SIXTEENTH MEETING ON THE IMPROVEMENT OF AIR TRAFFIC SERVICES OVER THE SOUTH ATLANTIC
(SAT/16)

Recife, Brazil, 4 to 6 May 2011

Agenda Item 1.2: Follow up of the AORRA airspace implementation.

Extension of AORRA Airspace to the North

(Presented by IATA)

Summary

The objective of this paper is to discuss the need to move the north-eastern boundary of the AORRA to a position along the 4N parallel. It also addresses the need for this expansion, advantages and analyzes the possible implications of extending the AORRA boundary.

References
- SAT/14 Report
- SP AFI RAN 2008 Report
- SAT14TF1 Meeting Report

1. Introduction

1.1 Implemented on 21st December 2006, The Atlantic Ocean Random Routing RNAV Area (AORRA) is the volume of airspace from FL290 to FL410 between Africa and South America. It comprises of the Atlántico, Dakar, Comodoro Rivadavia, Ezeiza, Johannesburg Oceanic, parts delegated by Windhoek, Luanda Oceanic and Montevideo FIRs and is limited by a line indicative of the boundary at specific coordinates. The airspace within the AORRA boundary does not consist of airways, permitting aircraft to fly user-preferred routes based on significant weather conditions and benefiting from upper wind patterns.

1.2 The concept of filing and flying 'User-preferred Trajectories' in remote and oceanic airspace, supported by availability of volumes of 'random-route' airspace is not new. Starting in the mid-1960s, Random Route volumes of airspace are now commonly in use in many parts of the world: the N. Atlantic, South Atlantic, Indian Ocean and Pacific. Airlines primarily deploy long-haul and heavy aircraft along these routes, where fuel, CO_2 and time benefits derived from trajectory optimization are in direct proportion to flight length. Due to the remarkable efforts put in by ICAO groups such as the SAT, in the Indian Ocean, the extrapolated benefits from actual data on savings are estimated to be in excess of 2.7 million kilograms of fuel per annum in the Melbourne FIR alone.

1.3 Based on discussions at the SAT/11 and SAT/12 meetings, the AORRA boundaries were established and implemented to maximize airspace efficiency and aligned with the ICAO Global Plan Initiatives (GPI). Initially a limited number of existing waypoints were used for entry and exit to/from the AORRA. Additional points were later added on to provide more flexibility and increase the number of transitions to/from domestic airspace. The routing area was planned to be implemented in four incremental phases in the following order:

- Phase 1 in 2007
- Phase 2 in April 2009
- Phase 3 and 4 in August 2010

The final phases were implemented (appendix A) with the AORRA Random Routing boundary remaining at the Equator where it was from Phase II.

1.4 The minimum navigation requirement for operating within the AORRA is RNP 10 capability. Additionally, a large number of aircraft operating in this airspace are equipped with ADS/CPDLC and SATCOM. Flights must also follow guidelines related to flight plans, airworthiness and operational procedures within the airspace.

2. Background

2.1 IATA's iFLEX program, launched in September 2010, generated a paradigm shift in the way airline-generated Flexible Routings are generated, filed and flown. The iFLEX routings are supported by multiple States/ANSP's along a single city-pair for a truly seamless experience. The underlying enabler is in building the required airspace flexibility within the entire optimization ellipse by a series of waypoints that support point-to-point flight planning. However where a State/ANSP deems that the fixed airway structure is a safety requirement due to CNS deficiencies, a multiple airway structure is developed while expecting the CNS improvements (Appendix B). The success of the iFLEX program is predicated on a seamless flight across the Domestic and Oceanic & Remote domains as also providing the required infrastructure for a smooth transition between these two domains.

2.2 Following a series of 3 iFLEX workshops to support flexible routings between Dubai – Sao Paolo and Atlanta – Johannesburg, several airspace changes resulted. Emirates Airlines and Delta Airlines were lead carriers and all stakeholders worked towards a common goal of building seamless flight trajectories that optimized for upper wind patterns and significant weather avoidance. The airspace changes in the main were:

- Introducing a vast array of new waypoints for routing flexibility in the domestic operating area
- Introducing strategically located AORRA boundary points (called gates)
- Creating transition segments to connect the closest Domestic waypoint/Navaid with the optimal AORRA boundary point (gate)

This strategy thus leverages the highest potential for benefiting from the Random Routes allowed once within the AORRA airspace volume.

