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AERODROME SAFEGUARDING WORKSHOP

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Overview ICAO Standards and Recommended Practices for Aerodrome Mapping Data reported to AIM

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References

- ICAO SARPS – Annex 14 Vol. I, 7th Edition, July 2016
- ICAO SARPS – Annex 15, 15th Edition, July 2016
- ICAO PANS- Aerodromes-Doc 9981, 2nd Edition, 2016
- ICAO PANS-OPS (Aircraft Operations) - Doc 8168
- ICAO Manual on Certification of Aerodromes Doc 9774
- ICAO Airport Services Manual - Doc 9137- Part 6
- Regional Safety Advisories - MID-RSA/11(Safeguarding Guidelines & Tool Kit)



ICAO SARPs

- ✓ **Annex 14 Volume I – 7th Edition, July 2016 - Aerodrome Design and Operations**
 - Chapter 2:** Aerodrome Data
 - 2.1 Aeronautical Data
 - 2.5 Aerodrome dimensions and related information including Obstacles
 - Appendix 5: Accuracy and Integrity requirements Tables A5-1 to A5-5

- ✓ **Annex 15 – 15th Edition, July 2016 - Aeronautical Information Services**
 - Chapter 3:** Aeronautical information management
 - Chapter 11:** Aerodrome Mapping Data
 - Appendix 7: Aeronautical data publication resolution and integrity classification
 - Appendix 8: Terrain and obstacle data requirements

- ✓ **Annex 4 – 11th Edition, July 2009 last Amended 10/11/2016 - Aeronautical Charts**
 - Chapters 3 to 6** Aerodrome Obstacle Charts
 - Appendix 6 Aeronautical data quality requirements

- ✓ **Annex 5 – 5th Edition, July 2010 - Units of Measurement to be Used in Air and Ground Operations**

- ✓ ICAO Manual on Aeronautical Information Services (Doc 8126)
- ✓ World Geodetic System — 1984 (WGS-84) Manual (Doc 9674)



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General

➤ Definitions

- **Accuracy:** A degree of conformance between the estimated or measured value and the true value.
- **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
- **Aerodrome mapping data** (AMD): Data collected for the purpose of compiling aerodrome mapping information
- **Aerodrome mapping database** (AMDB): A collection of aerodrome mapping data organized and arranged as a structured data set.
- **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



General

➤ Definitions Cont'd

- **Confidence level:** The probability that the true value of a parameter is within a certain interval around the estimate of its value. Note.— The interval is usually referred to as the accuracy of the estimate.
- **Digital Elevation Model (DEM) or (DTM):** The representation of terrain surface by continuous elevation values at all intersections of a defined grid, referenced to common datum.
- **Ellipsoid height (Geodetic height):** The height related to the reference ellipsoid, measured along the ellipsoidal outer normal through the point in question
- **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
- **Geoid undulation:** The distance of the geoid above (positive) or below (negative) the mathematical reference ellipsoid
- **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.



General

➤ Definitions Cont'd

- **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.
- **Integrity classification (aeronautical data):** Classification based upon the potential risk resulting from the use of corrupted data. Aeronautical data are classified as:
 - a) **routine data:** there is a very low probability when using corrupted routine data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe (ex. Apron boundaries, Displaced threshold distance,.. ;
 - b) **essential data:** there is a low probability when using corrupted essential data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe (ex. ILS localizer alignment, Taxiway width,..); and
 - c) **critical data:** there is a high probability when using corrupted critical data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe (ex. Runway thresholds, runway-holding position, Runway Centre line points ...).



