



ATS/AIS/SAR/SG/11/WP-22

**INTERNATIONAL CIVIL AVIATION ORGANIZATION
EASTERN AND SOUTHERN AFRICAN OFFICE**

ELEVENTH APIRG ATS/AIS/SAR/SG/11 MEETING

(Nairobi, Kenya 26 - 30 April 2010)

Agenda Item 11: Review of the outcomes of the Third Regional AIM Congress, Fourth AFI-CAD Informal Consultative meeting, First AFI e-TOD Working Group Meeting and the Fifth meeting of the APIRG AIS/MAP TF.

(Presented by the Secretariat)

Summary

This Paper presents the Summary Report of the Third Regional AIM Congress, Fourth AFI-CAD Informal Consultative meeting, First AFI e-TOD Working Group Meeting, and the Fifth Meeting of the AFI AIS/MAP Task Force, pursuant to the implementation of APIRG/16 Conclusions 16/41, 16/42, 16/43, 16/44 respectively, taking into account AFI RAN/8 Meeting Recommendations 6/11 and 6/25 which call for the implementation of WGS-84, e-TOD and the elimination of AIS-MAP deficiencies.

The Sub-Group is required to review and adopt Draft Conclusions emanating from this Paper.

References :

APIRG/16 – Report
AFI/8 RAN Report (Doc.)
AFI-CAD /4 Meeting Report
AFI e-TOD WG/1 Meeting Report
AIS/MAP Task Force/5 – Report of Fifth Meeting (Dakar, 11-12 May 2009)

1. Introduction

1.1 The Fifth meeting of the AFI AIS/MAP Task Force was convened in Dakar, Senegal from 11-12 May 2009 by the International Civil Aviation Organization (ICAO). The main objective of this meeting is to provide guidance to States, in accordance with the requirements of the AFI Air Navigation Plan, for the implementation of the above-mentioned APIRG/16 in Conclusions, AFI RAN/8 Meeting Recommendations and provide efficiency and cost-effectiveness the development of a standardized integrated and automated AFI AIS system in order to provide harmonized quality products and services to users.

2. Review of the Report of the Third Regional Aeronautical Information Management (AIM) Congress.

2.1 The Third Regional AIM Congress organized by the Global AIM Consortium in cooperation with ICAO was hosted by ATNS of South Africa and held in Johannesburg, from 23-25 June 2009.

The main objective of the Congress was to inform and involve the ICAO AFI Region in the evolution of the Concept of AIM and to act as catalyst for change.

2.2 The moderator of the AFI AIM Congress noted the following endorsed Conclusions:

That :

- Institutional issues particularly funding and cost recovery for the transition from AIS to AIM were of prime concern;
- The availability of well trained Human resources were of equal concern;
- Technology was not the issue as it appears to exist;
- Africa needs change, but in reality it is no different to the other ICAO Regions;
- AIM need to be aware of the needs of Future Flight Plan said to be in operation in 2011;
- That all supported the work of the AIS-AIM Study Group, and that expectations are high;

- In Africa implementation of WGS-84 was critical and that discussions on the implementation of e-TOD were meaningless without it.

2.3 The moderator of the AFI AIM Congress noted the following endorsed Recommendations:

That :

- States and other continue to support ICAO in the transition process

- States should explore ways and means of increasing Regional co-operation; and

- Make every effort to sensitize their management to the challenges of transiting to AIM and why it is essential to obtain the necessary understanding, commitment, support and resources;

- That the AIM Community working with the Flight Data processing Community identify how AIM can meet the requirements of the future flight plan implementation;

- Provide strong support to the AIS-AIM Study Group and its Regional members to help progress its work;

- That States of the AFI Region should speed up the complete implementation of WGS-84.

2.4 The Congress noted that the Special AFI RAN/8 Meeting recalled that APIRG and AFI States had been working towards WGS-84 implementation for many years and that a large part of the work had been completed by most States. However, considerable work still remains.

2.5 Additionally, the WGS-84 reference system requires regular updating. The AFI RAN/8 meeting recognized that implementation is now most urgent, as availability of geographical coordinates in the commonly agreed WGS-84 reference system is a prerequisite for States to obtain the benefits of PBN, and also an important step in preparing for the transition from Aeronautical Information Services (AIS) to Aeronautical Information Management (AIM) for which the provision of digital geographic data of appropriate quality will be essential.

2.6 In order to allow for a comprehensive analysis of the status of implementation of WGS-84 throughout the AFI Region, it is important that appropriate background information be provided to substantiate any discrepancy in the current implementation status.

2.7 In order to keep pace on the subject, the Secretariat prepared a regional status report at **Appendix- A** for consideration and review by the APIRG/17 Meeting. On this basis, the meeting adopted the following Draft Conclusions to guide the work of APIRG.

Draft Conclusion xx- SIP Project for complete WGS-84 Implementation in the AFI Region.

That APIRG:

Take necessary action to initiate an SIP for the total and complete implementation of WGS-84 within AFI States having difficulties to complete WGS-84 implementation.

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3. Review of the Report of the Fourth Consultative Meeting of the AFI Region Study Group on the Establishment of a Centralized AFI Region AIS Data base (AFI-CAD/Study Group/3)

3.1 The Fourth consultative meeting of the AFI Regional Study Group on the Establishment of a Centralized AFI Region AIS Data Base (AFI – CAD) held in Johannesburg, South Africa, 26 June 2009. The main objective of this Informal consultative meeting was for States and Stakeholders to provide inputs to assist the ICAO Designated Consultant in the consolidation of the draft AFI-CAD Business Plan.

3.2 The meeting noted the adoption of the framework and guidance material for the AFI-CAD by the APIRG 16th meeting (APIRG Conc.16/41 refers), the main objective of this informal consultative meeting was for States and Stakeholders to provide inputs to assist the ICAO designated consultant in the consolidation of the draft Business Plan. However, the meeting revised the AFI-CAD Guidance material in order to include new additional Recommendations endorsed by the Study Group (*Recommendations 11 to 22 of Appendix-B refers.*)

3.3 The meeting also noted that the rough timeline for the implementation of the AFI-CAD Project covers about the next four years 2009 to 2014 until the first Centre /Area could move into operational use. The figure under **Appendix –C** gives an overview. The meeting noted that the timeline culminates with the implementation of phase 2 of the Roadmap of the transition from AIS to AIM on migration to digital databases which calls for establishment of database driven processes for the production of the current products in all States.

3.4 The Study Group in collaboration with the designated ICAO Consultant are expected to submit the results of the project which is the final AFI-CAD Business Plan to the APIRG/17 Meeting for consideration and endorsement.

4. Review of the Report of the First Meeting of the AFI Region Electronic Terrain and Obstacle Data Working Group (AFI e-TOD WG/1)

4.1 The meeting noted that to cope with the new technologies and expanding operational needs, the provision of Aeronautical Information Services (AIS) had to move from a provider of traditional services in hard copy (AIP, NOTAM, etc) to a more dynamic service making quality assured and timely information available to users in a digital format. In this regard, the meeting recalled that Amendment 33 to Annex 15 introduced new requirements for the provision of electronic Terrain and Obstacle Data (eTOD). The meeting noted that South Africa has already developed its e-TOD implementation plan in compliance with ICAO provisions contained in Annex 15, as amended, and Document 9881. This plan will be managed by the SACAA as a national program supported by necessary resources, a high level framework and detailed planning, including priorities and timelines for the implementation of the program. The meeting also noted that a South African e-TOD Implementation Workgroup has been established, consisting of stakeholders in the South African Aviation Community, to manage and oversee the e-TOD implementation in South Africa.

4.2 The meeting noted the advantages associated with e-TOD confirming that all of them are safety-related and highlighted that the AFI e-TOD Working Group was established with the main objective to assist and guide States for a harmonized, timely and cost-effective implementation of eTOD.

Implementation of e-TOD and the draft development of a policy for the management of national e-TOD programmes by States in the AFI Region.

4.3 The meeting noted that 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.

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Area 2 shall be the terminal control area as published in AIPs, limited to a 45KM radius from the aerodrome reference point. If the terminal control area is not established, Area 2 shall be the area within the 45KM radius from the aerodrome reference point.

Area 3 shall cover the area which is within 50 meters 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.

4.4 *The meeting also noted that 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- D** lists a series of short- and medium-term tasks which are proposed with a view to facilitate 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- E** provides the structure for an AFI ANP FASID table which is proposed to be used to provide detail of regional eTOD requirements and as a tool to track implementation.*

4.5 The meeting also noted that a structured approach to implementation is required to realize the important safety and efficiency benefits to be derived from the uniform implementation of terrain and obstacle data (eTOD) provisions. On this basis, the meeting adopted the following Draft Conclusions to guide the work of APIRG.

Draft Conclusion XX : e-TOD Checklist

That, States be encouraged to use the e-TOD checklist at Appendix-F in order to assist them in the process of planning and implementation of the e-TOD provisions.

Draft Conclusion XX : Adoption of the e-TOD Implementation Plan Template at Appendix -G as a regional model

That, States be encouraged to use the e-TOD Implementation Plan Template at Appendix- G as a regional model in order to assist them in the process of planning and implementation of the e-TOD provisions.

Draft Conclusion XX : Adoption of the South African National e-TOD Implementation Plan as a Sample

That, States be encouraged to use the South African National e-TOD Implementation Plan at Appendix H as a Sample when developing their national e-TOD plans.

Draft Conclusion xx —Implementation of WGS-84 and electronic terrain and obstacle data

That :

a) the AFI Planning and Implementation Regional Group (APIRG) adopt the revised AIM Performance Objective “Implementation of WGS-84 and electronic terrain and obstacle data” as

contained in the Performance Framework Form in the **Appendix D** to this Report as its strategy for implementation.

b) the proposed FASID Table at **Appendix-E** be adopted for inclusion as a requirement in the AFI FASID Document 7474 Vol.II.

c) that the adopted draft AFI Region e-TOD Implementation strategy under **Appendix-I** be reviewed for adoption by APIRG .

d) that the revised terms of reference of the AFI Region e-TOD Working Group under **Appendix-J** be reviewed for adoption by APIRG.

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Draft Conclusion XX- Review of the outcomes of the Third and Fourth AFI-CAD Meetings

That APIRG:

Would take action on the outcomes of the Reports of the Third and Fourth Meetings of the AFI Region Study Group on the Establishment of a Centralized AFI Region AIS Data base (AFI-CAD/Study Group/3and 4).

Draft Conclusion xx – Adoption of the AIS to AIM Transition Roadmap

That APIRG :

a) adopts the Roadmap as Guidance material to plan, manage and facilitate the global transition from AIS to AIM within the AFI Region.

b) by using the Roadmap as Guidance material, assist States in planning the scope and prioritizing projects and actions for the transition to AIM.

Draft Conclusion xx: e-TOD implementation awareness campaigns

Taking into consideration the adopted dates of applicability of E-TOD provisions introduced by AMDT 33 to Annex 15 and the resources required for the implementation of these new provisions, the States' AIS should take the lead and carry out awareness campaigns at national level to promote a better understanding of the planning and implementation issues related to e-TOD.

Draft Conclusion xxx: Development and management of a national e-TOD programme

That: States, in accordance with sound management principles and procedures, should:

a) develop a framework and a detailed planning including priorities and timelines, for the implementation of a national e-TOD programme;

b) adopt/follow a collaborative approach, involving all concerned parties, in the implementation of e-TOD provisions; and

c) make an inventory of and evaluate the quality of existing terrain and obstacle data sources, and in the case of data collection, consider carefully the required level of details of collected terrain and obstacle data with particular emphasis on obstacle data and associated cost.

Draft Conclusion xx: Coordination and exchange of experience for the implementation of e-TOD requirements

That: Implementation of E-TOD provisions should be considered a global matter concerning all ICAO Regions, which thereby necessitates coordination and exchange of experience between States, ICAO and other national/international organizations and industry partners involved.

Draft Conclusion xx: Coordination between states and data providers/ I integrators for the

provision of e-TOD

That: Collaboration between States and data providers/integrators should be considered in the process of e-TOD provision.

Draft Conclusion xx: responsibility for the provision of e-TOD

That: States, while maintaining the responsibility for data quality and availability, should consider the extent to which provision of electronic terrain and obstacle data could be delegated to national geodetic Institutes/Agencies, based on Service Level Agreement (SLA) reflecting such delegation.

