Guidance Document
eTOD Project Objectives

	Prepared by:	*Reviewed by:*	*Approved by:*
Position			
Signature			
Fecha			

Scope

This Document must serve as a guide for defining the objectives related to the execution of the eTOD project.

This Document applies to the Aeronautical Information Service (AIS) and State offices providing terrain and obstacle data.

The Document describes in detail the steps required to ensure a satisfactory implementation and to have electronic terrain and obstacle data available, which in turn may be used for the production of charts and by users that so require it.

Control of changes

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Record Sheet and List of Amendments

Amendments

Amendments to this Document must be made by page: replaced, added, deleted, or completely revised.

The personnel responsible for amending this Document must complete the following Record of Amendments.

Record of Amendments

Amendment No.	*Date of the amendment*	*Amended by*	*Date*

Table of Contents

Reference Documentation

- ICAO Annex 4 – Aeronautical Charts
- ICAO Annex 15 - Aeronautical Information Services
- ICAO Doc 8126 OACI – Aeronautical Information Services Manual
- ICAO Doc 8697 OACI – Aeronautical Chart Manual
- ICAO Doc 8400 OACI – ICAO Abbreviations and Codes
- ICAO Doc 9881 - Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information
- ICAO Doc 9859 – Safety Management Manual (SMM)

Terms and Definitions

The definitions and abbreviations contained in ICAO Doc 8400 – ICAO Abbreviations and Codes are adopted.

Other Definitions

AIS-AIM Transition Roadmap:	Plan established for the set of tasks that will permit the transition from the current AIS to the new AIM concept
Amendment:	Correction of existing information

Abbreviations

AIM:	Aeronautical information management
AIP:	Aeronautical information publication
AIS:	Aeronautical information service
CAR:	Caribbean Region
eTOD:	Electronic terrain and obstacle data
GIS:	Geographic information system
GPWS:	Ground proximity warning systems
MSAW:	Minimum safe altitude warning
ICAO:	International Civil Aviation Organization
PBN:	Performance-Based Navigation
SAM:	South American Region
SLA:	Service Level Agreement

1.Background

This AIS-AIM Transition Roadmap describes in detail the provision of terrain and obstacle data by States, as a priority task for the first phase.

Amendment 33 to ICAO Annex 15 introduces the concept of electronic terrain and obstacle data (eTOD) sets to be made available to users.

Given the importance of this proposal, the SAM/AIM/2 meeting issued draft Conclusion 13/3, Provision of Electronic Terrain and Obstacle Data (eTOD), as follows:

That CAR/SAM States and Territories take urgent action to:

a) Represent the geodetic data of WGS-84 aeronautical charts in electronic format in support of performance-based navigation (PBN), and

b) Have electronic terrain and obstacle data of high quality and integrity available, as required in ICAO Annex 15.

Accordingly, the aformentioned meeting worked on the definition of a work project, which was finally called G1 “Developments for the provision of electronic terrain and obstacle data (eTOD) (SAM)”.

Task 10 of said project is *“Establish and prioritise objectives of eTOD implementation project (tasks, costs, implementation, target dates, project risks)*”, based on which the deliverable “Draft the Guidance Document containing the objectives of the ETOD project” Is defined.

It should be noted that it is very important to define the area of influence for the collection of both terrain and obstacle data, as defined in Amendment 36 to Annex 15. Accordingly, Appendix 1 contains the latest definitions of the “terrain and obstacle data collection area”.

The quality of the aforementioned terrain and obstacle information will have a direct impact on:

- ground proximity warning systems (GPWS),
- the minimum safe altitude warning (MSAW),
- the definition of contingency procedures to be used in case of an emergency during a missed approach or rejected take-off,
- the analysis of aircraft operational limitations,
- the design of instrument approach procedures,
- the determination of en-route cruise descent procedures and location of en-route emergency landing,
- advanced surface movement guidance and control systems (A-SMGCS);
- the production of aeronautical charts and on board databases,
- the performance-based navigation (PBN) concept,
- search and rescue activities (especially in mountainous areas)

Since eTOD requirements have raised the level of concern by States from both the technical and institutional perspective, it has been deemed necessary to present this guidance document in support of the tasks that need to be implemented.

To that end, this Guidance Document contains a series of tasks, costs, target dates, and risks for the implementation of the eTOD project as a whole.

2. Tasks

The tasks to be carried out are detailed below.

2.1. Understand ICAO requirements and State policies in force

ICAO has designated eight (8) geographic areas for the collection of electronic terrain and obstacle data (eTOD) that States must make available to users of airspaces defined in their territory. A proper understanding of such requirements will be essential for subsequent tasks.

To that end, Appendix 1 to this document contains a description of such areas. Likewise, ICAO Annex 15 “Aeronautical Information Services”, in Chapter 10 and Appendix 8, describes such areas and suggests dates when terrain and obstacle information shall start being provided.

In addition to ensuring a proper understanding of such requirements, existing State policies must also be identified. These may include domestic regulatory restrictions, State policies that are in conflict with Annex 15, data collection problems, data processing, and participation of third parties in such task. It is recommended that all States review their current policies concerning ICAO requirements and identify the adjustments or new procedures that may be required.

States that do not meet the relevant dates must file a ”difference” before ICAO and set a date for compliance and an action plan.

States must recognise that compliance requirements may imply collaboration by organisations other than the aeronautical authority. That would be the case if the responsibility for data collection is shared or delegated to more than one organisation, which will result in agreements and eventually some type of training to make sure that information received is the right one.

2.2. Identification of data types

The types of data to be collected are related to “terrain” and “obstacles”.

“Terrain” is defined as the surface of the Earth containing naturally occurring features such as mountains, hills, ridges, valleys, bodies of water, permanent ice and snow, and excluding obstacles (Annex 15, Chapter 2 “Definitions”).

“Obstacles”, in turn, are defined as all fixed (whether temporary or permanent) and mobile objects, or part thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surfface intended to protect aircraft in flight. (Annex 15, Chapter 2 “Definitions”).