General

➤ Definitions Cont'd

- **Minimum obstacle clearance altitude (MOCA):** The minimum altitude for a defined segment of flight that provides the required obstacle clearance.
- **Terrain:** 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.
Note.— In practical terms, depending on the method of data collection used, terrain represents the continuous surface that exists at the bare Earth, the top of the canopy or something in-between, also known as “first reflective surface”.
- **Obstacle/terrain data collection surface:** A defined surface intended for the purpose of collecting obstacle/terrain data.
- **Orthometric height:** Height of a point related to the geoid, generally presented as an MSL elevation



General

➤ Definitions Cont'd

- **Position (geographical):** Set of coordinates (latitude and longitude) referenced to the mathematical reference ellipsoid which define the position of a point on the surface of the Earth.
- **Quality:** Degree to which a set of inherent characteristics fulfils requirements (ISO 9000*).
- **Note 1.—** The term “quality” can be used with adjectives such as poor, good or excellent.
- **Note 2.—** “Inherent”, as opposed to “assigned”, means existing in something, especially as a permanent characteristic.
- **Resolution:** A number of units or digits to which a measured or calculated value is expressed and used.



Common reference systems for air navigation

➤ Horizontal reference system

- World Geodetic System — 1984 (WGS-84) shall be used as the horizontal (geodetic) reference system for international air navigation. Consequently, published aeronautical geographical coordinates (indicating latitude and longitude) shall be expressed in terms of the WGS-84 geodetic reference datum.
- Specifications governing the determination and reporting (accuracy of field work and data integrity) of WGS-84-related aeronautical coordinates for aerodrome/heliport-related positions, are contained in Annex 14, Volumes I and II, Chapter 2, and in Table A5-1 of Appendix 5 and Table A1-1
- Comprehensive guidance material concerning WGS-84 is contained in the World Geodetic System — 1984 (WGS-84) Manual (Doc 9674) Geographical coordinates that have been transformed into WGS-84 coordinates but whose accuracy of original
- Field work which does not meet the requirements in Annex 14, Volumes I and II, Chapter 2, shall be identified by an asterisk.



Common reference systems for air navigation

➤ Vertical reference system

- Mean sea level (MSL) datum, which gives the relationship of gravity-related height (elevation) to a surface known as the geoid, shall be used as the vertical reference system for international air navigation.
- In addition to elevation referenced to the MSL (geoid), for the specific surveyed ground positions, geoid undulation (referenced to the WGS-84 ellipsoid) for those positions specified in Annex 15, Appendix 1 shall also be published.
- The order of publication resolution of elevation and geoid undulation shall be that specified in Annex 15, Table A7-2 of Appendix 7 while the order of chart resolution of elevation and geoid undulation shall be that specified in Annex 4, Appendix 6, Table 2.



Common reference systems for air navigation

➤ **Temporal reference system**

- The Gregorian calendar and Coordinated Universal Time (UTC) shall be used as the temporal reference system
- for international air navigation.

➤ **Units of measurement** used in the origination, processing and distribution of aeronautical data and aeronautical information should be consistent with the decision taken by the State in respect of the use of the tables contained in Annex 5 to the Convention on International Civil Aviation - Units of Measurement to be Used in Air and Ground Operations.

- The International System of Units developed and maintained by the General Conference of Weights and Measures (CGPM) shall be used as the standard system of units of measurement for all aspects of international civil aviation air and ground operations



Units of measurement

- **Units of measurement** used in the origination, processing and distribution of aeronautical data and aeronautical information should be consistent with the decision taken by the State in respect of the use of the tables contained in Annex 5 to the Convention on International Civil Aviation - Units of Measurement to be Used in Air and Ground Operations.
- The International System of Units developed and maintained by the General Conference of Weights and Measures (CGPM) shall be used as the standard system of units of measurement for all aspects of international civil aviation air and ground operations.



State Responsibilities relevant to aeronautical data and aeronautical information

Each Contracting State shall:

- provide an aeronautical information service (AIS)
- ensure that the provision of aeronautical data and aeronautical information covers its own territory and those areas over the high seas for which it is responsible for the provision of air traffic services
- ensure that the aeronautical data and aeronautical information provided are complete, timely and of required quality in accordance with Chapter 3 of Annex 15
- ensure that formal arrangements are established between originators of aeronautical data and aeronautical information and the AIS in relation to the timely and complete provision of aeronautical data and aeronautical information



Exchange of aeronautical data and aeronautical information

- Each State shall designate the office to which all elements of the Integrated Aeronautical Information Package originated by other States shall be addressed. Such an office shall be qualified to deal with requests for aeronautical data and aeronautical information originated by other States
- Wherever practicable, direct contact between AIS shall be established in order to facilitate the international exchange of aeronautical data and aeronautical information