Appendix-A

STATUS OF IMPLEMENTATION OF WGS-84 IN THE AFI REGION AS OF April 2010

----- ETAT DE MISE EN OEUVRE DU WGS-84 DANS LA REGION AFI Avril 2010

STATE <i>ETAT</i>	Implemented in FULL <i>Mise en oeuvre complète</i>	Implemented in PART <i>Mise en oeuvre partielle</i>	Under way (Completion 2010) <i>En cours (Finition 2011)</i>	Planned date to Start <i>Date prévue de démarrage</i>	No known plan (or no reply) <i>Pas de renseignements</i>
Algeria	x				
Angola		x			
Benin	x				
Botswana		x			
Burkina Faso	x				
Burundi	x				
Cameroon	x				
Cape Verde	x				
Central African Republic	x				
Chad	x				
Comoros	x				
Congo Brazzaville	x				
Côte d'Ivoire	x				
Congo DR of		x			
Djibouti		x			
Egypt	x				
Equatorial Guinea	x				
Eritrea		x			
Ethiopia		x			
Gabon	x				
Gambia	x				
Ghana		x			
Guinea Conakry		x			
Guinea-Bissau		x			
Kenya		x			
Liberia		x			
Libyan Arab Jamahiriya		x			
Madagascar		x			

STATE ETAT	Implemented in FULL <i>Mise en oeuvre complète</i>	Implemented in PART <i>Mise en oeuvre partielle</i>	Under way (Completion 2010) <i>En cours (Finition 2011)</i>	Planned date to Start <i>Date prévue de démarrage</i>	No known plan (or no reply) <i>Pas de renseignements</i>
Malawi		x			
Mali	x				
Mauritania	x				
Mauritius	x				
Morocco	x				
Mozambique		x			
Namibia		x			
Niger	x				
Nigeria		x	<i>Complete Implementation under contract With IATA</i>		
Sao Tome & Principe	x				
Senegal	x				
Seychelles		x			
Sierra Leone		x			
Somalia					x
South Africa	x				
Sudan		x			
Swaziland		x			
Togo	x				
Tunisia	x				
Uganda		x			
United Republic of Tanzania		x			
Zambia		x			
Zimbabwe		x			

Appendix-B
AFI-CAD Doc. 006
AFI-CAD Document 006
Revision 1 . AFI-CAD GUIDANCE MATERIAL

The Guidance Material for the establishment of AFI-CAD emanated from the Recommendations of the AFI-CAD/ Study Group/1 meeting and subsequently endorsed by ICAO under Conclusion 16/41 of the APIRG/16 Meeting. Consequently, the Guidance Materials are listed herewith in the form of Recommendations attached to the Framework as necessary requirements for the establishment of AFI-CAD.

Recommendation 1 :	<p>Basic Criteria</p> <p>The AFI AIS/MAP TF/4 meeting then concluded that :</p> <p>a) whether the service provision is subcontracted or not:</p> <ul style="list-style-type: none"> i. the service shall at all times be AFI States owned service. The service provider shall ensure the service is at all times perceived and recognized as being an AFI States provided service. ii. the service provision shall be an activity of cost-recovery nature and shall not generate profit on its own behalf (bearing in mind that the AFI CAD facilitates the safety, regularity and efficiency of international air navigation); iii. the service provision shall be subjected to a “ trial phase” of operation at the end of which the service may be reviewed if there has been insufficient take-up by clients and/or if the service levels have not been met; iv. all clients’ service level agreements shall be between the client and the Agency entrusted by the AFI States. v. the Agency shall not be allowed to sell, trade or commercialize the data and/or services of the AFI CAD on its own behalf and/or profit.
Recommendation 2 :	<p><i>AFI CAD services</i></p> <p><i>That AFI CAD should provide the following major services:</i></p> <ul style="list-style-type: none"> a) <i>the International NOTAM Operation (INO) providing facilities for world-wide NOTAM, SNOWTAM, ASHTAM and AFTN or equivalent message handling and for pre-flight Information Bulletins (PIB) generation.</i> b) the Static Data Operation (SDO) providing facilities for AFI Static Aeronautical Data/information handling and reporting. moreover, a minimum set of data is also maintained to allow the correct functioning of the INO system.
Recommendation 3 :	<p>AFI CAD Clients</p> <p>That the recommended AFI CAD clients are the following:</p> <ul style="list-style-type: none"> a) the Data Providers which are AIS Organizations providing aeronautical information to the Centralized AFI Database; b) the Data Users which are Air Transport Community and beyond.
Recommendation 4 :	Proposed AFI CAD System Design

	<p>That the proposed AFI CAD System should be designed to provide the following:</p> <ul style="list-style-type: none"> a) a single repository for aeronautical information and IAIP elements of participating States; b) data questioning enhancement through multilevel consistent data checking processes, including cross border data verification; c) a secure channel/vehicle for timely and efficient electronic distribution of aeronautical information and IAIP elements; d) harmonization and interoperability will be ensured by common and standardized: <ul style="list-style-type: none"> - System interface and data exchange model (AIXM), - Static data model (AICM).
<p>Recommendation 5 :</p>	<p>AFI CAD System Data Operations Services</p> <p>That the proposed System Data Operations Services will then provide the Centralized AFI Database clients with the following system services:</p> <ul style="list-style-type: none"> a) support to edit and provide (to the system) aeronautical information; b) electronic access to and delivery of aeronautical information; c) browsing and downloading of participating State's aeronautical information; and d) generation of reports.
<p>Recommendation 6 :</p>	<p>Access to AFI CAD</p> <p>That the Data Operations System Services will be accessed by clients via direct electronic interface in one or more of the following three ways:</p> <ul style="list-style-type: none"> i. The Client Interface terminal (CIT). A terminal located at the client site, connected to the AFI CAD, and allowing download, modification (only by data providers) and reporting of aeronautical information as determined by the clients Service Level Agreement (SLA); ii. The Client Interface (CI). A technical toolkit allowing clients' own systems to access and interact with the AFI CAD to upload, download, modify (only Data Providers can modify) and report aeronautical information as determined by the clients' SLA; iii. INTERNET: Access to the Centralized AFI AIS Data Base will also be allowed via the Internet.
<p>Recommendation 7 :</p>	<p><i>Development of AFI CAD user requirements specifications</i></p> <p>That States and/or Organizations in a position to do so, provide the required technical expertise to assist the Study Group to develop user requirements specifications (URS) for AFI CAD.</p>
<p>Recommendation 8 :</p>	<p>Scope of Services Provided</p> <p>That :</p>

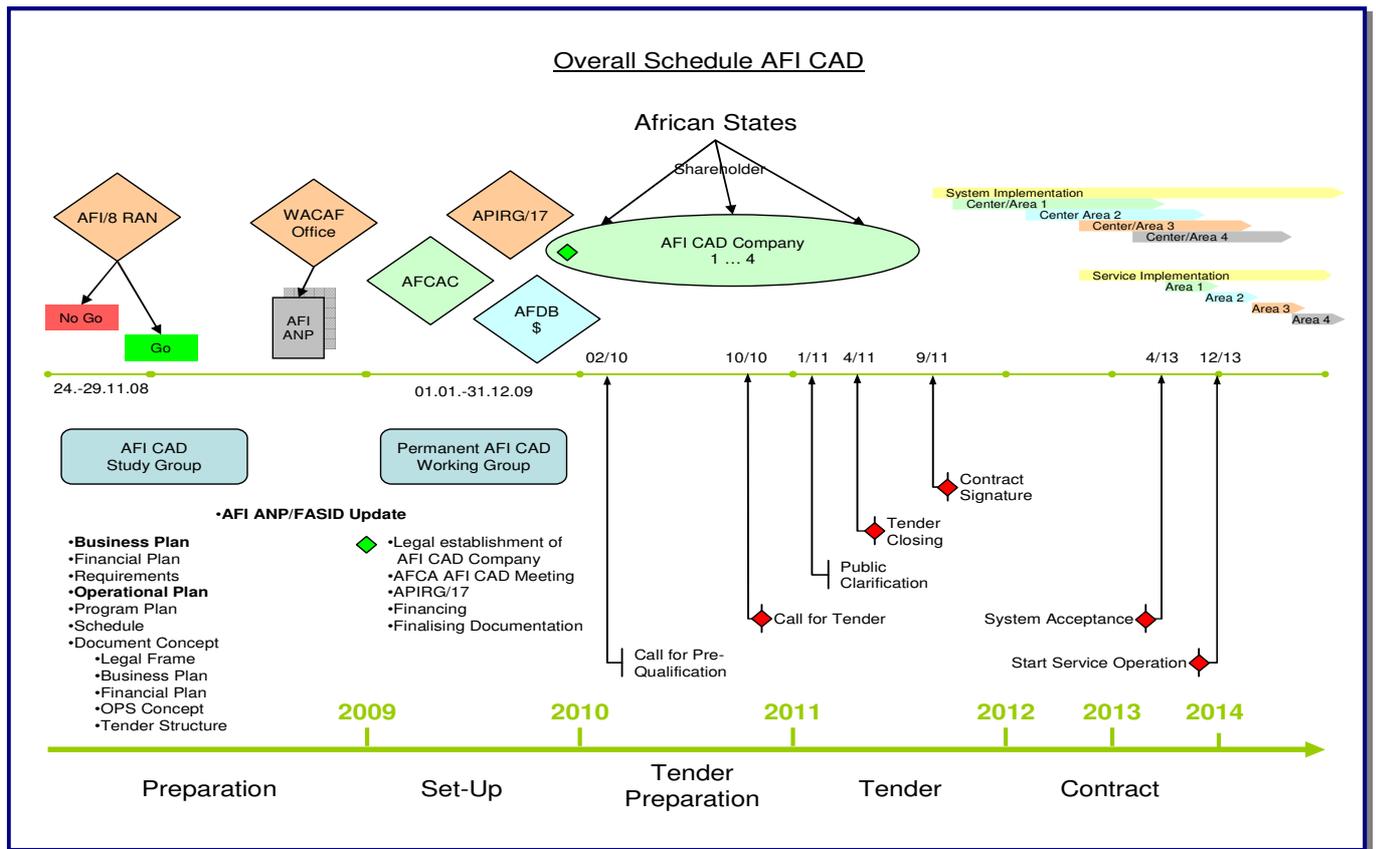
	<p>a) Regarding the data operations service domains, the services provided shall ensure:</p> <ol style="list-style-type: none"> i. Co-ordination of the resolution of data conflicts detected by the system data checking processes ; ii. for non-participating States (world wide) : <ul style="list-style-type: none"> - NOTAM processing (verification, validation, etc...) - entry of the statistic data required by the system NOTAM function. <p>b) As currently defined, the service does <u>not</u> include the provision of AIS services on behalf of participating States, i.e. the service <u>shall not comprise</u> the following activities :</p> <ol style="list-style-type: none"> i. creation of NOTAMs ii. origination and publication of AIP, AIP supplements, AIP amendments, AIC and charts. <p>c) As part of the provision of the service, the service provider will deliver to the centralized AFI Region AIS Data Base client the following services :</p> <ol style="list-style-type: none"> i. 24 hour operational and technical help desk ii. Client training iii. Management and monitoring of the delivery of aeronautical information and AIP elements.
<p>Recommendation 9:</p>	<p>Institutional Arrangements</p> <p>That AFI States shall:</p> <ol style="list-style-type: none"> a) Identify or set up an agency to develop, establish and operate the centralized AFI CAD; b) Determine the most effective and appropriate ways of funding, implementing and delivering the service. c) Commit to the timely provision of the required information to the AFI CAD; <i><u>Note: This shall not preclude them from providing the same data to other agents and/or entities.</u></i> d) Continue to be responsible for providing an AIS singularly or jointly with one or more other States or by delegating the authority for the provision of the service to a non-governmental agency in accordance with Annex 15 of the Chicago Convention; e) Maintain the intellectual property rights for the data provided to the AFI CAD; f) Provide advice and other appropriate support to any administration outside the AFI Region to consider the introduction of an aeronautical information database system compatible with the AFI CAD;

