



ICAO MID

الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY



Webinar on the provision of Terrain and Obstacle (TOD) and AIP Datasets

19 May 2022



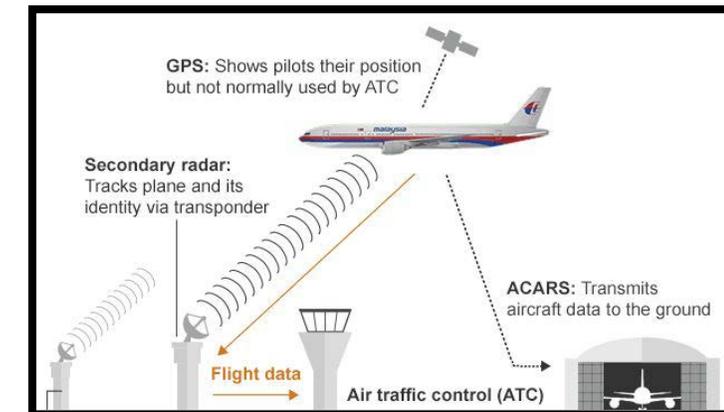
Kedari Manthanwar

Provision of Electronic Terrain and Obstacle Data (TOD)



BACKGROUND – Technology Development

- Advent – Modern Technology
(Onboard Monitoring, Robotics, AR, VR, artificial intelligence, the internet of things, unmanned aircraft systems..)
- Improved – Navigation Techniques
 - Global Positioning System (GPS)
 - Inertial Reference Systems (IRS)
 - Radio Aids (VORs, DMEs, ADFs, ILSs)
- Increase Demands – Safety and Performance (PBN)





Digital Data Sets - eTOD

- Expressed to ICAO by industry
- Included within Amendment 33 to ICAO Annex 15
- Introduction of SARPs related to the provision of terrain and obstacle data (eTOD)

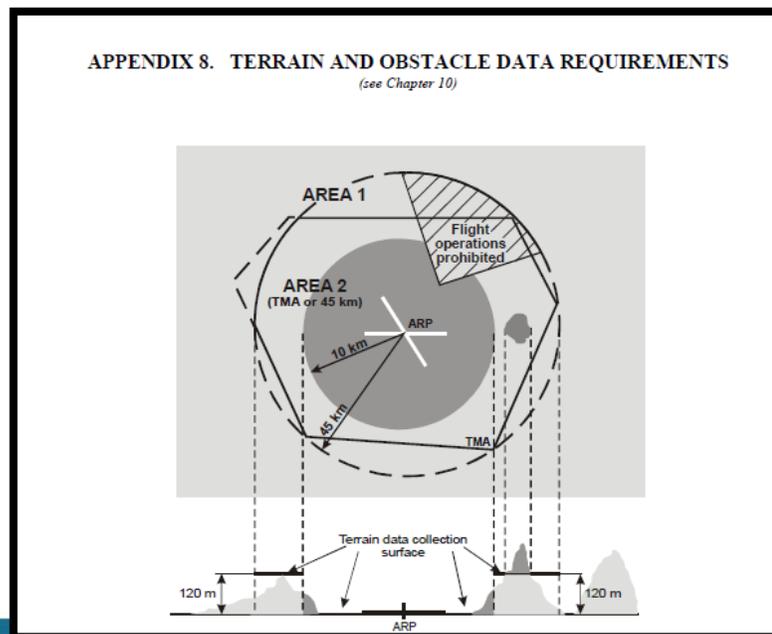


Table A6-2. Obstacle attributes

Obstacle attribute	Mandatory/Optional
Horizontal extent	Mandatory
Horizontal reference system	Mandatory
Elevation	Mandatory
Height	Optional
Vertical accuracy	Mandatory
Vertical confidence level	Mandatory
Vertical resolution	Mandatory
Vertical reference system	Mandatory

