



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) IN SOUTH AFRICA

(Presented by South Africa)

SUMMARY

This information paper presents the implementation status of the World Geodetic System-1984 WGS-84 and electronic terrain and obstacle data (eTOD) in South Africa.

1. INTRODUCTION

1.1 World Geodetic System – 1984 (WGS-84)

1.1.1 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.

1.1.2 World Geodetic System-1984 (WGS-84) was adopted and implemented as the datum for all aeronautical information in South Africa. All new aeronautical information and revisions to existing aeronautical information must be provided in WGS-84. Some legacy data, however still exists in the Clarke 1880 Modified datum.

1.2 Electronic Terrain and Obstacle Data (eTOD)

1.2.1 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*.

1.2.2 A South African eTOD Work Group was established to manage and oversee eTOD implementation in South Africa. Some of the larger aeronautical service providers are currently represented on the South African eTOD Work Group.

1.2.3 The South African eTOD Work Group is currently focusing its work on Area 1 and 4 due to the implementation date of 20 November 2008. Area 2 and 3 will be addressed after the implementation of Area 1 and 4.

2. BACKGROUND

2.1 World Geodetic System – 1984 (WGS-84)

2.1.1 World Geodetic System-1984 (WGS-84) was adopted and implemented as the datum for all aeronautical information. Some existing legacy data, however could still be in the Clarke 1880 Modified datum. The status of aeronautical information is as follows:

Area/En-Route Coordinates	
ATS/RNAV Route Points	Mostly WGS-84, some legacy ATS point data still in Clarke 1880 Modified (legacy data review presently being conducted)
Holding points	WGS-84
En-route Radio Navigation Aids	WGS-84
Restricted/Prohibited/Danger Areas	Mostly WGS-84, some legacy data still in Clarke 1880 Modified (legacy data review presently being conducted)
En-Route Obstacles	Unknown, suspect mostly WGS-84, others in Clarke 1880 Modified (legacy data review presently being conducted)
FIR Boundaries	WGS-84
CAT/CTR Boundaries	Mostly WGS-84, some legacy data still in Clarke 1880 Modified (legacy data review presently being conducted)
Other Significant Points	Unknown, suspect mostly WGS-84, others in Clarke 1880 Modified (legacy data review presently being conducted)

Aerodrome/Heliport Coordinates	
Aerodrome/Heliport Reference Points	Mostly WGS-84, some legacy data still be in Clarke 1880 Modified (legacy data review presently being conducted)
Runway/FATO Thresholds	Mostly WGS-84, some legacy data still be in Clarke 1880 Modified (legacy data review presently being conducted)
Terminal Radio Navigation Aids	Mostly WGS-84, some legacy data still be in Clarke 1880 Modified (legacy data review presently being conducted)
FAF/FAP and other IAP Essential Points	WGS-84
Runway Centreline Points	Mostly WGS-84, some legacy data still be in Clarke 1880 Modified (legacy data review presently being conducted)
Aircraft Stand Points	WGS-84
Aerodrome/Heliport Obstacles	Unknown, suspect mostly WGS-84, others in Clarke 1880 Modified (legacy data review presently being conducted)

3. DISCUSSION

3.1 Current Situation

3.1.1 All new aeronautical information and revisions to existing aeronautical information must be provided in WGS-84.

3.1.2 The majority of aeronautical information is currently maintained in paper-based documents such as the AIP and not contained in a centralized aeronautical database. All aeronautical data is currently being captured in a GIS database as part of the establishment of a centralized aeronautical database. This process is highlighting possible errors in the existing data. The information is verified and corrected before entry into the GIS database where after the aeronautical publications are updated accordingly.

3.2 Electronic Terrain and Obstacle Data (eTOD)

3.2.1 A South African eTOD Work Group was established to manage and oversee the eTOD implementation in South Africa. The objectives of the South African eTOD Work Group is to:

- Develop an understanding of the eTOD requirements.
- Make an inventory of and evaluate the quality of existing (legacy) terrain and obstacle datasets.
- Develop a South African eTOD Programme (including guidance material), taking into consideration the certification and maintenance of data as well as the timelines and specification/delegation of responsibilities.
- Develop a South African eTOD Implementation Plan, including timelines and specification/delegation of responsibilities, in accordance with ICAO Annex 15 and Doc 9881 requirements and the AFI Region eTOD Implementation Strategy.
- Create a theoretical case study for a representative aerodrome in South Africa based on a Cost-Benefit Analysis considering the various data acquisition techniques.
- Promote eTOD awareness and training in South Africa.
- Coordinate the exchange of data between States, ICAO, data originators, integrators, system designers and end users.
- Assist other AFI Region States by the submission of the South African eTOD Implementation Programme and Implementation Plan to the ICAO AFI Regional Office for distribution to the AFI region States for consideration or adoption.
- Assist, where possible, the ICAO AFI Regional Office with the harmonization of eTOD implementation in the AFI region.
- Represent South Africa on the proposed AFI Region eTOD Working Group.