	<p>g) Promote the use of the AFI CAD by taking active steps to provide appropriate information to the public on the services available from the AFI CAD and encourage the use of the service;</p> <p>h) Define a legal and financial framework to be applied to States participating in the AFI CAD, and non members of the AFI Region States, covering contribution to the funding of the data operations service provision;</p> <p>i) Define a charging policy that:</p> <ul style="list-style-type: none"> - complies with the principle of free exchange of aeronautical information amongst States AIS, in accordance with Annex 15 of the Chicago Convention; - Continues to allow recovery by States of the costs incurred for the provision of AIS services; - Avoids double charging of the Data Users.
<p>Recommendation 10 :</p>	<p>Suggestions for Financial Model</p> <p>a) <u>Business Plan</u></p> <ol style="list-style-type: none"> i. <u>Setup Capital</u>: The business plan to be adopted must define the total set-up costs and where this capital will be obtained (eg Loans, Donations/Aid, State Contributions). Each states responsibility in this regard must be defined and be enforceable in any AFI CAD membership agreement ii. <u>Financial Sustainability</u>: The business plan to be adopted must also define how financial sustainability will be ensured (eg by State Contributions, fees to be charged for access by users, en-route charges, etc). This must also show how continuous improvement and safety monitoring systems will be maintained and funded. iii. <u>Service Provider</u>: The resources that the Service Provider will bring to the project must be defined and enforced in the Service Providers contract. It should not be the sole responsibility of the member states or the Agency to fund this project as it should be based on the User/ Beneficiary Pays principle. <p>b) <u>Financial Plans</u>: The financial model for AFI CAD as discussed above also needs to address the following operational considerations</p> <ol style="list-style-type: none"> i. <u>Continuous Operational Cost Recovery</u>: Continuous Operational Cost Recovery must be ensured as a minimum requirement. If this does not occur AFI CAD will not be a viable concern. ii. <u>Cost Benefit Analysis</u>: A Cost Benefit Analysis reflecting the advantages and disadvantages of all business models discussed above needs to be performed before a particular model can be recommended and accepted by AFI CAD member states. iii. <u>Future Cost Benefits</u>: To AFI CAD (eg via provision of services additional to what is presently being provided) will need to be assessed to ensure organizational structuring to take advantage of

	these future benefits.
Recommendation 11 :	<p>Evaluation criteria for the identification of the AFI-CAD Operating Centers:</p> <ol style="list-style-type: none"> 1. Geographical Location 2. Communication Infrastructure 3. Sustainability of Economy 4. Political Stability 5. Information Technology – currently available and sustainable 6. Provision of training – Training ability / infrastructure 7. Power supply : <ul style="list-style-type: none"> – availability – reliability – sustainability 8. Human Resource availability – <ol style="list-style-type: none"> i. AIM ii. Management iii. Project Management iv. Information Technology v. Training 9. Financial availability / sustainability 10. Previous experience – Track record 11. Common consensus 12. Infrastructure – Buildings 13. Evaluation to be conducted by an International Organization with a proven track record of successfully completing similar evaluations (e.g. ICAO/ United Nations/ EUROCONTROL, etc.)
Recommendation 12 :	<p>Introduction of QMS by AFI-CAD States</p> <p>That each contracting AFI – CAD Member State shall take all necessary measures to introduce a properly organized QMS containing procedures, processes and resources necessary to implement the quality management at each function stage. The execution of such quality management shall be in accordance with Annex 15, Chapter 3 paragraph 3.2.1.</p>
Recommendation 13 :	<p>Measurement tool for evaluation of AIS Services</p> <p>That Appendix K to APIRG/15 report as per Attachment A to DP/7 be adopted by AFI States as a measurement tool for evaluation of services in order to provide room for improvement and the prevention of non-conformity.</p>
Recommendation 14 :	<p>Framework for development of the QMS</p> <p>That AFI – CAD member States adopt the template for a project proposal in Appendix XX to Attachment A of DP/7(AFI-CAD/2) as a framework for development of the QMS in terms of defining scope, assessing the potential benefits, continuing the program, determining the roles and responsibilities of those involved in the development and implementation of the QMS, and specifying deliverables, target dates and the resources needed.</p>
Recommendation 15 :	<p>Timelines for the development and implementation of the AFI – CAD</p> <p>That ICAO would synchronize the most suitable timelines for the development and implementation of the AFI – CAD based on the evolution of events.</p>

Recommendation 16 :	<p>Development of the required training modules</p> <p>That AFI – CAD through the cooperation with GroupEAD develops the required training modules for AFI-CAD member States.</p>
Recommendation 17 :	<p>Development of the required format of a service level agreement</p> <p>That AFI – CAD through the cooperation with GroupEAD develops the required format of a service level agreement for the AFI – CAD member States.</p>
Recommendation 18 :	<p>Compilation of the URS Document :</p> <p>That it is therefore necessary to compile the user and other requirements in one document based on the input from:</p> <ul style="list-style-type: none"> - the Framework and Guidance Material of the AFI-CAD, as per Appendix H of the APIRG/16 Report, - the EUROCONTROL URS Documents (General, Common Services, Static Data, NOTAM, AIP, Charting), - the AFI States based on a filled Questionnaires (cf. DP/04) to include further AFI Requirements.
Recommendation 19:	<p>Institutional Framework:</p> <ol style="list-style-type: none"> a. Establishment of a supervisory management board composed of Technical Representatives appointed by the Civil Aviation Directors. They should also be empowered to make decisions. b. Appoint a Technical team competitively, to participate in the project processes from its initiation stage to completion, so that all members gain an understanding of the project tasks and objectives c. Appoint Service Provider competitively to develop, implement and manage the AFI-CAD. The Service Provider may also take responsibility for Hardware and Software maintenance
Recommendation 20 :	<p>Procurement Process:</p> <ul style="list-style-type: none"> • That the Business plan includes the development of procurement procedures acceptable to participating member states. • That the Business Plan includes the development of a logical acquisition system, which would include an efficient and transparent procurement process for implementation of the AFI-CAD • That participating states should ensure that the procurement is done in a transparent manner acceptable to the participating states.
Recommendation 21:	<p>Location of AFI-CAD</p> <p>That the Technical Board should determine the centre and sub-centers location subject to the agreed set criteria listed in Recommendation11. There is need to take into account the geographical locations and requisite infrastructure currently available.</p>
Recommendation 22 :	<p>Realization of the AFI-CAD</p> <p>That in order to realize the maximum benefits of the AFI Region centralized AIS Database all AFI Region States need to fully participate in its development, implementation and operations.</p>

Appendix -C



AIM PERFORMANCE OBJECTIVES

APPENDIX-D

NATIONAL PERFORMANCE OBJECTIVE					
IMPLEMENTATION OF WGS-84 AND ELECTRONIC TERRAIN AND OBSTACLE DATA					
Benefits					
Environment	none				
Efficiency	required by Performance Based Navigation 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				
Strategy					
Short term (2010)					
Medium term (2011 - 2015)					
ATM COMPONENTS	OC	TASKS	TIMEFRAME START-END	RESPONSIBILITY	STATUS

ATM CM	Electronic terrain and obstacle data (eTOD) Share experience and resources in the implementation of eTOD through the establishment of an eTOD working group.	2008-2011	APIRG States	
	Report requirements and monitor implementation status of eTOD using a new AIS Table of the AFI FASID (Ref. Appendix B). Develop e-TOD implementation plan as per the implementation template endorsed by the AFI e-TOD WG/1 Meeting.	2009-ongoing	APIRG States	
	Develop a high level policy for the management of a national eTOD Programme.	2008- 2011	States	
ATM AUO	WGS-84 Report requirements and monitor implementation status of WGS-84 using the AIS-5 Table of the AFI FASID.	Ongoing	APIRG States	
Link to GPIs	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-E

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.

eTOD Regulator Checklist to Support Implementation Planning

Awareness

- Determine the affected stakeholders in your State:
 - Ministry responsible for Transportation;
 - Civil Aviation Authority;
 - AISP; ○ ANSP; ○ Military;
 - National Geodetic, Cadastral or State Survey organisation;
 - Commercial survey companies or associations such as the Royal Institute of Chartered Surveyors (UK);
 - Military survey organisation;
 - Aerodrome operator or airport association(s);
 - National airlines;
 - General Aviation;
 - Helicopter operators or helicopter operator associations including Air Ambulance and civil SAR;
 - Local authorities or those responsible for aerodrome safeguarding / construction approval in the vicinity of the aerodrome;
 - Ministry responsible for local government, land planning and environment;
 - Power transmission companies;
 - Regulatory authority for radio and television broadcasts;
 - GSM antenna operators;
 - Local port authorities if ports exist within close proximity to an airport.
- From the foregoing, identify the Focal Point(s) in your State;
- Consider holding an eTOD awareness day or regional awareness days;
- Consider the establishment of a State Working Group to identify costs and determine an implementation plan.

The Four Areas

- Establish the State's policy with regard to implementing the current SARPS;
- Determine a State policy for what data will be made available for each of the four Areas, for which aerodromes and when;
- Determine a State policy for how and by whom the eTOD will be made available.

Regulation

- Confirm the State policy for the safeguarding of aerodromes from obstacle penetration, consider how effective the policy is and determine if available data can be demonstrated to be in compliance with eTOD requirements. In the absence of a declared or established policy, consider establishing one

- Consider the application of National regulation to allocate responsibility for the provision of eTOD;
- Consider and map the development and implementation of an obstacle permission process (*note: there are currently several commercial tools to support this process*);
- Consider the nature, scope, content, time and processes associated with the development of legislation for any obstacle permission process;
- Determine which data sources should be regulated, how standards may be placed upon them and with whom responsibility for data and the data processes should rest.

Data Sources

- Collate a list of possible sources of terrain and obstacle data;
- Establish a meeting to discuss the appropriateness and possible use of these data sources;
- Determine where liability for each data source resides.

Survey

- Determine the common survey formats to be used by surveyors and geodetic institutes;
- Determine the survey requirements for each of the four Areas, including resurvey intervals;
- Prepare example contracts for surveyors to ensure that the data provided meets the necessary numerical requirements;
- Determine the responsibilities that may be placed upon surveyors to ensure that they use the correct standards, and how this may be confirmed.

Cross-border Harmonisation

- Consider how cross-border harmonisation could be organised, if applicable;
- Consider the establishment of agreements with neighbouring States to exchange and harmonise common data.

Oversight Monitoring

- Determine a means of providing oversight management for monitoring progress;
- Determine a policy for the audit of involved organisations.

Charging and Cost Recovery

- Identify how the costs, both initial and ongoing, are to be recovered for each Area;
- If there is to be a charge levied on the use of data, identify the appropriate means / mechanisms by which the revenue can be collected.

Data Validation and Verification

- Identify if means to validate data, including metadata, already exist and, if not, determine how existing data could be assessed to determine its suitability;
- Determine what existing data may be reused and how its quality can be verified and validated;
- Determine how new data will be validated and verified.

Data Provision and Maintenance

- Consider the adoption of interoperable exchange formats for eTOD;
- Determine the means/media by which each dataset shall be made available;
- Determine a policy for data maintenance.

APPENDIX-G

Insert Organisation Name Here

**Insert
Organisation
Logo Here**

**eTOD Implementation Plan
Template**

AFI eTODWG/1

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1. INTRODUCTION

1.1 Purpose and Scope

This document provides the plan for **[Name of State]** relating to the implementation of electronic Terrain and Obstacle Data (eTOD).

This covers the following activities:

- The Four Areas;
- Regulation;
- Data Sources;
- Survey;
- Cross-border Harmonisation;
- Oversight Mechanism;
- Charging and Cost Recovery;
- Data Validation and Verification;
- Data Provision and Maintenance.

[Supporting material may be found in ATTACTMENT- A. It is intended that at an appropriate stage of its development, this material is transferred to the eTOD Manual.

Text in blue is that which needs to be replaced by the developers of the implementation plan in the State. Text in green may be used as guidance in developing the implementation plan.

It should be noted that some sections of this template may not be applicable / appropriate for a State to include in its implementation plan. The sections are not intended to be mandatory and a State may select to include whichever sections it deems appropriate. Moreover, the issues addressed by the template are not exhaustive and States may add to the template, as required.]

2. THE FOUR AREAS

2.1 State Policy with Regard to Current SARPS

2.1.1 Purpose of this Section

This section documents the **[Name of State]** policy relating to the implementation of the SARPS in place on **[enter date here]**.

2.1.2 State Policy

[Provide the State policy here.]

2.1.3 Considerations

[Discussions should take place in a State with representatives of the aviation community to help define a national policy for the implementation of Chapter 10, ICAO Annex 15. The discussions should include, as a minimum, the Regulator, Military and ANSP. Mindful that any change proposals have not yet been submitted to ICAO for consideration, it is important that the State determines, as a minimum, what it intends to do with regards Areas 1 and 4 as these have an effective date of 20th November, 2008. In cases where there is data available, which meets the necessary numerical requirements, no action other than making it available needs to be taken. However, should this data not be available or data that is available does not meet the numerical requirements or the requirements of quality, including data validation, it is suggested that the State files a difference to ICAO.]

2.1.4 Text of ICAO Difference

[Provide the State ICAO difference text here, if applicable.]

2.2 State Policy for Scope of eTOD for Four Areas

2.2.1 Purpose of this Section

This section documents the **[Name of State]** policy for the scope of data provision for Areas 1, 2, 3 and 4, and for which aerodromes Areas 2 and 3 are applicable. The policy should include the quality requirements, such as accuracy, resolution, etc.

2.2.2 State Policy for Area 1

[Provide the State Policy for Area 1 here.]

2.2.3 State Policy for Area 2

[Provide the State Policy for Area 2 here.]

2.2.4 State Policy for Area 3

[Provide the State Policy for Area 3 here.]

2.2.5 State Policy for Area 4

[Provide the State Policy for Area 4 here.]

2.3 State Policy of How, When and by Whom eTOD will be Made Available

2.3.1 Purpose of this Section

This section documents the **[Name of State]** policy of how, when and by whom eTOD will be made available.

2.3.2 State Policy

[Provide the State Policy for the availability of eTOD.]

3. REGULATION

3.1 Applicable Regulation

3.1.1 Purpose of this Section

This section documents ICAO, AFI Region and other international and national regulations applicable to eTOD.

3.1.2 International Regulation

[\[List international regulation for eTOD here.\]](#)

3.1.3 National Regulation

[\[List any national regulation for eTOD here.\]](#)

3.1.4 Considerations

[In addition to ICAO regulation, the Aeronautical Data Quality Implementing Rule should be included.

