NextGen for Airports, Volume 5: Airport Planning and Development

DETAILS
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Best Practices and Lessons Learned from Airport Case Studies

Case Study Selection Criteria

The goal of this team's case study research is to identify, select, and study projects that reflect the various types and sizes of airports in the NAS with direct relevancy to FAA NextGen program initiatives and airport planning. The research team's approach for this task was to:

- Develop several screening criteria for the selection of candidate case studies,
- Identify a preliminary set of candidate case study airports or projects to be considered based on the initial screening criteria,
- Evaluate and weigh each candidate study,
- Select final list of case study projects, and
- Conduct the case studies for the guidebook.

The following sections describe each step of this methodology through the identification of six case study projects selected by the panel, as well as a summary of each case and a discussion of best practices and lessons learned.

Screening Criteria for the Identification of NextGen Projects at Airports

As part of the literature review phase of the project and through team discussions, several criteria were identified as a means to identify candidate case studies for the final project. These criteria include:

- Incorporation of NextGen into airport system, master planning, or environmental planning studies;
- Performance-based navigation;
- Multiple runway operations;
- Reduced airspace interaction through the de-coupling of adjacent airports;
- Surface operations management;
- Time-based flow management;
- Separation management; and
- Low-visibility approaches.
Case Studies Selected

Six cases were selected based on the criteria established as part of this research effort as follows:

- Colorado Wide Area Multilateration Implementation,
- Friedman Memorial Airport Required Navigational Performance Approach,
- The New York John F. Kennedy International Airport Collaborative Decision Making,
- Newark Liberty International Airport Ground-Based Augmentation System,
- San Francisco International Airport—Simultaneous Offset Instrument Approach, and
- The Puget Sound Regional Council—Preparing Busy Airports for NextGen Technology.

Table B-1 highlights the relevance of each case as related to the criteria established. These six case studies represent over 15 airports of all sizes throughout the country with relevance to multiple NextGen capabilities.

Case Studies Summary of Best Practices and Lessons Learned

Colorado Wide Area Multilateration Implementation

Many of the commercial airports in Colorado are located in high mountainous terrain, serving tourist destinations including ski areas. Historically, operations in low-visibility conditions to and from these airports were constrained due to the lack of radar coverage available below 10,000 feet MSL. During low-visibility weather events, arrivals and departures at these airports would drop from a range of 12 to 17 per hour to just 4 to 5 per hour. This often resulted in the cancellation or delay of flights, lost revenue, and inconvenienced travelers.

Most of the flights cancelled originated at the Denver International Airport. When flights were cancelled, travelers would resort to renting cars and driving to their final destination, increasing the usage of an already overcrowded Interstate and state highway road system. CDOT made solving this problem a high priority and dedicated significant resources to it. CDOT leadership also developed a “laser-focused” strategy, with tenacity, to solve this problem.

The Colorado WAM project demonstrates multiple best practices and lessons learned including:

- Collaborative working process between CDOT, local communities, businesses, airports, airlines, and FAA. CDOT identified the many stakeholders that would benefit from solving this problem and their strategy included actively reaching out to them, educating them, enlisting their service, and even raising necessary funds from them.
- The relative ease of implementing the technology and the utilization of existing infrastructure. The CDOT team included the right experts in the subject matter, who devised a way of using largely existing technology in a unique manner to tailor a solution to this problem.
- Airports, airlines, passengers, and businesses have benefitted in measurable ways through the implementation of this technology. The system has proven itself in saving money and time and increasing reliability and safety.
Table B-1. Case Study selection matrix.

<table>
<thead>
<tr>
<th>AIRPORT SIZE</th>
<th>MULTIPLE SMALL</th>
<th>SMALL</th>
<th>LARGE HUB</th>
<th>LARGE HUB</th>
<th>LARGE HUB</th>
<th>MULTIPLE MEDIUM AND SMALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorporation of NextGen into System, Master, or Environmental Planning Studies</td>
<td>X</td>
<td>X</td>
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<td>PBN</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Multiple Runway Operations</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>Reduced Airspace Interactions Through Decoupling of Adjacent Airports</td>
<td>X</td>
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<td></td>
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<td>Surface Operations Management</td>
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<td>TBFM</td>
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<td>X</td>
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<tr>
<td>Separation Management</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Low-Visibility Approaches</td>
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</table>
One of the benefits of the project is in promoting the ability of an airport sponsor to enter into an agreement with the FAA to develop and integrate emerging NextGen technology into an airport system. This program allowed airport sponsors to have a role in implementing the improvement. It also allowed airport sponsors to factor in the increased capacity into their long-range planning. This program will allow airport sponsors to delay capital expenditures due to the increased capacity.

The willingness of FAA to embrace a project where the need justifies a technologically feasible and economically beneficial solution was demonstrated.

One of the more significant lessons learned from this program, and one of the primary reasons for its success, was a small, tenacious group of individuals that made it their mission to solve this problem. They never gave up, even when confronted with technical, political, and budget challenges. This group exhibited a unique blend of technical savvy, political astuteness, creativity, and force of will to make it all happen. It is doubtful airports, airlines, passengers, and businesses would be experiencing these benefits if it were not for this group.

