NextGen CDA: Solutions for Aviation Challenges

Captain Ken Kirk
UPS Advanced Flight
Our Current Noise Challenge:

European Commission via Eurocontrol has mandated 100 Airports establish Continuous Descent Arrivals by 2013.

Develop a simple, effective arrival procedure to reduce noise:
- with the ultimate goal of a P-RNAV solution.

Defining and measuring success using standardized methodology:
- each airport manages noise differently.

Educate ATC & Pilots about noise, airspace design, and develop vectoring/flight techniques to minimize noise signature.
UPS European Airports with CDAs:

East Midlands (EMA): Vectored CDA
Stansted (STN): Vectored CDA
Stockholm (ARN): P-RNAV CDA
Cologne (CGN): Vectored CDA
CDA Developments:

WAW: CDA Test phase began 14 OCT 2008
MD11 & B757
Flt 8, CGN-WAW, 0530-0600 local arrival
Vectored CDA designed with UPS

CGN: Test phase June-November 2008
Implementation: 1st Quarter 2009
Radar Vectored CDA
RNAV CDA in development: 2009
CGN Noise Test

Requested by the Airport Director: Wolfgang Klapdor

Parameters:

• Incremental Implementation: Radar Vectors 1st then RNAV
• No changes to published arrival procedures
• Develop a Vectored CDA: reduces noise only
• Minimal Training for Pilot & ATC
• Participants: 80 aircraft arriving in a 150 minutes

Langen Radar          CGN Environmental Office
UPS (A300, MD11, 767/757)  Star (767)  MMG (A300)
Tuifly (737 NG)          German Wings (A319)
Arrivals without CDA
1st Night of CDA Test
Initial Feedback:

Airport:
- 77% Success rate for August
- Measurable Noise Reduction during all phases of the arrival
- MD11:
  - noise reduction of 8db > 24-12 track miles
- A300/B767/A319/B737NG:
  - 4-6 db average reduction > 24 -12 track miles
- Impact on arrival rate: minimal

Langen Radar (ATC):
- Uneven deceleration rates between aircraft types
- Controller workload not as heavy as anticipated
Initial Feedback:

**Pilots:**
Not knowing if they were going to fly the CDA or not

**Altimetry:** setting QNH, passing Transition Level

**FOQA:** 99% + Stabilization Rate at 1000’
No ASAP reports to date
Our Current Noise Challenge:

UPS destinations designing CDAs
Budapest (BUD)
Madrid (MAD)
Malmo (MMX)
Oslo (OSL)

(Source: Eurocontrol)
Key to Success for a successful Noise Program:

**Partnership: Air Carriers & Airport & ATC**

**Effective Communication of challenges between participants**

**Standardization of procedures to the maximum extent possible**

**Achievable Goals**
Definition of NextGen CDA:

Fly Continuous Descent Arrivals (CDA)

- **30% reduction in noise** *(up to 6 dB)* 2004 CDA trials
- **34% reduction in nitrous oxide (NOx) emissions** *(Below 3000 ft)* 2004 CDA trials
- Reduces time enroute and burns less fuel

Utilize Merging and Spacing

- Spacing task is delegated to the flight crew
- Allows CDA operations with minimal impact to throughput
- Enables full time use of CDA
UPS Implementation of RNAV / ADS-B

Three tools required for NextGen CDA:

• Flight deck tools
• RNAV arrival
• Airline Based Enroute Sequencing & Spacing (ABESS)
UPS Implementation

Flight Deck Tools

- Dual Boeing Class 3 EFBs
- Single ADS-B Guidance Display (AGD)
- ACSS ADS-B SafeRoute System
- ACSS/Astronautics CDTI
- Retrofit to UPS B-757/767 Fleets
UPS Implementation

Boeing/Astronautics EFB

*Dual processor/dual hard drive*

- Windows side-Class 2
  - Document Browser-Type A
  - Terminal Charts-Type B
- Linux side-Class 3
  - ACSS/Astronautics CDTI-Type C
  - ACSS SafeRoute Applications-Type C
UPS Implementation

- ACSS SafeRoute System (ADS-B Apps)
  - Surface Area Movement Management (SAMM)
  - Merging & Spacing (M&S)
  - CDTI Assisted Visual Separation (CAVS)

M&S and CAVS require AGD device
ADS-B Guidance Display (AGD)