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Aerodrome Data Requirement

- **Aeronautical data**
- Aerodrome Reference Point
- Aerodrome and runway elevations
- Aerodrome reference temperature
- **Aerodrome dimensions and related information**
- Strength of pavements
- Pre-flight altimeter check location
- Declared distances
- Condition of the movement area and related facilities
- Disabled aircraft removal
- Rescue and firefighting
- Visual approach slope indicator systems



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Aerodrome Data Requirement

➤ **Aeronautical data:**

- Determination and reporting of aerodrome-related aeronautical data shall be in accordance with the accuracy and integrity requirements set forth in Tables A5-1 to A5-5 contained in Appendix 5 to Annex 14 Vol. I while taking into account the established quality system procedures.



Aerodrome Data Requirement

➤ Aeronautical data Cont'd:

- Accuracy requirements for aeronautical data are based upon a 95 per cent confidence level and in that respect, three types of positional data shall be identified:
 - surveyed points (e.g. runway threshold);
 - calculated points (mathematical calculations from the known surveyed points of points in space, ..); and
 - declared points (e.g. flight information region boundary points).



Aerodrome Data Requirement

➤ Aerodrome dimensions and related information

- The following data shall be measured or described, as appropriate, for each facility provided on an aerodrome:

Runway, Strip, Taxiway, Apron, the boundaries of the Air Traffic Control service, Visual aids for approach procedures, location and radio frequency of any VOR aerodrome checkpoint, location and designation of standard taxi-routes; and distances to the nearest meter or foot of localizer and glide path elements comprising an instrument landing system (ILS)



Aerodrome Mapping Data

- Aerodrome mapping databases related provisions are contained in Annex 15, Chapter 11
- Guidance Material on Aerodrome Mapping Data can be found in the Airport Services Manual, Part 8 — Airport Operational Service (Doc 9137)



Aerodrome Mapping Data

➤ Introduction

The aerodrome mapping data features are collected and made available to the Aeronautical Information Management for aerodromes designated by States where the application of the data would provide a safety benefit or could be used as mitigation of a safety concern.



Aerodrome Mapping Data

➤ Applications

- Aerodrome mapping data include aerodrome geographic information that supports applications which improve the user's situational awareness or supplement surface navigation, thereby increasing safety margins and operational efficiency.
- With appropriate data element accuracy, these data sets support collaborative decision-making, common situational awareness and aerodrome guidance applications.



Aerodrome Mapping Database

➤ Applications (Cont'd)

The data sets are intended to be used in the following air navigation applications:

- a) on-board positioning and route awareness including moving maps with own aircraft position, surface guidance and navigation;
- b) traffic awareness including surveillance and runway incursion detection and alerting (such as, respectively, in A-SMGCS levels 1 and 2);



Aerodrome Mapping Database

➤ Applications (Cont'd)

- c) ground positioning and route awareness including situational displays with aircraft and vehicles position and taxi route, surface guidance and navigation (such as A-SMGCS levels 3 and 4);
- d) facilitation of aerodrome-related aeronautical information, including NOTAMs;
- e) resource and aerodrome facility management; and
- f) aeronautical chart production.



Aerodrome Mapping Database

- The data may also be used in other applications such as:
 - training/flight simulators;
 - and on-board or ground enhanced vision systems (EVS);
 - synthetic vision systems (SVS); and
 - combined vision systems (CVS).



TERRAIN AND OBSTACLE DATA REQUIREMENTS

- Terrain and Obstacle Data Requirements are contained at Chapter 10 and Appendix 8 of Annex 15
- obstacle data collection surfaces and criteria used to identify obstacles in the defined areas are contained at Chapter 8 of Annex 15



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TERRAIN AND OBSTACLE DATA REQUIREMENTS

- Coverage areas and requirements for data provision
- Terrain data set — content, numerical specification and structure
- Obstacle data set — content, numerical specification and structure



APPENDIX 8. TERRAIN AND OBSTACLE DATA REQUIREMENTS

(See Chapter 10 of Annex 15.)