The State must identify the sources of such data. In general, terrain data is available at

State geographical institutes. There may also be other providers of such data, reason why there may be a need to enter into some type of agreement to that end. In this sense, the signing of a service level agreement (SLA) with such providers is recommended in order to formalise the initial and subsequent acquisition of data.

As to obstacles, data may be available from:

- Mobile telephone companies (antennae, transmission frequencies)
- Aviation service provider (NAVAIDS / aerodrome data)
- Airports (aerodrome data)
- Public service authorities (electric lines, dams, cable railways, chimneys, wind mills, etc.)
- Military
- Local authorities (buildings)
- Existing studies on obstacles

Some States have offices that collect all this information; consequently, such offices shall be identified and queried accordingly.

These sources will provide all the basic data for building an eTOD database, which will be modified as new data emerges, or when the existing data is modified or deleted.

2.3. Data collection

Once originating data sources, both internal and external, have been identified, and taking into account that such sources are capable of sharing such data, the State may import the available electronic data.

Similarly, the imported data may be incomplete, given the fact that there are much more data still uncollected. In that case, and if no terrain and obstacle data were available, an analysis shall be made of how to obtain them.

The State must create mechanisms for collecting new or additional data for the database in such a way as to ensure that the information is accurage and up-to-date. It must take into account the amount of data that needs to be collected, and do it efficiently.

These data collection methodologies will depend on the data already available, the extent of the territory, and economic resources available. Therefore, it is recommended that a study be made on the possibility of working together with other areas of the States so that they can all benefit from the collection of this type of information.

Another point to consider is the need to collect data on territory of another State. In that case, it is recommended that an agreement be signed whereby the parties define the corresponding data collection permits and data sharing criteria. In this regard, Annex 15 “Aeronautical Information Services”, Ch. 3, 3.1.5, 3.1.6, and 3.3.4 should be considered.

2.4. Ensure data validity, quality and accuracy

Before gathering data in a database, it is essential to make sure that such data meets quality, validity, and accuracy requirements. Appendix 2 to this document describes the level of detail required from the data collected (this Appendix shall be updated after the approval of AMDT NR 37 to ICAO Annex 15).

In order to meet quality requirements, data must be accompanied by the corresponding metadata, that is, a registry of data sources or origin and all relevant aspects concerning how it was obtained, training of those who obtained them, conditions, etc., with the corresponding records.

2.5. Creation of an eTOD database

Before entering data on an eTOD database, the State must consider the following:

- The ideal database shall provide real-time support to operations, imposing no restrictions on size, and run on an open systems environment in order to enable future analysis.
- The database must be structured in an industry standard format with sufficient safety mechanisms against unauthorised access.
- The database must permit immediate inclusion of new data sources and obstacles.
- The database shall permit the export and publication of data, especifically in AIXM standards.

Furthermore, the authority may analyse how to structure the database in such a way as to provide operational benefits not only to airspace users, but to the authority itself, since this could generate cost savings. The eTOD database designed to meet ICAO terrain and obstacle data requirements could also offer:

- Inclusion and management of data on aerodromes, navaids, obstacles, Annex 14, and data on other surfaces;
- Easier assessment of obstacles through advanced 2D and 3D displays;
- Inclusion of GIS tools to facilitate the analysis;
- Automation mechanisms to increase efficiency and improve the assessment; and
- Historical reference data for assessment purposes.

2.6. Publication of information

ICAO Annex 15, Chapter 10.6 points to the need to public electronic terrain and obstacle data. Once the State has created an eTOD database, it will have to consider what data will be published and what mechanisms will be used for that purpose.

Likewise, the State shall also consider if it will charge the users for the provision of data or it will make them available free of charge.

A possible platform for publication could be the web, since it offers a simple means of publication. Likewise, there is the possibility of doing the publication directly to the user, that is, through some magnetic or digital medium.

An additional benefit would be the ability to export the aforementioned data in industry standard formats, such as AIXM, XML, for their use in other applications.

2.7. Continuous review

Within the context of the quality concept, the State shall also consider conducting a continuous review of its information so as to keep the database up-to-date at all times. Equally important is to take into account the responsibility and impact of the data provided. Accordingly, their review will be crucial.

3. Costs

The generation of an eTOD database will generate expenses that must be taken into account by the State.

3.1. Elements to be taken into account

For cost calculations, a set of elements must be taken into account and specifically analysed by each State based on a series of parameters:

- the extent of its territory,
- the existence or absence of previous terrain and obstacle data,
- the methodology to be used for capturing information,
- others that may have an impact on the equation.

In addition to these parameters, consideration shall also be given to the way in which new information will be collected in the future. This aspect is extremely important de define whether the information will be collected directly by the State or through third parties.

In case of outsourcing, the cost of training and the possible signing of an SLA clearly specifying the required data shall also be taken into account.

As an example, the cost could include:

- work planning,
- data collection,
- entry of data in the database,
- final verification of data

Likewise, consideration shall be given to paragraph 2.6 of this document referred to the way in which both the initial investment as well as any future investment on future data collections will be recovered.

Accordingly, States must analyse how they will recover their investment. Some mechanisms are listed below by way of example:

- payment for using the information whenever the database is queried,
- an initial payment for the right to use the information and a fixed annual charge for such use,
- other options that the State may consider appropriate

4. Implementation timetables

Taking into account the eTOD Project Plan defined at the SAM/AIM/2 meeting, the deadline for the completion of this document has been set for 31 August 2012.

In turn, the technical specifications for the execution of the eTOD project will be based on this document.

But States should make reference to the aforementioned eTOD project plan in order to properly plan the implementation timetable for each of the tasks contained therein. The analysis of the possibility of complying with the timetable will be extremely important in order to put the database at the disposal of users by 12 November 2015.

Likewise, the analysis of the eTOD project plan will be very useful if, for any reason, the State is unable to meet the date or any of the tasks contained therein.

5. Project risks

The risk analysis must be conducted by each State in the event it is unable to develop the eTOD database or any of the tasks contained in the aforementioned eTOD project plan, in accordance with the forms shown below.

