

# *Atlantic Interoperability Initiative to Reduce Emissions (AIRE)*

## *Briefing to the ICNS*

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Federal Aviation  
Administration



# Introduction to AIRE



Marion C. Blakey  
FAA Administrator

Jacques Barrot  
EU Vice President &  
EC Transport Commissioner

- **AIRE cooperative agreement signed at Paris Air Show in June 2007**
  - FAA
  - European Commission (EC)
- **Hasten development of environmental improvements for all phases of flight**
- **Validate improvements with flight trials and demos**

*Airline Industry Under Pressure to “Go Green”*

# Program Overview

- **AIRE:**
  - Objectives
  - Metrics
  - Domains
    - Oceanic
    - Surface
    - Arrivals
  - Timing

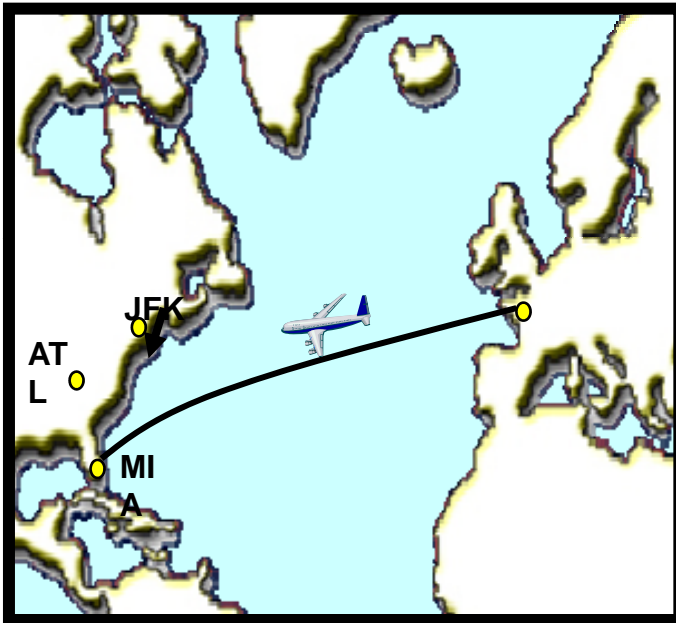


# NextGen and SESAR

- AIRE is part of the NextGen and SESAR efforts
- Environmental constraints to aviation growth are real and looming
- AIRE allows ANSPs to address near term issues with stepping stone approach and lay the foundation for the future
- Ultimate goal is innovative solutions that offer environmental protection and system efficiencies



# AIRE Objectives



- Hasten development of operational procedures to reduce aviation's environmental foot print on a “gate-to-gate” basis
- Quantify environmental benefits to aid in formulation of potential business cases
- Accelerate incorporation and worldwide interoperability of procedures/standards
- Capitalize on existing technology on either side of Atlantic
- Identify implementation issues, obstacles, choke points, metrics and solutions, working with our European partners

**Showcase “International Partnership” in Environmental Area**

# Validation of Benefits

- The AIRE domain demonstrations are *proof of concept* ATM system enhancements that have been shown to offer major environmental benefits as well as improved operational efficiency.
- For each AIRE domain technology/technique, levels of fuel savings / emission and noise reductions will be quantified for the participating trans-Atlantic flights.
- Metrics will identify the overall potential for emissions reduction.

