schedules were "trimmed and smoothed"[20] as necessary when airport capacity limits restricted hourly demand.

Refined and Expanded Methodology

The FACT2 analysis was based on both ASV and NAS-wide modeling. These remain the principal tools used in FACT3, although the methodology has been revised and refined.

The NAS-wide simulations now run much more quickly. This made it possible to simulate 16 demand days for each alternative scenario versus only two traffic scenarios ("good weather" and "bad weather") for FACT2. This also led to a need for new metrics for determining which airports are "capacity constrained." The FACT2 metrics were based on good weather and bad weather delay measures, but the 16 days in FACT3 represented real-world mixtures of good weather and bad weather across the airports being modeled.

NAS-wide modeling was also expanded from runways and airspace to include taxiways and gates as well. Discussions with airport operators after the publication of FACT2 often addressed factors other than runways and ATC that affected airport delays. The operators also mentioned taxiway restrictions and limited numbers of terminal gates as common causes of delays and inefficiencies. These factors have been added to the NAS-wide model, although in a simplified form.

The NAS-wide modeling relies on calculated capacity curves for each airport. In the past, these capacity curves have assumed the same mix of aircraft types (with associated performance and wake vortex characteristics) or fleet mix across all time periods. FACT3 includes forecasts of future fleet mixes for the first time based on TAF data and projections of airline fleets.

[20] "Trimming" refers to the practice of reducing demand when capacity is significantly exceeded over one or more hours.

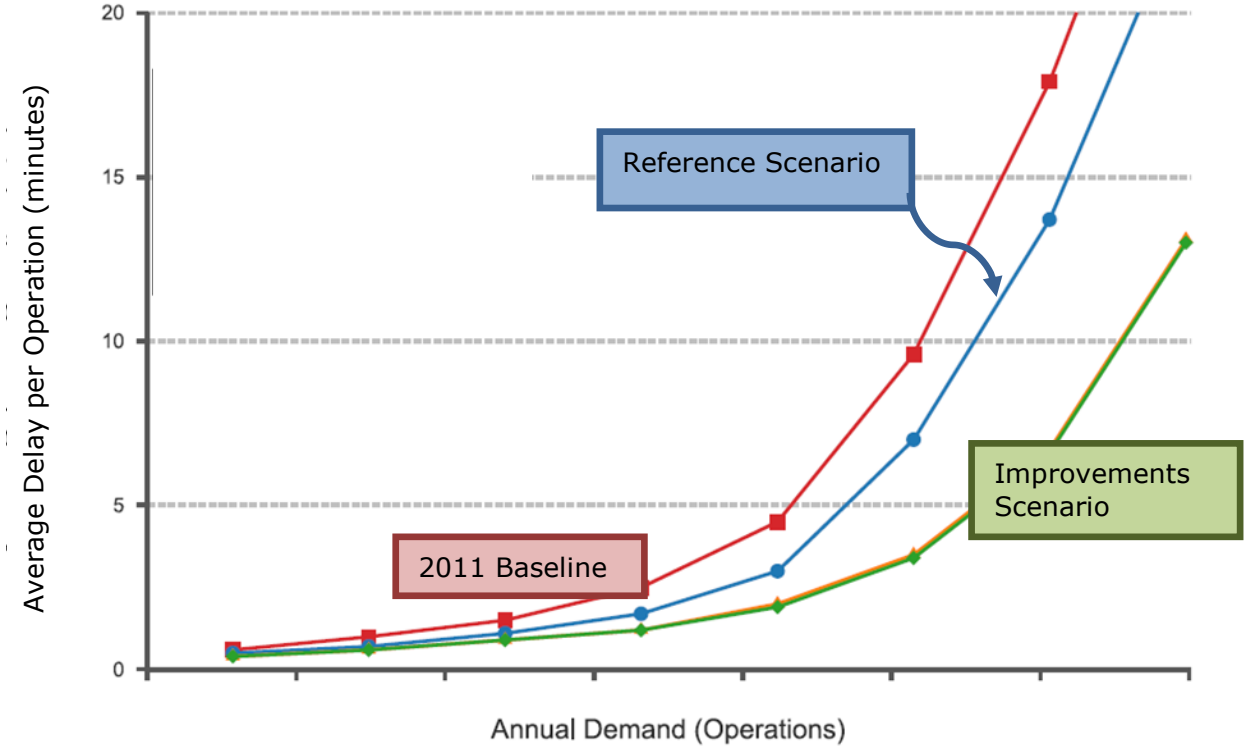
Modeling

Annual Service Volume

The ASV is the yearly demand that results in a given level of average delay in simulated operations. The ASV studies are conducted by the Capacity Analysis Group (AJR-G5) at the FAA's William J. Hughes Technical Center using the Runway Delay Simulation Model (RDSIM). The ASV analysis considers multiple runway configurations, weighted by the annual frequency of occurrence, and utilizes an annual estimation of weather conditions for each configuration in its calculation.

