



SESAR Joint Undertaking - Project AIRE Flight Trials for Trajectory Optimization in Oceanic Airspaces

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Introduction

- SESAR (Single European Skies ATM Research) is the European air traffic control infrastructure modernization program
- SESAR Joint Undertaking (JU) was established in 2007 to manage the SESAR development phase. Responsible for coordinating and concentrating all SESAR program R&D
- SESAR JU has contracted NAV Portugal, TAP Portugal, Air France and Adacel to conduct proof of concept trials to reduce CO2 emissions through the optimization of aircraft trajectories in oceanic airspaces



Introduction

- Trials are called Project NATCLM for: “NorthATlanticcruiseClimbLateraldeviationMach number”
- NAV Portugal uses Adacel’s Aurora ATM system to control traffic in the Santa Maria (Azores, Portugal) Flight Information Region from where the trials are being coordinated
- Part of the FAA – European Atlantic Interoperability Initiative to Reduce Emissions (AIRE)
- Presentation will provide an overview of SESAR JU, AIRE and these specific trials which are part of an extensive set of trials being supported by the SESAR JU in 2009

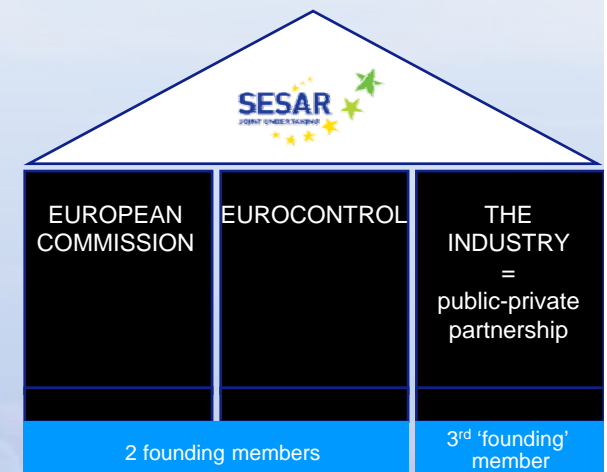
SESAR Background – European Challenges:

- **Capacity:**
Air Traffic to double by 2030
- **Safety:**
Improvements linked to growth
- **Environment:**
Growth must be “green”
- **Economics:**
Incentives & liberalization
- **Operations:**
Eliminate fragmentation
- **Technology:**
All above & interoperability



Who is the SESAR Joint Undertaking?

- Public - Private Partnership
- Budget of €2.1 billion
- Responsibilities:
 - to ensure the modernisation of the European air traffic management system,
 - to execute the Air Traffic Management Master Plan,
 - to coordinate and to concentrate all relevant research and development efforts,
 - to ensure the involvement of all stakeholders of ATM sector
 - To manage “green programmes”



Accelerating the pace of change: AIRE



Accelerating the pace of change: AIRE

- Atlantic Interoperability Initiative to Reduce Emissions = agreement between the European Commission and the US FAA
- To improve energy efficiency, lower engine emissions and aircraft noise
- To accelerate implementation of environmentally friendly procedures for all phases of flight
- To perform trials in real conditions
- Example of environmental validation activity focusing on “quick wins” and strengthening cooperation within Europe and with the FAA



3 Main Benefits of AIRE

- Enhancing the ATM system presents the potential to reduce CO² emissions by up to 10%
- Enhancing the ATM system will yield other environmental upsides such as reduced noise
- Focusing on environmental effectiveness will result in enhancing the general service level of air transportation for passengers

