OPTIMIZED PROFILE DESCENT APPLICATION AND BENEFITS

FUEL BURN AND EMISSION REDUCTION ANALYSIS
ORIGINS OF OPD AT MSP: NON-TRADITIONAL PATH

- 2005: NOC CDA Test Site Request to FAA
- 2007: NOC RNAV Evaluation Begins
- April 2009: NOC/Delta Runway 17 RNAV River Departure Procedure Trial
- November 2010: FAA Moves Forward with Airspace-wide PBN Project
- March 2011: NOC PBN Design Criteria Sent to FAA & NOC Takes on Leadership role in Accelerated FAA Process
- November 2012: MAC Action Supporting Partial RNAV SID implementation & FAA Abandons RNAV SIDs
- NOC Resolution 01-2014
- The FAA moved forward with the implementation of the arrival procedures due in large part to strong local support through the NOC for the integration of OPD
The NOC remains supportive of the RNAV STARs as presented and the FAA should move forward with the implementation of these procedures at MSP.

The FAA RNAV STAR procedures should incorporate Optimized Profile Descents for all runways at MSP.
COLLABORATION THAT HAS CONTRIBUTED TO AN EVOLVING INDUSTRY PROCESS
Leaders were briefed on the environmental benefits of RNAV arrivals incorporating OPD.

Commitment was made to evaluate the real-world benefits of the procedures at MSP as part of this partnership.

Due to FAA resource constraints data was not available post-procedure implementation.

In 2015, the MAC Environment Department embarked on the development of the OPD Procedure Use and Benefit Analysis Application.

March 29, 2017 – MAC awarded the ACI-NA Environmental Achievement Award – Innovative and Special Projects
APPLICATION PARTNERS

Flight Track Data
Airports Planning and Environmental Division

Operational Fuel Data Airlines

Consultation and Validation
MSP Tower, TRACON and Center

Model Verification
NextGen Systems Analysis and Modeling Office

Application Development
In partnership with the airlines and FAA officials MAC staff has worked to develop a first-of-its-kind OPD Application using PostgreSQL hosted by Amazon Web Services, PostGIS spatial extension and Python scripts.

The OPD Application determines which arrivals into MSP flew a descent profile that would be representative of an OPD.

The application uses fuel data specific to aircraft type and runway, it calculates fuel savings for each aircraft.

The application is robust enough to cut the data results in various ways: such as by runway, by aircraft type, by time period.

Finally, using a standard conversion from gallons of fuel, the resultant carbon emission can be calculated.
FLIGHT DATA – MACNOMS
FLIGHT DATA – MSP TRACON (M98)
FLIGHT DATA – MSP CENTER (ZMP)
Determining Top of Descent

The Top of Descent in this application is the 4-D point when the aircraft began its descent, which is calculated by going through the following steps:

• Determine if each subsequent point is descending, level, or ascending

• If there are 20 consecutive descending points, TOD is then identified as the first point in the sequence

• If more than one TOD is found, the OPD TOD is considered to be the latest TOD that is not preceded by a level flight segment of greater than 20 nautical miles

APPLICATION OUTPUTS

FLIGHT ATTRIBUTES
• MSP Arrival Date/Time
• Aircraft Type
• Arrival Runway
• Origin Airport
• Airspace Arrival Gate

DESCENT STATISTICS
• Top of Descent 4-D Location
• Descent Distance to 8,000
• Descent Distance to ground
• Percent of Descent in Level Flight

CRUISE STATISTICS
• Ring Intersection Location
• Distance and Time Flown to Ground

FUEL STATISTICS
• Fuel Burn (lbs / meter)
• Fuel Burn Reduction Value
DETERMINING OPD TRAJECTORY
Evaluate aircraft descents between “Top of Descent” and 8,000 feet
RNAV Arrival procedures end before the final approach segment of the descent

- Less than 10% of descent is level flight
- This determination was developed with validation of individual observations and collaboration with FAA controllers

