



WORKING PAPER

**SPECIAL AFRICA-INDIAN OCEAN (AFI)
REGIONAL AIR NAVIGATION (RAN) MEETING**

Durban, South Africa, 24 to 29 November 2008

Agenda Item 6: Development of a set of comprehensive work programmes in the air navigation field, aimed at improving efficiency of the air navigation system (Efficiency Committee)

**IMPLEMENTATION OF THE WORLD GEODETIC SYSTEM-1984 (WGS-84)
AND ELECTRONIC TERRAIN AND OBSTACLE DATA (eTOD)**

(Presented by the Secretariat)

SUMMARY

This paper reviews requirements to publish geographical coordinates using the WGS-84 common reference model for international aviation and requirements for the provision of eTOD. The paper proposes actions related to implementation in the region, including the tracking of implementation using requirements established in specific AFI FASID tables. Information on current initiatives underway with respect to global and regional database considerations are also presented.

Action by the meeting is in paragraph 5.

1. INTRODUCTION

1.1 On 23 February 2004, the ICAO Council adopted Amendment 33 to Annex 15 — *Aeronautical Information Services* which included the addition of a new Chapter 10 — Electronic Terrain and Obstacle Data, a new Appendix 8 – Terrain and Obstacle Data Requirements, and a number of amendments to Appendix 1 — Contents of Aeronautical Information Publication (AIP) and Appendix 7 — Aeronautical Data Quality Requirements.

1.2 The applicability dates for Amendment 33 to Annex 15 (paragraph 10.6.1 refers) are as follows:

- a) 20 November 2008 for those parts of the amendment related to the availability of terrain and obstacle data in accordance with Area 1 specifications (entire territory of a State) and for the availability of terrain data in accordance with Area 4 specifications (Category II or III operations area); and
- b) 8 November 2010 for those parts of the amendment related to the availability of terrain and obstacle data in accordance with Area 2 (terminal control area) and Area 3 (aerodrome/heliport area) specifications

1.3 On 28 February 1994, the Council adopted Amendment 28 to Annex 15 which included the specification of World Geodetic System-1984 (WGS-84) as the standard geodetic reference system for international aviation. Shortly thereafter amendments were adopted to Annex 4 — *Aeronautical Charts* and Annex 11 — *Air Traffic Services* which both also included requirements regarding the provision of geographical coordinate information in terms of WGS-84. These requirements became applicable on 1 January 1998.

2. BACKGROUND

2.1 Annex 15 requires States to provide terrain and obstacle data at different precisions for different areas as necessary to accommodate current and planned new air navigation systems or functions. Four coverage areas have been defined for which specific levels of precision are required, with Area 1 requiring the least precision and Area 4 requiring the most, as follows:

- **Area 1** shall cover the entire territory of a State, including aerodromes.
- **Area 2** shall be the terminal control area as published in AIPs, limited to a 45 km radius from the aerodrome reference point. If the terminal control area is not established, Area 2 shall be the area within the 45 km radius from the aerodrome reference point.
- **Area 3** shall cover the area which is within 50 m from the edges of defined aerodrome or heliport surface movement areas.
- **Area 4** shall be restricted only to those runways where precision approach Category 2 or 3 has been established. Area 4 terrain data shall be provided in order to enable operators to assess the effect of terrain on decision height determination by use of radio altimeters.

2.2 The features relevant to air navigation for which WGS-84 coordinates are needed are as follows:

<i>Area/en-route coordinates</i>	<i>Aerodrome/heliport coordinates</i>
ATS/RNAV route points	Aerodrome/heliport reference points
Holding points	Runway, FATO thresholds
En-route radio navigation aids	Terminal radio navigation aids
Restricted/prohibited/danger areas	FAF, FAP and other IAP essential points
Obstacles en route	Runway centreline points
FIR boundaries	Aircraft standpoints
CAT, CTR boundaries	Aerodrome/heliport obstacles
Other significant points	