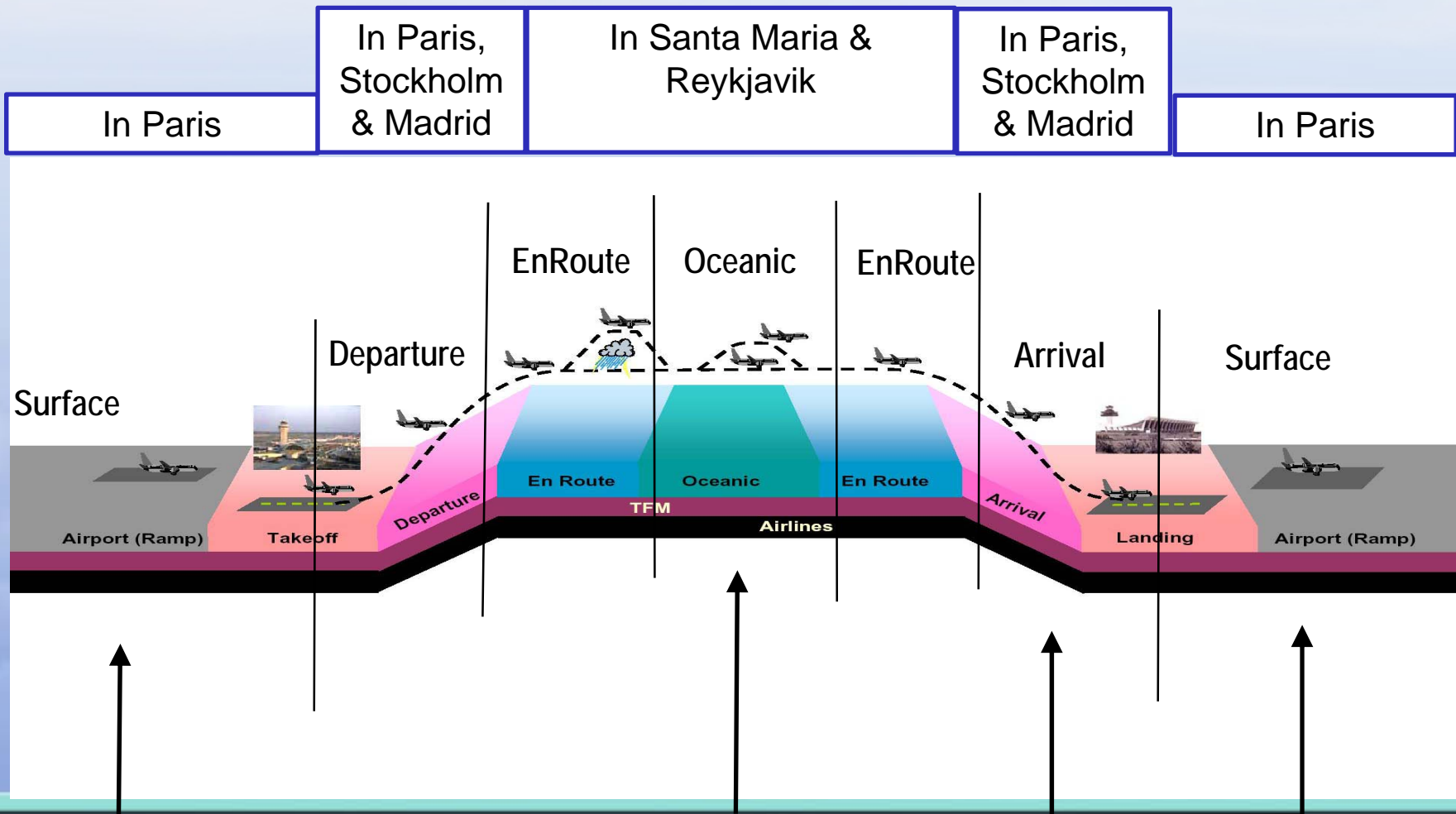


SESAR JU partners for AIRE

- 17 airlines, airports, air navigation service providers and manufacturers to test low-CO2-emission flight procedures in real conditions
- More than one hundred trials will be performed in 2009
- Partners:
- **Airbus, Air France, DSN, Aéroports de Paris, Thales,**
- **ADACEL, AVTECH, Egis Avia, Nav Portugal, TAP Portugal,**
- **Isavia, Icelandair, AENA, INECO, Iberia, LFV and Novair.**
- A growing family