DEFICIENCY (HAZARD) REPORT AND RISK ASSESSMENT	
1. Description of the identified deficiency	
2. State/Territory/ Organisation:	
3. Report N°:	
4. Date of identification:	
5. Deficiency reported by:	
6. Air navigation area – Facility/service involved:	
7. Specific requirement:	
8. Potential consequences of the deficiency:	
9. Currently implemented mitigation (if known):	
10. Remarks:	
11. Report prepared by:	

DEFICIENCY (HAZARD) REPORT AND RISK ASSESSMENT (CONT.)

		RISK SEVERITY				
		Catastrophic **A**	Hazardous **B**	Major **C**	Minor **D**	Insignificant **E**
RISK PROBABILITY	Frequent **5**	***5A***	***5B***	***5C***	***5D***	***5E***
	Occasional **4**	***4A***	***4B***	***4C***	***4D***	***4E***
	Remote **3**	***3A***	***3B***	***3C***	***3D***	***3E***
	Improbable **2**	***2A***	***2B***	***2C***	***2D***	***2E***
	Extremely Improbable **1**	***1A***	***1B***	***1C***	***1D***	***1E***

Risk index	*Tolerance*	*Required action*
5A, 5B, 4A	Extreme risk	IMMEDIATE STOP THE OPERATION OR PROCESS. Unacceptable under the current circumstances. No operation is to be permitted until sufficient control measures are implemented to reduce the risk to an acceptable level. Top management approval is required.
3A, 4B, 5C	High risk	CAUTION. Make sure the risk assessment has been satisfactorily completed and the corresponding preventive controls have been established. Management authorisation of the risk assessment is required before starting the operation or process.
1A, 2A, 2B, 3B, 3C, 4C, 4D, 5D, 5F	Moderate risk	Implement or review risk mitigation as necessary. The approval by the risk assessment department is required.
1B, 1C, 2C, 2D, 3D, 3E, 4E	Low risk	Risk mitigation or revision is optional.
1D, 1E, 2E	Insignificant risk	Acceptable as it is. No risk mitigation is required.

PROBABILITY	Is defined as the probability that an event or unsafe condition may occur
Frequent:	Likely to occur many times (has occurred frequently)
Occasional:	Likely to occur some times (has occurred infrequently)
Remote:	Unlikely, but may occur (rarely occurs)
Improbable:	Very unlikely (no occurrence is known)
Extremely improbable:	Almost unconceivable that the event may occur.

SEVERITY:	Is defined as the possible consequence of an event or unsafe condition, taking as a reference the worst case scenario
Catastrophic:	• Equipment destruction • Multiple casualties
Hazardous:	• Major reduction of safety margins, physical damage or workload such that operators cannot perform their tasks in a precise and complete manner • Severe injury • Major damage to equipment
Major:	• Significant reduction of safety margins, reduced ability of the operator to respond to adverse operational conditions resulting from increased workload or conditions hindering its efficiency • Serious incident • Personal injury
Minor:	• Interference • Operational limitations • Use of emergency procedures • Minor incidents
Insignificant:	• Minor consequences

EXPLANATION OF THE FORM
"DEFICIENCY (HAZARD) REPORT AND RISK ASSESSMENT"

1. **Description of the identified deficiency:** Specifies the deficiency identified and validated by the corresponding Regional Office.

2. **State/Territory/Organisation:** Identifies the name of the State/Territory/Organisation involved.

3. **Report N°:** Unique code that identifies the deficiency by State.

4. **Date of identification:** Indicates the date of notification of the identified deficiency, if applicable.

5. **Deficiency reported by:** Indicates the source that identified and reported the deficiency.

6. **Air navigation area facility/service involved:** Specifies the air navigation area directly involved in the identified deficiency. More than one area may be listed.

7. **Specific requirement:** ICAO Annex standard/recommended practice or reference to the requirement of the air Navigation Plan associated to the deficiency. If known, the error or specific failure that affecte the operation is included.

8. **Potential consequences of the deficiency**: Initial assessment of the consequences of the identified deficiency, either by the source that reports the deficiency or by the Regional Office that sends the notification.

9. **Currently implemented mitigation (if known):** If known, currently implemented defences are included.

10. **Remarks:** Remarks or comments on the identified deficiency may be included.

11. **Report prepared by (ICAO Officer):** Indicates the Regional Office and the ICAO Officer that send the notification.

REPORT OF RECOMMENDATIONS TO MITIGATE THE RISK				
1. Description of the identified deficiency:				
2. State/Territory/Organisation:				
3. Report N°:				
4. Date of identification:				
5. Level of risk before the adoption of mitigation measures				
6. Solution # 1				
7. Description of the solution:				
8. Estimated cost and time for implementation of this solution: $ _____	9. Revised risk assessment if only this solution is to be implemented	10. Probability:		
		11. Severity:		
		12. Level of risk:		
13. Potential implementation problems:				
14. Solution # 2				
15. Descripción de la Solución:				
16. Estimated cost and time for implementation of this solution $ _____	17. Revised risk assessment if <u>only</u> this solution must be	18. Probability:		
		19. Severity:		

REPORT OF RECOMMENDATIONS TO MITIGATE THE RISK				
	implemented:	20. Level of risk		
21. Potential implementation problems:				
22. Solution # 3				
23. Description of the solution:				
24. Estimated cost and time for implementation of this solution $ _____	25. Revised risk assessment if only this solution must be implemented:	26. Probability:		
		27. Severity:		
		28. Level of risk:		
29. Potential implementation problems:				
30. Recommended solution(s):				
31. Estimated cost and time for implementation of the recommended solution(s):	$			
32. Revised risk assessment if implemented as recommended:				

		RISK SEVERITY				
		Catastrophic **A**	Hazardous **B**	Major **C**	Minor **D**	Insignificant **E**
RISK PROBABILITY	Frequent **5**	***5A***	***5B***	***5C***	***5D***	***5E***
	Occasional **4**	***4A***	***4B***	***4C***	***4D***	***4E***
	Remote **3**	***3A***	***3B***	***3C***	***3D***	***3E***
	Improbable **2**	***2A***	***2B***	***2C***	***2D***	***2E***

REPORT OF RECOMMENDATIONS TO MITIGATE THE RISK						
	Extremely Improbable **1**	***1A***	***1B***	***1C***	***1D***	***1E***
33. Report prepared by (State/Territory/ Organisation):						

EXPLANATION OF THE FORM "REPORT OF RECOMMENDATIONS TO MITIGATE RISK DE"

The State involved shall complete the form in accordance with the following explanations:

1. **Description of the identified deficiency:** Complete with the same text as the deficiency report validated by the corresponding Regional Office.