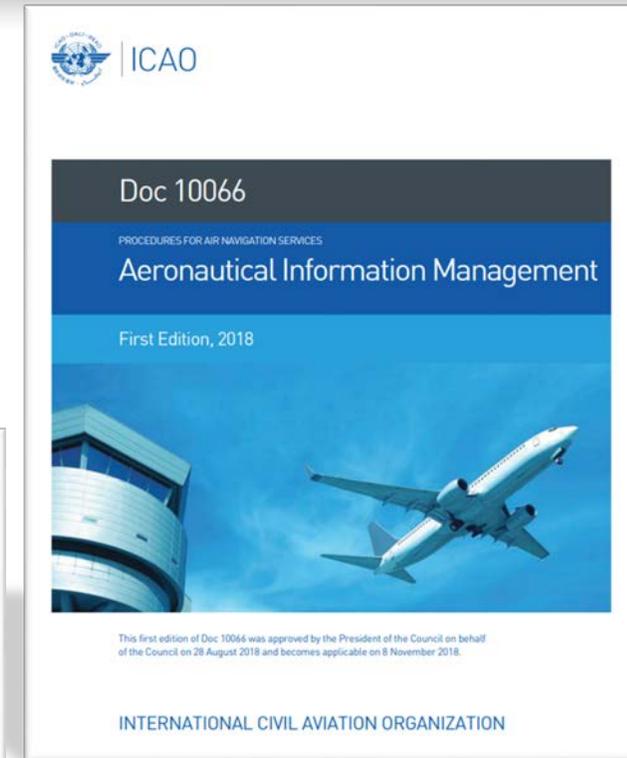
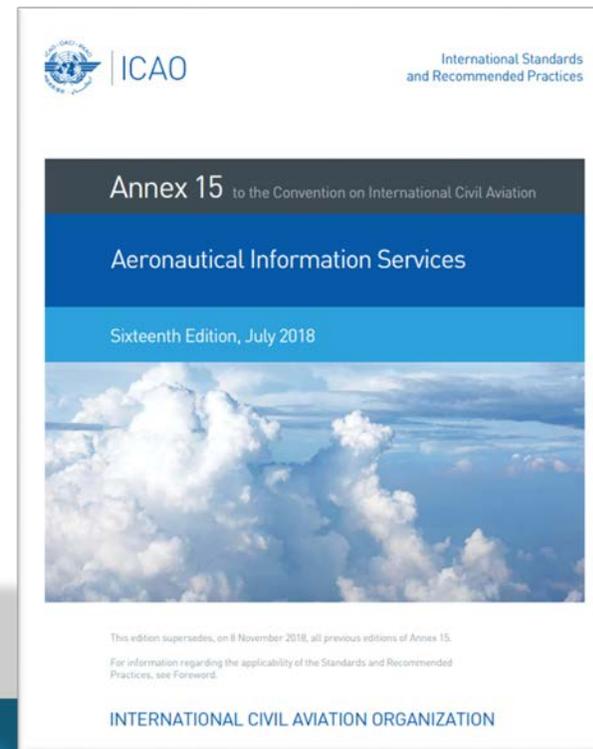
Current ICAO SARPs

- Doc 10066 – PANS AIM
 - First Edition 2018; AMDT # 2; Applicable 4 November 2021
 - New concept – Data Catalogue

- Annex 15 - AIS
 - Sixth Edition 2018; AMDT # 42; Applicable 4 November 2021

Table A1-8. Terrain data

	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%
Integrity classification	routine	essential	essential	essential
Maintenance period	as required	as required	as required	as required





ICAO - DEFINITION

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.

Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that:

- a) are located on an area intended for the surface movement of aircraft; or
- b) extend above a defined surface intended to protect aircraft in flight; or
- c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.



ICAO - REQUIREMENTS

- Area 1: the entire territory of a State;
- Area 2: within the vicinity of an aerodrome, subdivided as follows:
 - Area 2a: a rectangular area around a runway that comprises the runway strip plus any clearway that exists;

Note.— See Annex 14, Volume I, Chapter 3, for dimensions for runway strips.
 - Area 2b: an area extending from the ends of Area 2a in the direction of departure, with a length of 10 km and a splay of 15 per cent to each side;
 - Area 2c: an area extending outside Area 2a and Area 2b at a distance of not more than 10 km from the boundary of Area 2a; and
 - Area 2d: an area outside Areas 2a, 2b and 2c up to a distance of 45 km from the aerodrome reference point, or to an existing terminal control area (TMA) boundary, whichever is nearest;
- Area 3: the area bordering an aerodrome movement area that extends horizontally from the edge of a runway to 90 m from the runway centre line and 50 m from the edge of all other parts of the aerodrome movement area; and
- Area 4: the area extending 900 m prior to the runway threshold and 60 m each side of the extended runway centre line in the direction of the approach on a precision approach runway, Category II or III.