2.3 Discussion at subsequent SAT meetings (SAT 14/TF/1 – WP10, SAT 15 – WP03) have continued efforts to improve and maximize the benefits of random route airspace within AORRA. This is possible by extending, albeit marginally, the airspace to the north-eastern portion of AORRA and the airspace abutting the FIR's of Roberts (GLRB), Dakar Terrestrial/Abidjan FIS (GOOO) and Accra (DGAC).

2.4 Based on input from IATA and airlines, focus has been placed on:

- Extending the AORRA boundary, nominally to the 4N parallel
- Providing 13 additional boundary points in addition to the 4 existing points to increase flexibility
- Creating 11 additional transitions to/from the domestic airspace within these 3 FIRs.

3. Proposal for boundary extension

3.1 This paper identifies the potential for further airspace efficiencies due to the radar service and VHF communication currently available. The proposed modifications will result in the following benefits:

- Reduction of carbon footprint due to CO_2 emissions
- Reduced flight times due to optimized trajectories
- Decrease in aircraft fuel consumption
- Improved Surveillance
- Increased fuel efficiency

4. Analysis

4.1 The extension of the northern AORRA boundary from 0 deg latitude to 4 deg latitude (figure 1) is estimated to provide increased environmental benefits. Compared to the other alternatives, this option would extend the AORRA boundary to an optimum distance from the North East continental border in order to benefit from the ground radar and VHF coverage where currently available.

4.2 Table 1 shows savings in flight time and CO_2 emissions using the proposed northern boundary shift to 4 deg latitude. All flight plans were tested with a flight planning software using daily wind patterns and the results were compared with the existing AORRA boundary. As an example, the flight trajectory for the Dakar – Cape Town route is shown in Appendix C, which resulted in the samples of CO_2 savings calculated.

Table 1: Benefits of AORRA boundary extension using different routes*

Route	CO_2 Savings per Flight (kg)
Johannesburg - Atlanta	142
Dubai - Sao Paulo	94.5
Dakar - Cape Town	400

4.3 The extension of the northern AORRA boundary shows positive benefits for all variants of transitioning traffic. The larger random routing airspace will enable flights to fly optimized trajectories, recognizing the opportunity of flying user preferred routes, thereby increasing airspace efficiency.

* Analysis was conducted using March winds on the fwz flight planning software. Savings may vary on a daily/monthly basis.

5. Discussion

5.1 As a result of the proposed extension, the following are envisaged:

- All existing waypoints "within" the new AORRA airspace will be removed, unless otherwise required by air traffic authorities
- Increase in airspace efficiency due to higher number of transitions between domestic and AORRA airspace
- The existing ground-based radar coverage and VHF will support operations till flights transition into random routing airspace
- Increase on AORRA random routing area will increase the range of optimized trajectories

5.2 Individual ANSPs have limited potential to improve long haul fuel efficiencies. However multiple ANSPs working to a common goal have the capacity for dramatic gains. With the deployment of ultra long range aircraft on new city-pairs around the world, it is important that stakeholders collaborate to provide efficiencies in areas and on route orientations where it was never envisaged before. Dakar oceanic, Abidjan FIS, Ghana and Roberts FIR have agreed in principle to the proposed modifications. However, coordination amongst air traffic service providers will be required. Considering this proposal is accepted, each ANSP will need to undertake specific modifications in airspace and coverage area.

5.3 In order to aid discussion regarding the implications on ATM of the new AORRA boundary, the following must be considered:

- New waypoints to be created on the boundary
- New transitions to/from domestic airspace

Waypoints at regular intervals on the AORRA boundary increase the number of possible transitions. For the extension of the boundary to 4N latitude, 13 additional boundary points, 17 in total are estimated to provide the much needed flexibility (Appendix D).