2. **State/Territory/Organisation:** Complete with the name of the State/Territory/Organisation.

3. **Report N°:** Complete with the same code as the deficiency identified for each State.

4. **Date of identification:** Insert the date of completion of this form.

5. **Level of risk before the adoption of mitigation measures:** Complete with the level of risk calculated with the existing mitigation measures.

6. **Solution # 1:** Identifies the number of the solution.

7. **Description of the solution:** Complete with a brief description of the first solution to be implemented.

8. **Estimated cost and time for implementation of this solution:** Insert the estimated cost for the implementation of the first solution.

9. **Revised risk assessment if <u>only</u> this solution is to be implemented:** Associated to boxes 10, 11, and 12.

10. **Probability:** Insert the probability index, in code and in simple text, that would be achieved with the implementation of this mitigation measure.

11. **Severity:** Complete with the severity index, in code and in simple text, that would be achieved with the implementation of this mitigation measure.

12. **Level of risk:** Complete with the tolerability index resulting from the implementation of this mitigation measure, in code and in simple text.

13. **Potential implementation problems:** Insert a brief description of potential implementation problems that might prevent the application of the identified solution.

14. **Solution # 2:** Identifies the number of the solution or scenario.

15. **Description of the solution:** Insert a brief description of the second solution to be implemented.

16. **Estimated cost and time for the implementation of this solution:** Insert the estimated cost for the implementation of the second solution.

17. **Revised risk assessment if <u>only</u> this solution is to be implemented:** Associated to boxes 18, 19, and 20.

18. **Probability:** Insert the probability index, in code and in simple text, to be attained with the implementation of this mitigation measure.

19. **Severity:** Complete with the severity index, in code and in simple text, that would be attained with the implementation of this mitigation measure.

20. **Level of risk:** Insert the tolerability index resulting from the implementation of this mitigation measure, in code and in simple text.

21. **Potential implementation problems:** Insert a brief description of the potential implementation problems that might prevent the execution of the identified solution

22. **Solution # 3:** Identifies the number of solution or scenario.

23. **Description of the solution:** Insert a brief description of the third solution to be implemented.

24. **Estimated cost and time for implementation of this solution:** Insert the estimated cost of the implementation of the third solution.

25. **Revised risk assessment if <u>only</u> this solution is to be implemented:** Associated to boxes 26, 27, and 28.

26. **Probability:** Insert the probability index, in code and in simple text, to be achieved with the implementation of this mitigation measure.

27. **Severity:** Inser tht severity index, in code and in simple text, to b achieved with the implementation of this mitigation measure.

28. **Level of risk:** Insert the tolerability index resulting from the implementation of this migitation measure, in code and in simple text.

29. **Potential implementation problems:** Insert a brief description of potential implementation problems that might prevent the application of the identified solution.

30. **Recommended solution(s):** Insert the solution(s) to be implemented to reduce the tolerability index to an acceptable level.

31. **Estimated cost and time for implementation of the recommended solution(s):** Insert with the estimated cost related to the solutions to be implemented.

32. **Revised risk assessment if implemented as recommended:** Complete with the risk assessment once the aforementioned solution(s) has(have) been implemented.

33. **Report prepared by (State/Territory/Organisation):** Insert the name of the aeronautical authority or person/area generating the report.