2009 SESAR JU AIRE Domains



Project AIRE Oceanic Trials

Increasing traffic flows between Europe and North America =

inefficient fuel consumption
fewer accepted pilot requests
airline schedule disruptions

**Trials for “green” Oceanic procedures and techniques
(speed, horizontal and lateral flight profile optimization)**

**Partners: Santa Maria FIR: Nav Portugal, TAP Portugal, Air France
and ADACEL**

Reykjavik FIR: Isavia and Icelandair



AIRE Domains – Oceanic Benefits

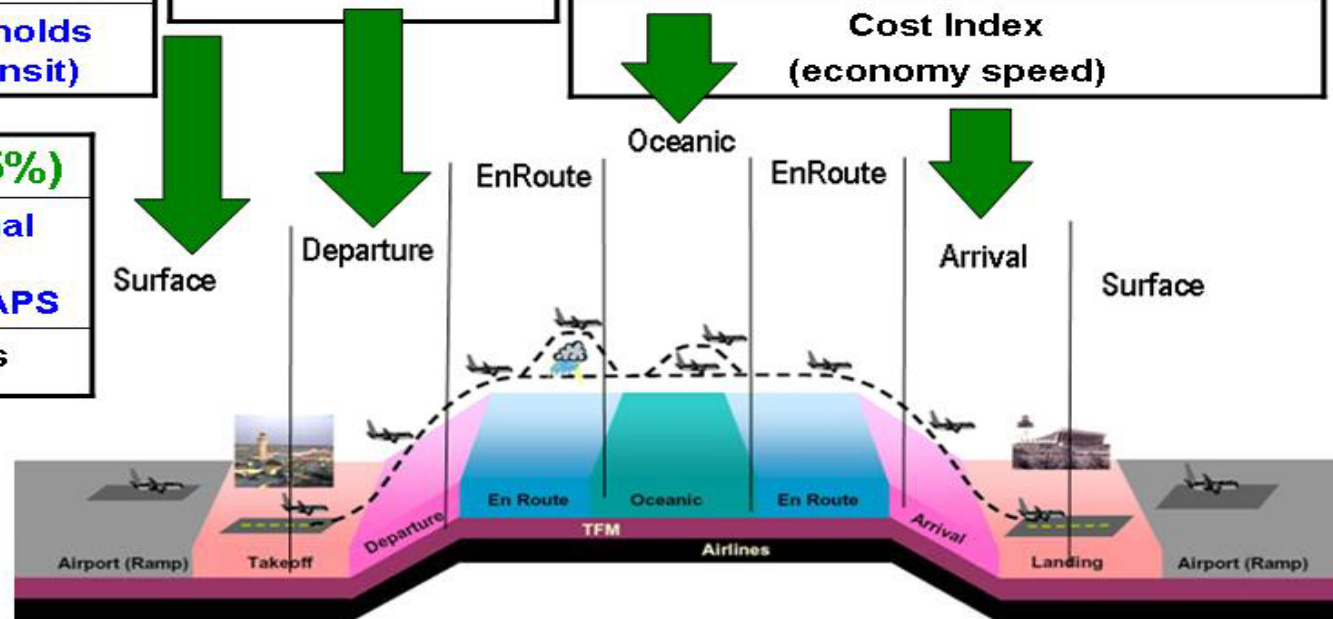
Efficiency Mechanisms

| |
|--|
| SURFACE (12%) |
| Min APU use or alt clean power |
| “just in time” refueling |
| Min taxi time & holds (continuous transit) |

| |
|----------------------------|
| DEPARTURE (3%) |
| use of Maximum climb power |

| |
|---|
| OCEANIC (60%) |
| use of UPR-User Preferred Routes—updated winds |
| Use of DARP - Dynamic Airborne Reroute Procedure - shorten path |
| operate at optimum altitude/ft level |
| Cost Index (economy speed) |

| |
|--|
| ARRIVAL (25%) |
| Request optimal vertical – CDA/OPD/TA/TAPS |
| Delayed flaps |



Project NATCLM Description

- An integrated proof of concept evaluation to assess the potential to reduce CO² emissions in these areas:
 - Cruise Climb (Vertical) – unrestricted climb profile
 - Lateral (horizontal) – dynamic optimization of route
 - longitudinal (time, cost index) – optimal speed
- Ultimate Objectives:
 - Optimization of future en route Oceanic system
 - Removal of present system constraints (lateral, longitudinal and vertical) that prevent aircraft from flying courses that maximize fuel efficiency and consequently minimize CO² emissions.