CONVENTIONAL
- 10% or more of descent is level flight
- Non-Jet Aircraft
- Flights that never reached 12,000 feet
NON-OPD TRAJECTORY – DELTA CRJ-200

Flights with more than 10% level flight during descent are categorized as non-OPD
NON-OPD TRAJECTORY – DELTA B737-900
Flights with more than 10% level flight during descent are categorized as non-OPD
OPD TRAJECTORY – DELTA CRJ-900

Flights with less than 10% level flight during descent are categorized as OPD.
OPD TRAJECTORY – DELTA B757

Flights with less than 10% level flight during descent are categorized as OPD
RESULTS
OPD USAGE

79.4%

OF ALL CAPABLE MSP ARRIVALS HAVE AN OPD DESCENT PROFILE
OPD USAGE

79.4%
OPD Usage

79.4%
OPD HAS REDUCED FUEL BURN BY 15.1 GALLONS OF FUEL PER FLIGHT
OPD HAS REDUCED FUEL BURN BY 2,892,385 GALLONS OF FUEL ANNUALLY.
OPD HAS REDUCED FUEL BURN BY 5,816,467 GALLONS OF FUEL SINCE IMPLEMENTATION
OPD HAS REDUCED CARBON EMISSIONS BY

28,465 METRIC TONS ANNUALLY
OPD HAS REDUCED CARBON EMISSIONS BY 57,243 METRIC TONS SINCE IMPLEMENTATION
IMPLEMENTING OPD WOULD BE LIKE...

- **Removing 12,092 cars from the road.**
- **Reducing miles driven on roads by 137,191,757.**
- **Reducing CO₂ emissions from 6,441,206 gallons of automobile gas.**
- **Recycling instead of landfilling 18,166 tons of waste.**
- **Recycling instead of landfilling 2,595 garbage trucks of waste.**
- **Eliminating the energy used at 6,045 homes.**
- **Changing 2,029,174 incandescent light bulbs to LED.**
- **Planting 1,483,518 trees and letting them grow for 10 years.**
- **Planting 54,186 acres of forest.**
- **Having a solar field at MSP that is 2.5 times its current size.**
Environment Department Guiding Principles:

We apply a strategic approach and are willing to take risks based on sound business judgment supported by planning, clear goals, expectations, and opportunities for employee growth.

We are committed to responsible environmental stewardship through a balanced approach that considers our stakeholders’ interests. We focus our efforts on performance and commitment beyond compliance.

We rise to challenges with an approach that encourages an entrepreneurial spirit, embraces critical thinking, innovation, service, and the continuous pursuit of excellence.

We provide value through solutions to complex environmental issues using innovative thinking and appropriate resource allocation in a way that advances aviation while strengthening relationships.

We forge partnerships that combine diverse strengths, skills, knowledge and resources.

We are here to serve and approach each challenge with a focus on understanding our customers and serving them to the best of our abilities.

We maintain a respectful work environment by treating all with high regard and valuing individual viewpoints. We carefully consider the impact of our decisions and we recognize exceptional contributions by celebrating the success of others.

We hold ourselves accountable to each other and our stakeholders with a commitment to conduct that exemplifies our values.
ACI–NA Environmental Achievement Award – Innovative and Special Projects

“..........the advanced staff skillset required to develop the OPD application at minimal cost, as well as the leadership in developing the application in a way that it could be easily shared with other airports. We would like to recognize all of the work and coordination, as well as exemplary leadership that went into this project............”

Kevin M. Burke
President/CEO – ACI-NA
MEMBERS OF THE MAC ENVIRONMENT TEAM THAT HELPED MAKE IT HAPPEN

• Dana Nelson, Manager – Noise, Environment and Planning
• Bradley Juffer – Asst. Manager – Noise, Environment and Planning
• Matt Baker, GIS Coordinator
• James Christensen, Systems Administrator