Appendix 1 – Data collection areas

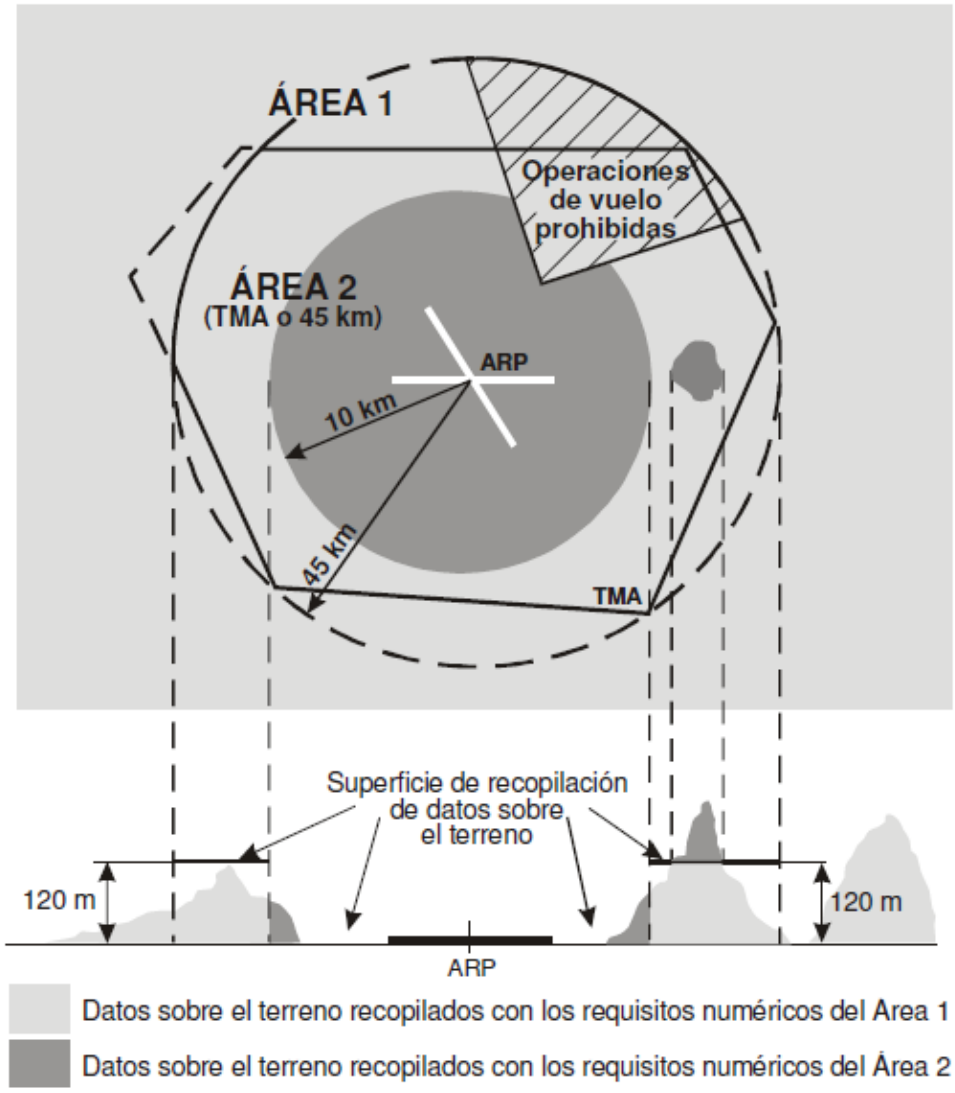

Figure A1-1. Terrain data collection surfaces — Area 1 and Area 2

1. In the area contained within a radius of 10 km from the ARP, terrain data will be adjusted to the numerical requirements of Area 2.

2. In the area between 10 km and TMA boundaries or 45 km from the radius (whichever is smaller), terrain data that penetrates 120 m of the horizontal plane above the lowest runway elevation will be adjusted to the numerical requirements of Area 2.

3. In the area between 10 km and TMA boundaries or 45 km from the radius (whichever is smaller), terrain data that do not penetrate 120 m of the horizontal plane above the lowest runway elevation will be adjusted to the numerical requirements of Area 1.

4. In those sectors of Area 2 where flight operations are prohibited because of too high terrain or other local restrictions or regulations, terrain data will be adjusted to the numerical requirements of Area 1.

Note.- The numerical requirements of terrain data for Areas 1 and 2 are shown in Table A2-6.

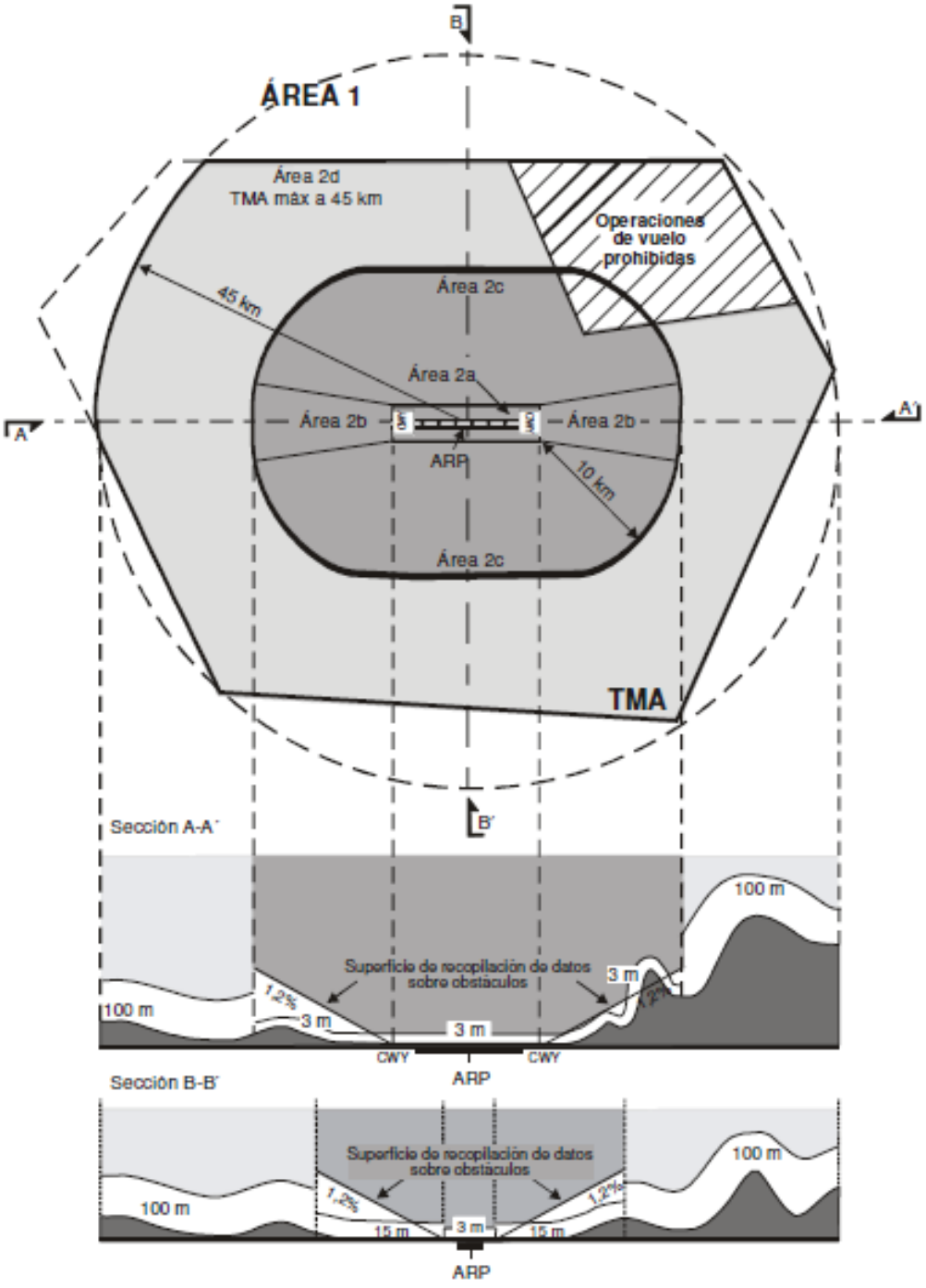

Figure A1-2. Obstacle data collection surfaces — Area 1 and Area 2

1. Obstacle data will be collected and recorded in accordance with the numerical requirements of Area 2 shown in Table A2-7:

   a) Area 2a: rectangular area around a runway that includes the runway strip and whatever clearway exists. The obstacle data collection surface of Area 2a will be at a height of three metres above the closest runway elevation measured along the runway centre line, and for those parts related to a clearway, if any, the elevation of the closest runway end;

   b) Area 2b: area that extends from the ends of Area 2a in the outbound direction, with a length of 10 km and a widening of 15% to each side. The data collection surface of Area 2b follows a slope of 1,2% that extends from the ends of Area 2a to the elevation of the runway end in the outbound direction, with a length of 10 km and a widening of 15% to each side;

   c) Area 2c: area extending outside of Area 2a and Area 2b to a distance not exceeding 10 km with respect to the boundaries of Area 2a. The data collection surface of Area 2c follows a slope of 1,2% that extends outside of Areas 2a and 2b at a distance not exceeding 10 km with respect to the boundary of Area 2a. The initial elevation of Area 2c will be the elevation of the point of Area 2a where it starts; and

   d) Area 2d: Area extending outside of Areas 2a, 2b and 2c up to a distance of 45 km with respect to the aerodrome fix, or up to the existing TMA boundary, if this boundary is closer. The obstacle data collection surface of Area 2d is located at a height of 100 m above the terrain.

2. In those sectors of Area 2 where flight operations are prohibited because of too high terrain or other local restrictions or regulations, obstacle data will be identified and recorded in accordance with the requirements of Area 1.

3. The data on each obstacle within Area 1 that has a height above the ground of 100 m or more will be collected and recorded in the data set, in accordance with the numerical requirements of Area 1 specified in Table A2-7.

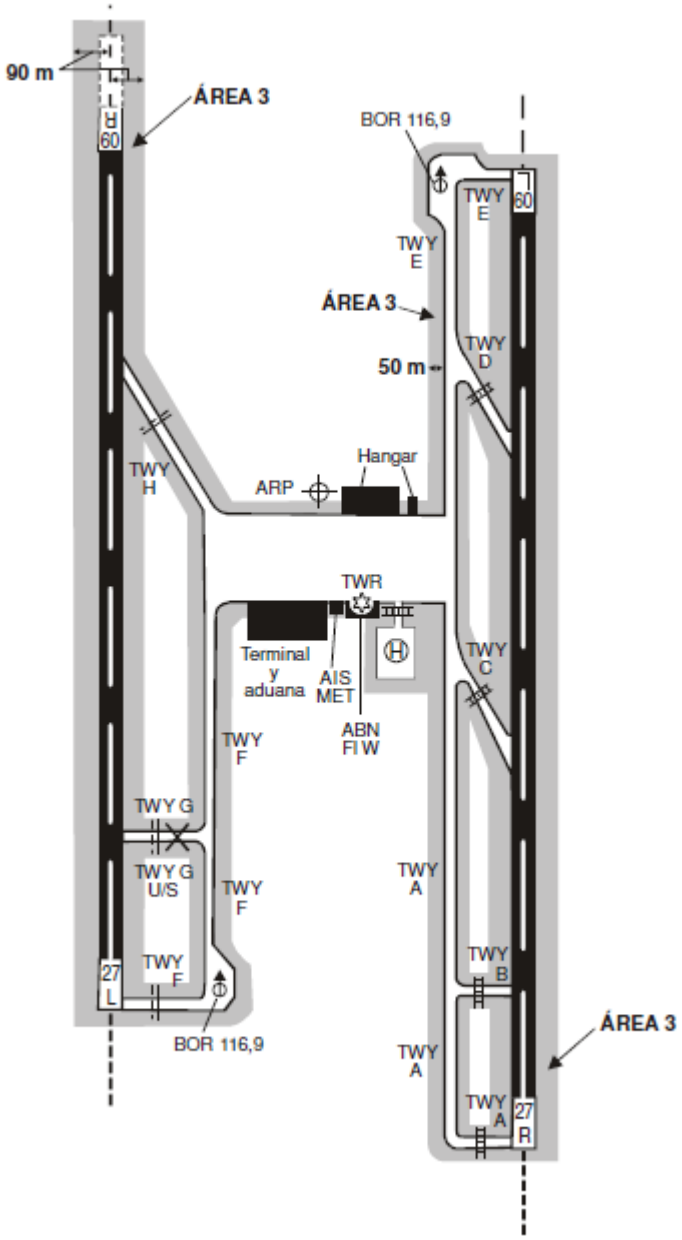

Figure A1-3. Terrain and obstacle data collection surface — Area 3

1. The terrain and obstacle data collection surface is prolongued half a metre (0,5 m) over the horizontal plane crossing the closes point in the aerodrome movement area.

2. Terrain and obstacle data in Area 3 will be adjusted to the numerical requirements specified in Table A2-6 and Table A2-7, respectively.