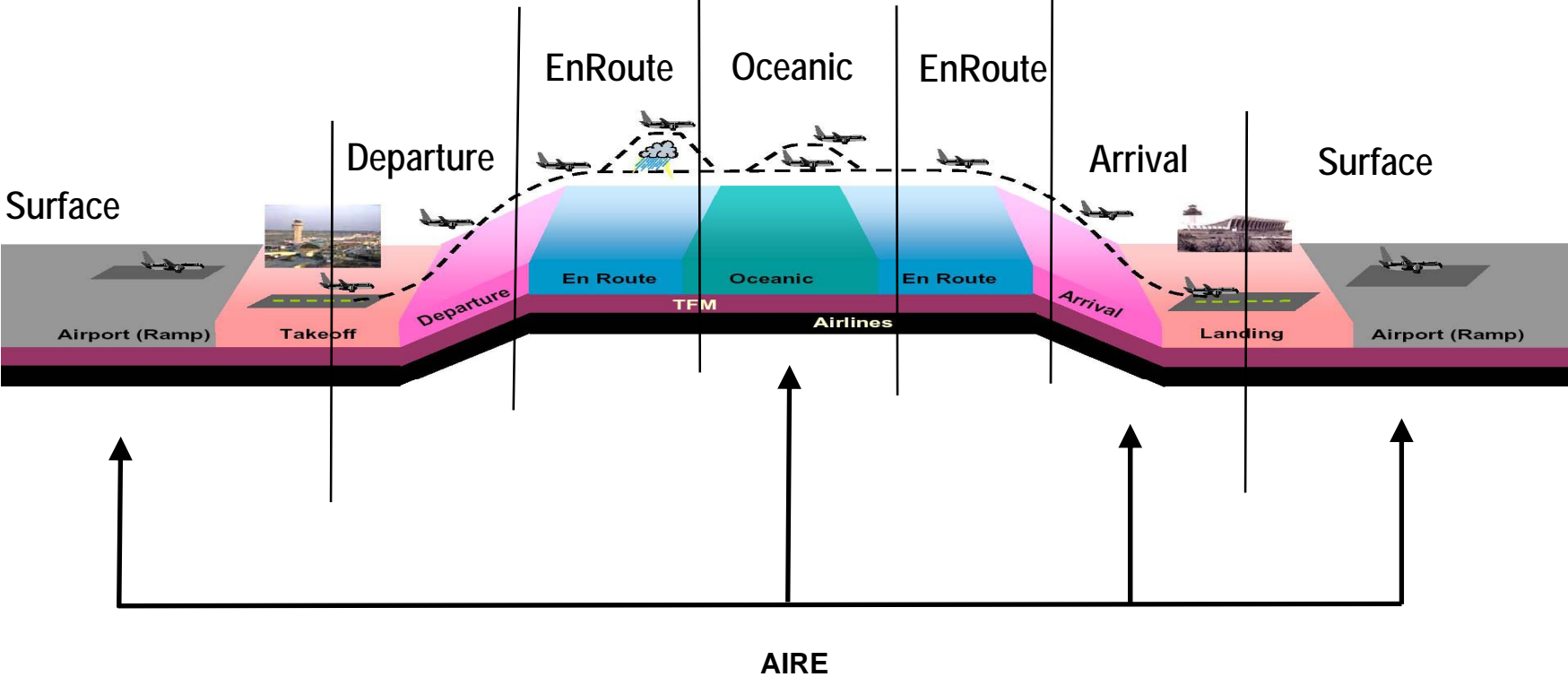


# AIRE Technologies, Metrics, Estimates and Baseline

Domain - Demonstration Technology	Operational Metric (source)	Environmental Metric Fuel Burn, lbs	Fuel Burn Operations Segment Estimate	Baseline
Surface - ASDE-X	Taxi time (per ASDE-X)	Derived using ICAO Engine Performance Data	2%	JFK operations (w/o ASDE-X)
Oceanic - ATOP	Fuel burn calculation (per ATOP)	Derived by ATOP	4%	2004 operations
Arrival - CDA/TA	Flight Trajectories (per ET MS/PDARS)	Derived AEDT	2%	Pre CDA/ Pre TA operations