It may be determined during State discussions that some form of national Regulation may be needed to expedite the implementation of eTOD and ensure that all actors accept their responsibilities. Any national Regulation related to eTOD should be listed in 3.1.3.

Consideration should also be given to guidance material, such as ISO 9001, ISO 19100, OGC standards, (draft) Doc 9881, etc.]

3.2 State Policy on Aerodrome Safeguarding

3.2.1 Purpose of this Section

This section documents the [\[Name of State\]](#) policy for the safeguarding of aerodromes.

3.2.2 State Policy

[\[Provide the State policy for aerodrome safeguarding here.\]](#)

3.3 Obstacle Permission Process

3.3.1 Purpose of this Section

This section documents the obstacle permission process of [\[Name of State\]](#) and any legislation that applies.

3.3.2 Process

[\[Provide the State obstacle permission process here and list any legislation that applies.\]](#)

3.3.3 Considerations

[It is recommended that a State considers the development of an obstacle permission process. This may take best practice from South Africa and other

States which have a declared policy. In addition, States may wish to consider the development of legislation to enforce this process on those responsible for the erection and maintenance of obstacles.]

3.4 Regulation of Data Sources

3.4.1 Purpose of this Section

This section documents the **[Name of State]** approach to regulating data sources, to ensure that the appropriate standards and processes are applied.

3.4.2 Regulation

[Provide the State's policy for regulating data sources.]

4. DATA SOURCES

4.1 Purpose of this Section

This section lists the organisations that have been consulted to assess if the data they originate and maintain meets the appropriate requirements of eTOD. To be fully able to assess the data source, States should determine if the type of data source provider, i.e., State-owned, commercial organisation, etc, in order to be able to fully assess the impact of using its data. Where data is available and is suitable for use, this section provides information about the liability, cost/cost recovery and licence issues associated with it. Where arrangements are made for data source providers to make data available for aviation use, to the State, formal arrangements should be established between the data source providers and the receiving body. This section should list the formal arrangements in place which are related to the provision of eTOD.

The use of a Service Level Agreement is one example of a formal arrangement being established.

4.2 Data Sources Consulted

4.2.1 Data Source Provider

[For each data source provider identified, provide information about its status, i.e., State-owned, commercial organisation and list any particular areas of issue that arise from this.]

4.2.2 Liability

[For each data source identified, provide information about where the liability for the data lies.]

4.2.3 Cost Model

[For each data source identified, provide information related to the costs for the data.]

4.2.4 Licensing

[For each data source identified, provide information related to the licensing of the data.]

4.2.5 Formal Arrangements

[List the formal arrangements in place for the provision of eTOD.]

4.3 Considerations

[The owners of the following data sources or the following organisations, as an example, should be consulted:

- Geodetic institutes;
- Power / energy supply companies;
- Wind farm operators;
- Mapping agencies;

- Authority(ies) responsible for the authorisation of radio/TV and other broadcast antenna;
- Cell phone operators;
- Port authorities.

States should establish their own list of data sources which they will consult in the process of trying to identify eTOD providers. Following this, it is recommended that a meeting is held with each possible data source to discuss the appropriateness and possible use of their data and where liability lies.

States should assess the cost model and licensing of the data from a data source, taking into account whether the organisation is State-owned or a commercial organisation. Clearly, commercial organisations that already provide data for a charge to its users will not be willing to lose this revenue stream, this making the cost model and licensing for these products, more complex.

Formal arrangements should be made between data source providers and the receiving party. This will clearly state the quality requirements for the data, means of provision, etc. It is recommended that where a data source provider will provide data regularly, over a period of time, a Service Level Agreement is used to capture this agreement. Where data provision is likely to be a one-off or a very infrequent occurrence, it is recommended that a contract is established between the two parties.]

5. SURVEY

5.1 Survey Formats

5.1.1 Purpose of this Section

This section documents the common survey formats to be used by surveyors and geodetic institutes.

5.1.2 Formats

[\[List the common survey formats to be used here.\]](#)

5.2 Survey Requirements

5.2.1 Purpose of this Section

This section documents the survey requirements for each of the four Areas.

5.2.2 Survey Requirements for Area 1

[\[Provide the survey requirements for Area 1 here.\]](#)

5.2.3 Survey Requirements for Area 2

[\[Provide the survey requirements for Area 2 here.\]](#)

5.2.4 Survey Requirements for Area 3

[\[Provide the survey requirements for Area 3 here.\]](#)

5.2.5 Survey Requirements for Area 4

[\[Provide the survey requirements for Area 4 here.\]](#)

5.3 Survey Contracts

5.3.1 Purpose of this Section

States may, if they wish, include in their implementation plans details of requirements that should be included in survey contracts. If this is the case, this section will include the requirements that should be included in survey contracts for each of the four Areas, to ensure that the data provided through the contract meets the necessary numerical and quality requirements.

5.3.2 Survey Contracts

[\[Provide the text to be used in survey contracts here.\]](#)

5.4 Surveyor Vetting

5.4.1 Purpose of this Section

This section documents how surveyors are vetted to ensure that they adhere to the correct standards and discharge their legal responsibilities in accordance with the contract.

5.4.2 Vetting Process

[Provide the State vetting process for surveyors here.]

5.4.3 Considerations

It should be noted that this section may not be relevant to every State. Responsibility for the vetting of surveyors may rest elsewhere and, therefore, this section only applies to those States that have responsibility for this.

6. CROSS-BORDER HARMONISATION

6.1 State Agreements / Arrangements

6.1.1 Purpose of this Section

This section documents the arrangements in place with other States for the exchange, provision and receipt of common eTOD.

6.1.2 Arrangements

[List the arrangements in place with neighbouring States for the exchange, provision and receipt of common eTOD.]

6.1.3 Considerations

[It is recommended that some form of harmonisation activity is undertaken with neighbouring States, perhaps through the medium of a Service Level Agreement (SLA). Further, it is recommended that, where appropriate, States could make arrangements for data within its boundary to be provided to the other State, where it is needed for the other State's aerodrome. Alternatively, arrangements could be made to share the survey costs or to use one survey company, all with the intention of lowering the cost of data acquisition.

To assist with the exchange of data between States and other users, it is recommended that a common TOD exchange format is adopted.]

7. OVERSIGHT MECHANISM

7.1 Progress Monitoring

7.1.1 Purpose of this Section

This section details the mechanism by which the State intends to monitor the implementation of eTOD.

7.1.2 Monitoring Policy

[Detail how the State will monitor the implementation of eTOD, including how any obligations to meet ICAO Requirements .]

[List the State policy for monitoring eTOD implementation.]

7.2 Audit

7.2.1 Purpose of this Section

This section details the **[Name of State]** plan for the audit of the organisations involved in the implementation and subsequent management and maintenance of eTOD.

7.2.2 State Plan

[Provide the State's plan for the audit of organisations.]

8. COST RECOVERY AND CHARGING

8.1 Cost Recovery

8.1.1 Purpose of this Section

This section identifies how **[Name of State]** will finance eTOD. It states from whom the finance will be obtained and the cost recovery mechanisms associated with the initial and ongoing costs for eTOD, for each of the four Areas.

8.1.2 Initial Costs

8.1.2.1 *Cost Recovery for Area 1*

[Provide the means of cost recovery for Area 1 here.]

8.1.2.2 *Cost Recovery for Area 2*

[Provide the means of cost recovery for Area 2 here.]

8.1.2.3 *Cost Recovery for Area 3*

[Provide the means of cost recovery for Area 3 here.]

8.1.2.4 *Cost Recovery for Area 4*

[Provide the means of cost recovery for Area 4 here.]

8.1.3 Ongoing Costs

8.1.3.1 *Cost Recovery for Area 1*

[Provide the means of cost recovery for Area 1 here.]

8.1.3.2 *Cost Recovery for Area 2*

[Provide the means of cost recovery for Area 2 here.]

8.1.3.3 *Cost Recovery for Area 3*

[Provide the means of cost recovery for Area 3 here.]

8.1.3.4 *Cost Recovery for Area 4*

[Provide the means of cost recovery for Area 4 here.]

8.1.4 Considerations

[Consideration should be given to the need to recover costs not only in the initial implementation but as an ongoing activity including the:

- Increased costs for AISPs in managing the data;
- Increased costs for regulators in monitoring and auditing those associated with eTOD implementation and provision;
- Indirect costs such as the adaptation of procedures due to new / updated obstacle data.]

8.2 Charging Mechanisms

8.2.1 Purpose of this Section

This section identifies the charging mechanisms in place in **[Name of State]** to recover the costs associated with the initial and ongoing provision of eTOD.

8.2.2 Mechanisms

[Provide the charging mechanisms for eTOD here.]

9. DATA VALIDATION AND VERIFICATION

9.1 Assessment of Existing Data

9.1.1 Purpose of this Section

This section identifies how existing data should be assessed to determine if it meets the eTOD requirements.

9.1.2 State Policy

[Provide the State Policy for assessment of existing data here.]

9.1.3 Considerations

[Consideration should be given to whether means already exist in the State to validate data, including its associated metadata, to determine its appropriateness.]

Consideration should be given to the following:

- Does the data meet the ICAO numerical requirements?
- Does the data have the associated metadata?
- Does the data have full traceability?

[Methods for the assessment of different data types should be determined / identified.]

9.2 Data Validation and Verification

9.2.1 Purpose of this Section

This section details the approach of **[Name of State]** to the validation and verification of existing and new data.

9.2.2 Approach to Data Validation and Verification of Existing Data

[Provide the State's approach to data validation and verification of existing data.]

9.2.3 Approach to Data Validation and Verification of New Data

[Provide the State's approach to data validation and verification of new data.]

9.2.4 Considerations

[Consideration should be given to whether means already exist in the State to validate data, including its associated metadata.]

The approach should ensure that the data has full traceability.]

10. DATA PROVISION AND MAINTENANCE

10.1 Data Exchange Formats

10.1.1 Purpose of this Section

This section details the data exchange formats to be used for eTOD.

10.1.2 Data Formats

[List the exchange formats to be used for eTOD.]

10.2 Means / Media

10.2.1 Purpose of this Section

This section details the means / media by which each data set shall be made available.

10.2.2 Means of Provision: XXXX

[Insert explanation of how the means will be used to make the data sets available.]

10.2.3 Considerations

[It is intended that a subsection is provided for each means of provision, for example, Means of Provision: DVD, Means of Provision: Internet, etc.]

10.3 Data Maintenance

10.3.1 Purpose of this Section

This section details the State policy for the update / maintenance of data, including periodicity.

10.3.2 State Policy

[Provide the State's policy for data maintenance.]

ATTACHMENT- A GUIDANCE FOR INCLUSION IN eTOD MANUAL**A.1 Identification of all Stakeholders**

It is important that the stakeholders in the State are identified so that there is full awareness of eTOD and that there is an efficient flow of information between the parties involved. It is anticipated that the stakeholders will meet, as appropriate, to plan and implement the eTOD policies for the State.

A.2 eTOD Awareness Day

It is recommended that a national awareness day or a series of regional seminars are held to raise the awareness of stakeholders to the requirements of eTOD. This would allow all parties, especially those that do not usually attend the TOD WG or Aeronautical Information (AI) Team, to be briefed on the requirements of ICAO and the pan-European progress towards the implementation of eTOD. The attendance by personnel of the following organisations should be considered, though the list is by no means exhaustive:

- Ministry of Transport;
- Civil Aviation Authority;
- AISP;
- ANSP;
- Military;
- Aerodrome operators;
- Survey organisations – civil and military;
- Geodetic institutes;
- Airline representatives;
- General Aviation.

In the interests of economy, States may wish to co-host such workshops and to share their experiences and best practices associated with eTOD for the common good.

A.3 State Working Group

This section would include information related to the establishment of a State Working Group for TOD.

This has been demonstrated as a successful initiative in States and has, therefore, been taken as an example of best practice.

A.3.1 Considerations

It is recommended that such a working group be formed by, amongst others:

- State Regulator responsible for TOD provision;
- State AIS for publication;
- Military AIS (when applicable to data provision);
- State survey organisation;
- Military survey organisation, if applicable;

- Representative(s) of national aerodromes;
- Representation (probably at a national level) of local authorities or those with the responsibility for safeguarding and/or approving construction in the vicinity of an aerodrome;
- Authorities or organisations responsible for the authorisation or maintenance of obstacles, such as:
 - ◇ Broadcast transmission antennas;
 - ◇ GSM masts;
 - ◇ Electricity transmission pylons;
 - ◇ Wind turbine farms.
- In States, where aerodromes may be adjacent to ports, representatives of the Port Authority.

A.4 Focal Points

This section will include guidance about which organisations should be considered to establish contact points in a State. This would include:

- Ministry of Transport
- The Civil Aviation Authority;
- The Military;
- The ANSP;
- The civil AIS / AIM;
- Aerodrome authorities;
- National geodetic institutions.

