Optimized Profile Descent (OPD)

Lead: Jim Arrighi
Optimized Profile Descent (OPD) - What Is It?

- Published procedure
  - Possibility of vertical and/or speed constraints
- Provide a more optimized descent profile
  - Increased opportunity for reduced-power descent
  - Time, Fuel, Emissions Benefits

**Step-down arrivals**
“Descend to 7000, reduce speed to 210 knots”

**OPD**
“Descend Via DIRTY ONE”

Distance flown in level flight
Conventional Procedure - RIIVR TWO Arrival at LAX

Atlantic Interoperability Initiative to Reduce Emissions (AIRE)

November 17, 2008
RNAV Procedures – DIRTY RNAV Arrival at ATL, RUTLG RNAV Arrival at MIA

DIRTY RNAV Arrival

- BEBAD Cross at FL340
- ODF
- FLCON
- DIRTY Cross at or above 11000 ft
- BYRDS Cross at 10000 ft and 250 KIAS
- TIGOE Cross at 8000 ft
- ZINTU Cross at 7700 ft and 220 KIAS
- YABBA Cross at 7000 ft and 210 KIAS

RUTLG RNAV Arrival

- JORAY
- OSGOY
- ENVOY
- YGSSI
- MLEY
- CLYON
- BOYUR
- HLEY
- POZER
- RUTLG Cross at or above 11000 ft
- KANS Cross at or below 11000 ft
- PABOY
- SHEAM
- Cross at 3000 ft and 180 KIAS
- Cross at 4500 ft and 210 KIAS
- Cross at 240 KIAS

Atlantic Interoperability Initiative to Reduce Emissions (AIRE)

November 17, 2008
Demonstrations and Analysis of Optimized Profile Descent (OPD) Procedures

- Atlantic Interoperability Initiative to Reduce Emissions (AIRE) – Signed June 07
- Administrator’s Goal: “Complete demos at ATL and MIA by May 08”
- FAA/Industry teams formed for ATL and MIA
  - Kickoff meeting occurred in Sept. 07
  - 20+ demo flights flown at ATL and MIA in May 08
  - Savings: Fuel (48-52 gals/flt), CO2 (460-497 kg)
    - Driven by improved vertical profiles
- ATL plans for on going East flow demos for regular operational usage (HITLS 10/27)
- MIA plans include Oceanic tie via Tailored Arrivals
- Hank Krakowski (FAA - Chief Operating Officer) and Joe McCarthy (FAA - Mgr. RNAV and RNP Group) briefed Mr. Sturgell in July, he said accelerate!
- FY09 – FAA/CAASD analysis for industry coordination on site prioritization due in February of 2009
## AIRE - OPD Milestones and Deliverables

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Atlantic Interoperability Initiative to Reduce Emissions (AIRE)

Federal Aviation Administration

November 17, 2008
FY08 OPD Activities

- AIRE OPD Coordination
  - Two OPD procedures were developed at ATL and MIA
  - 21 OPD demonstration flights were conducted

- Technical Analysis
  - AIRE CDA/OPD Demonstration Recap
  - Benefit Analysis of AIRE CDA Demonstration Flights
  - AIRE CDA Human-In-The-Loop (HITL) Simulations
  - AIRE CDA Airspace and Airport Impacts
## Atlanta OPD Benefits Analysis Results

<table>
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<tr>
<th>Metric</th>
<th>Baseline Average Per Flight</th>
<th>Average OPD Difference from Baseline</th>
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<tr>
<td>Fuel Burn (gal)</td>
<td>393</td>
<td>-38 (-10%)</td>
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<tr>
<td>CO₂ emissions (kg)</td>
<td>3780</td>
<td>-360 (-10%)</td>
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<tr>
<td>Time Flown (min)</td>
<td>31.5</td>
<td>-0.8 (-3%)</td>
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- Estimated fuel burn reductions of **38 gallons per flight**
- Estimated CO₂ emissions reductions of **360 kilograms per flight**
- Observed time savings of **0.8 minutes per flight**
  - Consistent with higher average groundspeeds for CDA flights
Miami OPD Benefits Analysis Results – West Flow

- Estimated fuel burn reduction of 48 gallons per flight
- Estimated CO₂ emissions reductions of 460 kilograms per flight
- Fuel efficiency gains are most noticeable where baseline flights level off at FL240 and 16000 ft MSL

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<thead>
<tr>
<th>Metric</th>
<th>Baseline Average per Flight</th>
<th>Average OPD Difference from Baseline per Flight</th>
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<tr>
<td>Fuel Burn (gal)</td>
<td>233</td>
<td>- 48 (-21%)</td>
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<tr>
<td>CO₂ emissions (kg)</td>
<td>2241</td>
<td>- 460 (-21%)</td>
</tr>
<tr>
<td>Time Flown (min)</td>
<td>22.7</td>
<td>- 0.75 (-3%)</td>
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![Graph showing fuel flow, altitude, and groundspeed over distance.]
Miami OPD Benefits Analysis Results - East Flow

- Estimated fuel burn reduction of 52 gallons per flight
- Estimated CO₂ emissions reductions of 497 kilograms per flight
- Observed flight time increase of 2.4 min/flight
  - Consistent with increased route distance on the RUTLG in the terminal area
- Fuel efficiency gains are most noticeable where baseline flights level off at FL240 and 16000 ft MSL
Human In the Loop Simulations

- **Objective:** Identify issues and possible mitigation strategies associated with conducting CDA during peak traffic operations
  - Identify factors involved in deciding which aircraft could be cleared to the CDA
  - Investigate impact of CDA on surrounding traffic
    - Under what circumstances must the CDA be discontinued?
    - Identify methods for mitigating these impacts
  - Increase understanding of necessary inter-facility communications
- **Operational impacts of CDA identified through HITLs**
  - Crossing traffic
  - Merging traffic
  - Sector point-outs
  - Inter-facility coordination
Human In the Loop Simulations

Controller issues descent to FL340 for N236N to avoid crossing traffic just south of JORAY at FL360 and FL370.
FY 09 and 10 OPD Plans

- OPD Prioritization Analysis February 09
  - Coordination with EWG, industry, and FAA lines of business (e.g. AVN, AFS, etc.)
  - Site specific analysis, procedures design, and implementations
- Integrated Oceanic/Arrival Demo April 09
- Working with AIRE for Integrated Arrival Surface Demo - March 10
- Working with AIRE for Gate-to-Gate Demo Sept. 10
- CHS OPD Demos September 09 (DoD)
- ATL OPD HITL
- Procedure Design Activity
Conclusions

- **OPD/CDA benefits demonstrated through AIRE demos at ATL and MIA**
  - ATL: Estimated fuel burn reductions of approximately 38 gallons per flight, \( CO_2 \) reductions of approximately 360 kg per flight
  - MIA: Estimated fuel burn reductions of approximately 48-52 gallons per flight, \( CO_2 \) reductions of approximately 460-500 kg per flight

- **Operational CDA impacts identified through HITLs at ATL and MIA**
  - Crossing traffic
  - Departure traffic
  - Sector point-outs
  - Inter-facility coordination

- **Airspace and airport impacts of CDA**
  - Sector geometries
  - Traffic flows in sector
  - CDA top-of-descent location