# AIRE Domains

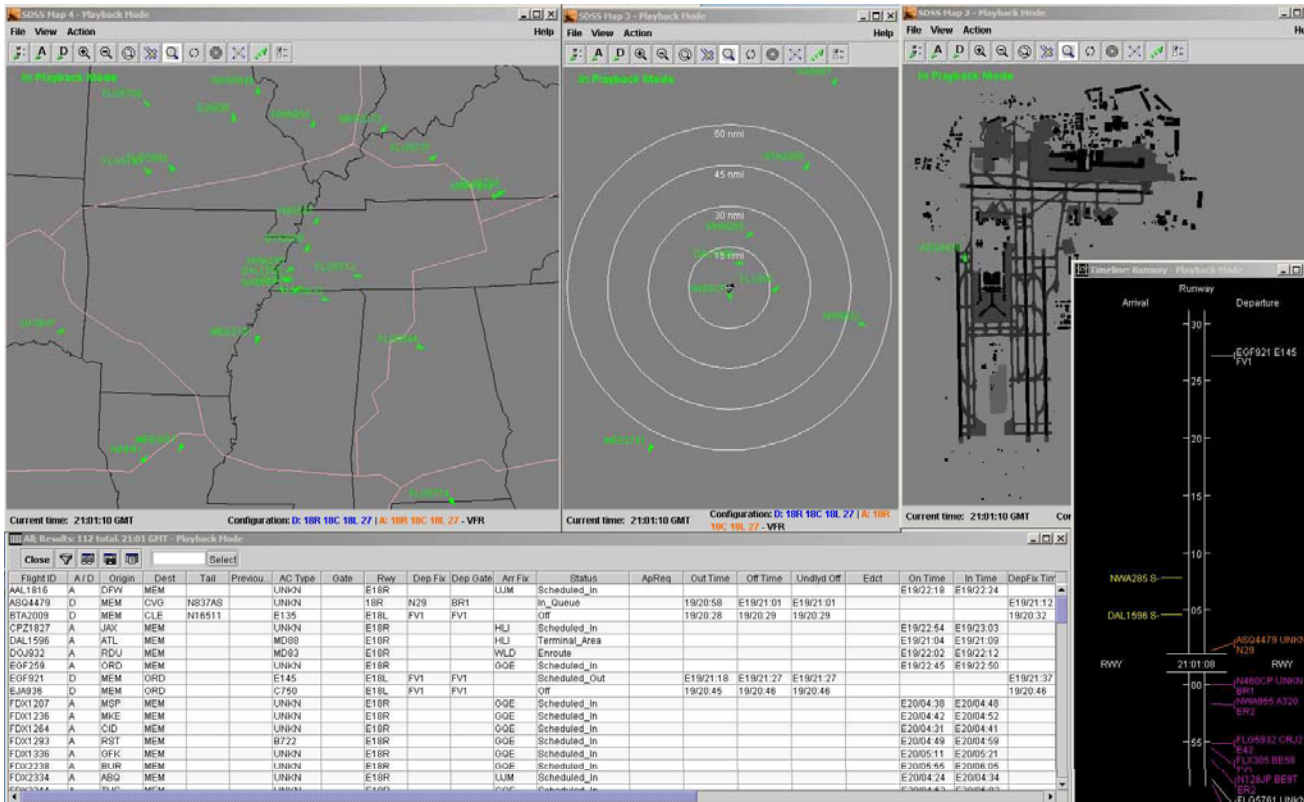


# Surface Domain

- **Surface Traffic Management (STM) provides situational awareness information to and data exchange among airport stakeholders (ATCT, TRACON, ARTCC, ramp towers, and airline operational control centers).**
- **STM displays aircraft surveillance and flight plan information, and generates predictions to provide decision support to the user.**
- **Collaborative STM is a critical first step toward trajectory-based operations (TBO) on the airport surface.**



# Surface Domain



- Shared Situational Awareness
- Data Sharing / Collaboration
- Decision Support Tools
- Greater Capacity
- Lower Emissions



# Surface Domain Plans

- **Memphis Airport Test Bed**
  - Installation Complete 11/09
  - Surface Conformance Monitoring Simulation 11/09
  - Collaborative Departure Queue Management Demonstration FY 2010
- **Orlando Airport Test Bed**
  - Installation Complete FY 2010



# Oceanic Domain

- **Analyze AIRE demonstration performance metrics and establish baseline to measure fuel consumption and emissions for current transatlantic flights in order to demonstrate fuel savings and emissions reductions**
- **Investigate the use of existing oceanic systems and oceanic trajectory optimization tools to improve fuel savings and reduce emissions**
- **Validate new procedures and tools in a controlled environment**
- **Expand AIRE demonstration activities and partnerships with airlines, other government agencies and industry partners**