A.5 Cross-border Harmonisation

Consideration should be given to means by which States may share common data. It is recommended that meetings are held with neighbouring States to discuss possible ways forward. Consideration should also be given to the use of common exchange formats.

End of Document

SOUTH AFRICAN



***CIVIL AVIATION
AUTHORITY***

**South African
Electronic Terrain and Obstacle Data (eTOD)
Implementation Plan**

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EXECUTIVE SUMMARY

Amendment 33 to ICAO Annex 15 (effective 12/07/2004) introduced requirements for States to ensure that electronic sets of Terrain and Obstacle Data (TOD) are available. The data shall be provided for four distinct areas, with each having specific data collection requirements.

Implementation of these requirements has caused significant concerns, mainly as a result of the high costs associated with data collection and processing, and the lack of a clear business case to support this expenditure.

This document provides the plan for South Africa relating to the implementation of electronic Terrain and Obstacle Data (eTOD). The purpose of providing terrain and obstacle data in an electronic format is stated in ICAO Annex 15, 10.1, where a set of applications / operations is listed.

The requirements for providing electronic terrain and obstacle data can be grouped as follows:

- Data collection requirements (geographical area): Areas 1,2,3 and 4;
- Data quality requirements (data accuracy, integrity and resolution);
- Database requirements (terrain database and obstacle database);
- Availability requirements (when / how data to be made available by States).

As regards Area 1 Electronic Terrain Data, South Africa will fully comply with Chapter 10, ICAO Annex 15, and therefore does not intend to file any difference with regards the technical content requirements. However not all of Electronic Obstacle Data complies with the data integrity requirements, therefore South Africa will not fully comply with Chapter 10, ICAO Annex 15, and has filed differences (alternative method of compliance differences have been filed on 10.2.5, 10.4.2 and 10.5.6). The issue is that we are dealing with legacy data whose integrity cannot be guaranteed at present. Circular Error of Probabilities (CEPs) will be provided with all data whose positional integrity does not fully comply with Chapter 10, ICAO Annex 15. The SACAA has taken responsibility for the provision of Area 1 data. For Area 2, IFR Aerodrome with ATS Service Provider, eTOD will be provided by the ATS Service Provider in conjunction with the SACAA, and for IFR Aerodrome without an ATS Service Provider, eTOD will be the responsibility of the Aerodrome License Holder in conjunction with the SACAA. Area 3 and Area 4 will be the responsibility of the Aerodrome License Holder.

Two databases shall be provided: a terrain database and an obstacle database. Neither of the databases shall contain data belonging to the other. All the eTOD data will reside with the SACAA in a Geodatabase that will be maintained by the Procedure Design & Cartography Department, and the data will be maintained by the respective data providers for each area.

Terrain and obstacle data shall comply with ISO 19100 series requirements in terms of data modelling. The eTOD implementation shall be in compliance with ICAO provisions contained in Annex 15, as amended, and Document 9881, and will be

managed by the SACAA as a national programme supported by necessary resources, a high level framework and detailed planning, including priorities and timelines for the implementation of the programme.

Data validation and verification will be done to ensure that the data meets the ICAO numerical requirements, has the associated metadata and has full data source traceability. Updating of the database shall be done on a regular basis to account for errors, new or amendments to existing data sets. In that way, applications that use data continue to be trustworthy.

The SASACAA will adopt/follow a collaborative approach involving all concerned parties in the implementation of eTOD and establish a multi-disciplinary team defining clearly the responsibilities and roles of the different Administrations within and outside the SACAA in the implementation process i.e. AIS Department, Aerodrome Operators, Military, National Mapping Agency, *et cetera*.

For eTOD implementation, commercial geospatial data vendors will be used in order to acquire Area 1 terrain data, and with regard to obstacle data the SACAA's obstacle dataset will be used, together with additional data from ATNS, ACSA, ESKOM, Local Municipalities Telecommunication companies, Petroleum & Gas companies, as well as the SA National Defence Force.

Currently there are arrangements to include as part of the South African eTOD implementation the terrain data for Lesotho and Swaziland, but there no arrangements for cross-border harmonization with Namibia, Botswana, Zimbabwe and Mozambique at present. It is recommended that some form of harmonisation activity is undertaken with neighbouring States, perhaps through the medium of a Memorandum of Understanding (MoU).

A South African eTOD Implementation Workgroup has been established, consisting of stakeholders in the South African aviation community, to manage and oversee the eTOD implementation in South Africa.

1. INTRODUCTION

This document provides the plan for South Africa relating to the implementation of electronic Terrain and Obstacle Data (eTOD). This covers the following activities:

- The Four Areas;
- Regulation;
- Data Sources;
- Cross-border Harmonisation;
- Oversight Monitoring;
- Charges and Cost Recovery;
- Data Validation and Verification;
- Data Provision and Maintenance.

1.1 Geographic Information

Geographic phenomena could broadly be divided into two categories: discrete and continuous. Discrete phenomena are objects with well-defined boundaries or spatial extent (buildings, bridges, etc.), and continuous phenomena vary over space and have no specific extent (elevations, temperatures, etc.) These two categories are not mutually exclusive as many elements of the landscape could be categorized as discrete or continuous.

Geographic information is treated and presented as vector data or raster data. Vector data deals with discrete phenomena – features, which spatial characteristics are presented by a set of one or more geometric primitives (point, curve, surface). Raster data deals with geographic phenomena that vary continuously over the space and contain a set of values each associated with one of the elements in a regular arrangement of points or cells in space.

2. ICAO eTOD REQUIREMENTS

2.1 ICAO eTOD SARPS

The purpose of providing terrain and obstacle data in an electronic format is stated in ICAO Annex 15, 10.1, where a set of applications / operations is listed.

All these applications / operations should ideally be supported by relevant provisions at the ICAO level in a compliant and harmonised manner that would be easily referenced and understood.

2.2 Text of ICAO Difference

With regard to Electronic Terrain Data, South Africa will fully comply with the technical content requirements for Chapter 10, ICAO Annex 15, and therefore does not intend to file any difference. However not all of Electronic Obstacle Data complies with the data integrity requirements, therefore South Africa will not fully comply with Chapter 10, ICAO Annex 15, and has filed differences (alternative

method of compliance differences have been filed on 10.2.5, 10.4.2 and 10.5.6). The issue is that we are dealing with legacy obstacle data whose integrity cannot be guaranteed. Circular Error of Probabilities (CEPs) will be provided with all data whose positional integrity does not fully comply with Chapter 10, ICAO Annex 15. The SACAA text will state that not all Electronic Obstacle Data complies with the integrity requirements of Chapter 10, ICAO Annex 15.

2.3 State Policy for Scope of eTOD for Four Areas

The requirements for providing electronic terrain and obstacle data can be grouped as follows:

- Data collection requirements (geographical area): Areas 1,2,3 and 4;
- Data quality requirements (data accuracy, integrity and resolution);
- Database requirements (terrain database and obstacle database);
- Availability requirements (when / how data to be made available by States).

Area	Definition
Area 1	Entire State territory including aerodromes / heliports
Area 2	For IFR aerodromes / heliports, designated TMAs or 45 km radius, whichever is smaller (45 km where no TMA is established)
Area 3	RWY edges up to 90 metres from RWY centre line and 50 metres from the edges of the rest of the movement areas
Area 4	60 m on either side of the extended runway centre line while the length shall be 900 m from the runway threshold measured along the extended runway centre line (<u>only for precision approach Cat II / III RWYs</u>)

2.3.1 Area 1

Terrain Data

The SACAA has taken responsibility for the provision of Area 1 data and will consist of a complete 20 m seamless DEM of South Africa (including Swaziland and Lesotho as well as a 35 km buffer into neighbouring countries).

- Datum: WGS84
- Spheroid: WGS84
- Projection: Lamberts Conformal Conic
- Format: DTED1/ESRI Binary

Quality Attributes	Area 1 – the State
Horizontal Accuracy	50.0 m
Data Integrity	Routine (10^{-9})
Vertical Accuracy	30.0 m
Vertical Resolution	1.0 m
Confidence Level	90 %
Post Spacing	3 arc second (approx. 90 m)

Obstacle Data

This is the responsibility of the South African Civil Aviation Authority and will consist of every known obstacle within Area 1 whose height above the ground is equal to or greater than 60 m.

Quality Attributes	Area 1 – the State
Horizontal Accuracy	50.0 m
Data Integrity	Routine (10^{-9})
Vertical Accuracy	30.0 m
Vertical Resolution	1.0 m
Confidence Level	90 %
Maintenance Period	As required

The integrity of legacy obstacle data cannot be guaranteed, Circular Error of Probability will therefore be specified for every non-compliant obstacle, and differences have been filed in this respect.

2.3.2 Area 2

Area 2 is the responsibility of the ATS Service Provider, and for IFR Aerodrome without an ATS Service Provider, eTOD will be provided by the ATS Service Provider in conjunction with the SACAA.

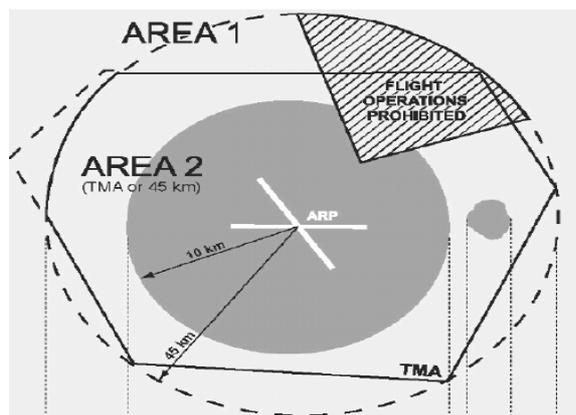
Area 2 is the most complex area in terms of the operations supported. It addresses to the following functions:

- Take-off and landing
- Arrival, approach and departure procedures
- Contingency procedures
- Instrument flight procedure design
- Aeronautical chart production (SID/STAR/IAC, PATC, AOC, etc.)
- Aerodrome / heliport obstacle restriction and removal

Terrain Data

Terrain data for Area 2 has a geographical footprint as follows:

- Within 10 km from the ARP;
- Between 10 km from the ARP extending to the TMA boundaries or to 45 km, whichever is smaller, for terrain that penetrates the horizontal plane of 120 metres above the lowest RWY elevation.

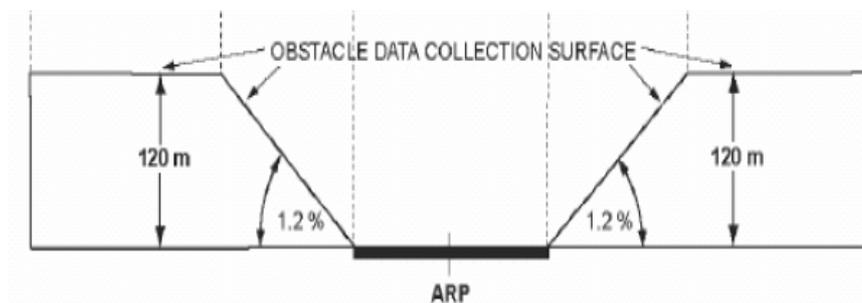


Quality Attributes	Area 2 – Terminal Airspace
Horizontal Accuracy	5.0 m
Data Integrity	Essential (10^{-9})
Vertical Accuracy	3.0 m
Vertical Resolution	0.1 m
Confidence Level	90 %
Post Spacing	1 arc second (approx. 30 m)

Obstacle Data

Obstacle data for Area 2 has a geographical footprint as follows:

- The conical surface whose origin is at the edges of the 180 m wide rectangular area and at the nearest runway elevation measured along the runway centre line, extending at 1.2 % slope until it reaches 120 m above the lowest runway elevation of all operational runways at the aerodrome;
- Between 10 km from the ARP extending to the TMA boundaries or to 45 km, whichever is smaller, the horizontal plane of 120 metres above the lowest RWY elevation.