Single unit on Captain’s side

Provides

- Command Speed (M&S only)
- Differential Ground Speed
- Distance to Target
- CDTI Message Advisories/Alerting

Easily Viewed by Either Pilot
CDA Development Status

High Density Traffic Merging and Spacing

• Multi-post arrival scheme
  – RNAV Development Team met 16-18 June 08
    – Initiated FAA 18-Step RNAV approval process
    – Developed to optimize continuous descent profile
    – Process will address ATC concerns

• Presently being tested in UPS simulators for all fleets

• Deployment anticipated Dec 2009
SDF EMA RNAV Arrival
SDF SACKO South RNAV Arrival

SACKO SOUTH RNAV ARRIVAL

1. For M & S trail aircraft, upon initial contact with each controller, announce, “COMPANY SPACING.” All aircraft must be at 170 Kts or less at FAF.
2. Load the ILS prior to loading the arrival. Verify speed/altitude constraints for the arrival and approach. Do not put the final approach speed in either the runway or FAF waypoint.
3. Set the FMG descent speed to 80/310.
4. Set the altitude window to the lowest assigned ATC altitude.
5. Use VNAV. A200: Use the appropriate vertical mode to meet crossing and speed restrictions. MD-11: Use Profile Mode.
7. Arm the localizer after receiving ILS approach clearance.
8. After capturing the localizer, fly path or glide slope to the FAF.
9. No later than 1 mile prior to the final approach fix, select gear down and approach flaps.
SDF SACKO North RNAV Arrival

SACKO NORTH RNAV ARRIVAL PILOT NOTES

1. For M & S trail aircraft, upon initial contact with each controller, announce, "COMPANY SPACING." All aircraft must be at 170 KTs or less at FAF.
2. Load the ILS prior to landing the arrival. Verify speed/altitude constraints for the arrival and approach. Do not put the final approach speed in either the runway or FAF waypoint.
3. Set the FMS descent speed to .80/030.
4. Set the altitude window to the lowest assigned ATC altitude.
5. 07/07/70/70/47/40: Use VNAV A30: Use the appropriate vertical mode to meet crossing and speed restrictions.
6. Maintain speed 100 knots IAS of published speeds, unless M & S trail aircraft.
7. Arm the localizer after receiving ILS approach clearance.
8. After capturing the localizer, fly path or glide slope to the FAF.
9. No later than 1 mile prior to the final approach fix, select gear down and approach flaps.
Surface Area Movement Management

Airport surface map and traffic displayed in the cockpit provides surface situational awareness leading to:

- Reduction in runway incursions and traffic conflicts
- Tracking the movements of own aircraft and other ground and airborne traffic in the terminal area using ADS-B
- Alerting crews of potential conflicts with traffic
Video of SAMM with traffic

UPS
ABESS Status

• Two track development effort
  – Original MITRE effort was not viable
  – Mosaic ATM version development efforts started to provide alternative to MITRE version
    • May 08/Aug 08 Field Test showed more improvement needed in MITRE version
    • Mosaic ATM version needs additional support and funding to complete

• Next Field Test set for 18-20 Nov 08
Issues

Ownship GPS/LDPU Position Drop
- Target Degrade
- Flashing Amber: ADS-B, Pos, Track

15 knot A/S differential in Algorithm
- Aggressive AGD Speed Commands
- Variable distances at Threshold

MS Windows Failures
- Loss of Term Charts and Doc Browser
UPS NextGen CDA Statistics

• Received 757 Operational Approval in December 07
• 84 successful NextGen CDAs flown since 18 Jan 2008
• Fuel savings over normal arrival:
  - 250 to 465 # of fuel (2004 CDA Test)
  - 757 = 21% (last 25-min of flight)
  - 767 = 31% (last 25-min of flight)
• Intense data collection effort underway
• Received 767 SafeRoute STC in 24 July 08
• Expect 767 Operational Approval in November 08
Next Steps to Achieve NextGen CDAs

- Ensure easily accepted by controllers and pilots
- Remain motivated by Safety, Capacity and Efficiency gains short term
- Maintain portability to other airports and operators (PHL)
- Continued development of SafeRoute to support high density operations
- Develop RNAV procedures for multi-post arrival
- Install ground tool to establish inbound flow for both sequencing and initial spacing
Questions?