# AIRE – Oceanic Preliminary Demonstration

1 Aircraft on a Pre-Optimization Flight profile

2 Using latest conditions, AOC recalculates profile and sends new profile to Oceanic Coordinator

3 Oceanic Coordinator trial probes improved trajectory

4a Profile Available: Coordinator sends new profile to ATC for clearance

4b Profile Not Available: Coordinator trial probes alternatives (Speed, Altitude, Route)

5 Alternative profile sent to AOC Flight Operations for assessment

6 If alternative profile is acceptable to AOC, it is sent to ATC for clearance

Optimization Sequence

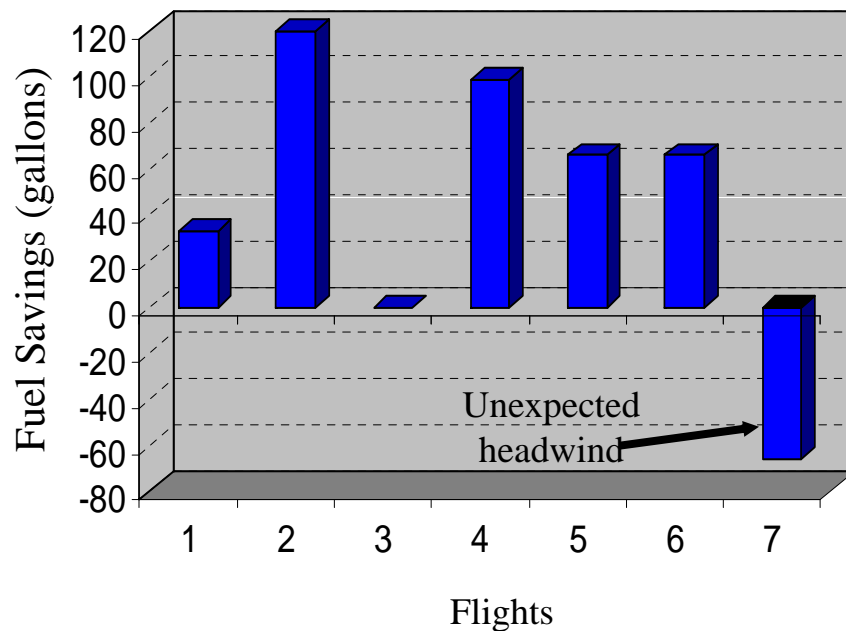
Coordination and Clearance Sequence



Sequences repeat at every 10 degrees of longitude



# AIRE-Oceanic Demonstration Results



Demonstration Dates:  
*May 19, 20, 26, and 27, 2008*

- **Total 6,946 lbs of CO<sub>2</sub> with 7 flights (up to 1% fuel saved). This equates to:**

- CO<sub>2</sub> emissions from 330 gallons (6.8 barrels) of oil consumed
- CO<sub>2</sub> emissions avoided by recycling 1.0 ton of waste instead of sending to landfill
- Carbon sequestered by 75 trees seedlings grown for 10 years

# Arrival Domain

- **Optimized Profile Descent (OPD)**
  - Continuous Descent Arrivals (CDA)
- **Tailored Arrivals (TA)**



# AIRE Arrivals Management

## Benefits:

Noise significantly decreased (near idle descent)