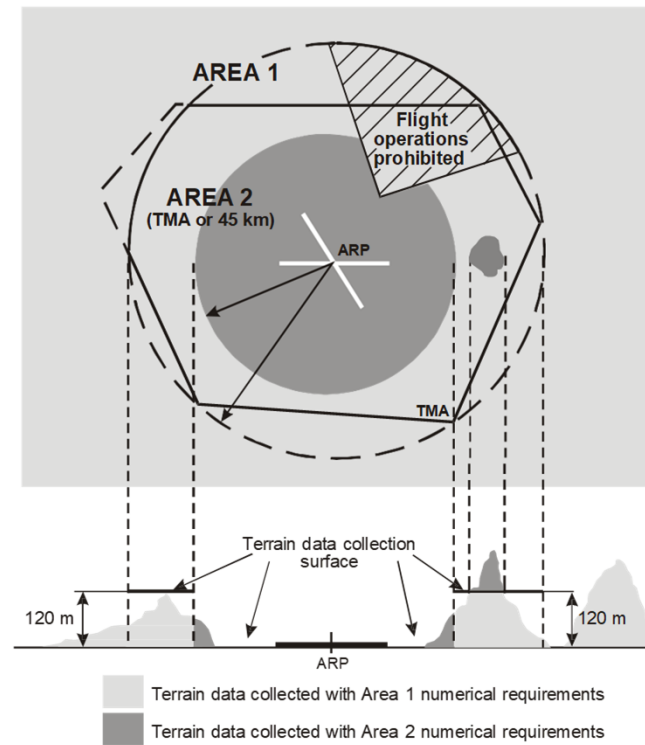


Figure A8-1. Terrain data collection surfaces — Area 1 and Area 2

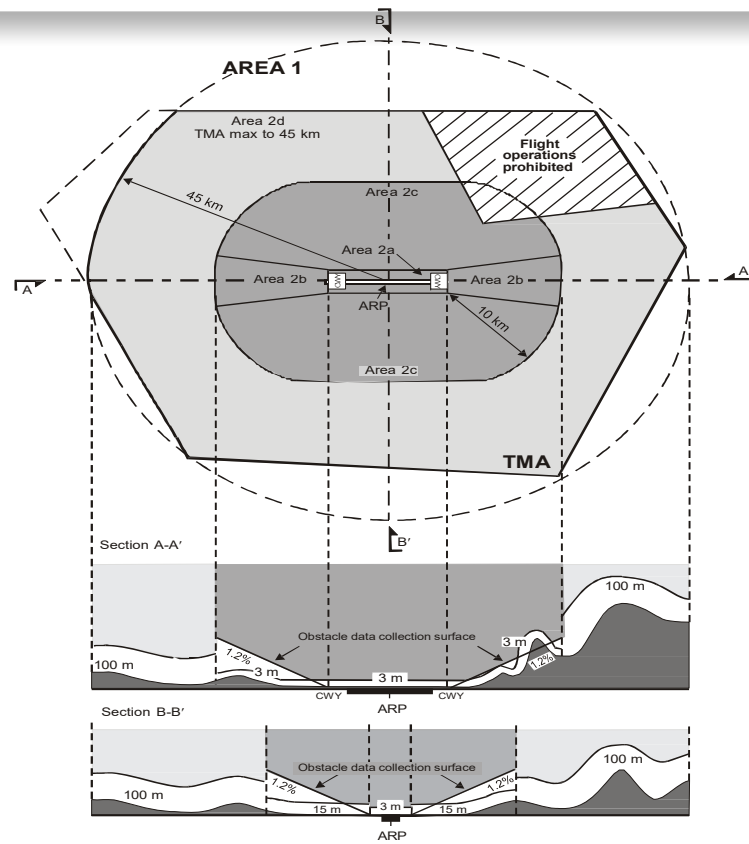


Figure A8-2. Obstacle data collection surfaces — Area 1 and Area 2



Terrain and obstacle data collection surface

- Figure A8-3. Terrain and obstacle data collection surface — Area 3
- 1. The data collection surface for terrain and obstacles extends a half-metre (0.5 m) above the horizontal plane passing through the nearest point on the aerodrome movement area.
- 2. Terrain and obstacle data in Area 3 shall comply with the numerical requirements specified in Table A8-1 and Table A8-2, respectively.