The RDSIM simulations calculate the amount of delay at different levels of traffic. The analyst can then determine which traffic level would produce the target level of delay (usually by interpolating between the calculated results). Alternatively, the same demand-delay curve can be used to estimate the average annual delay that results for a given annual demand. Example ASV curves are shown in Figure B-2.

Figure B-2. Example ASV Curves



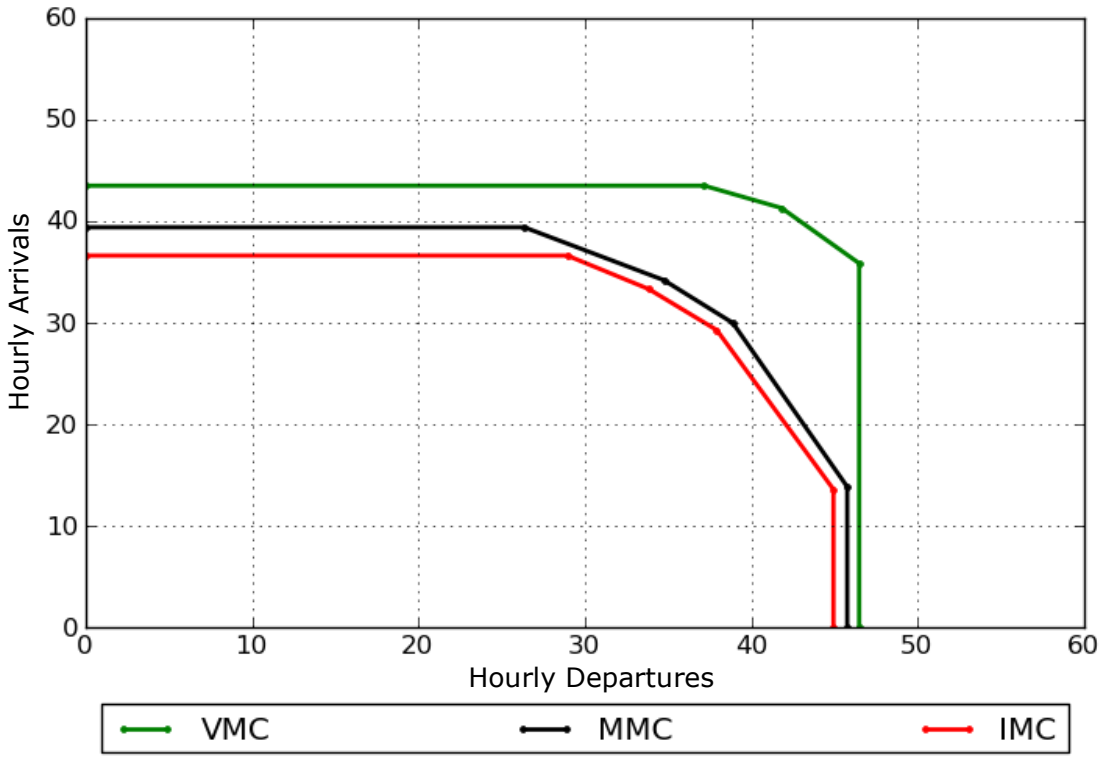
The process for FLL, ORD, and PHL was slightly different. Rather than conducting a new analysis, average annual delays for these airports relied on previously published studies conducted as part of the airport Master Plan or EIS.

NAS-Wide Modeling

The other technique used to estimate delays was NAS-wide modeling. Projected traffic demand schedules and airport capacity information are used as inputs in a simulation of the NAS as a whole, thus capturing the interactive effects of delays on flights throughout the system.