Emissions reduction anticipated

Flight duration reduced

Reduced VHF voice communication

Overall efficiency and predictability of flight path improved

## Continuous Descent Arrivals – CDAs

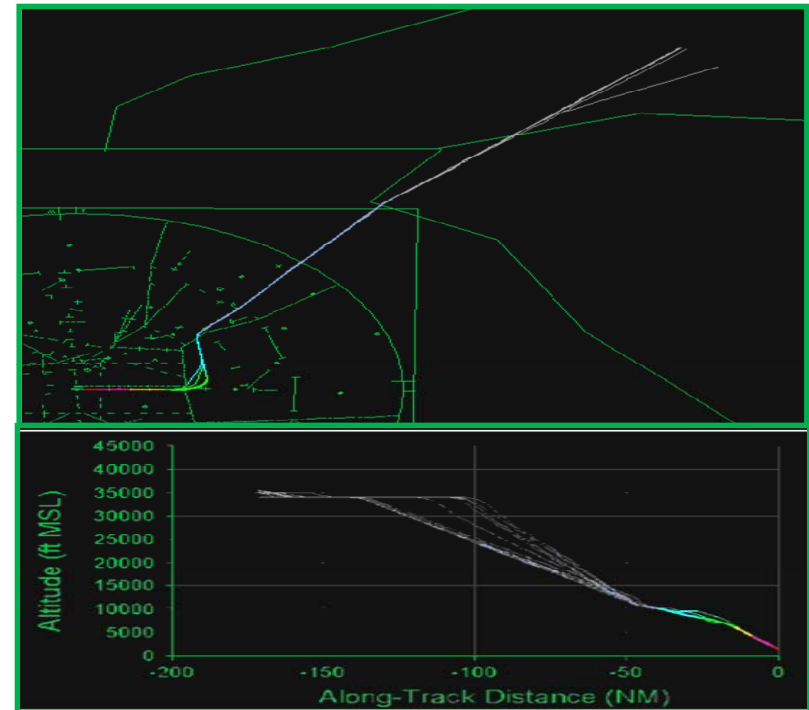
- Atlanta
- Miami
- Charleston

## Tailored Arrivals - TAs

- San Francisco
- Miami

# Optimized Profile Descent

- Procedure characterized by operations that descend continuously at or near idle power settings
- Reduced noise and emissions compared to standard step-down arrival techniques
- Published OPD procedures facilitate use cockpit based techniques by the pilot, allowing a Flight Management System (FMS) to efficiently manage the vertical and speed profiles of the aircraft.



# Optimized Profile Descent

## Key Features:

- **RNAV STAR**
  - Fixed lateral path
- **Optimized Vertical Profile**
  - Minimize level segments
  - Idle descent
  - Uses existing descend via phraseology
- **Benefits**
  - Uses FMS capabilities to manage energy
  - Reduces pilot/controller communications
  - Fuel savings
  - Reduced noise
  - Reduced emissions



# OPD Achievements

- **Significant fuel and emission reductions observed during demonstrations in May 2008**
- **ATL, 38 gallons of fuel and 360 kg CO<sub>2</sub> per flight**
  - 350 baseline flights, 11 OPD flights
- **MIA, 50 gallons of fuel and 480 kg CO<sub>2</sub> per flight**
  - 235 baseline flights, 10 OPD flights



# OPD Achievements

- **AIRE post-demonstration benefits analysis report delivered Sep 2008**
- **Atlanta Human-in-the-Loop (HITL) simulation final report delivered Nov 2008**
- **OPD site prioritization analysis delivered Feb 2009**
- **Atlanta OPD procedures submitted for Feb 2010 publication**



# OPD FY 2009 Plans

- **Conduct OPD demonstrations at CHS**
- **Measure potential CDA fuel and emissions benefits**
- **Strike balance between increased efficiency and airspace constraints**
- **Assess environmental improvements and operational impacts during daytime, “normal business” hours**
- **Begin NAS-wide OPD implementations**



# Tailored Arrivals (TA)

- Tailored Arrivals are a comprehensive method of planning, communicating, and flying highly efficient arrival trajectories from cruise altitude to the runway threshold.
- ATC ground automation “tailors” an adaptable trajectory solution to provide a fuel-efficient, low-noise descent profile while complying with arrival sequencing requirements and other airspace constraints.
- Tailored Arrivals represents a specific application of one of the Next Generation Air Traffic System (NextGen) key concepts of utilizing 4D trajectories to efficiently manage aircraft.
- The TA project is focused on the use of Integrated FANS/ATN equipped aircraft.



# Tailored Arrival Accomplishments

- **Since December 2007, >1500 SFO TAs flown with 30% full TAs.**
- **Completed 6 TAs (4-full, 2 partial) at MIA Sept. 08**
- **Successfully corrected critical ATOP software issues and expect resumption of in-service MIA TAs in June 2009**



# Tailored Arrival Plans

- **Preparing to restart in-service MIA TAs integrated with optimized oceanic procedures**
- **Preparing for the June G2G Green Flight Demonstrations CDG to MIA.**
- **LAX Profile development underway. TA flights expected to start in mid-summer 2009**