3. DISCUSSION

3.1 Implementation of eTOD

3.1.1 Significant safety and efficiency benefits for international civil aviation can be provided by in-flight and ground-based applications that rely on quality electronic terrain and obstacle data (eTOD). The performance of these applications, which often make use of multiple data sources, may be degraded by data with inconsistent or inappropriate specifications for quality. The increasing

worldwide equipage of aircraft and air traffic control units with systems that make use of electronic terrain data requires standardization in the provision of supporting eTOD. Furthermore, as terrain information is increasingly finding its primary use in the cockpit, many other personnel involved with operations will benefit from the use of quality terrain and obstacle data. Annex 15, paragraph 10.1 lists the many air navigation applications that are supported by eTOD. It should be noted that, while not a prerequisite, eTOD is of particular importance to facilitate the design and implementation of performance-based navigation (PBN) approach, arrival and departure procedures and to ensure the data quality throughout the procedure design process.

3.1.2 The implementation of eTOD requirements is a challenging process that must be accomplished with a high level commitment, careful planning, sharing of resources and a structured tracking of regional progress. Appendix A lists a series of short- and medium-term tasks which are proposed with a view to facilitating implementation. These tasks are based on experience gained at the AFI Regional Seminar on Electronic Terrain and Obstacle Data held in Casablanca, Morocco from 1 to 3 April 2008. Appendix B provides the structure for an AFI air navigation plan (ANP) facilities and services implementation document (FASID) table which is proposed to be used to provide detail of regional eTOD requirements and as a tool to track implementation.

3.2 Implementation of WGS-84

3.2.1 In the AFI Region, the AFI Planning and Implementation Regional Group (APIRG) has been dealing with WGS-84 implementation. Conclusions were adopted to provide guidelines, and ways and means for States to facilitate implementation of WGS-84. However, some States have not yet completed the provision of all geographical coordinates as indicated in paragraph 2.2 above.

3.2.2 The major difficulties reported by States were:

- a) insufficient finances dedicated by their administration for WGS-84 implementation;
- b) lack of effective coordination between the aeronautical and geodetic departments;
and
- c) no reliable equipment are available to conduct the task.

3.2.3 In this respect, while it is noted that a large part of the work has been completed by most States, considerable work remains and further effort directed at implementation is required. The availability of geographical coordinates in the commonly agreed reference system WGS-84 is critical to the implementation of PBN, without implementation of WGS-84, PBN implementation will be impossible.

3.3 Database considerations and the AFI-CAD project

3.3.1 The production of aeronautical data in electronic format as required for the terrain and obstacle data will become more and more common in the future. Not only will terrain and obstacle data have to be made available in format suitable for computer data exchange, but also most of the other aeronautical information. In this context, the meeting may note two major initiatives in the field of aeronautical information service (AIS) in which ICAO is taking a leading role.

3.3.2 The first initiative is the transition from AIS to aeronautical information management (AIM) that the ICAO Secretariat has undertaken to reinforce future amendments to Annex 15 with the help of the newly created AIS-AIM Study Group.

3.3.3 The second initiative is the study underway for the establishment of an AFI Centralized AIS Database (AFI-CAD) Programme. The framework and guidance material have been

agreed by APIRG Conclusion 16/41 and further work is currently being conducted by the AIS/MAP Task Force in AFI and one of its subgroups.

3.3.4 These two initiatives will require States to provide data in a format suitable for data computer exchange in the future. Therefore, as a first step, it is important that the current agreed requirements on data format and data coverage are being implemented in full.

4. **RECOMMENDATION**

4.1 A structured approach to implementation is required to realize the important safety and efficiency benefits to be derived from the uniform implementation of WGS-84 and eTOD provisions. On this basis, the meeting is invited to adopt the following recommendation to guide the work of APIRG:

Recommendation 6/x — Implementation of WGS-84 and eTOD

That the AFI Planning and Implementation Regional Group (APIRG) adopt the AIM Performance Objective “Implementation of WGS-84 and eTOD” as contained in the performance framework form in Appendix A to this paper as its strategy for implementation.

5. **ACTION BY THE MEETING**

5.1 The meeting is invited to:

- a) note the information in this working paper; and
- b) approve the draft recommendation in paragraph 4.1 above.