Friedman Memorial Airport—RNP Approach Implementation

The Friedman Memorial Airport (SUN) is located in Hailey, Idaho, about 13 miles south of Ketchum, and about 4 miles north of the City of Bellevue. The airport is in the narrow valley of the Big Wood River and is surrounded on three sides—north, east, and west—by mountains. The weather, combined with the high terrain in the area, creates a challenging environment for aircraft operators. Instrument operations had been limited due to terrain and the high minimums associated with the conventional non-precision instrument approaches to the runways at the airport. As a result, many flights are delayed or cancelled each year, creating loss of revenue for area businesses and inconveniences for the traveling public.

The Friedman Memorial Airport Authority (FMAA) had attempted to improve the instrument approach capability at the airport through the implementation of available technology beginning in 1994, including a microwave landing system and a transponder landing system. In 2006, the FAA published an RNP AR SIAP in an attempt to improve all weather access to the airport. The procedure offered lower minimums and access to properly equipped aircraft. However, the missed approach segment of the procedure extended an extremely long distance of over 60 nm. The long missed approach segment exceeded the operating specifications of the airlines serving SUN, thereby inhibiting its use.

The FMAA has worked to solve the problems with the RNP approach since 2011. Recently, FAA issued a notice that due to criteria changes, the approach is in jeopardy of being cancelled. Best practices and lessons learned from this case study include:

- The promise of NextGen may delay long-term planning. The FMAA had been pursuing the relocation of SUN to a new site away from the valley, due to the terrain and resultant reliability issues. The process to build a new airport was compromised by the fact that opponents routinely made the argument that technology could solve the problem. In this case, it did not. From an airport sponsor perspective, it can be said that the FMAA worked very hard, with tenacity and diligence, to try and fix the problem.

- The promise of NextGen may not be fully realized at small airports with limited resources. The FMAA devoted significant resources (their own money) to trying to resolve the reliability issue through the implementation of NextGen technologies. It was a challenge to continue doing this, since there were other capital and operating expenses competing for limited budget resources.

- NextGen solutions do exist at smaller airports; however, the FAA does not have sufficient resources to address specialty projects at smaller airports. It is believed that the 60 mile missed approach issue, which is the reason commercial airlines cannot take advantage of the RNP approach, can be
resolved. The FAA would have to change the rules in order to make that happen and they also face resource challenges, making it difficult to solve the problem.

- Changing instrument flight procedures criteria can adversely impact existing minimums at airports.

The New York John F. Kennedy International Airport
Collaborative Decision Making

The Surface Management Program at The New York John F. Kennedy International Airport (JFK) aims to leverage the availability of comprehensive airport surface surveillance data and airline schedule information to better manage the taxi-out process, reduce taxi times, and improve efficiency. During periods when departure demand exceeds capacity, departing aircraft are held at the gate or another holding location, and released to the runway in time to join a short departure queue before taking off. As a result, aircraft absorb the delay with engines off and decrease their fuel burn, emissions, and engine maintenance costs.

A key element of the process was the use of predictive analytics to accurately forecast up to eight hours in advance the expected departure and arrival slot counts based on the weather forecast and past airport performance under similar predicted weather conditions. This in turn was used with the requested push-times sourced from the airlines to develop the initial allocation of flights to available taxi slot times over the forecast period.

Some of the best practices and lessons learned from this program include:

- A surface management program similar to the JFK program would only apply at airports that experience significant surface congestion or that have very limited taxiway and apron space for the staging and queuing of departures.

- One of the key enablers of such a surface management program is that it requires either available gates or ramp space in order to store aircraft that are in the virtual queue waiting for their clearance to taxi.

- Achieving the full benefits of such a surface management or departure metering program at some of the most congested airports could require substantial investment in additional gates or ramp space that may not be feasible or economically justifiable.

There was a general feeling that the program would have worked better if the local ATC facilities had been more involved. Recently, the FAA Surface Operations Office has been implementing changes at the Port Authority’s airports without involving the Port Authority. This office views surface management as an ATC function; unlike the original surface management program that was developed at JFK, which was largely an airport and airlines function. Nevertheless, although the current JFK surface management system does not exactly follow the FAA Surface Operations process, the two programs have common goals and objectives and many common elements.

Newark Liberty International Airport Ground-Based Augmentation System

The goal of GBAS implementation is to provide an alternative to the ILS supporting the full range of Category I, II, and III approach and landing operations. The GLS is an ILS “look alike” system based on the use of the GPS. It is used only in the final approach phase of flight. Newark Liberty International Airport (EWR) was the first airport in the United States to have GBAS.

Some of the best practices and lessons learned from this program include:

- GBAS has more flexible siting criteria, allowing the GBAS to serve runways that ILS is unable to support.
• A GBAS is sited to minimize critical areas, which places fewer restrictions on aircraft movement during ground taxi and air operations.

• The GBAS approach guidance is steadier than ILS approach guidance and does not fluctuate.

