

Environment IPT Operations Initiative Panel FY 06 Activities FY 07-09 Draft Work Plans

Ev Palmer & Joe Wat

September 2006



Operations Initiative Panel Objectives

Pursue aviation operational changes to reduce environmental impacts

- Develop tools and procedures for reducing the environmental impact of air traffic operations, i.e. noise and emissions
- Conduct simulations and field demonstrations to validate benefits and explore implementation issues



Operations Panel Activities in FY06

- Continuous Descent Arrival (CDA) Workshops to coordinate industry development of near-term CDAs (Ongoing)
- Work with candidate airports for appropriate implementation of CDA (Ongoing)
 - ATL, LAX, SDF, and Mather
- Design Guidelines for developing CDAs ... “The CDA Cookbook” (4Q FY06)
 - John-Paul Clarke’s CDA Design Methodology and Workstation tool.
- Complete plan for accommodating low noise approaches in moderate traffic without negatively impacting capacity (4Q FY06)
 - SCT Airspace redesign and CDA project
- Collect data to support business case for airlines on benefits of CDA (Ongoing)
 - SDF, ATL, LAX, Mather
- CDA Operational Concept Document and R&D Roadmap (4Q FY06)
- ----- Deferred to FY07 -----
- Initiate assessment of CDA applicability to airports with greater traffic levels, general mixed fleet, mixed operations
 - NASA NGATS Airspace - Field Evaluations & HITL Simulations are addressing these issues
 - FAA / MITRE / NASA Merging and Spacing project
 - Complete plan for developing controller decision aids for improved operations
 - NASA NGATS Airspace Project - HITL Simulations are addressing these issues
 - John-Paul Clarke’s algorithm development for aircraft spacing for CDAs
- Complete plan for improved surface planning to reduce emissions
 - Surface operations work is just getting going.
 - Leveraging off prior NASA work.



Continuous Descent Arrivals - CDA

A CDA is an flight procedure where the vertical profile of an arrival has been optimized, to not include “step downs” or intermediate level flight operations, so that it can be flown from a high altitude at low or idle thrust until a stabilization point prior to touch down on the runway.

i.e. A Standard Terminal Arrival (STAR) with an optimized vertical profile.



CDA Design Methodology

John-Paul Clarke

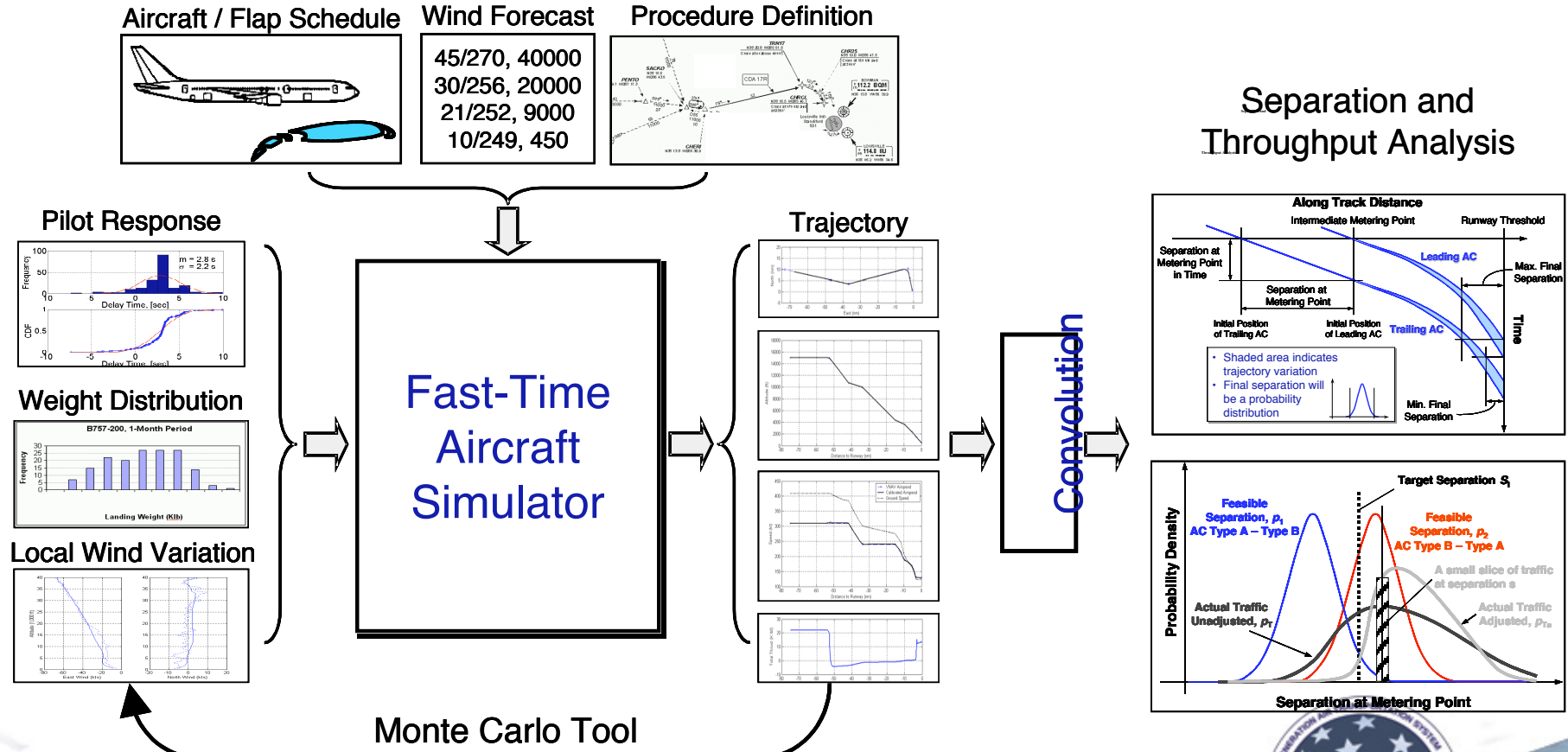
- Determine lateral profile
- Build wind model
 - Develop a model for each definable set of wind conditions
- Use *Tool for Analysis of Separation And Throughput* (TASAT) to determine:
 - Range of crossing altitudes at each waypoint for each aircraft type in unrestricted descent from cruise
 - Required separation at top-of-descent and at transition altitude for each pair of aircraft types in unrestricted descent from cruise
- Develop (if airspace is constrained) set of scenarios with different transition altitudes and waypoint (altitude and speed) restrictions
- Use TASAT to determine:
 - Required separation at top-of-descent and at transition altitude for each pair of aircraft types
- Determine “best” transition altitude, waypoint restrictions and required separations given:
 - Trade-off between noise, emissions, fuel burn and throughput