Airport capacity curves were prepared for each airport for all alternative scenarios using MITRE's *runway*Simulator model. Some example curves for different weather conditions are shown in Figure B-3. "Airport capacity" as used in this analysis is defined as the average number of operations that can be handled in an hour, under conditions of continuous demand, while adhering to all relevant ATC rules and procedures. Each capacity curve shows the tradeoff between arrivals and departures as the operational mix ranges from arrivals only to a balanced mix of arrivals and departures to departures only. Separate curves were generated for: visual meteorological conditions (VMC), marginal visual meteorological conditions (MMC), and IMC.

Figure B-3. Example Capacity Curves



For certain NextGen operational improvements that allow changes to separations when crosswinds are favorable for displacing wake vortices, separate curves were generated for favorable and unfavorable wind conditions.

The capacity curves and daily demand schedules, together with data about the airspace, taxiway performance, and airport gate usage, were provided to the NAS-wide model, MITRE's *systemwide*Modeler. This model simulates the progress of individual flights through airports, terminal areas, and en route sectors while tracking delays caused by system resources that reflect limited airport capacity, congestion, and the impacts of weather.

Taxiway congestion was estimated through airport-specific formulas that relate total taxi-in and taxi-out time to the number of arrivals and departures while taxiing based on historical data.

The gate resource in *systemwide*Modeler tracks gate occupancy as flights arrive and depart at each airport. Because accurate gate assignments are not available for 2020, "clusters" of perhaps 5 to 10 gates were defined at each airport based on the airline and sometimes on the market segment (regional shuttle, domestic, or international). A flight would be assigned to a cluster rather than to an individual gate; only when all gates in the cluster were occupied would the arrival have to wait.

For the 2030 scenarios, uncertainties about the numbers of gates at each airport, airline location within the terminal, and flight assignment to specific airlines, made it impractical to define reasonable gate clusters. Instead, the gate resource simply tracked the number of flights at the gates (and thus the minimum required number of gates) over the day.

Identification Criteria

Both the ASV and the NAS-wide models were used to define whether an airport would be considered "capacity constrained" in any scenario. At the forecasted level of traffic, an ASV delay of 7 minutes per flight or greater identified a potential capacity constraint. In addition, the NAS-wide model needed to show a high percentage of hours with high levels of delay for either arrivals or departures. A "high level of delay" was defined as the 90^{th} percentile value seen at the 30 Core airports in the 2011 baseline simulation of 16 representative days. Only the hours between 0700 and 2259 local time were considered. A congested hour at the airport was thus defined as an average arrival delay of 6.22 minutes per flight or an average departure delay of 6.65 minutes per flight. In order to be considered "capacity constrained," over 30 percent of the hours at the airport between 0700 and 2259 needed to meet the criteria for either arrival or departure congestion.

Higher values for these criteria were used to identify airports with severe levels of capacity concerns. Specifically, the ASV delay criterion was increased to 15 minutes, and the percentage of congested hours was increased from 30 percent to 50 percent.

Similarly, lower values for these criteria served to identify airports that were not capacity constrained but were approaching that condition. An airport fell into this category if the ASV delay was 5 minutes or greater or the percentage of congested hours was 20 percent or greater for either arrivals or departures.

Note that these criteria, as used in FACT3, must not be considered as an FAA definition of acceptable delay for the purpose of justifying proposed airport development without prior consultation with the FAA's Office of Airport Planning and Programming, Airport Planning and Environmental Division (APP-400).

APPENDIX C: COMPARISON OF FACT1/2/3 METHODOLOGIES

Table C-1: Data and Methodology Comparison

	FACT1	FACT2	FACT3
Timeframe			
Base Year	2002	2005	2011
Middle-Term	2013	2015	2020
Far-Term	2020	2025	2030
Demand Forecast			
TAF version	March 2003	March 2006	January 2013 (32% fewer operations at Core airports in 2025 than FACT2)
FATE Forecast	2003	2005	TAF-M with FATE methodology planned for use in sensitivity analyses when available
Scenario Days	1	2 (good and bad weather)	16 with mixed weather; aligned to ATO demand days with trimming
Fleet Mix	Current/Constant	Current/Constant	Evolves in future years; aligned to FAA APO Fleet Forecast
Future NAS Technology			
Interim	OEP v.5.0	OEP v.8.0	NSIP Segment A with adjustments
Long Term	Aggressive assumptions	NextGen (early) assumptions	NSIP Segment B with adjustments
Airports			
Primary Airports	OEP 35	OEP 35	30 Core
Additional Airports	21	21	18 (including general aviation)
Models and Metrics			
NAS Components	Runways	Runways	Runways, plus gate-to-gate with general constraints of airspace, taxiways, and gates
ASV	ASV average delay	ASV average delay	ASV average delay
NAS-Wide Simulation:	Arrival Delay	Expanded Delay Metrics	NAS arrival/departure delay, congested hours, throughput