3.2.2 The organisations currently represented on the South African eTOD Work Group are:

- South African Civil Aviation Authority (SA CAA) (Procedure Design and AIS departments)
- Air Traffic & Navigation Service (ATNS) (Procedure Design and Survey departments)
- Airports Company of South Africa (ACSA) (Aviation Compliance & Policy and GIS departments)
- South African Air Force (Procedure Design/AIS section)
- Chief Directorate: Surveys and Mapping (Cartography and GIS departments)
- International Air Transport Association (IATA)
- Private IFR aerodrome license holder (Kruger Mpumalanga International Airport)

3.2.3 The South African Civil Aviation Authority, in an attempt to disperse the eTOD acquisition and maintenance cost, proposed that the data for the respected areas be supplied and maintained by the following organisations:

- Area 1: Area 1 will be the responsibility of the South African Civil Aviation Authority.
- Area 2:
 - o IFR Aerodrome with ATS Service Provider, Area 2 eTOD will be the responsibility of the ATS Service Provider.
 - o IFR Aerodrome without Service Provider, Area 2 eTOD will be the responsibility of the Aerodrome License Holder.

Note: Aerodromes with Cloud-break procedures were not considered as IFR aerodromes.

- Area 3: Area 3 will be the responsibility of the Aerodrome License Holder.
- Area 4: Area 4 will be the responsibility of the Aerodrome License Holder.

3.2.4 Status of Area 1 Electronic Terrain and Obstacle Data: Terrain Data: Shuttle Radar Topography Mission (SRTM) data, available for free from NASA Jet Propulsion Laboratory (JPL) or from the US Geological Survey (USGS), were considered as a possible source of Area 1 Terrain data. The SRTM data were evaluated and considered unsuitable for Area 1 application due to voids in certain mountainous areas, certification and maintenance issues. The terrain data is compliant with Area 1 Data Quality Requirements are commercially available in South Africa at a reasonable cost. These commercially obtainable terrain datasets include the whole of South Africa, Lesotho, Swaziland and a 35km buffer area into Namibia, Botswana, Zimbabwe and Mozambique. Certification and maintenance of the data will be the responsibility of the data originator/integrator. The maintenance of the data will be included in a maintenance agreement with the selected supplier. These data suppliers can also provide 20m contour derived digital terrain models compliant with Area 2 Data Quality Requirements.

3.2.5 Obstacle Data: The Area 1 obstacle database of the South African Civil Aviation Authority consists of 12502 obstacles. 108 obstacles are 100m and above, 325 are 60m and above and the height of 50 obstacles is unknown. Owners of structures higher than 60m were requested to provide information compliant with Area 2 Data Quality Requirements in an attempt to verify and update the existing information contained in the obstacle database. Survey reports must be provided where possible. South African AIC 21.14, listing obstacles (higher than 60m) which are of significance to air navigation, will be amended and updated accordingly. The obstacle data will be augmented with commercially obtainable “clutter data” if required. Digital surface models depicting buildings and structure larger than 9m² are currently available for the larger cities in South Africa and would be available for the whole of South Africa by the end of 2009.

3.2.6 Status of Area 4 Electronic Terrain and Obstacle Data

3.2.6.1 Terrain Data: Terrain data for Area 4 is currently only applicable to Cape Town and OR Tambo International. ACSA is in possession of and maintains the Area 4 compliant terrain data for these two airports.

3.2.6.2 Obstacle Data: ICAO does not currently require obstacle data for Area 4. Obstacle data for Area 4 are available for Cape Town and OR Tambo International and are maintained by ACSA.

4. CONCLUSION

4.1 The World Geodetic System-1984 (WGS-84) was adopted and implemented as the datum for all aeronautical information in South Africa. All new aeronautical information and revisions to existing aeronautical information must be provided in WGS-84. Some legacy data could still be in the Clarke 1880 Modified datum. All existing data is being captured in a centralised aeronautical GIS database. The information is first verified and corrected, and South African aeronautical publications are then updated accordingly.

4.2 A South African eTOD Work Group was established to manage and oversee eTOD implementation in South Africa.

4.3 Area 1 terrain data consisting of a commercially procured digital terrain model which includes the whole of South Africa, Lesotho, Swaziland and a 35km buffer area into Namibia, Botswana, Zimbabwe and Mozambique has been procured. Area 1 obstacle data consisting of obstacles 60m and above has been obtained from the SACAA Obstacle database and updated with survey data obtained from the owners of these structures or is augmented with commercially obtained “clutter data” where possible.

4.4 Area 4 terrain data is available from ACSA for Cape Town and OR Tambo INTL. Area 4 obstacle data is also available for these two airports even though it is not presently an eTOD requirement.

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