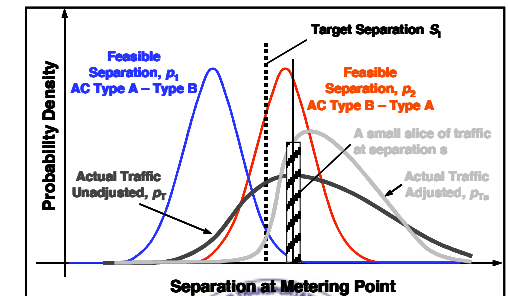
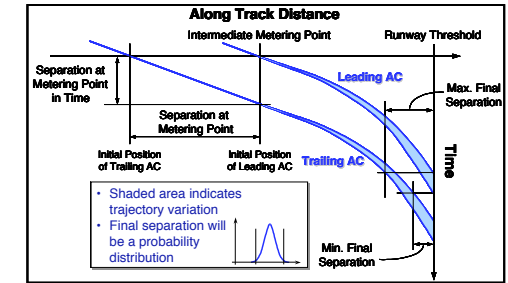
CDA Design Methodology & Tool

Tool for Analysis of Separation And Throughput (TASAT)

John-Paul Clarke



Separation and Throughput Analysis



CDA Activities

- **CDA Operational Applications**
 - SDF Special procedure ... UPS, Georgia Tech, NASA Langley
 - LAX Public procedure designed for CDA ... SCT, Georgia Tech
- **CDA Validation Activities**
 - ATL FMS Visual Special ... Delta / Georgia Tech
 - Long Beach FMS Visual ... Boeing, SCT
 - Oceanic Tailored Arrivals Initiative ... United / Boeing / NASA Ames
 - Merging & spacing research ... SF21 / UPS / MITRE / NASA Langley & Ames
 - Phase 1 - En route preconditioning of arrivals + CDA Special
 - Phase 2 - Airborne Merging and Spacing - (with cruise altitude merge)
 - Phase 3 ... N - Full Airport Operations - not defined yet
- **CDA Research Activities**
 - Low Noise FMS VNAV Guidance ... NASA Langley
 - Development of advanced spacing algorithms for TMA or other tool ... Georgia Tech
 - Trajectory Oriented Operations with Limited Delegation ... NASA Ames
 - Merging and Spacing (A-STAR) with ATC Tools ... NASA Langley & Ames / UPS / MITRE



Operations Panel Work Plan for FY07

- Analyze data from recent Continuous Descent Arrival (CDA) field and full mission simulator studies to identify the key drivers of environmental and economic benefits under differing scenarios. (April 2007)
- Document the environmental and economic benefits that result from the redesign of SCT airspace to enable the introduction of CDA for west bound arrivals to LAX. (September 2007)
- Collect data required to define the requirements for controller and pilot support tools to enable CDA in high traffic conditions without negatively impacting capacity. (September 2007)
- Develop a plan for field and simulator demonstrations of procedures and automation that when implemented would reduce fuel burn and emissions during ground operations. (June 2007)
- -----
- Initial exploration of improved departure operations to reduce emissions and noise
- Initial exploration of improved en route operations to reduce emissions and noise