Project NATCLM Description

- The introduction of these trajectory operational enhancements is fundamental to achieving the full expected benefits of reduced separation (lateral, longitudinal)
- Validate areas where operational procedural changes, including system changes (air/ground) are required so that global, extended benefits can be obtained
- Demonstrate how to implement operational solutions, in the air and on the ground will cater to the goals of AIRE

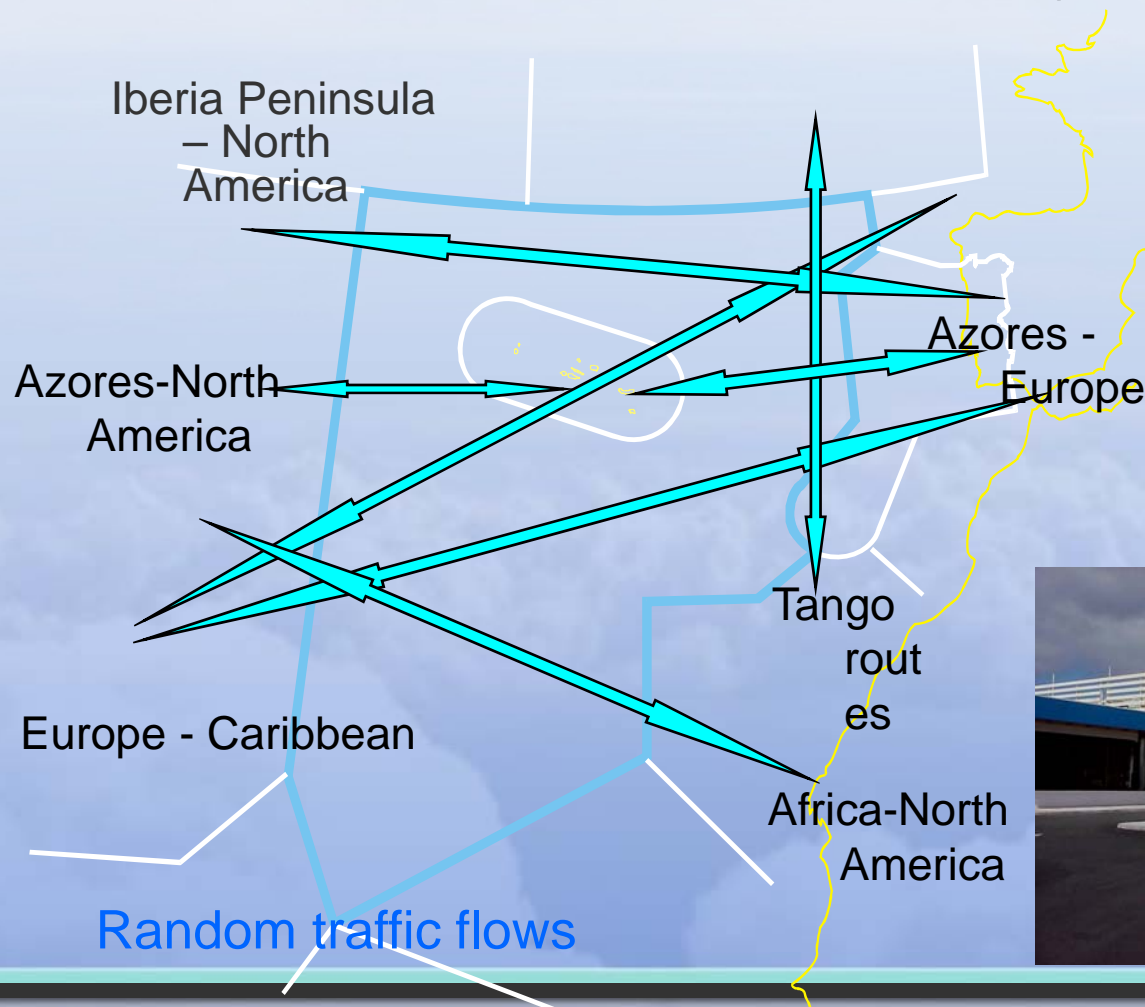
Project NATCLM – Participating Flights

- Two types of Air France flights will participate in the flight demonstrations:
 - (1) Flights from Paris-ORY to French West Indies cruising over Santa Maria and New York Oceanic airspace. Focus on B777 aircraft type with Point a Pitre, Fort de France and Cayenne as destinations