5.5 The number of new transitions proposed above is based on current traffic flows within the region. In the future, emergence of new city-pairs could result in a change in demand and traffic, resulting in some airways not being used. In order to prevent the clutter of too many airways in any FIR, air traffic authorities could implement "ATS Directs", which could also avoid lengthy processes of creating/removing airways in the future.

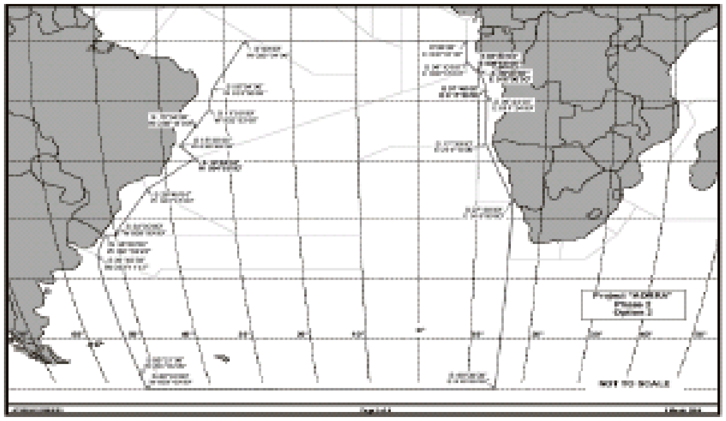
6. Conclusion

6.1 The meeting is invited to:

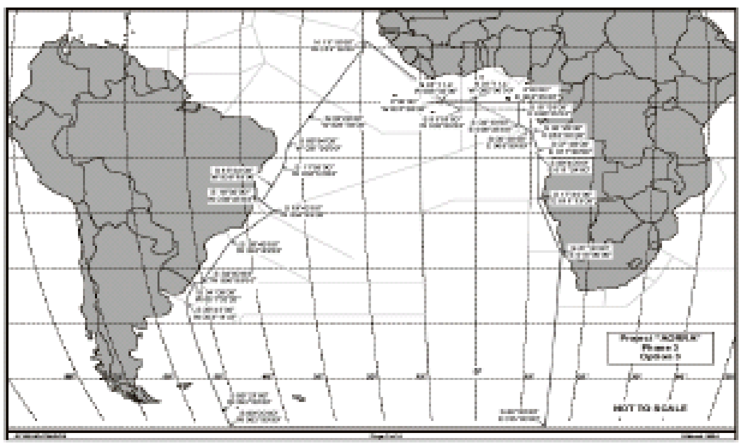
- Note the information contained in this paper
- Recognize the extension of the northern boundary of the AORRA, within the FIRs of GLRB, GOOO and DGAC to the preferred 4 deg latitude position
- Note that the above States/ANSPs suspend all airways within the resultant AORRA airspace in order to allow full random routing operations at a common Airac date
- Note the new transitions connecting the Domestic airspace structure to the AORRA boundary gates
- Establishment of a Task Force including Ghana, ASECNA (Abidjan), Roberts FIR and IATA