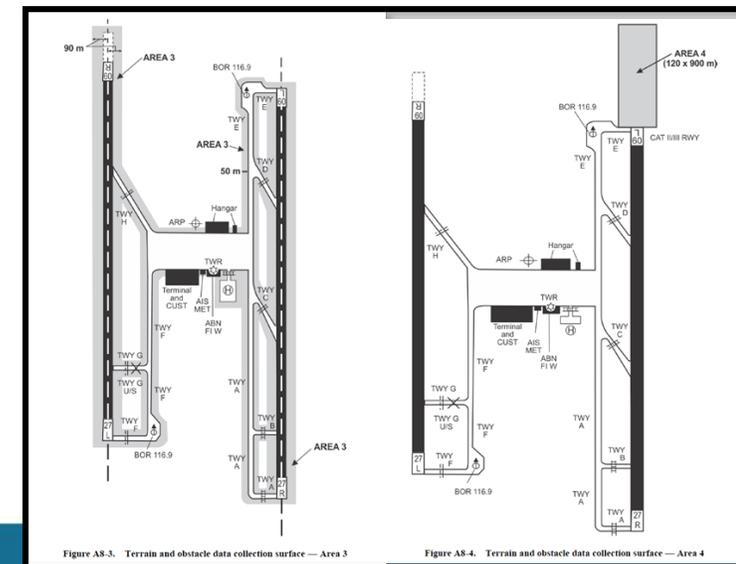
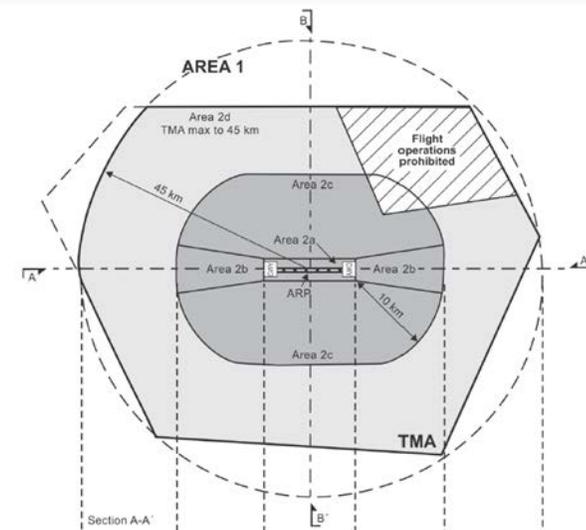


Figure AS-3. Terrain and obstacle data collection surface — Area 3

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



ICAO - REQUIREMENTS

- Terrain Attributes – Mandatory and Optional

Table A6-1. Terrain attributes

Terrain attribute	Mandatory/Optional	Terrain attribute	Mandatory/Optional	Terrain attribute	Mandatory/Optional
Area of coverage	Mandatory	Horizontal confidence level	Mandatory	Surface type	Optional
Data originator identifier	Mandatory	Horizontal position	Mandatory	Recorded surface	Mandatory
Data source identifier	Mandatory	Elevation	Mandatory	Penetration level	Optional
Acquisition method	Mandatory	Elevation reference	Mandatory	Known variations	Optional
Post spacing	Mandatory	Vertical reference system	Mandatory	Integrity	Mandatory
Horizontal reference system	Mandatory	Vertical resolution	Mandatory	Date and time stamp	Mandatory
Horizontal resolution	Mandatory	Vertical accuracy	Mandatory	Unit of measurement used	Mandatory
Horizontal accuracy	Mandatory	Vertical confidence level	Mandatory		



ICAO - REQUIREMENTS

- Obstacle Attributes – Mandatory and Optional

Table A6-2. Obstacle attributes

Obstacle attribute	Mandatory/Optional	Obstacle attribute	Mandatory/Optional	Obstacle attribute	Mandatory/Optional
Area of coverage	Mandatory	Horizontal extent	Mandatory	Obstacle type	Mandatory
Data originator identifier	Mandatory	Horizontal reference system	Mandatory	Geometry type	Mandatory
Data source identifier	Mandatory	Elevation	Mandatory	Integrity	Mandatory
Obstacle identifier	Mandatory	Height	Optional	Date and time stamp	Mandatory
Horizontal accuracy	Mandatory	Vertical accuracy	Mandatory	Unit of measurement used	Mandatory
Horizontal confidence level	Mandatory	Vertical confidence level	Mandatory	Operations	Optional
Horizontal position	Mandatory	Vertical resolution	Mandatory	Effectivity	Optional
Horizontal resolution	Mandatory	Vertical reference system	Mandatory	Lighting	Mandatory



ICAO - REQUIREMENTS

- Data Catalogue – Accuracy & resolution (Terrain & Obstacles)