# AIRE Gate-to-Gate (G2G) Green Flight Demonstration

3. Continuous Climb

7. Tailored arrival

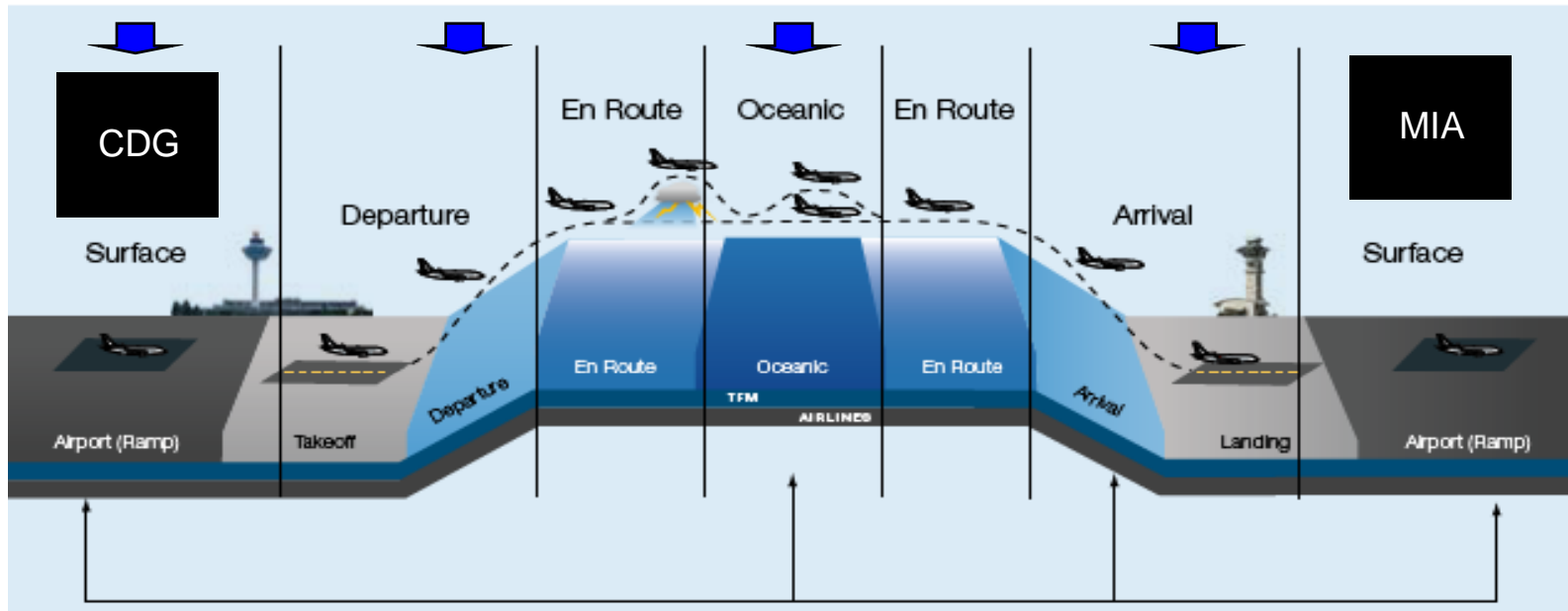
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Partners



1. Dep. Taxi time Reduction

2. Dep. Taxiing 1 or 2 engines off

4. Lateral Dynamic Optimization

5. Cruise Climb

6. Block of Mach

8. Arrival Taxi time Reduction

Atlantic Interoperability Initiative to Reduce Emissions (AIRE)