APPENDIX D: SENSITIVITY ANALYSIS OF THE 2013 TAF ON FACT3 RESULTS

The FACT3 analysis of expected airport constraints in 2020 and 2030 was based on the demand forecasts contained in the 2012 TAF, released in March 2013. Since the analysis was completed, FAA published a new version of the TAF in January 2014 (known as the 2013 TAF). Although most airports had only minor changes in forecasted 2020 and 2030 demand, the updated forecast did contain substantial demand changes at a few airports.

This appendix presents an estimate of the potential changes to the FACT3 results if the forecasts in the 2013 TAF had been used. The results described below were estimated based on previous simulations without rerunning the NAS-wide model.

Overview of the 2013 TAF

The FAA releases a new TAF annually. The initial phase in developing a TAF is to update the forecast of passenger demand at each airport based on the latest data. Next, a forecast of aircraft operations is generated using the passenger forecast and current operational trends. Thus, a particular airport's operational forecast may change from a single year to the next if the:

- passenger forecast at the airport has changed;
- market served by individual airlines changes; or
- expected operational outlook (such as fleet mix and load factors) at the airport has changed.

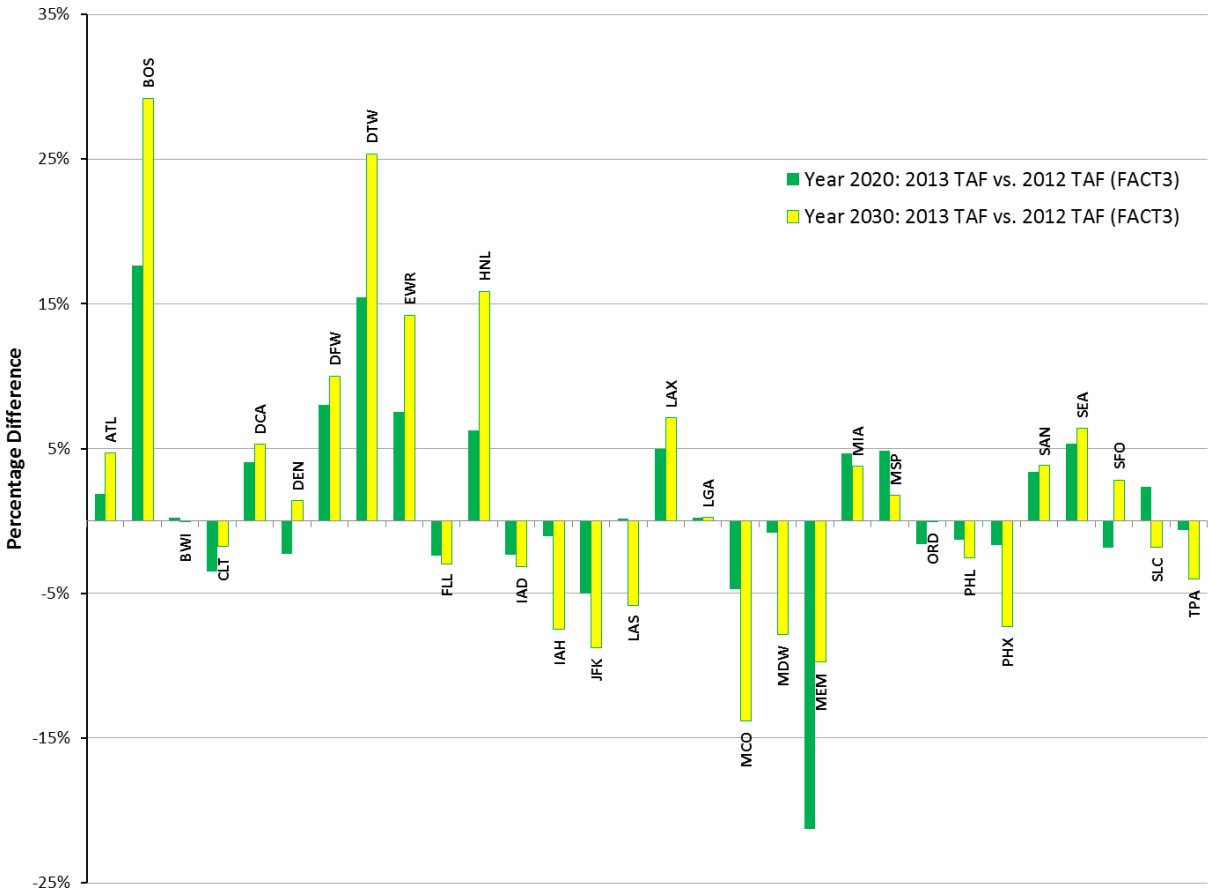
Figure D-1 shows the difference between the 2013 TAF and 2012 TAF forecasts for 2020 and 2030 at the 30 Core airports.

