Flying Green!

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Green Initiative Categories

- Procedural/NextGen
- Avionics/NextGen Projects
- Engineering Efficiency
- Weight Reduction
- Alternative Fuels
- New Aircraft

Current Average just under $200M annual fuel spend savings!
Procedural

- RNAV
- OPVs
- Tailored Arrivals
- 3D-Path Arrival Management
- ASPIRE
- Green Corridor
- New F:WZ Flight Planning System
RNAV Efficiency

Near-term – Optimize RNAV operations reduce fuel burn and increase capacity

Mid-term – procedures to de-conflict arpts and leverage RNP with RF
  - Atlanta, Chicago, Dallas, Denver, Florida, Houston, New York, Nor Cal, Ohio Valley, Seattle, So Cal, Nevada, and Washington, DC

Navigation Efficiency: ATL departure paths before/after RNAV implementation

Path consistency = efficiency and block/fuel savings!
Using Optimized Profile Descents everywhere possible – saves 200-800 lbs per flight!

Route uploaded to FMS for Merging and Spacing

Constant Descent Approach

CDTI Assisted Visual Separation
Tailored Arrivals – UAL HNL-SFO  
True 4-D procedure “tailored” for flight using continuous descent

Fuel Saved = 1200-2600 lbs!
What is 3DPAM?

- 3D Path Arrival Management
- An interim step to meet NextGen requirements for 4D trajectory flight profiles
- Computer decision support tool designed to maneuver aircraft (airspeed changes or path stretches) to meet timing requirements at corner posts (e.g. SAYGE, RAMMS, etc)
- Descents are designed to start at TOD using idle thrust
- Currently accomplished by delaying vectors and intermediate altitude changes
- 3DPAM does consider conflict resolution
3DPAM Route Possibilities

- Assign new Mach/IAS
- Use “path stretch”
- Combination of both

1. EDA selects initial path maneuver. Controller can override EDA selection by specifying turn out angle (15, 30, 45, 60) and direction of turn (left or right)

2. EDA selects cruise and descent speeds to minimize path distance

3. EDA calculates turn back location (specified as a PBD from the return waypoint)
ASPIRE Flight Components

Gate to Gate demonstrations, involving:
- No-Delay taxi to the runway
- Unimpeded climb-out on departure
- User Preferred Route for the oceanic phase of flight
- Reduced Vertical Separation Minima (RVSM)
- Cruise Climb
- Variable optimized speed
- RNP-4 oceanic separation minima (30/30)
- Frequent Dynamic Airborne Reroutes (DARP)
- Tailored Arrival to the approach
- No-Delay taxi to the gate
- Saved 1564 Gallons (10,500 lbs) and avoided 32,656 lbs CO2!
Green Corridor Flight Components

Gate to Gate demonstrations, involving:
- No-Delay taxi to the runway
- Unimpeded climb-out on departure
- User Preferred Route for the entire flight
- Cruise Climb (enabled by block altitudes)
- Variable optimized speed
- Optimum Profile Descent
- No-Delay taxi to the gate

Two flights on World Environment Day, June 5, 2010
- ORD-FRA, and FRA-ORD

Achieved a 3.2% fuel and emissions savings compared to normal flights!
Green Corridor Flight Components

UA 945 FRA-ORD Arrival Profile
New F:WZ Flight Planning System
Avionics/NextGen

- RNP
- ADS-B in/out
  - In Trail Procedures
- DataComm
  - FANS expansion
- DCNS – VDL/2
RNP is RNAV with Containment and Flight Deck Alerting

RNP 1.0 guarantees the aircraft is within 1 nm of expected flight path with 95% confidence.

Typical RNP values from 0.1-4.0

SAAAR required below 0.3

RNP 1.0
Separation using RNP

• Q routes are RNP routes where aircraft are separated by time using constant Mach
  • Typical RNP 0.3

• SIDs and STARs can be used to separate aircraft by Precision departures or arrivals
  • Typical RNP 0.3
Using RNP for “quicker” approach design
ADS-B In-Trail Procedures
- 12 UAL B747s in SOPAC

BENEFITS: Improved Situational Awareness
→ Detailed information on surrounding traffic
→ Provides assistance with strategic decision making and informed request to controllers

Improvements over existing systems
→ 200nm range
→ Additional information on traffic available

Improved Efficiency of Oceanic Operations
Data Communications

Digital ATC comm for revised Departure clearances, reroutes, and routine communications

- Operators who equip will receive revised Dep clearances more expeditiously
- Ability to obtain WX reroutes without waiting queue
  - Continue Collaborative Decision Making
    - Integrate flight planning systems with FAA traffic automation
      - Cost of this concept is unknown, potentially huge benefits
      - Common operational picture for ATC and airlines
  - Expand time based metering and leverage RTA capabilities
  - Efficient management of Special Activity Airspace
Demonstrated Cruise Efficiency

Using an Electronic Flight Bag with real time weather to “optimize” current routing
Engineering Efficiency

- Weight Reductions
  - 75% ovens
  - Curtains
  - Consumables (potable water, galley supplies)
  - Mirrors
  - Trash compactors
- Engine Washes
- Aircraft Washes
- Winglets
Synthetic Fuel Validation Fight

- United A319 Aircraft
- 60-40 blend of ASTM-certified JetA + Renjet synthetic fuel
- DEN-FL390-DEN, Day-VFR
- Tank to Engine configuration – Engine #1 and APU on blend
- Blended fuel tested 3 times prior to flight
- Engine parameters downloaded on prior flight and at 5 minute intervals during flight
- High Altitude APU start
- Engine ran about 10 degrees C hotter on blend, estimated 2% performance increase
- All parameters normal!
Synthetic Fuel Validation Fight
New Aircraft

- 25 A350XWB-900
- 25 B787-9
- 20-25% More efficient per ASM!
Thank you!