AIRE – Coordination aspects of exceptional G2G AIRE demonstration  
May 15, 2009



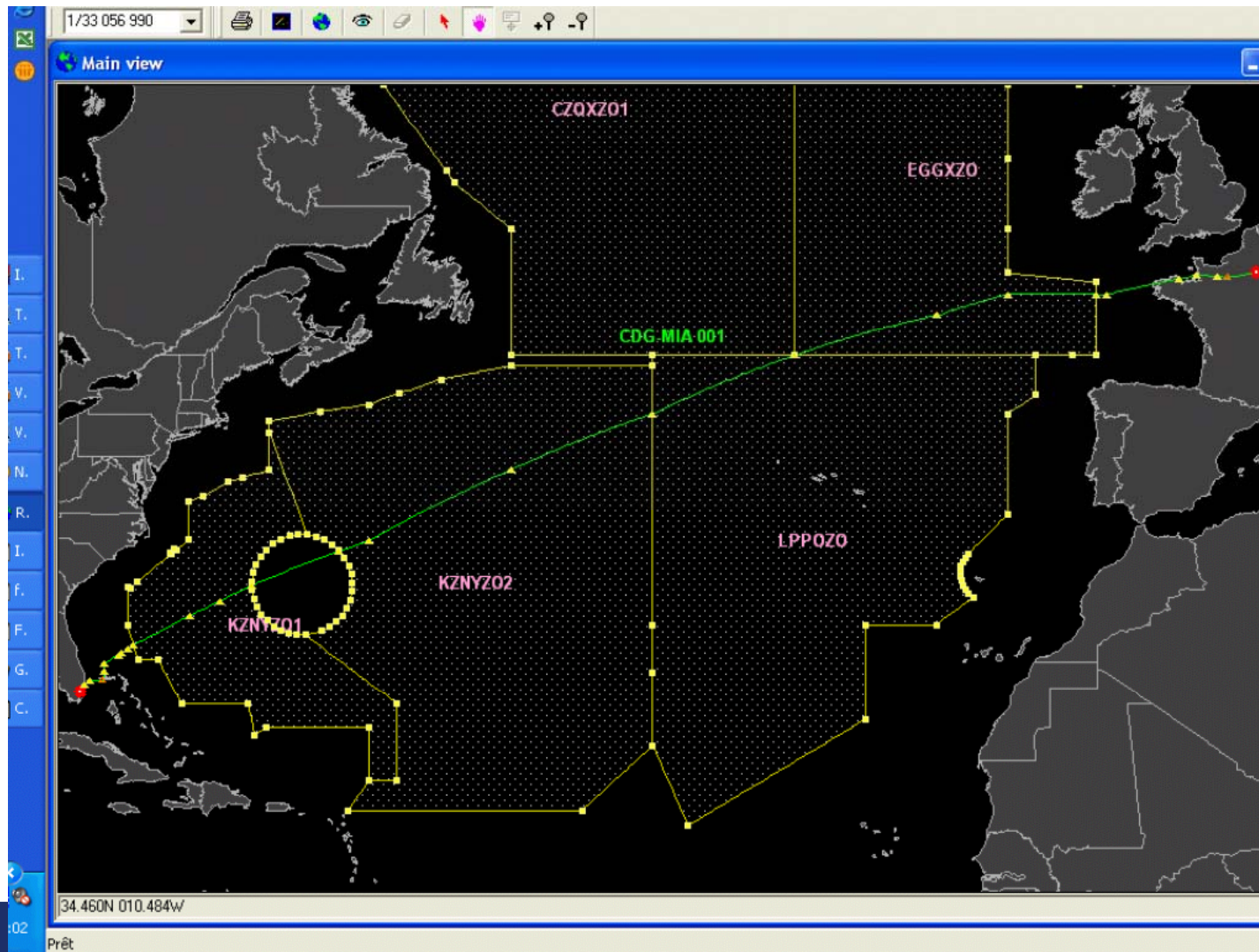
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# G2G Green Flight Demonstration



# AIRE Program Plans

- **2008**
  - Demonstrate achievable environmental benefits
- **2009**
  - Advance partnership
  - Accelerate international cooperation (Conduct joint interoperability demos)
- **2010**
  - Gate-to-gate transition
  - Address all phases of flight
- **Long-Term**
  - Definition of business case
  - Transition modules / segments to implementation



# Program Summary

**Metrics will be collected for each demonstration to validate fuel burn and emissions savings**

- **Oceanic:**

- Proof of concept demonstration within the overall Oceanic Trajectory Based Operations development program of Oceanic Trajectory Management 4D (OTM-4D)

- **Arrivals:**

- Vertical profile optimization for CDAs in ATL, MIA, CHS
- Initial implementation of Tailored Arrival capability at MIA

- **Surface:**

- Establish a fully-collaborative surface test bed at MEM and MCO to support NextGen/ AIRE objectives