Comparing the 2013 TAF to the 2012 TAF, BOS showed the largest increase in expected operations with a 17.7 percent increase over the previous 2020 forecast and a 29.2 percent increase over the previous 2030 forecast. On the other hand, MEM had the largest decrease compared to the previous 2020 forecast at -21.2 percent, and MCO had the largest decrease for 2030 at -13.8 percent. However, some Core airports had very little change between the 2012 TAF and 2013 TAF: For example, BWI and LGA had less than 0.2 percent change in their 2020 and 2030 operational forecasts.

Considering only the constrained airports from the FACT3 analysis, the following substantial changes were seen in the 2013 TAF:

- EWR increased 7.5 percent in 2020 and 14.2 percent in 2030
- JFK decreased 5.0 percent in 2020 and 8.7 percent in 2030
- LAS decreased 5.8 percent in 2030
- IAH decreased 7.5 percent in 2030
- PHX decreased 7.3 percent in 2030

Figure D-1. Change in Forecasted Demand (2013 TAF vs. 2012 TAF)



Methodology for Estimating Effect of Demand Changes on FACT3 Results

Does the new forecast in the 2013 TAF change the results of the FACT3 analysis for an airport?

In some cases, the answer is straightforward. If an airport had been identified as needing additional capacity and the forecasted traffic level increased in the 2013 TAF, then the airport will still need more capacity. The converse is also true.

At most airports, it was necessary to estimate the effect of the new TAF on the original analysis. Two different methodologies, the ASV and the NAS-wide simulation, were used in FACT3 to estimate future delays. Both analyses were reviewed for this sensitivity analysis.

The ASV analysis produces a curve of average annual delay versus annual traffic (see the example in Figure B-2). Changing the forecast simply requires moving to a different part of the curve to obtain the new value for average delay.

Rerunning the NAS-wide analysis with the new forecast would be considerably more difficult, since this analysis would require new daily traffic schedules for 2020 and 2030 at each airport. Rather than rerun the NAS-wide simulations, an alternative approach was used to estimate the effect of the new forecasts. While the FACT3 results in this report had been produced using the NAS-wide model and the 2012 TAF demand; the model had also been run earlier using 2011 TAF demand forecasts. The interpolation between these two demand levels is used to estimate the potential effect of the 2013 TAF on future airport congestion.

This interpolation does not provide exact results, but it can provide a reasonable estimate of the number of congested hours if the 2013 TAF demand is between or close to either the 2011 TAF or 2012 TAF demand projections. Together with the new average annual delay from the ASV analysis, this NAS-wide interpolation greatly reduced the uncertainty around the potential effects of the 2013 TAF on the FACT results.

Potential Effect of the 2013 TAF

For each airport and future scenario, the potential status was determined using the updated ASV delay values and an estimate of the NAS-wide congested hours. The results of this reassessment are summarized in Tables D-1 and D-2 for 2020 and 2030, respectively. Substantial uncertainty about the potential status is indicated in the chart by a question mark ("?").