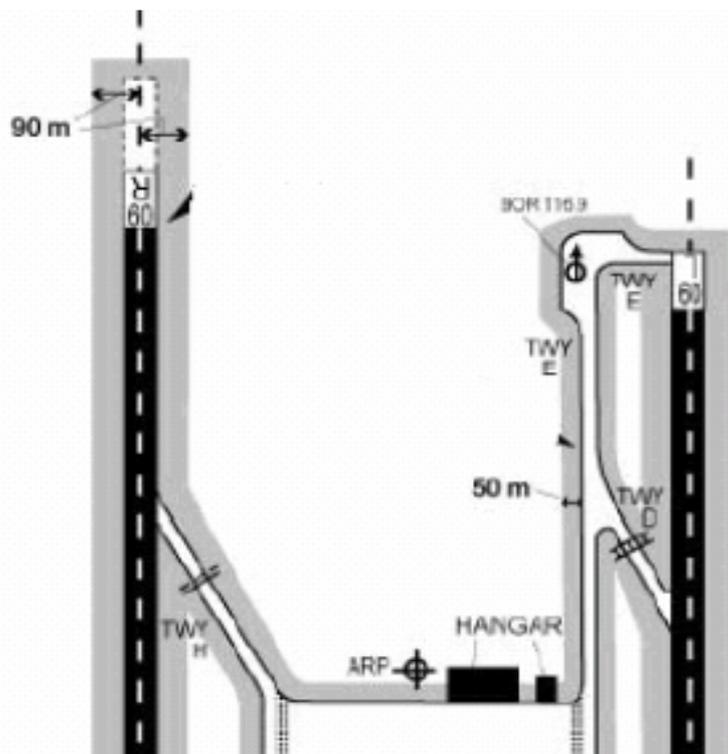
Area 2 Profile View

Quality Attributes	Area 2 – Terminal Centred Area
Horizontal Accuracy	5.0 m
Data Integrity	Essential (10^{-9})
Vertical Accuracy	3.0 m
Vertical Resolution	0.1 m
Confidence Level	90 %
Maintenance Period	As required

The integrity of legacy data cannot be guaranteed, Circular Error of Probability will therefore be specified if applicable, and differences have been filed in this respect.

2.3.4 Area 3

Area 3 is adjacent to the movement area and extends from the edges of the RWYs up to 90 metres from the RWY centreline and for the rest of the movement area, 50 metres from its edges.



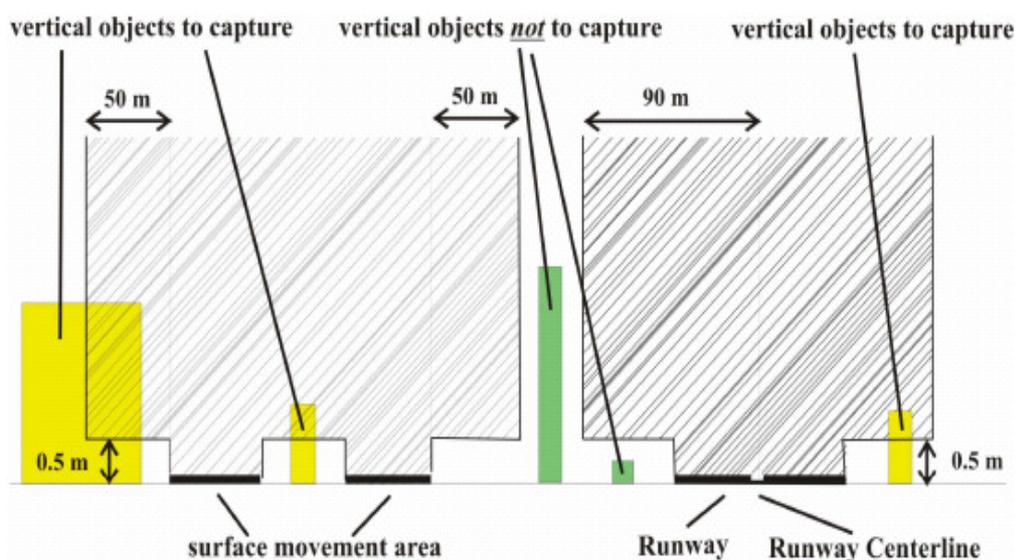
Concerning the obstacle collection, all obstacles that rise higher than 0.5 metres above the horizontal plane passing through the nearest point of the movement area shall be taken into consideration.

Terrain Data

Quality Attributes	Area 3 – Aerodrome Mapping
Horizontal Accuracy	0.5 m
Data Integrity	Essential (10^{-9})
Vertical Accuracy	0.5 m
Vertical Resolution	0.01 m
Confidence Level	90 %
Post Spacing	0.6 arc second (approx. 20 m)

Obstacle Data

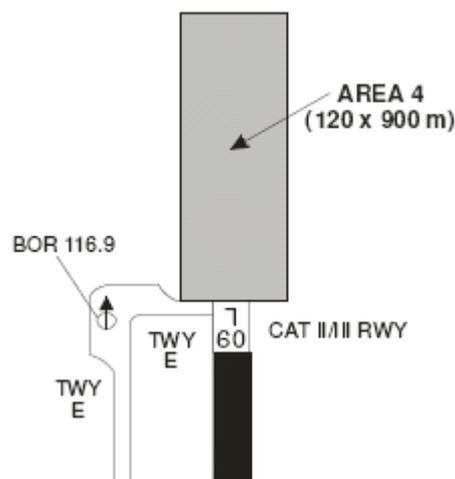
Quality Attributes	Area 3 – Terminal Centred Area
Horizontal Accuracy	0.5 m
Data Integrity	Essential (10^{-9})
Vertical Accuracy	0.5 m
Vertical Resolution	0.01 m
Confidence Level	90 %
Maintenance Period	As required



2.3.5 Area 4

Defined as the radar altimeter area for CAT II/III precision approach procedures, and is restricted to those runways where precision approach Category II or III operations have been established and where detailed terrain information is required by operators to enable the assessment, by use of radio altimeters, the effect of terrain on decision height determination.

The width of the area shall be 60m on either side of the extended runway centre line while the length shall be 900m from the runway threshold measured along the extended runway centre line.



The policy of the South African Civil Aviation Authority is that the eTOD responsibility for Area 4 fall to the Aerodrome License Holder – which for South Africa is presently limited to 2 ACSA owned aerodromes:

- Cape Town International;
- OR Tambo International.

Terrain Data

Quality Attributes	Area 4 – CAT II/III Operation Area
Horizontal Accuracy	2.5 m
Data Integrity	Essential (10^{-9})
Vertical Accuracy	1.0 m
Vertical Resolution	0.1 m
Confidence Level	90 %
Post Spacing	0.3 arc second (approx. 9 m)

Obstacle Data

There are currently no ICAO obstacle data requirements for Area 4, but SACAA intends to make available a dataset that contain all the features which may impact on height determination and which are not contained within the terrain dataset.

Obstacle data includes data generated and issued to ACSA by ATNS as well as additional obstacles identified within the ACSA Geodatabase.

2.4 How, When and by Whom eTOD will be Made Available

All the eTOD Obstacle data will reside with the SACAA in a Geodatabase, the database will be maintained by the Procedure Design & Cartography Department. Area 1 Obstacle data will be maintained and disseminated to all interested parties by the SACAA.

With regard to Area 1 Terrain data, the SACAA intends to conclude an Accredited Supplier arrangement with a Commercial Vendor, who would then be the official supplier of the data. Any Person/Organisation/Sub-contractor/State Organ that requires the terrain data would be directed to the Accredited Supplier.

Area 2 terrain and obstacle data for IFR Aerodrome **with** an ATS Service Provider shall remain the responsibility of ATS Service Provider – hence they will also be the custodians of this data for both maintenance and for data dissemination. For an IFR Aerodrome **without** an ATS Service Provider, eTOD will be the responsibility of the Aerodrome License Holder.

Area 3 and Area 4 will be the responsibility of the Aerodrome License Holder and they will be the custodians of this data for both maintenance and for data dissemination.

2.5 Considerations

Two databases for each area shall be provided: a terrain database and an obstacle database. Neither of the databases shall contain data belonging to the other one. Ref. ICAO Annex 15, 10.3.2: Terrain is, “*naturally occurring features such as mountains, hills, ridges, valleys, bodies of water, permanent ice and snow, and excluding obstacles*”. Ref. ICAO Annex 15, 10.4.1: Obstacles are “*all fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight shall not be included in terrain databases.*”

3. REGULATION

3.1 Applicable Regulation

ICAO Annex 15, 10.5.2 requires States to provide specifications for the terrain and obstacle data made available: "... *statement of available electronic terrain and obstacle data sets shall be provided in the form of terrain data product specifications as well as obstacle data product specifications ...*". Terrain and obstacle data shall comply with ISO 19100 series requirements in terms of data modelling.

3.1.1 International Regulation

The eTOD implementation shall be in compliance with ICAO provisions contained in Annex 15, as amended, and Document 9881, and will be managed by the SACAA as a national programme supported by necessary resources, a high level framework and a detailed planning, including priorities and timelines for the implementation of the programme.

3.1.2 National Regulation

No National Regulation currently exists. It is foreseen that National Regulations will be required. Required regulations will be drafted by the SACAA and will undergo the normal CARCOM process before promulgation. Voluntary compliance with the national implementation is expected of all stakeholders pending the promulgation of the required regulations.

3.1.3 Considerations

The SACAA has adopted/followed a collaborative approach involving all concerned parties in the implementation of eTOD provisions and has established a multi-disciplinary implementation team defining clearly the responsibilities and roles of the different stakeholders within and outside the SACAA in the implementation process i.e. AIS Department, Aerodrome Operators, Military, National Mapping Agency, *et cetera*.

3.2 Regulation of Data Sources

This section documents the South Africa approach to regulating data sources, to ensure that the appropriate standards and processes are applied.

3.2.1 Regulation

Terrain and obstacle data shall comply with ISO 19100 series requirements in terms of data modelling. Appendix 8 of ICAO Annex 15 contains the provisions for the definition of Areas 1, 2, 3 and 4 as well as for the quality requirements and data attributes (metadata) for collecting terrain and obstacle numeric data.

4. DATA SOURCES

This section lists the organisations that have been consulted to assess if the data they originate and maintain meets the appropriate requirements of eTOD. Where data is available and is suitable for use, this section provides information about the liability, cost/cost recovery and license issues associated with it.

4.1 Data Sources Consulted

For eTOD implementation, 3 commercial vendors were consulted in order to acquire Area 1 terrain data – ComputaMaps, GISCOE and TeleAtlas. Furthermore, the SACAA also looked at using Shuttle Radar Topography Mission (SRTM) data - available for free from NASA Jet Propulsion Laboratory (JPL) or from the US Geological Survey (USGS).

4.1.1 Liability

ComputaMaps

“ComputaMaps disclaims all other warranties, express or implied, including the implied warranties of merchantability and fitness for a particular purpose. ComputaMaps shall not be liable for any damage or loss of any kind arising out of or resulting from your possession or use of the Product (including data loss or corruption), regardless of whether such liability is based in tort, contract or otherwise. If the foregoing limitation is held to be unenforceable, Computa Maps maximum liability to you shall not exceed the amount of the licence fees paid by you for the Product. The remedies available to you against ComputaMaps under this agreement are exclusive. In the event that any particular state does not allow the limitation or exclusion or implied warranties or liabilities for incidental or consequential damages contained herein, the above limitations and exclusions shall not apply to you.”

TeleAtlas Africa

Will not be liable to the SACAA “for any damages, which includes incidental and/or consequential damages (including but not limited to loss of profit), which may arise out of any occurrence related to the work done with the DATA or the Product or from the use of the DATA or the Product by the Purchaser or ant third party. In this regard TeleAtlas Africa guarantees the accuracy of our processes and the subsequent results to be guaranteed according to the source data used.”

NASA - SRTM

NASA states that “..Although these data have been processed successfully on a computer system at the U.S. Geological Survey, EROS Data Center, no warranty expressed or implied is made by either regarding the utility of the data on any system, nor shall the act of distribution constitute any such warranty. The USGS will warrant the delivery of this product in computer-readable format and will offer appropriate adjustment of credit when the product is determined unreadable by

correctly adjusted computer peripherals, or when the physical medium is delivered in damaged condition...”

4.1.2 Cost Model

ComputaMaps

South Africa, including Lesotho, Swaziland and a 35km buffer: ca 1,381,000 km² – R540,000.00.

TeleAtlas Africa

South Africa, including Lesotho, Swaziland and a 35km buffer: ca 1,381,000 km² – R190,000.00.

GISCOE

South Africa, including Lesotho, Swaziland and a 35km buffer: ca 1,381,000 km² – R473,533.20.

NASA – SRTM

South Africa, including Lesotho, Swaziland and a 35km buffer: ca 1,381,000 km² – Free, but coverage is incomplete.

4.1.3 Licensing

ComputaMaps

“ComputaMaps grants the licensee a non-exclusive, personal, non-transferable and non-assignable right to use the Product on a maximum of fifteen (15) workstations within a single client organisation.

The ownership of the copyright and all other intellectual property rights in the digital data contained in the Product vests in ComputaMaps and its suppliers and is supplied under license from the said copyright owner(s). Furthermore, the copyright and intellectual property rights in the data selection, processing, enhancements, packaging, structure and format of the Product vest in ComputaMaps.”

TeleAtlas Africa

“All spatial data products licensed by TeleAtlas Africa, remains the sole property of TeleAtlas Africa. Data is licensed on a user license basis and the following conditions apply:

- *Spatial Data products licensed by TeleAtlas Africa are licensed without distribution rights and may not be licensed (value added or not) or distributed in any form to other organizations but the Purchaser without express permission from TeleAtlas Africa.*

- *Copyrights exists on all spatial data products licensed by TeleAtlas Africa. Data may not be copied in any form (analog or digital) without express permissions by TeleAtlas Africa.*
- *TeleAtlas Africa must be acknowledged in publications referring to the data and in any electronic media using the data.”*

NASA – SRTM

The objective of the SRTM mission is to obtain elevation radar data on a near-global scale and generate the most complete high-resolution digital topographic database of the Earth. The information collected by SRTM will be used to provide a tool to enhance the activities of scientists, the military, commercial, and civilian users and there are no licensing issues to consider.