 - (2) Flights from Paris-CDG to Central and South America cruising over Santa Maria and New York Oceanic airspace. Focus on B747 aircraft type with Havana, Santo Domingo and Caracas as destinations
- TAP Portugal is participating in the trials with A330 and A340 fleets of aircraft in flights to and from Lisbon and Oporto Stations, to and from North, Central and South America.
- All the aircraft involved in the trials are FANS1/A equipped.



Project NATCLM

The demonstration flights are being coordinated from the Santa Maria OACC, located in the Azores Islands in the NAT Region



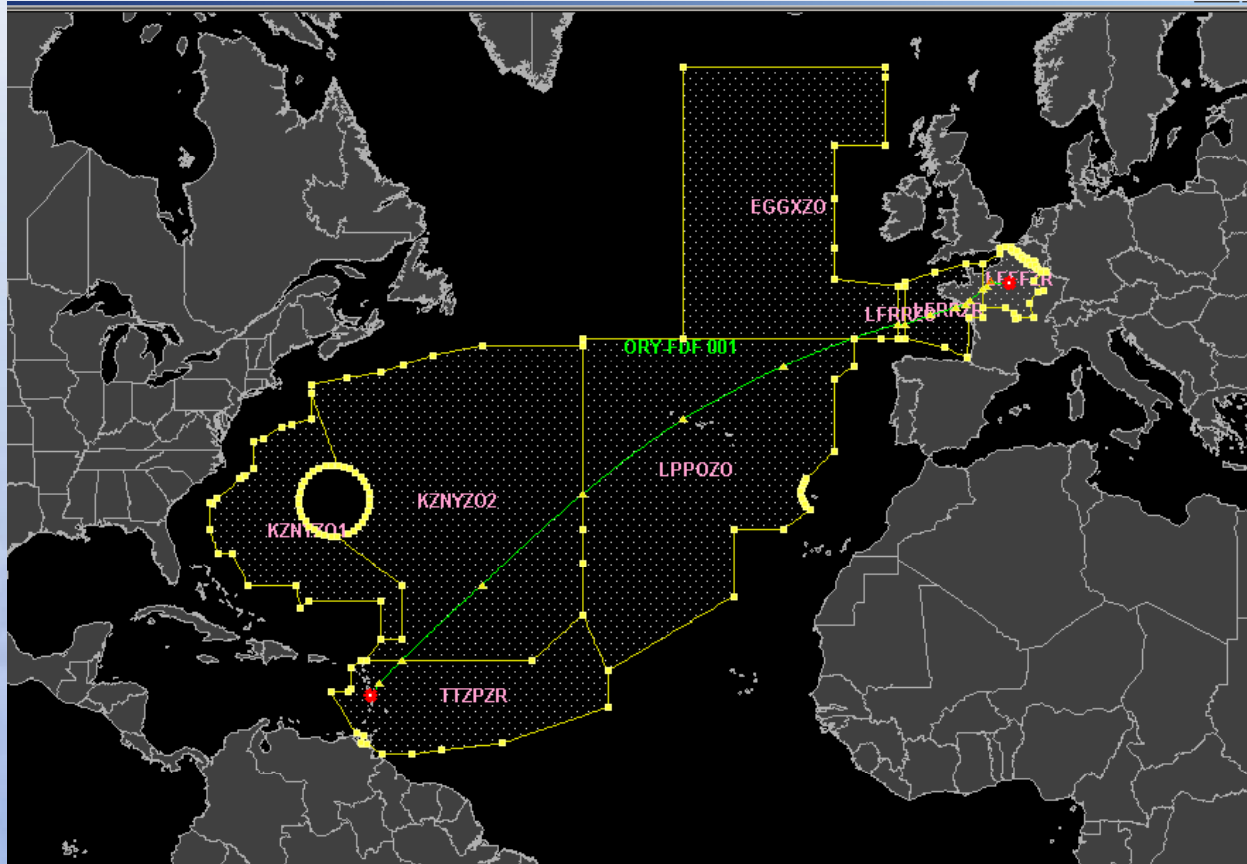
Santa Maria ACC – Adacel Aurora ATM Automation