Table D-1. Sensitivity Analysis Results for 2020 Scenarios

Airports Needing Additional Capacity	Reference		Improvements	
	2012 TAF	2013 TAF	2012 TAF	2013 TAF
ATL Hartsfield-Jackson Atlanta Int'l	♦	n/c	♦	n/c
EWR Newark Liberty Int'l	♦	n/c	♦	n/c
JFK John F. Kennedy Int'l	♦	n/c	♦	n/c
LGA LaGuardia	♦	n/c	♦	n/c
PHL Philadelphia Int'l	♦	n/c	♦	n/c
SFO San Francisco Int'l	♦	-	-	n/c

♦ = Capacity constrained or severe status
n/c = No change to designation
? = Uncertain
- = Not capacity constrained

Table D-2. Sensitivity Analysis Results for 2030 Scenarios

Airports Needing Additional Capacity	Reference		Improvements	
	2012 TAF	2013 TAF	2012 TAF	2013 TAF
ATL Hartsfield-Jackson Atlanta Int'l	♦	n/c	♦	n/c
BOS Boston Logan Int'l	-	♦	-	♦
CLT Charlotte Douglas Int'l	♦	n/c	♦	-
DFW Dallas-Ft. Worth Int'l	-	♦	-	♦
EWR Newark Liberty Int'l	♦	n/c	♦	n/c
FLL Fort Lauderdale/Hollywood Int'l	♦	n/c		n/c
IAH George Bush Intercontinental/Houston	♦	n/c	♦	n/c
JFK John F. Kennedy Int'l	♦	n/c	♦	n/c
LAS McCarran Int'l	♦	n/c	♦	n/c
LGA LaGuardia	♦	n/c	♦	n/c
ORD O'Hare Int'l	♦	n/c	-	n/c
PHL Philadelphia Int'l	♦	n/c	-	n/c
PHX Phoenix Sky Harbor Int'l	♦	?	♦	?
SFO San Francisco Int'l	♦	n/c	♦	n/c

♦ = Capacity constrained or severe status
n/c = No change to designation
? = Uncertain
- = Not capacity constrained

Overall, most of the airports that are identified by FACT3 as constrained in 2020 or 2030, when using the 2012 TAF, remain unchanged when the 2013 TAF is considered. This is particularly true for the 2020 scenarios. Since these airports are likely to be capacity-constrained under a variety of demand scenarios, this underscores the rationale to focus on solutions at these airports.

2020 Reference Scenario

The 2013 TAF shows a pattern of greater concentration of demand at many airports that are currently busy, including ATL and EWR. Both airports had previously been identified as needing more capacity in 2020 in the Reference scenario. Since their 2020 demand increases in the 2013 TAF, ATL and EWR would still need more capacity. JFK and PHL would still be identified as needing more capacity even though their forecasted demand for 2020 declines slightly in the 2013 TAF. Demand at LGA is virtually unchanged, given the constrained forecast used in the TAF; accordingly, its status does not change.

On the other hand, the decline in forecasted 2020 demand at SFO reduces the expected delays at the airport. As a result, SFO may not meet the criteria for a constrained airport.

2020 Improvements Scenario

Even though the 2020 forecast in the 2013 TAF has changed, the difference does not affect the list of airports expected to need additional capacity with the improvements scenario (i.e., midterm NextGen and runway improvements). These improvements would reduce delays at ATL and EWR so they would no longer be considered severely congested, despite higher traffic levels. JFK would not be expected to be severely delayed either due to the reduction in the 2020 forecast. The status of LGA and PHL does not change with the new

forecast. SFO was not identified as capacity constrained in this scenario at 2012 TAF demand levels nor at the slightly lower demand level in the 2013 TAF.

2030 Reference Scenario

Several airports that had been identified as severely congested in the 2030 Reference Scenario are still expected to be severely congested, as their 2030 demand levels stay the same, decline only slightly, or increase in the 2013 TAF. These airports include ATL, EWR, JFK, LGA, ORD, PHL, and SFO.

Other airports with lower forecasts in the 2013 TAF would still be capacity constrained but not severely so. This includes CLT, FLL, IAH, and LAS. PHX also has a lower forecast but its status is uncertain.

On the other hand, BOS and DFW are expected to be constrained at the 2013 TAF demand levels and would no longer be in the caution category.

2030 Improvements Scenario

Given the demand increases at ATL, EWR, and SFO in the 2013 TAF, these airports would still be expected to be severely congested. JFK would also be expected to be severely congested despite a reduced demand forecast. LGA would be unchanged.

IAH, LAS, and perhaps PHX would be constrained in 2030 even with a lower demand forecast. CLT would no longer be considered a constrained airport due to the decrease in the demand forecast but would remain in the caution category.

BOS and DFW would continue to be capacity constrained even with the planned improvements due to the higher demand forecasts at those airports.

Due to runway development underway or planned at FLL, ORD, and PHL, these airports will no longer meet the FACT3 criteria to be capacity constrained under either the 2012 or 2013 TAF demand level.