4.2 Considerations

With regard to obstacle data the following organisations have/will be contacted and engaged with:

- ATNS
- ACSA
- ESKOM
- Telecommunication companies
- Petroleum & Gas companies
- SA National Defence Force
- Department of Public Works
- Statistics SA
- NIMAC
- Local Councils

5. CROSS-BORDER HARMONISATION

Currently there are arrangements to include as part of the South African eTOD implementation the terrain data for Lesotho and Swaziland, but there no arrangements for cross-border harmonization with Namibia, Botswana, Zimbabwe and Mozambique.

It is recommended that some form of harmonisation activity is undertaken with neighbouring States, perhaps through the medium of a Memorandum of Understanding (MoU). Further, it is recommended that, where appropriate, States could make arrangements for data within its boundary to be provided to the other State, where it is needed for the other State's aerodrome. To assist with the exchange of data between States and other users, it is recommended that a common eTOD exchange format is adopted.

The SACAA, in its function as the manager of the South African eTOD implementation program, will endeavour to attempt to establish contact with neighbouring states in order to implement MoUs to enable data harmonisation.

6. OVERSIGHT MONITORING

6.1 Progress Monitoring

A South African eTOD Workgroup has been established, consisting of stakeholders in the South African aviation community, to manage and oversee the eTOD implementation in South Africa.

The following stakeholders are involved:

- SACAA (PD&C, AIS, Aerodrome Section);
- ATNS;
- ACSA;
- SA Air Force;
- Chief Director Surveys and Mapping;
- Private IFR Aerodrome License holders;
- IATA.

6.2 Audit

Make an inventory of and evaluate the quality of existing (legacy) terrain and obstacle datasets.

7. CHARGING AND COST RECOVERY

This section documents how South Africa will finance, from whom the finance will be obtained and the cost recovery mechanisms associated with the initial and ongoing costs for eTOD, for each of the four Areas.

7.1 Initial Costs

7.1.1 Cost Recovery for Area 1

	Who	How	Cost
Terrain	SACAA	50k interpolation	Data user
Obstacles	SACAA	Obstacle database	Data user

7.1.2 Cost Recovery for Area 2

	Who	How	Cost
Terrain	ATNS	10k interpolation	User charges
Obstacles	ATNS	Obstacle database	User charges

7.1.3 Cost Recovery for Area 3

	Who	How	Cost
Terrain	ACSA	stereoscopic aerial photography	User charges
Obstacles	ACSA	ATNS Surveys	User charges

7.1.4 Cost Recovery for Area 4

	Who	How	Cost
Terrain	ACSA	stereoscopic aerial photography	User charges
Obstacles	ACSA	ATNS Surveys	User charges

7.2 Ongoing Costs

	Terrain	Obstacles
Area 1	Data user	Owner
Area 2	Data user	ATS Service Provider
Area 3	Data user	AD charges
Area 4	Data user	AD charges

8. DATA VALIDATION AND VERIFICATION

The requirements for aeronautical data quality are provided in several ICAO SARPS, grouped in two main categories:

- Data collection (calculated or surveyed) – accuracy and integrity level;
- Data publication – (charting and publication) resolution and integrity level.

The ICAO SARPS responsible for data collection requirements are:

- ICAO Annex 11 Air Traffic Services, Appendix 5 geographical coordinates and the elevations for obstacles in Area 1 and Area 2 (outside the aerodrome / heliport boundary); instrument approach procedure altitudes; obstacle clearance altitudes / heights; minimum (flight) altitudes
- ICAO Annex 14, Volume I, Appendix 5 – geographical coordinates and the elevations for obstacles in Area 2 (within the aerodrome / heliport boundary) and Area 3;
- ICAO Doc 8168, Vol. II – PANS-OPS (for calculated data):
 - obstacle clearance altitudes / heights;
 - minimum (flight) altitudes.
- ICAO Doc 9674 WGS-84 Manual (for surveyed and calculated data):
 - obstacles en-route;
 - obstacles in the approach and take-off area;
 - obstacles in the circling area;
 - instrument approach procedure altitudes;
 - obstacle clearance altitudes / heights;
 - minimum (flight) altitudes.

The ICAO SARPS responsible for data publication requirements are:

- ICAO Annex 4, Aeronautical Charts, Appendix 6 (charting resolution and integrity level):
 - geographical coordinates and the elevations for obstacles in Areas 1, 2 and 3;
 - instrument approach procedure altitudes;
 - obstacle clearance altitudes / heights (OCA / H);
 - minimum (flight) altitudes.
- ICAO Annex 15, Appendix 7:
 - geographical coordinates and the elevations for obstacles in Areas 1, 2 and 3;
 - minimum (flight) altitudes.
- ICAO Doc 8168, Vol. II – PANS-OPS (for calculated data):
 - obstacle clearance altitudes / heights;
 - procedure altitudes;
- ICAO Doc 9674 WGS-84 Manual (for surveyed and calculated data):
 - obstacles en-route;
 - obstacles in the approach and take-off area;
 - obstacles in the circling area;
 - instrument approach procedure altitudes;

- obstacle clearance altitudes / heights;
- minimum (flight) altitudes.

8.1 Data Quality – Confidence Levels

Accuracy requirements for aeronautical data are based upon a 95% confidence level, as required by ICAO Annex 11, 2.19.1 and ICAO Annex 14, Vol. I and II, 2.1.1. Three types of positional data are considered: surveyed points, calculated points (mathematical calculations from known surveyed points / fixes) and declared points.

ICAO Doc 9674, WGS-84 Manual provides an interpretation of the 95% confidence level to be taken into consideration.

- The statistical principles governing the determination of a two dimensional position consider a circular normal distribution around the real location of the measured data. Because there is no 100% certainty that what is measured reflects the reality, the statistical calculation aims at determining the probability of the measurement to fall inside of a circle of a certain radius, centred on the reported position.
- In order to better understand the confidence level, another two terms have to be introduced: confidence interval and confidence limit.
- Confidence interval: an estimated range of values which is likely to include an unknown population parameter, the estimated range being calculated from a given set of sample data.
- Confidence limits: represent the lower and upper boundaries / values of a confidence interval.
- Confidence level: the statistical probability that a random variable (in our case the position) lies within the confidence interval of an estimate.

8.2 Assessment of Existing Data

Change in mindset required for ICAO AMDT 33:

- Change from “approval-oriented” (Annex 14) to a “flight-safety and data-oriented mindset”(Annex 15);
- Electronic obstacle data should no longer be a by-product of an approval process.
- Electronic obstacle data should be a tool to ensure flight safety.

Electronic Data Provision

- Standards for electronic data exchange

Quality and integrity

- Verify 3D-elevations against accurate terrain model;
- Verify accuracy of existing obstacles;
- Ensure integrity in the data chain.

8.3 Requirements

Data must comply with requirements of Annex 15, Chapter 10 (as supplemented by ICAO Doc 9881), which include the following:

- Data must meet the ICAO numerical requirements as specified;
- Dataset must have the required associated metadata;
- Data must have full traceability.

9. DATA PROVISION AND MAINTENANCE

9.1 Data Exchange Formats

Establish a consistent basis for the interchange of data among originators, integrators, system designers and users. Furthermore, the exchange format must be compliant with ISO 19100 series of standards, provide unique DPS for terrain, obstacle, and aerodrome mapping data sets.

The Aeronautical Information Exchange Model (AIXM) is a data exchange format originating from Eurocontrol and FAA that is now readable using ArcGIS, PLTS aeronautical extension. AICM and AIXM are emerging international standards for describing and exchanging aeronautical data. AIXM is being increasingly used in government aviation agencies and COTS vendors are beginning to adopt AIXM for representing aeronautical data.

The SACAA will ultimately deliver eTOD data to users in an AIXM database format which will allow interoperability with AIS packages.

9.2 Means / Media

Data will be distributed to users via CD, DVD or external Hard Drives, depending on file size.

9.3 Data Maintenance

The erecting and dismantling of temporary obstacles happens on short notice and within days:

- Besides the initial preparation of the data a constant monitoring of the information is necessary to provide updated obstacle data
- Periodic systematic surveys are not sufficient to meet this requirement
- A collaborative approach for improving the data collection and data delivery process for obstacles involving owners, local authorities, airports, AISP and regulator should guarantee the timely availability of quality data

Updating of database to account for errors, new or amendments to existing data sets. In that way, applications that use data continue to be trustworthy. The updates should be as required, or in accordance with the AIRAC system. The process should include data integrator issuing updated database together with list of changes made from the previous edition.

9.4 Recommendations

- Collaborative approach involving all affected parties with possible ICAO support;
- Update cycle, institutional issues such as cost recovery, sharing of liability need to be addressed and defined;
- Closer collaboration of States with data integrators (electronic data exchange, application requirements in the transition phase);
- Sharing information on eTOD in States already advancing on the Implementation.

ANNEXURE A – IMPLEMENTATION STATUS

	Feature	ICAO Implementation Data	Status	Target Implementation Date	Action Plan Reference Number
Area 1	Terrain	20 November 2008	Not implemented	28 February 2009	AP/001/8/9/10
	Obstacle	20 November 2008	Not implemented	28 February 2009	AP/002
Area 2	Terrain	18 November 2010	Not implemented	18 November 2010	AP/003
	Obstacle	18 November 2010	Not implemented	18 November 2010	AP/004
Area 3	Terrain	18 November 2010	Not implemented	18 November 2010	AP/005
	Obstacle	18 November 2010	Not implemented	18 November 2010	AP/006
Area 4	Terrain	20 November 2008	Implemented	20 November 2008	AP/007
	Obstacle	Not required	Not required	Not required	

ANNEXURE B – ACTION PLAN

Ref Number	Area	Feature	Description	Action By	Target Date	Implementation Date	Comments
AP/001	1	Terrain	Terrain dataset for South Africa, including Lesotho and Swaziland, available from commercial vendors. Not yet verified and validated to ensure compliance with ICAO requirements.	SACAA	28/02/2009	28/02/2009	Awaited SACAA budget approval for procurement of terrain data for in-house use.
AP/002	1	Obstacle	Meeting held with owners of structures on the 14 th of October 2008 at SACAA offices. ICAO obstacle data requirements were discussed and their co-operation was requested.	SACAA	14/10/2008	14/10/2008	See AP/008
AP/003	2	Terrain	To be addressed at the SA eTOD WG meetings.	SA eTOD WG	18/11/2010		Next meeting on the 20 th January 2009.
AP/004	2	Obstacle	To be addressed at the SA eTOD WG meetings.	SA eTOD WG	18/11/2010		Next meeting on the 20 th January 2009.
AP/005	3	Terrain	To be addressed at the SA eTOD WG meetings.	SA eTOD WG	18/11/2010		Next meeting on the 20 th January 2009.
AP/006	3	Obstacle	To be addressed at the SA eTOD WG meetings.	SA eTOD WG	18/11/2010		Next meeting on the 20 th January 2009.

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AP/007	4	Terrain	Terrain dataset available from and maintained by ACSA.	ACSA	20/11/2008	20/11/2008	
AP/008	1	Obstacle	SACAA to provide the ICAO Obstacle data requirements to the owners of the structures.	SACAA	20/10/2008	17/10/2008	See AP/009
AP/009	1	Obstacle	Structure owners to provide available obstacle data for verification by the SACAA.	SACAA	13/03/2009		See AP/010
AP/010	1	Obstacle	Guarantee that all CEPs for obstacle data are eliminated.	SACAA	18/11/2010		

ANNEXURE C - ACRONYMS

A

ACSA	Airport Company South Africa
AGL	Above Ground Level
AIRAC	Aeronautical Information Regulation and Control
AIS	Aeronautical Information Service
AISP	Aeronautical Information Service Provider
AIXM	Aeronautical Information Exchange Model
AMDB	Aerodrome Mapping Database
AOC	Aerodrome Obstacle Chart
ARP	Aerodrome Reference Point
ASCII	American Standard Code for Information Interchange
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service

B

C

CARCOM	Civil Aviation Regulations Committee
CEP	Circular Error of Probability

D

DEM	Digital Elevation Model
DPS	Data Product Specification
DSM	Digital Surface Model
DTED1	Digital Terrain Elevation Data Level 1
DTM	Digital Terrain Model

E

ED	EUROCAE Document
EROS	Earth Resources Observation and Science
eTOD	electronic Terrain and Obstacle Database
EUROCONTROL	European organization for safety of air navigation

F

FAA	Federal Aviation Administration
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G

GIS	Geographic Information System
GPS	Global Positioning System

H

I

ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
ISO	International organisation for standardization

J

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K

L

M

MSL Mean Sea Level

N

NASA National Aeronautics and Space Administration
NIMAC National Imagery and Mapping Advisory Council
NM Nautical mile

O

P

PATC Precision Approach Terrain Chart
PD&C Procedure Design & Cartography

Q

R

RWY Runway

S

SACAA Civil Aviation Authority
SA eTOD WG South African eTOD Work Group
SARPs Standards and Recommended Practices
SID Standard Departure Chart – Instrument
SRTM Shuttle Radar Topography Mission
STAR Standard Terminal Arrival Route

T

TMA Terminal Area

U

V

W

WGS-84 World Geodetic System – 1984

X

XML Extensible Mark-up Language

Y

Z

ANNEXURE D - DEFINITIONS

Accuracy. A degree of conformance between the estimated or measured value and the true value.