— — — — —

APPENDIX A

AIM PERFORMANCE OBJECTIVES

NATIONAL PERFORMANCE OBJECTIVE – IMPLEMENTATION OF WGS-84 AND eTOD				
Benefits				
Environment	• none			
Efficiency	• WGS-84 is a prerequisite for performance-based navigation, benefits described in performance objectives for PBN. • support approach and departure procedure design and implementation • improve aircraft operating limitations analysis • support aeronautical chart production and on-board databases			
Safety	• improve situational awareness • support determination of emergency contingency procedures • support technologies such as ground proximity and minimum safe altitude warning systems • see benefits described in performance objectives for PBN			
Strategy				
Short term (2010)				
Medium term (2011 - 2015)				
ATM OC COMPONENTS	TASKS	TIMEFRAME START-END	RESPONSIBILITY	STATUS
ATM CM	<i>Electronic terrain and obstacle data (eTOD)</i> • share experience and resources in the implementation of eTOD through the establishment of an eTOD working group. • report requirements and monitor implementation status of eTOD using a new AIS Table of the AFI FASID (Ref. Appendix B). • develop a high level policy for the management of a national eTOD programme.	2008-2011	APIRG States	
		2009-ongoing	APIRG States	
		2008-2009	States	
ATM AUO	<i>WGS-84</i> • establish WGS-84 implementation goals in coordination with the national PBN implementation plan. • report requirements and monitor implementation status of WGS-84 using the AIS-5 Table of the AFI FASID and take remedial action if required.	2008-2009	States	
		Ongoing	APIRG States	
Link to GPIs	GPI-5: Performance-based navigation; GPI-9: Situational awareness; GPI-11: RNP and RNAV SIDs and STARs; GPI-18: Aeronautical Information; GPI-20: WGS-84; GPI-21: Navigation systems			

APPENDIX B

PROPOSED FASID TABLE AIS-X — eTOD REQUIREMENTS

EXPLANATION OF THE TABLE

Column

- 1 Name of the State, territory or aerodrome for which electronic terrain and obstacle data (eTOD) are required with the designation of the aerodrome use:
 - RS — international scheduled air transport, regular use
 - RNS — international non-scheduled air transport, regular use
 - RG — international general aviation, regular use
 - AS — international scheduled air transport, alternate use
- 2 Runway designation numbers
- 3 Type of each of the runways to be provided. The types of runways, as defined in Annex 14, Volume 1, Chapter I, are:
 - NINST — non-instrument runway;
 - NPA — non-precision approach runway
 - PA1 — precision approach runway, Category I;
 - PA2 — precision approach runway, Category II;
 - PA3 — precision approach runway, Category III.
- 4 Requirement for the provision of terrain data for Area 1, shown by an “X” against the State or territory to be covered.
- 5 Requirement for the provision of terrain data for Area 2 (TMA), shown by an “X” against the aerodrome to be covered.
- 6 Requirement for the provision of terrain data for Area 2 (45 km radius from the ARP), shown by an “X” against the aerodrome to be covered.
- 7 Requirement for the provision of terrain data for Area 3, shown by an “X” against the aerodrome to be covered.
- 8 Requirement for the provision of terrain data for Area 4, shown by an “X” against the runway threshold to be covered.
- 9 Requirement for the provision of obstacle data for Area 1, shown by an “X” against the State or territory to be covered.
- 10 Requirement for the provision of obstacle data for Area 2 (TMA), shown by an “X” against the aerodrome to be covered.
- 11 Requirement for the provision of obstacle data for Area 2 (45 km radius from the ARP), shown by an “X” against the aerodrome to be covered.

- 12 Requirement for the provision of obstacle data for Area 3, shown by an “X” against the aerodrome to be covered.
- 13 Remarks (timetable for implementation)

Note.— For columns 4 to 12 use the following symbols:

X — Required but not implemented

XI — Required and implemented

STATE, TERRITORY OR AERODROME FOR WHICH eTOD IS REQUIRED			TERRAIN DATA REQUIRED					OBSTACLE DATA REQUIRED				REMARKS
CITY/AERODROME	RWY No	RWY TYPE	Area 1	Area 2		Area 3	Area 4	Area 1	Area 2		Area 3	
				TMA	45 km				TMA	45 km		
			1	2	3	4	5	6	7	8	9	
STATE X			X					X				
(ABCD) City Y/AD Z				X		X			X		X	
RS	11 29	NPA PA1										

— END —