Appendix A

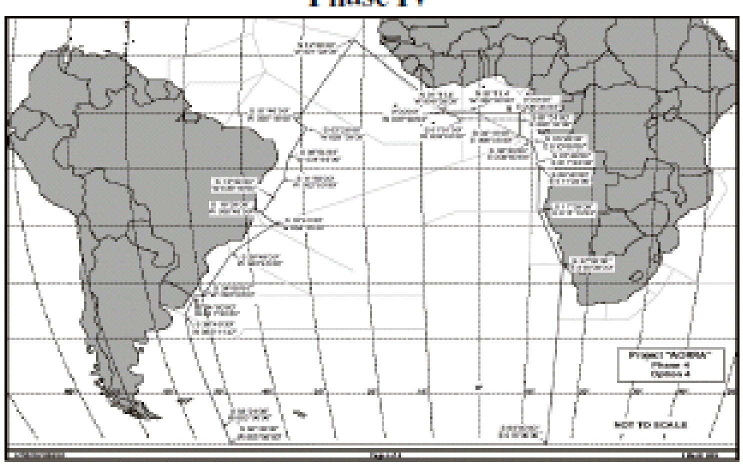
Phase II



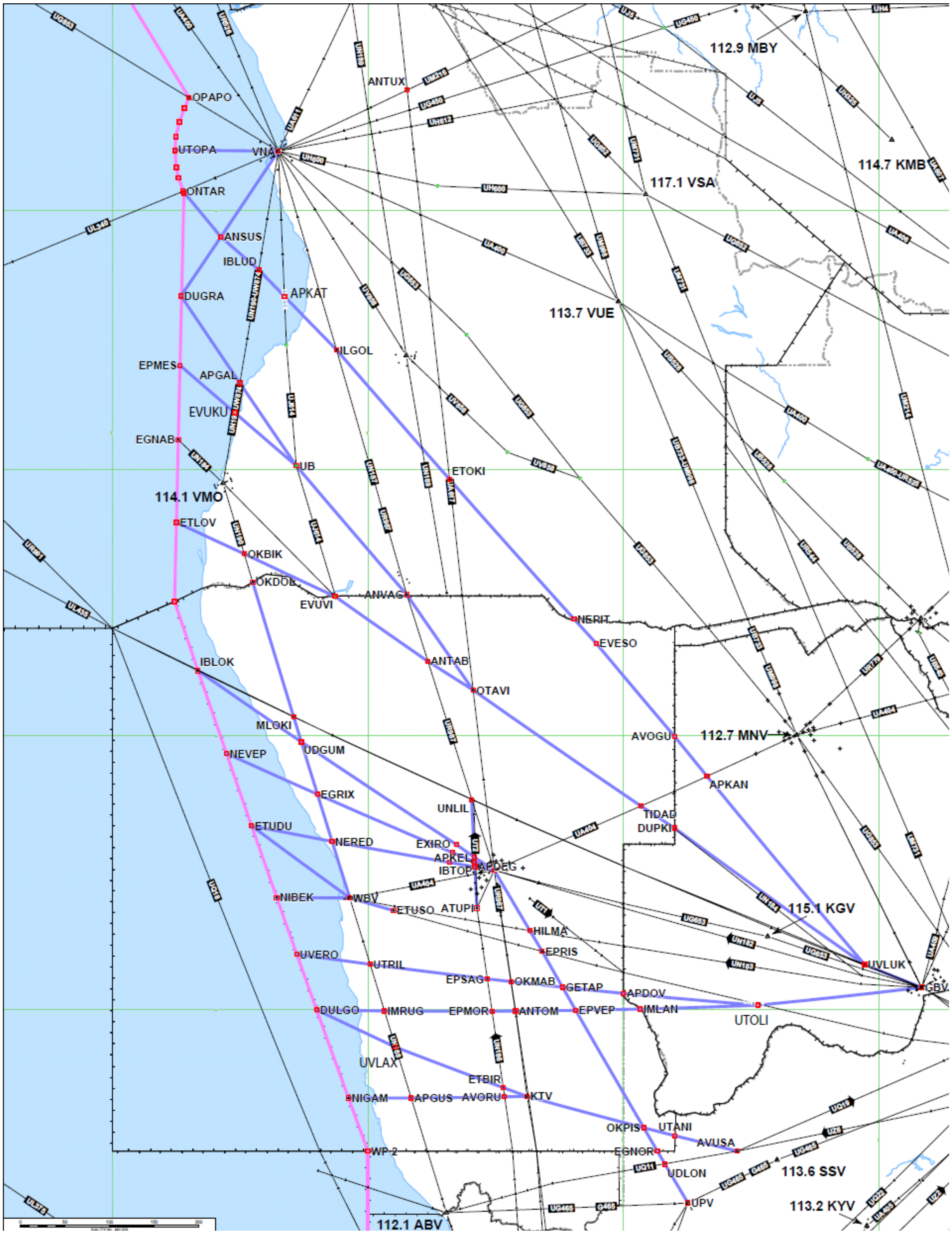
Phase III



Phase IV



Appendix B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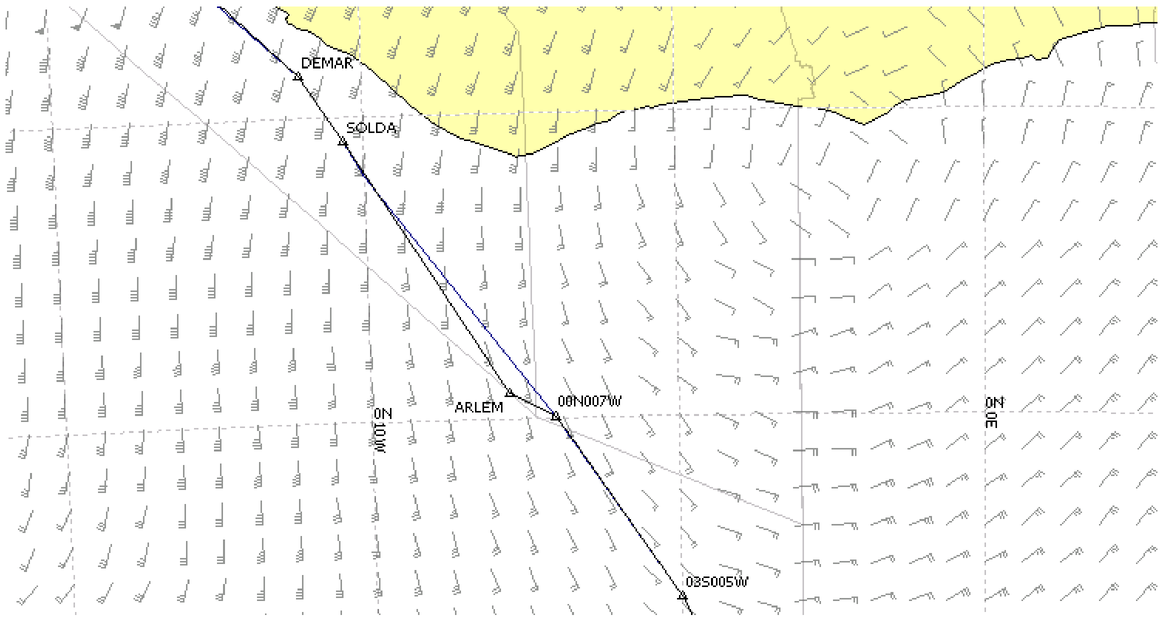
ANTOM
EPVEP
IMLAN
UTOLI
UVLAX
ETBIR
NIGAM
APGUS
AVORU
KTV
OKPIS
UTANI
AVUSA
WP 2
EGNOR
UDLON
113.6 SSV
UPV
113.2 KYV
112.1 ABV

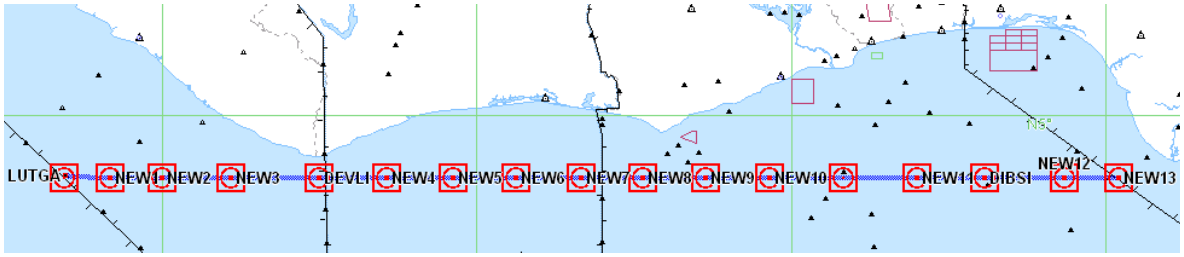
Appendix C

The current AORRA boundary forces the aircraft to waypoint ARLEM following an optimized trajectory within the AORRA airspace. The proposed changes of the boundary to 4 deg latitude will allow for trajectory optimization at an earlier stage (waypoint SOLDA) resulting in the CO_2 savings calculated.



Comparison of flight trajectories using the Dakar – Cape Town city-pair (Courtesy: fwz flight planning)

Appendix D



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