• GBAS installations are AIP eligible for funding using either AIP entitlement funds or PFC funds. However, these federal funds do not cover maintenance of the GBAS system.

• The Port Authority encountered soil problems at EWR that made it expensive to install the GBAS antenna.

The Port Authority now thinks it would have been more beneficial to implement GBAS at JFK first because it would have facilitated reducing the airspace conflicts between LaGuardia Airport (LGA) and JFK. In addition, Delta Air Lines, a predominant carrier at JFK, currently has 42 aircraft that are GBAS capable based out of JFK. In addition, one of the real benefits of GBAS would be that it would enable a straight-in approach to Runway 13R at JFK.

San Francisco International Airport—Simultaneous Offset Instrument Approach

During clear weather conditions SFO can accept up to 60 operations per hour to Runways 28L and 28R. During low cloud conditions, and conditions where the airport is not visible on approach due to broken cloud layers in the bay, simultaneous parallel runway operations (arrivals) are not achievable and the hourly acceptance rate drops to 30 operations. The drop in capacity is a result of IFR ATC separation requirements associated with closely spaced runways allowing only a single stream of traffic into the airport.

The FAA, RTCA, airlines, and SFO worked collaboratively in the late 1990s to develop concepts and demonstrate solutions using PBN and existing ground-based technology. A program was ultimately established named simultaneous offset instrument approach (SOIA) based on the implementation of PRM surveillance radar funded by the airport and the development of an offset ILS approach to Runway 28R.

At the time that the SOIA project was established, the NextGen initiative did not exist in FAA. The initial goal was to allow visual acceptance rates to the closely separated parallel runways at the airport during times when the cloud layers above 1,000 feet prevented visual sight of the runway in VFR conditions on the field. Multiple challenges needed to be addressed to enable the operation, including pilot procedures, ATC procedures, wake turbulence, adequate surveillance, and adequate navigation.

The solution to the problem involved implementation of a PRM and an offset LDA with glideslope equipment and approach procedure for Runway 28R. An offset localizer type directional aid (LDA) with glideslope is simply an ILS system that is offset more than 3 degrees from the runway centerline. The implementation of these technologies, combined with the conventional ILS serving Runway 28L, the establishment of controller and pilot standard procedures, and training enabled the operation.

Multiple lessons have been learned through the SOIA program, including:

• A local initiative in a collaborative working environment can lead to success.

• Airport funding of infrastructure may be an important factor in NextGen implementation.

• Unique uses of existing technology can create significant benefits in the NAS.

• Establishing and maintaining the SOIA program for the increase in capacity through technology has provided benefits over the course of the past 11 years.

• Interruption of service due to construction can be a driver to develop innovative technology applications and procedures to maintain operations.
Establishment of a successful technology-based program at an airport may lead to benefits at other airports. Additional capacity gained through NextGen may serve to delay the need for capital improvement projects.

Efforts continue today for the implementation of NextGen to improve operations and reduce cost.

The Puget Sound Regional Council—Preparing Busy Airports for NextGen Technology

The project represents the first NextGen study focused on a system of general aviation airports in the NAS and was funded via AIP grants. From the FAA’s perspective, PSRC was an ideal organization to fulfill the objectives of this grant. It already served as a forum for communication with airports in the region. There were also clear economies of scale to be achieved by studying the impact of NextGen on many closely related airports at the same time. In addition, a number of NextGen technologies and operational improvements were being evaluated at the Seattle-Tacoma International Airport (SEA).

The project was divided into two phases. Phase I studied airports within the PSRC jurisdiction that could benefit from NextGen. The analysis provided an overview of the FAA NextGen program, details of NextGen technologies and how they may apply to airports in the Puget Sound system, an inventory of all airports within the Puget Sound area including economic analysis, establishment of the busiest airports in the system, a gap analysis for the busiest airports to enable NextGen, and a NextGen analysis template for busy airports. Phase II of PSRC’s study focused on NextGen technologies to enhance airspace efficiency, reduce congestion and delay, and improve safety in the most congested airspace in the Puget Sound region.

The project has successfully brought together airlines, industry, airport management, regional planners, and FAA to plan for the NextGen implementation at smaller GA airports from a system perspective. Other outcomes include:

- Establishment of capital improvement programs for the Puget Sound area airports.
- Identification of survey requirements for airports in the Puget Sound area.
- Identification of obstacles to air navigation.
- Identification of airspace design and instrument approach alternatives for airports in the area to de-conflict operations with operations at SEA.

The PSRC NextGen study has provided multiple lessons for application in all airport systems across the NAS including:

- AIP funds can be used for NextGen airport system planning.
- The approach taken by FAA and PSRC can be applied to other regional airport systems to enable GA airports to plan and be prepared for NextGen improvements.
- Development of capital improvement programs to enable NextGen technologies is a prudent step for small airports.
- Identification of aeronautical survey requirements is essential to enable the development of PBN instrument approach capability at small airports.
- Identification of obstacles to air NAVAIDS in obtaining timely airspace reviews and approvals of NextGen improvements.
- Development of plans for future PBN SIAPs will aid in the protection of airspace for the future implementation.