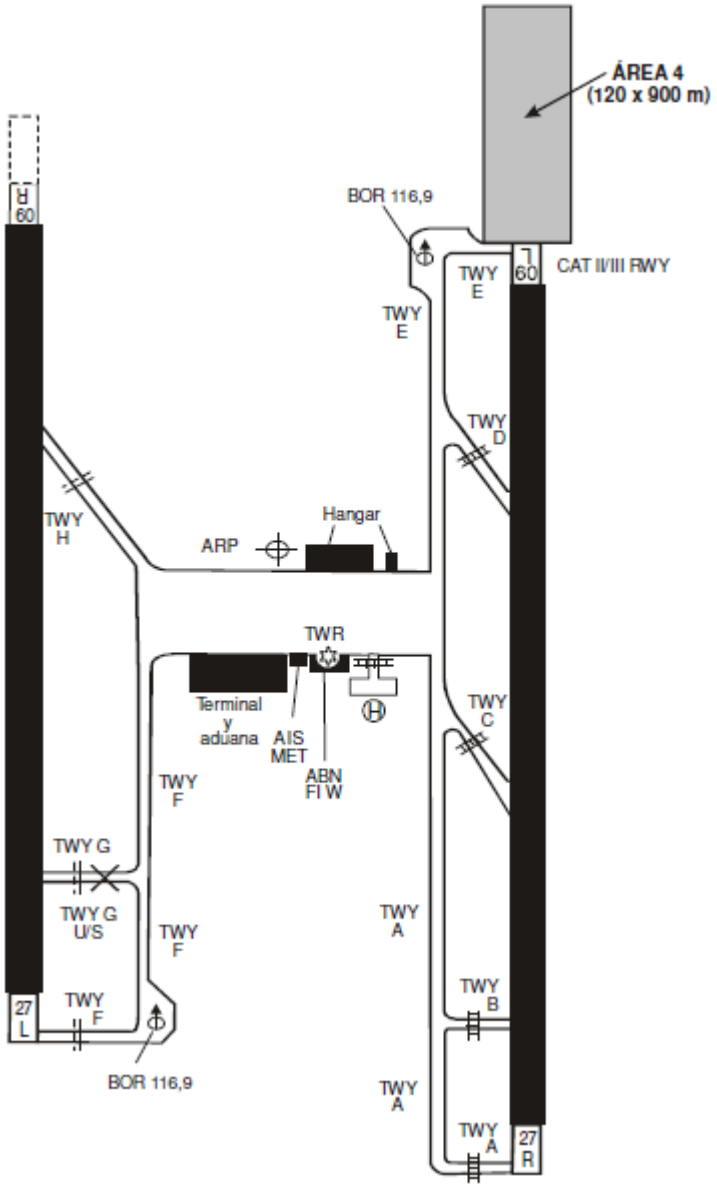

Figure A1-4. Terrain and obstacle data collection surface — Area 4

Terrain data in Area 4 will be adjusted to the numerical requirements specified in Table A2-6.

Note 1.- Area 2 spreads over Area 4, in the horizontal plane. More detailed obstacle data may be collected in Area 4 in accordance with the numerical requirements of Area 4 for the obstacle data specified in Table A2-7. (see Annex 15, 10.1.8.).

Note 2.- Area 4 may be extended in accordance with Annex 15, 10.1.2.

Appendix 2 – Data precision

Table A2-1 Latitude and Longitude

APPENDIX 7. AERONAUTICAL DATA QUALITY REQUIREMENTS

Table A7-1. Latitude and longitude

Latitude and longitude	Publication resolution	Integrity Classification
Flight information region boundary points	1 min	1×10^{-3} routine
P, R, D area boundary points (outside CTA/CTR boundaries)	1 min	1×10^{-3} routine
P, R, D area boundary points (inside CTA/CTR boundaries)	1 sec	1×10^{-5} essential
CTA/CTR boundary points	1 sec	1×10^{-5} essential
En-route NAVAIDS, intersections and waypoints, and holding, and STAR/SID points	1 sec	1×10^{-5} essential
Obstacles in Area 1 (the entire State territory)	1 sec	1×10^{-3} routine
Aerodrome/heliport reference point	1 sec	1×10^{-3} routine
NAVAIDS located at the aerodrome/heliport	1/10 sec	1×10^{-5} essential
Obstacles in Area 3	1/10 sec	1×10^{-5} essential
Obstacles in Area 2	1/10 sec	1×10^{-5} essential
Final approach fixes/points and other essential fixes/points comprising the instrument approach procedure	1/10 sec	1×10^{-5} essential
Runway threshold	1/100 sec	1×10^{-8} critical
Runway end	1/100 sec	1×10^{-8} critical
Runway holding position	1/100 sec	1×10^{-8} critical
Taxiway centre line/parking guidance line points	1/100 sec	1×10^{-5} essential
Taxiway intersection marking line	1/100 sec	1×10^{-5} essential

Latitude and longitude	Publication resolution	Integrity Classification
Exit guidance line	1/100 sec	1×10^{-5} essential
Aircraft stand points/INS checkpoints	1/100 sec	1×10^{-3} routine
Geometric centre of TLOF or FATO thresholds, heliports	1/100 sec	1×10^{-8} critical
Apron boundaries (polygon)	1/10 sec	1×10^{-3} routine
De-icing/anti-icing facility (polygon)	1/10 sec	1×10^{-3} routine

Note.— See Appendix 8 for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.

Table A7-2. Elevation/altitude/height

Elevation/altitude/height	Publication resolution	Integrity Classification
Aerodrome/heliport elevation	1 m or 1 ft	1×10^{-5} essential
WGS-84 geoid undulation at aerodrome/heliport elevation position	1 m or 1 ft	1×10^{-5} essential
Runway or FATO threshold, non-precision approaches	1 m or 1 ft	1×10^{-5} essential
WGS-84 geoid undulation at runway or FATO threshold, TLOF geometric centre, non-precision approaches	1 m or 1 ft	1×10^{-5} essential
Runway or FATO threshold, precision approaches	0.1 m or 0.1 ft	1×10^{-8} critical
WGS-84 geoid undulation at runway or FATO threshold, TLOF geometric centre, precision approaches	0.1 m or 0.1 ft	1×10^{-8} critical
Threshold crossing height, precision approaches	0.1 m or 0.1 ft	1×10^{-8} critical
Obstacles in Area 2	1 m or 1 ft	1×10^{-5} essential
Obstacles in Area 3	0.1 m or 0.1 ft	1×10^{-5} essential
Obstacles in Area 1 (the entire State territory)	1 m or 1 ft	1×10^{-3} routine

Latitude and longitude	Publication resolution	Integrity Classification
Exit guidance line	1/100 sec	1×10^{-5} essential
Aircraft stand points/INS checkpoints	1/100 sec	1×10^{-3} routine
Geometric centre of TLOF or FATO thresholds, heliports	1/100 sec	1×10^{-8} critical
Apron boundaries (polygon)	1/10 sec	1×10^{-3} routine
De-icing/anti-icing facility (polygon)	1/10 sec	1×10^{-3} routine

Note.— See Appendix 8 for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.

