MAC Optimized Profile Descent Application and Emission Reduction
Results

Submittal for International Airport Review Award 2017 for
Environmental Awareness and Sustainable Development
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INTRODUCTION

The Metropolitan Airports Commission (MAC) owns and operates Minneapolis-St. Paul International Airport (MSP) and six reliever airports located in the Minneapolis-St. Paul metropolitan area. The MAC Environment Department works to reduce the negative environmental impacts of operating an international airport within a major metropolitan area with a vision to advance environmental performance and commitment beyond compliance with a mission to support aviation through the advancement of innovative and responsible environmental stewardship.

In pursuit of its vision and related mission, the Environment Department continues to be innovative and resourceful with a focus on developing and supporting a technically skilled team. A major component of our activities is to provide valuable information to the communities, air traffic control and airport users and to pinpoint realistic opportunities to reduce environmental impacts. This includes shedding light on the results and outcomes of activities that reduce environmental impacts.

The MAC Environment Department recently accomplished a significant, award-winning and innovative achievement by developing a first-of-its-kind application to quantify fuel savings and emission reduction resulting from the implementation of Optimized Profile Descents (OPD) at MSP.

BACKGROUND

As a result of collaborative efforts beginning in 2005 between MSP, community stakeholders, airlines, and the Federal Aviation Administration (FAA), on March 24, 2015 the FAA implemented
new Performance Based Navigation arrival procedures which incorporate OPDs. Those involved in the planning and support for these procedures felt it was crucial to quantify the procedures’ environmental benefits. To effectively achieve this, MAC Environment Department partnered with the FAA’s Airports Planning and Environmental Division, the FAA NextGen Office, MSP Air Traffic Management, Delta Air Lines, Endeavor Air and Sun Country Airlines to develop and validate an application to track OPD usage. With actual flight track and fuel burn data, the MAC is able to quantify fuel and carbon emission reductions for real-time, event-based reporting. This is a one-of-a-kind application and a significant advancement in quantifying the environmental benefits of PBN procedures around the U.S. Moreover, the methodologies, assumptions and results have been tested and validated by the FAA NextGen Office and MITRE Corporation.

This document demonstrates that the MAC Environment Department’s OPD application is also deserving of the International Airports Review 2017 award in Environmental Awareness and Sustainable Development for the following reasons: the proven environmental benefit, innovative problem-solving, cost effective development, and the widespread applicability for other airports.

**PROVEN ENVIRONMENTAL BENEFIT**

The most recent Greenhouse Gas Inventory Report for the MSP airport highlighted that 85% of all MSP emissions are the result of aircraft emissions above 3,000 feet. While the MAC remains committed to monitoring and, when possible, reducing GHG emissions from all sources associated with MSP, the greatest possible opportunities for significant reductions lie in aircraft operations. From an emissions and noise reduction standpoint, the MAC has continually
supported the use of emerging technologies to decrease the impact of the airport on the environment.

According to the MAC’s OPD application, from March 24, 2015 through March 31, 2017, almost 80% of the capable jet arrivals to MSP have flown an OPD. Compared to the fuel burn and emissions from traditional approaches, these arrival procedures have saved MSP carriers over 15 gallons of fuel per flight. This adds up to a total of 5,816,467 gallons of fuel saved since the procedures were implemented, or an annual savings of 2,892,385 gallons. The fuel savings has prevented a total of 57,243 metric tons of CO₂e emissions from being released into the atmosphere. On an annual basis, OPD arrivals save 28,465 metric tons of CO₂e from being emitted every year during descent. Based on these findings, the implementation of OPD at MSP is the single largest action to reduce carbon emissions in the history of the airport.

**INNOVATION AND COST EFFECTIVENESS**

In its simplest form, the OPD application determines whether an aircraft flew an optimal descent profile or not. This provides MAC the ability to report on the procedure usage. Secondly, using actual fuel burn data provided by the airlines, the fuel savings and associated emission reduction is calculated.

The OPD application uses a number of innovative technologies for data processing and analysis. The most critical of these technologies is the PostgreSQL database and PostGIS spatial database extension used for storing and calculating data related to OPD. PostgreSQL and PostGIS are both industry-leading open source technologies that allow staff to quickly and easily create multiple database environments to run comparative analyses when developing and testing
techniques. Staff took advantage of new functionality available in PostgreSQL version 9.6 coupled with the significant computing power of cloud technology services to improve the efficiency and performance of the application.

Since complex spatial analysis on large datasets requires significant administrative overhead (i.e. calculation time, data storage, etc.), the application uses Amazon Web Services for powerful database capabilities. Additionally, by using new features such as Docker Swarm, the processing within the application is able to be horizontally scaled to improve calculation time. Finally, the use of containerization and open source technologies was critical in developing a process that can be easily shared and implemented at other airports. Without these emerging open source technologies, none of the benefits demonstrated by the OPD application would be possible within the current organizational framework of the MAC.

For many years, the MAC has maintained a conservative economic stance in the industry. Using cost per enplaned passenger as a crucial metric, the MAC strives to keep MSP in the lower ⅓ of domestic large hub airports to remain financially viable, provide an economic benefit to our tenant airlines, and help control the price of air travel for the public. This stance, while prudent, does not allow grandiose resource spending on superfluous projects. The MAC operates with fiscal conservatism, which deepens a staff culture of innovation and efficiency. The OPD application is the result of the staff technical abilities and innovation with little financial investment and consulting services.
The staff of the MAC Environment Department relied both on their shared expertise and the technical systems already in place. There was no budget allocated specifically to the OPD application. The only cost to the MAC for project development was staff time.

WIDESPREAD APPLICABILITY FOR OTHER AIRPORTS

From its infancy, the OPD application was designed with the intent to apply its benefit across the country. This paper discusses the technology and the methods that were utilized for building the application. Using open source database technologies and containerization will allow the methodology employed in this application to be applied to other airports.

The story of PBN and OPD implementation at MSP is one of partnership, innovation and substantive environmental benefit. Absent the OPD application, this story could not be told. It also represents a stark difference from the current narratives that can engulf an airport and a community when discussing implementation of PBN procedures. In the Minneapolis-St. Paul Metropolitan area, we are as cognizant of aircraft noise as any facility in the country. Even in this engaged community with high expectations, the environmental, economic and safety benefits of PBN were a driving consideration for local decision-makers. Providing concrete evidence of their worth to the non-aeronautical community was crucial to share the complete story.

CONCLUSION

To get toward carbon neutrality, consideration must be paid to aircraft operational efficiencies in flight—the source that contributes 85% of the carbon footprint at MSP. The airport and the communities around MSP saw that opportunity in 2012 and affirmed their environmental stewardship commitment by supporting the implementation of PBN arrival procedures. Now that
the procedures are in place, the MAC Environment Department has leveraged its expertise, technical systems and its history of successfully tackling complex questions to present the industry with a successful PBN implementation with demonstrated environmental benefits.

This submittal is a true example that the MAC Environment Department continues to pioneer airport environmental solutions and is deserving of the 2017 International Airport Review Award for Environmental Awareness and Sustainable Development.