Operations Panel Draft Work Plan for FY08-09

- Continue support for near-term CDA implementation
- Develop prototype controller and pilot tools and document the requirements for conducting CDAs with high throughput.
- Document the potential contribution of operations to addressing the environmental gap. (In coordinate with the JPDO's EAD & the E-IPTTools Panel.)
- Document the requirements for a CDA procedure design tool.
 - Based on John-Paul Clarke's methodology and design tool and other analysis tools
 - Explore doing this as an extension to the TARGETS tool
- Conduct human-in-the-loop or field evaluation of surface planning tool to minimize environmental impact.
- Conduct human-in-the-loop or field evaluation of new environmental RNAV departure procedure for a US airport
- Develop en route planning tool to optimize route for environmental emissions.



Issues

- Resources: Focused participation on Operations Panel by key players, and coordination within agencies and organizations
- Coordinate with the AGILE IPT (August 24th telecon)
- Coordinate with NASA's NGATS Airspace and Airportal Projects
- Coordinate with E-IPT Tools Panel to identify the potential contribution of operations to addressing the environmental gap
- Membership gaps
 - Currently advertising for members with FMS / VNAV experience
- Effective use of panel members

CDA operations in high capacity operations will likely require new pilot and controller tools. Improved controller tools will not be widely available until the ERAM is in place.

Backup Slides



CDA Workshop #1

Thursday 19 January 2006

- Review of US CDA Efforts *John-Paul Clarke (GaTech), James Brooks (Delta)*
- Two Perspectives on CDA *Carl Burluson (FAA), Karen Lee Jim Walton (UPS)*
- Overview of SDF Flight Test *John-Paul Clarke (GaTech)*
- Optimizing the Vertical Profile & Observed Aircraft and FMS Performance *David Williams (NASA), James Walton (UPS), Liling Ren (MIT)*
- Cockpit & Controller Feedback, Observed Economic and Environmental Benefits *Liling Ren (MIT), Nhut Ho (Cal State Northridge), Kevin Elmer (Boeing), Natalia Sizov (MIT)*
- Review of RNAV Implementation Efforts and Overview of the RNAV Approval Process *Bruce Tarbert (FAA)*
- Using TARGETS for CDA Development & Approval *Tom Becher (MITRE), Greg Tennille (MITRE), Dave Eccleston (MITRE)*
- Using NIRS Screening Tool to Evaluate Noise Change Data for New Operational Procedures *Terry Thompson (METRON)*

Friday 20 January 2006

- Overview of On-Going and Future R&D *Ray Miraflor (NASA)*
- CDA in the Redesigned Southern California Airspace– Medium to High Density Implementation *Walter White (FAA), Kathryn Higgins (FAA) John-Paul Clarke (GaTech), Sean Nolan (GaTech)*
- CDA for Nighttime Operations in the United States- Low Density Implementation *Sandy Liu (FAA)*
- Boeing Activities on Low Noise Approaches *Rob Mead (Boeing), Joseph Wat (Boeing), Jesse Follet (Boeing), Louis Bailey (Boeing)*

<http://www.ae.gatech.edu/people/jpclarke/cda>



CDA Workshop #2

Tuesday April 18th

- Presentation by *Sandy Liu (FAA / AEE)*
- Preliminary Results – Schipol CDA Trial *Jesse Follet (Boeing)*
- CDA Development – Dual Runway IAH *Kwok-On Tong (Boeing)*
- Successful RNAV STAR Development – ATO Perspective *Don Porter (FAA / RNAV RNP Group)*
- Experience Gained at SDF and LAX *Walter White (FAA) and John-Paul Clarke (Georgia Tech)*
- Identifying Opportunities for Near-Term Implementation *Woller (Delta)*

Wednesday April 19th

- FMS VNAV Capabilities *Sam Miller (Boeing)*
- Open Discussion / Air Carrier Coordination *Jim Walton (UPS)*
- Data Requirements – Pre & Post CDA *Jim Brooks (Georgia Tech)*
- FAA's Environmental Modeling Tools *Chris Roof (Volpe)*

<http://www.ae.gatech.edu/people/jpclarke/cda>



Airports with CDA Projects

- SDF (Merging and Spacing - UPS)
- LAX (FAA Southern California TRACON / Georgia Tech)
- ATL (Delta / Georgia Tech)
- SAC (Mather - UPS)
- MEM (FedEx)
- SFO (Tailored Arrival – NASA/Boeing)
- Long Beach (Boeing / FAA Southern California TRACON)
- PHL (MITRE / FAA Eastcoast ReDesign),
- Houston (Continental/Boeing)

