RNAV/RNP CDA
Route Design Considerations

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Overview

• Core Concept of Operations
• Route Design Issues
• Fast-Time Simulation Research
• Extension to Far-Term Concept
Core Concept of Operations

- RNAV/RNP routes
- Optimized vertical profiles (“CDAs”)
- Advanced scheduling automation and advisory tools

Key Questions

- How [well] can aircraft be set up to fly CDAs in high-density traffic environments?
- How much schedule error due to uncertainties in winds, weight, performance models, and pilotage can be expected to accrue during a CDA?
- How [well] can ANSPs cope with accrued error to achieve high throughput at the runway?
- When do operations become off-nominal and how should control/coping mechanisms adapt?
Reference Profile Separation ‘Maps’

- RNP 2
- RNP 1
- RNP 0.3
- RNP 0.15

Reference Vertical Profiles

Along track distance from CAT04 (nmi) vs. Altitude (ft)
Restrictions for Separation

Along track distance from CAT04 (nmi)

Altitude (ft)

Lateral Entry/Exit Fix Separation

RNP 1

RNP 0.15
Downwind Legs

Fast-time Simulations

- Iterative process to address progressive increases in:
  - traffic density
  - terminal-area automation tool capabilities
  - airspace and route flexibility
  - manageable uncertainty

- Controllability analysis
- Controller ‘agents’
- Prototype tools
- Noise/Emissions analysis

- Faithful descriptions of observed/modelled uncertainties
Definitions

- **Metroplex:**
  - Collection of airports serving a metropolitan area

- **Metroplex Configuration (MC):**
  - Collection of runway configurations at each metroplex airport suitable for specified winds at each airport in a given time frame, together with a set of RNAV/RNP routes to/from "pitch/catch" points to/from runways

- **Pitch/Catch (P/C) points (Terminal-Area Entry/Exit points):**
  - Points valid for transitioning to/from the en route environment during a given time frame
  - Metering points on (extended) terminal-area boundary
  - Runway-specific or multiple airport/runway

- **Operationally Viable MC:**
  - *Deconflicted* RNAV/RNP routes with optimized descent profiles and controllability characteristics identified

Far-Term ConOps Sketch

- **MC ‘Alpha’ is current until XX:YY Zulu**
  - ‘Alpha’ P/C points and routes to/from runways in use at metroplex airports

- **Metroplex Traffic Manager (MTM):**
  - Works ‘Bravo’ MC given winds/WX forecasts with coordination from Towers (local demands)

- **AOC/TMU/MTM recondition flows to P/C points using Bravo schedule**
  - Identify last Alpha A/C & Bravo sequence to/from each P/C point

- **Bravo changeover time broadcast**
  - ‘Sweet spot’ between prediction uncertainty and time horizon

- **Bravo routes uplinked**