Table A1-6 Obstacle data

Subject	Property	Sub-Property	Type	Description	Note	Accuracy	Integrity	Orig Type	Pub. Res.	Chart Res.	
Obstacle	All fixed (whether temporary or permanent) and mobile obstacles or parts thereof.										
	Obstacle identifier		Text	Unique identifier of obstacle							
	Operator / Owner		Text	Name and Contact information of obstacle operator or owner							
	Geometry type		Code list	An indication whether the obstacle is a point, line or polygon.							
	Horizontal position		Point	Horizontal position of obstacle							
			Line								
			Polygon								
	Horizontal extent		Distance	Horizontal extent of the obstacle							
	Elevation		Elevation	Elevation of the highest point of the obstacle							
	Height		Height	Height of the obstacle above ground							
	Type		Text	Type of obstacle							
	Date and time stamp		Date	Date and time the obstacle was created							
	Operations		Text	Feature operations of mobile obstacles							
	Effectivity		Text	Effectivity of temporary types of obstacles							
	Lighting										
Type		Text	Type of lighting								
	Colour	Text	Colour of the obstacle lighting								
Marking		Text	Type of marking of obstacle								
Material		Text	Predominant surface material of the obstacle								
		Note 1)	Obstacles in Area 1	50 m	routine	surveyed	1 sec	as plotted			
			Obstacles in Area 2 (including 2a, 2b, 2c, 2d, take-off flight path area and obstacle limitation surfaces)	5 m	essential	surveyed	1/10 sec	1/10 sec			
			Obstacles in Area 3	0.5 m	essential	surveyed	1/10 sec	1/10 sec			
			Obstacles in Area 4	2.5 m	essential	surveyed					
		Note 2)	Obstacles in Area 1	30 m	routine	surveyed	1 m or 1 ft	3 m (10 ft)			
			Obstacles in Area 2 (including 2a, 2b, 2c, 2d, take-off flight path area and obstacle limitation surfaces)	3 m	essential	surveyed	1 m or 1 ft	1 m or 1 ft			
			Obstacles in Area 3	0.5 m	essential	surveyed	0.1 m or 0.1 ft/0.01 m	1m or 1 ft			
			Obstacles in Area 4	1 m	essential	surveyed	0.1 m				

Table A1-8. Terrain data

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Confidence level	90%	90%	90%	90%
Integrity classification	routine	essential	essential	essential
Maintenance period	as required	as required	as required	as required



ICAO - REQUIREMENTS

- Data Product Specifications
- Metadata

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 (ISO 19131*).

Metadata. Data about data (ISO 19115*).

Note.— A structured description of the content, quality, condition or other characteristics of data.



REGULATIONS – UAE GCAA

- UAE AMC-54 - Transition from AIS to AIM
- UAE CAR-ASSP - Aeronautical Survey Service Providers

15 IMPLEMENTATION MATRIX			
PHASE	STEP	START DATE	END DATE
PHASE 1	STEP-01 — Data quality monitoring	2008	2011
	STEP-02 — Data integrity monitoring		
	STEP-03 — AIRAC adherence monitoring		
	STEP-04 — Monitoring of differences to Annex 4 and Annex 15		
	STEP-05 — WGS-84 implementation		
	STEP-08 — Aeronautical information conceptual model (Database - ICAO)		
	STEP-13 — Electronic terrain – Area 1 and 4		
PHASE 2	STEP-14 — Electronic obstacles – Area 1 and 4	2012	2015
	STEP-06 — Integrated aeronautical information database		
	STEP-07 — Unique identifiers (Database - ICAO)		
	STEP-11 — Electronic AIP		
	STEP-12 — Aeronautical information briefing		
	STEP-13 — Electronic terrain – Area 2 and 3		
	STEP-14 — Electronic obstacles – Area 2 and 3		
	STEP-16 — Personnel training		
	STEP-17 — Quality Management		
	STEP-18 — Agreements with data originators		
STEP-20 — Electronic aeronautical charts			

APPENDIX VI E-TOD IMPLEMENTATION MATRIX				
AREA	DESCRIPTION	RESPONSIBLE	IMPLEMENTATION TARGET DATE	STATUS
Area 1	Total State Territory	GCAA	20 November 2008	Mandatory Implemented
Area 2a	A rectangular area around a runway that comprises the runway strip plus any clearway that exists. <i>(Refer to CAR PART IX for the definition of the strip)</i>	Airport Authority Aerodrome Survey Classification 3 and 4	12 November 2015	Mandatory Implemented
Area 2b	An area extending from the ends of Area 2a in the direction of departure, with a length of 10 km and a splay of 15% to each side.	Airport Authority Aerodrome Survey Classification 3 and 4		Mandatory
Area 2c	An area extending outside Area 2a and Area 2b at a distance of not more than 10 km from the boundary of Area 2a.	Airport Authority Aerodrome Survey Classification 4		Mandatory
Area 2d	An area outside the Areas 2a, 2b and 2c up to a distance of 45 km from the aerodrome reference point, or to an existing TMA boundary, whichever is nearest.	Airport Authority Aerodrome Survey Classification 4	2019	Mandatory
Area 3	Aerodrome/heliport area and the area bordering an aerodrome movement area that extends horizontally from the edge of a runway to 90 m from the runway centerline and 50 m from the edge of all other parts of the aerodrome movement area.	Airport Authority Aerodrome Survey Classification 4		Mandatory
Area 4	Category II or III operations approach areas. The area extending 900 m prior to the runway threshold and 60 m each side of the extended runway centerline in the direction of the approach.	Airport Authority Aerodrome Survey Classification 4		Mandatory