- Air Traffic Situation Display - Extrapolated and radar targets, FMC and ADS-C WPR
- Automated Conflict Detection - Trajectory Based
- Electronic Flight Strips
- CPDLC
- AIDC
- Advanced Conformance monitoring, etc.

Project NATCLM

Santa Maria/New York Centers Support Trials



Santa Maria – New York Coordination for Trials



- Adjacent New York center uses the FAA's ATOP/Ocean 21 System
- Adacel's Aurora software provides the oceanic ATM automation capabilities
- High degree of cooperation between Santa Maria and New York Center

Project NATCLM Trials to Date

Trans-Atlantic flight demos

7 Air France flight trials performed

- **Dates:** February 2009 - 18 to 20 and 25 to 26
- **Optimizations:** Cruise Climb and Mach number/Cost Index -trans-Atlantic flight demos
- **Routes:** Paris (Orly) – Caribbean (Fort-de-France & Point-a-Pitre)
- **Aircraft:** Boeing 777
- **Objectives:** Assess impact of “Cruise Climb” and “Cost Index Cruise” on ATM procedures/systems and on pilot procedures and on board systems
- 100ft step size for cruise climbs

General Findings

- The test procedures were clear and were validated by the trials
- The cooperation between the partners was excellent
- The fuel savings due to the cruise climb are not huge but perceptible
- The flight transfer in climb and cost index mode between SMA ACC and the NY ACC was handled without pilots intervention
- The previously defined work-a-rounds for the systems limitations (air / ground) have performed well

Preliminary Results

- Fuel savings for cruise climb:
 - Estimated 300 ~ 400 kg (SMA and NY ACC)
- Fuel savings estimates if other ACCs are involved:
 - 200 kg if the cruise climb could start at Brest ACC (inc. Shanwick)
 - 100 kg without the 30 minutes “levelling” before entering Piarco ACC
- Flight time:
 - Cruise climb: no impact
 - Mach number/cost index: allows flight time optimization based on the conditions of the day

Major Lessons Learned

- From debriefing sessions and feed-back:
 - Sequence of optimizations: 1st Block of Mach number, 2nd Cruise climb
 - Use of messages: free text should be mostly preformatted
 - “Report ATC” messages should not be armed
- Major systems limitations:
 - Air: Manual cruise climb vs auto pilot function
 - Ground: Messages to implement inter-center transfer
- Advantages to expand to other oceanic ACS
 - The procedures defined by the project should work
 - Increase of savings

Next Steps

Next campaign planned to start in May 2009 with the following improvements:

- cruise climb and mach number/cost index cruise for other fleets and aircraft types;
- Other routes (A330: Lisbon – Caracas and A330/A340: Lisbon/Oporto - Newark)
- including dynamic lateral optimization;
- general use of the offset function



Thank You!

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