Elevation/altitude/height	Publication resolution	Integrity Classification
Aerodrome/heliport elevation	1 m or 1 ft	1×10^{-5} essential
WGS-84 geoid undulation at aerodrome/heliport elevation position	1 m or 1 ft	1×10^{-5} essential
Runway or FATO threshold, non-precision approaches	1 m or 1 ft	1×10^{-5} essential
WGS-84 geoid undulation at runway or FATO threshold, TLOF geometric centre, non-precision approaches	1 m or 1 ft	1×10^{-5} essential
Runway or FATO threshold, precision approaches	0.1 m or 0.1 ft	1×10^{-8} critical
WGS-84 geoid undulation at runway or FATO threshold, TLOF geometric centre, precision approaches	0.1 m or 0.1 ft	1×10^{-8} critical
Threshold crossing height, precision approaches	0.1 m or 0.1 ft	1×10^{-8} critical
Obstacles in Area 2	1 m or 1 ft	1×10^{-5} essential
Obstacles in Area 3	0.1 m or 0.1 ft	1×10^{-5} essential
Obstacles in Area 1 (the entire State territory)	1 m or 1 ft	1×10^{-3} routine

Note.- See in Appendix 1 the graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.

Table A7-3. Declination and magnetic variation

Declination/variation	Publication resolution	Integrity Classification
VHF NAVAID station declination used for technical line-up	1 degree	1×10^{-5} essential
NDB NAVAID magnetic variation	1 degree	1×10^{-3} routine
Aerodrome/heliport magnetic variation	1 degree	1×10^{-5} essential
ILS localizer antenna magnetic variation	1 degree	1×10^{-5} essential
MLS azimuth antenna magnetic variation	1 degree	1×10^{-5} essential

Table A7-4. Bearing

Bearing	Publication resolution	Integrity Classification
Airway segments	1 degree	1×10^{-3} routine
En-route and terminal fix formations	1/10 degree	1×10^{-3} routine
Terminal arrival/departure route segments	1 degree	1×10^{-3} routine
Instrument approach procedure fix formations	1/100 degree	1×10^{-5} essential
ILS localizer alignment (True)	1/100 degree	1×10^{-5} essential

Table A2-5 Length/distance/dimension

Table A7-5. Length/distance/dimension

Length/distance/dimension	Publication resolution	Integrity Classification
Airway segment length	1/10 km or 1/10 NM	1×10^{-3} routine
En-route fix formation distance	1/10 km or 1/10 NM	1×10^{-3} routine
Terminal arrival/departure route segment length	1/100 km or 1/100 NM	1×10^{-5} essential
Terminal and instrument approach procedure fix formation distance	1/100 km or 1/100 NM	1×10^{-5} essential
Runway and FATO length, TLOF dimensions	1 m or 1 ft	1×10^{-8} critical
Runway width	1 m or 1 ft	1×10^{-5} essential
Displaced threshold distance	1 m or 1 ft	1×10^{-3} routine
Clearway length and width	1 m or 1 ft	1×10^{-5} essential
Stopway length and width	1 m or 1 ft	1×10^{-8} critical
Landing distance available	1 m or 1 ft	1×10^{-8} critical
Take-off run available	1 m or 1 ft	1×10^{-8} critical
Take-off distance available	1 m or 1 ft	1×10^{-8} critical
Accelerate-stop distance available	1 m or 1 ft	1×10^{-8} critical
Runway shoulder width	1 m or 1 ft	1×10^{-5} essential
Taxiway width	1 m or 1 ft	1×10^{-5} essential

Length/distance/dimension	Publication resolution	Integrity Classification
Taxiway shoulder width	1 m or 1 ft	1×10^{-5} essential
ILS localizer antenna-runway end, distance	1 m or 1 ft	1×10^{-3} routine
ILS glide slope antenna-threshold, distance along centre line	1 m or 1 ft	1×10^{-3} routine
ILS marker-threshold distance	1 m or 1 ft	1×10^{-5} essential
ILS DME antenna-threshold, distance along centre line	1 m or 1 ft	1×10^{-5} essential
MLS azimuth antenna-runway end, distance	1 m or 1 ft	1×10^{-3} routine
MLS elevation antenna-threshold, distance along centre line	1 m or 1 ft	1×10^{-3} routine
MLS DME/P antenna-threshold, distance along centre line	1 m or 1 ft	1×10^{-5} essential

Table A2-6 Terrain data numerical requirements

Table A2-7 Length/distance/dimension - Obstacle data numerical requirements

Table A8-1. Terrain data numerical requirements

	Area 1	Area 2	Area 3	Area 4
Post spacing	3 arc seconds (approx. 90 m)	1 arc second (approx. 30 m)	0.6 arc seconds (approx. 20 m)	0.3 arc seconds (approx. 9 m)
Vertical accuracy	30 m	3 m	0.5 m	1 m
Vertical resolution	1 m	0.1 m	0.01 m	0.1 m
Horizontal accuracy	50 m	5 m	0.5 m	2.5 m
Confidence level	90%	90%	90%	90%
Data classification Integrity level	routine 1×10^{-3}	essential 1×10^{-5}	essential 1×10^{-5}	essential 1×10^{-5}
Maintenance period	as required	as required	as required	as required

Table A8-2. Obstacle data numerical requirements

	Area 1	Area 2	Area 3	Area 4
Vertical accuracy	30 m	3 m	0.5 m	1 m
Vertical resolution	1 m	0.1 m	0.01 m	0.1 m
Horizontal accuracy	50 m	5 m	0.5 m	2.5 m
Confidence level	90%	90%	90%	90%
Data classification Integrity level	routine 1×10^{-3}	essential 1×10^{-5}	essential 1×10^{-5}	essential 1×10^{-5}
Maintenance period	as required	as required	as required	as required