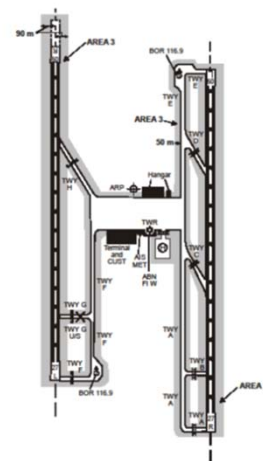


Figure A8-3. Terrain and obstacle data collection surface — Area 3

1. The data collection surface for terrain and obstacles extends a half-metre (0.5 m) above the horizontal plane passing through the nearest point on the aerodrome movement area.
2. Terrain and obstacle data in Area 3 shall comply with the numerical requirements specified in Table A8-1 and Table A8-2, respectively.



Terrain and obstacle data collection surface

- Terrain and obstacle data in Area 4 shall comply with the numerical requirements specified in Table A8-1 and Table A8-2 respectively.
- Note.— Area 4 may be extended in accordance with 10.1.2.

- Figure A8-4. Terrain and obstacle data collection surface — Area 4

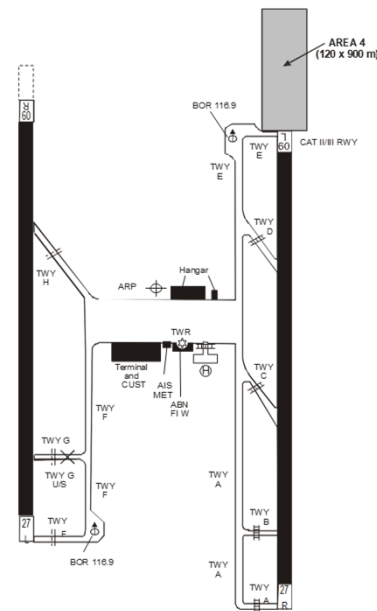


Figure A8-4. Terrain and obstacle data collection surface — Area 4



TERRAIN AND OBSTACLE DATA REQUIREMENTS

- The geographical coordinates of obstacles in Area 2 (the part within the aerodrome boundary) and in Area 3 shall be measured and reported to the aeronautical information services authority in degrees, minutes, seconds and tenths of seconds.
- In addition, the top elevation, type, marking and lighting (if any) of obstacles shall be reported to the aeronautical information services authority



Coordination between aeronautical information services and aerodrome authorities

- To ensure that aeronautical information services units obtain information to enable them to provide up-to-date pre-flight information and to meet the need for in-flight information;
- To ensure timely provision of the information to aeronautical information services, close coordination between those services concerned is therefore required.



Coordination between aeronautical information services and aerodrome authorities

- arrangements shall be made between aeronautical information services and aerodrome authorities responsible for aerodrome services to report to the responsible aeronautical information services unit, with a minimum of delay:
 - a) information on the status of certification of aerodromes and aerodrome conditions
 - b) the operational status of associated facilities, services and navigation aids within their area of responsibility;
 - c) any other information considered to be of operational significance



Coordination between aeronautical information services and aerodrome authorities

- Of a particular importance are changes aeronautical information that affect charts and/ computer-based navigation systems which qualify to be notified by the aeronautical information regulation and control (AIRAC) system, as specified in Annex 15, Chapter 6 and Appendix 4



Coordination between aeronautical information services and aerodrome authorities

- The predetermined, internationally agreed AIRA effective dates in addition to 14 days postage time shall be observed by the responsible aerodrome services when submitting the required information/data to aeronautical information services.



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Coordination between aeronautical information services and aerodrome authorities

- The aerodrome services responsible for the provision of raw aeronautical information/data to the aeronautical information services shall do that while taking into account accuracy and integrity requirements for aeronautical data as specified in Appendix 5 to Annex 14.



Any Question?



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