Aerodrome. A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

Aerodrome elevation. The elevation of the highest point of the landing area.

Aerodrome mapping database (AMDB). One or more files containing information in a digital form that represent selected aerodrome features. This data includes geo-spatial data and metadata over a defined area. The files have a defined structure to permit an AMDB management system and other applications to make revisions that include additions, deletions, or modifications.

Aerodrome reference point (ARP). The designated geographical location of an aerodrome.

Aerodrome surface movement area. That part of an aerodrome that is to be used for the take-off, landing, and taxiing of aircraft. This includes runways, taxiways, and apron areas.

Aeronautical data. A representation of aeronautical facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing.

Aeronautical database. Any data that is stored electronically in a system that supports airborne or ground based aeronautical applications. An aeronautical database may be updated at regular intervals.

Aeronautical Information Publication (AIP). A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation.

Aeronautical information regulation and control (AIRAC). A system aimed at advance notification based on common effective dates, of circumstances that necessitate significant changes in operating practices.

Aeronautical information service (AIS). A service established within the defined area of coverage responsible for the provision of aeronautical information/data necessary for the safety, regularity and efficiency of air navigation.

Altitude. The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).

Bare earth. Surface of the Earth including bodies of water and permanent ice and snow, and excluding vegetation and man-made objects.

Canopy. Bare earth supplemented by vegetation height.

Completeness. The primary quality parameter describing the degree of conformance of a subset of data compared to its nominal ground with respect to the presence of objects, associations instances, and property instances.

Confidence. Meta-quality element describing the correctness of quality information.

Confidence level. The probability that the true value of a parameter is within a certain interval around the estimate of its value. The interval is usually referred to as the accuracy of the estimate.

Coordinate reference system. Coordinate system that is related to the real world by a datum.

Coordinate system. Set of mathematical rules for specifying how coordinates are to be assigned to points

Coverage. A feature that acts as a function to return one or more feature attribute values for any direct position within its spatiotemporal domain.

Cultural features. Manmade morphological formations that include transportation systems (roads and trails; railroads and pipelines; runways; transmission lines), and other manmade structures, (buildings, houses, schools, churches, hospitals).

Culture. All man-made features constructed on the surface of the Earth, such as cities, railways and canals.

Database. One or more files of data so structured that appropriate applications may draw from the files and update them.

Data element. A term used to describe any component of an AMDB. For example: a feature, an attribute, an object, an entity, or a value.

Data integrator. The part of an organisation, which takes data from one or more sources to produce a terrain or obstacle database that satisfies a particular specification.

Data originator. The part of an organisation which performs measurements by a particular means and which then groups those measurements to represent an area of terrain or a set of obstacles.

Data product. Data set or data set series that conforms to a data product specification.

Data product specification. Detailed description of a data set or data set series together with additional information that will enable it to be created, supplied to and used by another party.

Data quality. A degree or level of confidence that the data provided meet the requirements of the data user in terms of accuracy, resolution and integrity.

Data set. Identifiable collection of data.

Data set series. Collection data sets sharing the same product specification.

Data type. Specification of the legal value domain and legal operations allowed on values in this domain.

Datum. Any quantity or set of quantities that may serve as a reference or basis for the calculation of other quantities.

Digital Elevation Model (DEM). The representation of terrain surface by continuous elevation values at all intersections of a defined grid, referenced to common datum.

Note.— Digital Terrain Model (DTM) is sometimes referred to as DEM.

Digital surface model. Digital model of the topographic surface, including vegetation and man-made structures.

Elevation. The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.

Ellipsoid height (Geodetic height). The height related to the reference ellipsoid, measured along the ellipsoidal outer normal through the point in question.

End-user. An ultimate source and/or consumer of information.

Error. Defective or degraded data elements or lost or misplaced data elements or data elements not meeting stated quality requirements.

Feature. Abstraction of real-world phenomena.

Format. The process of translating, arranging, packing, and compressing a selected set of data for distribution to a specific target system.

Geodetic datum. A minimum set of parameters required to define location and orientation of the local reference system with respect to the global reference system/frame.

Geographic coordinates. The values of latitude, longitude, and height that define the position of a point on the surface of the Earth with respect to a reference datum.

Geographic data. Data with implicit or explicit reference to a location relative to the Earth.

Geoid. The equipotential surface in the gravity field of the Earth, which coincides with the undisturbed mean sea level (MSL) extended continuously through the continents.

Height. The vertical distance of a level, a point, or an object considered as a point, measured from a specified datum.

Integrity (aeronautical data). A degree of assurance that an aeronautical data and its value has not been lost or altered since the data origination or authorized amendment.

Mean sea level (MSL). The average location of the interface between the ocean and the atmosphere, over a period of time sufficiently long so that all random and periodic variations of short duration average to zero.

Metadata. Data about data.

Model. Abstraction of some aspects of reality.

Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.

Originate. The process of creating a data item or amending the value of an existing data item.

Originator (data). The first organization in the aeronautical data chain that accepts responsibility for the data.

Polygon. A surface or area described by a closed line.

Position (geographical). Set of coordinates (latitude and longitude) referenced to the mathematical reference ellipsoid that define the position of a point on the surface of the Earth.

Post spacing. Angular or linear distance between two adjacent elevation points.

Precision. The smallest difference that can be reliably distinguished by a measurement process.

Quality. Degree to which a set of inherent characteristics fulfils requirements.

Quality assurance. Part of quality management focused on providing confidence that quality requirements will be fulfilled.

Resolution. A number of units or digits to which a measured or calculated value is expressed and used.

Runway. A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

Spatial resolution. The capacity of the system (lens, sensor, emulsion, electronic components, etc.) to define the smallest possible object in the image. Historically, this has been measured as the number of lines pair per millimetre that can be resolved in a photograph of a bar chart. This is the so-called analogue resolution. For the modern photogrammetric cameras equipped with forward motion compensation (FMC) devices and photogrammetric panchromatic black and white

emulsions, the resolution could (depending on contrast) be 40 to 80 lp/mm (line pairs per millimetre).

Specification. Document which establishes the requirements the product or service should be compliant with.

State. An internationally recognized geographic entity that provides aeronautical information service.

Terrain. The surface of the Earth containing naturally occurring features such as mountains, hills, ridges, valleys, bodies of water, permanent ice and snow, excluding obstacles.

Threshold. The beginning of that portion of the runway useable for landing.

Traceability. Ability to trace the history, application or location of that which is under consideration.

Validation. Confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled.

Verification. Confirmation, through the provision of objective evidence that, specified requirements have been fulfilled.

ANNEXURE E - REFERENCES

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DRAFT AFI REGION E-TOD IMPLEMENTATION STRATEGY

Considering:

The new provisions introduced by Amendment 33 to Annex 15 related to E-TOD; and

the guidance material contained in Doc 9881 (Guidelines for electronic Terrain, Obstacle and Aerodrome Mapping Information); and

Recognizing that:

Significant safety benefits to international civil aviation will be provided by in-flight and ground-based applications that rely on quality electronic Terrain and Obstacle Data; and

The implementation of E-TOD requirements is a challenging, costly, and cumbersome task of cross-domain nature;

The Seminar proposed an AFI Region implementation strategy based on the following adopted criteria as detailed below:

E-TOD implementation should be in compliance with ICAO provisions contained in Annex 15 and Doc 9881;

E-TOD implementation should be based on national plans/roadmaps;

E-TOD implementation should be managed by each State as a national E-TOD programme supported by necessary resources, a high level framework and a detailed national plan including priorities and timelines for the implementation of the programme;

States should adopt/follow a collaborative approach involving all concerned parties in the implementation of E-TOD provisions and establish a multi-disciplinary team defining clearly the responsibilities and roles of the different Administrations within and outside the Civil Aviation Administration in the implementation process (AIS, Aerodromes, Military, National Geographic and Topographic Administrations/Agencies, etc);

E-TOD requirements should be analyzed and a common understanding for the Implementation of these requirements developed;

States should make an inventory of and evaluate the quality of existing terrain and obstacle data sources and in the case of data collection, consider carefully the required level of details of collected terrain and obstacle data with particular emphasis on obstacle data and associated cost;

States should carry out theoretical studies of candidate techniques for data acquisition (photogrammetry, LIDAR, IFSAR, etc) based on a Cost-Benefit Analysis and supported by case study for a representative aerodrome;

In the development of their E-TOD programme, States should take into consideration the requirements for update/maintenance of data, especially the obstacle data;

States, while maintaining the responsibility for data quality and availability, should consider the extent to which the provision of electronic terrain and obstacle data could be delegated to national geodetic Institutes/Agencies, based on Service Level Agreement reflecting such delegation. Collaboration between States and data providers/integrators should also be considered;

ICAO and States should undertake awareness and training programmes to promote and expedite E-TOD implementation;

Implementation of E-TOD provisions should be considered a global matter, which necessitates coordination and exchange of experience between States, ICAO and other national/international organizations and industry partners involved;

To the extent possible, States should work co-operatively especially with regard to the cross-border issue, for the sake of harmonization and more efficient implementation of E-TOD; and

States encountering difficulties in the implementation of E-TOD may seek assistance (individually or collectively) from ICAO, through a TCB project, and/or from other States.

APPENDIX -J**AFI REGION ELECTRONIC TERRAIN AND OBSTACLE DATA WORKING GROUP (E-TOD WG)****A) TERMS OF REFERENCE**

With a view to harmonize, coordinate and support E-TOD implementation activities on a regional basis, the AFI Region E-TOD Working Group shall be established as follows:

Mission

To identify, develop, validate and establish support mechanisms and serve as a forum by which the AFI States may implement the provision of electronic Terrain and obstacle Data (eTOD), in accordance with ICAO Annex 15, in a consistent and harmonised manner.

Reporting Line

The e-TOD Working Group (*e-TOD WG*) will report to the APIRG.

Participants profile

The *e-TOD WG* will be open to participants from any relevant domain, including, but not limited to, AIS/AIM personnel, surveyors, regulators, industry and international organisations in AFI and non-AFI States.

Tasks

Overall, the *TOD WG* shall support the:

- establishment of a common understanding of the intentions of Annex 15 with regard to eTOD;
- promotion of awareness of the responsibility and accountability of States for the implementation of eTOD;
- specification of the responsibilities for the bodies involved (regulator, surveyor, service provider etc.);
- specification of a concept and the development of the associated guidance material for the implementation of eTOD. The guidance material should assist in the definition of:
 - Qualities of data collection techniques;
 - Methods for the validation and verification of eTOD;
 - The data model(s) to be used;
 - Mechanisms for the storage and exchange of eTOD;
 - Data protection and other quality processes;
 - Quality management / assurance (verification and validation) criteria;
 - Cross-border harmonisation;
 - Methodologies for cost recovery, if appropriate;

- Guidance relating to the assessment of eTOD for periodic resurvey (timeliness).
- working with other fora to develop harmonised approaches to copyright, liability, intellectual property, and methodologies for cost recovery, if appropriate; etc.;
- Review of the requirements for Area 2
- introduction by States, of regulation to support the act of data provision;
- facilitation and coordination of eTOD implementation within AFI Region;
- monitoring of the progress towards implementation of eTOD within the AFI Region;
- the promotion of the means for global harmonisation;
- submission of material created under the project to ICAO and its promotion on a world-wide basis;
- AIM domain in gaining the necessary support and resources from the Agency management.

B) COMPOSITION

The AFI Region E-TOD Working Group will be composed of Experts nominated by the AFI Region States, ANSP and participants from any relevant domain, including, but not limited to AIS/AIM personnel, surveyors, regulators, industry and international organisations in AFI and non-AFI States.

Other representatives from industry and user organizations having a vested interest in the aeronautical services and E-TOD in particular, could participate in the work of this Working Group

C) WORKING ARRANGEMENTS

The AFI Region E-TOD Working Group shall report to the AIS-AIM Implementation Task Force established under the AFI Planning Implementation Regional Group (APIRG).

The work of the AFI E-TOD Working Group shall be carried out mainly through exchange of correspondence (email, facsimile, Tel., etc) between its Members. The Working Group shall meet as required and at least once in every year prior to an APIRG Meeting. The convening of the Working Group meetings should be initiated by the established AIS-AIM Implementation Task Force Secretariat based on the need to address AIS-AIM deficiencies in the AFI Region.