UAE AIM ACTIONS – PLAN

- Specification – Terrain and Obstacle data collection
 - Quality Requirements
 - Data Formats
 - Deliverables (Includes reports – Quality)
- Contract – Provision and Maintenance
- Management of Change – Identify Risk and Coordination

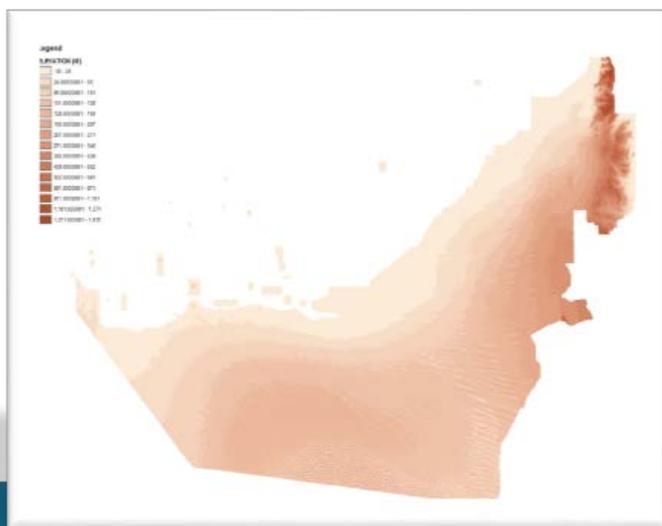




What we deliver?

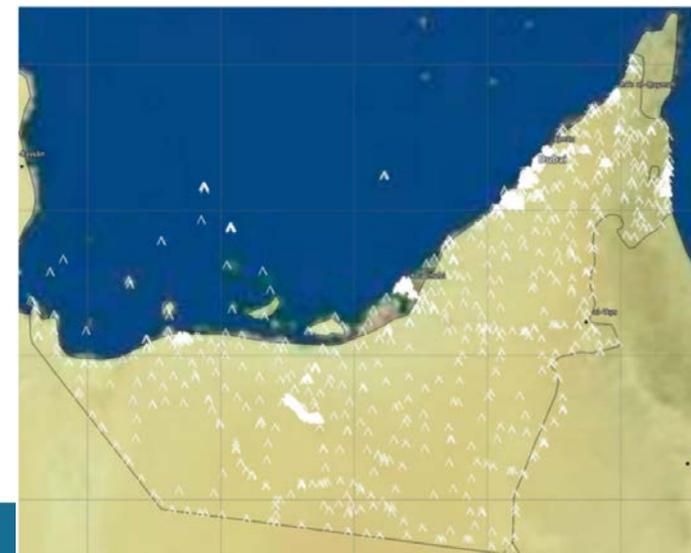
Terrain Data Set

- Terrain Data – DEM, ESRI GRID & GDB
- DPS – PDF, Excel
- Metadata – PDF, Excel



Obstacles Data Set

- Obstacles Data – AIXM 5.1 (Baseline, Permdelta)
- DPS – PDF, Excel
- Metadata – PDF, Excel





How we deliver?

- Self Declaration for Data access
- Access through file sharing
- Notification on updates
- Provision through SWIM (Planned - End of 2022)

Dear UAE ETOD Area-1 Data Subscribers;
Below listed updates are added to UAE ETOD Area-1 Datasets. This is for your kind information and awareness.

- Batch7 Updates

Regards
UAE GCAA - AIM

[Click here to view this folder](#)

DATA REQUEST FORM - UAE eTOD Area 1

Requested By

Individual / Company:

Address:

E-mail:

Telephone:

Telefax:

Purpose of using eTOD (Quote from ICAO SARPs):

Note. — Electronic terrain and obstacle data are intended to be used in the following air navigation applications:

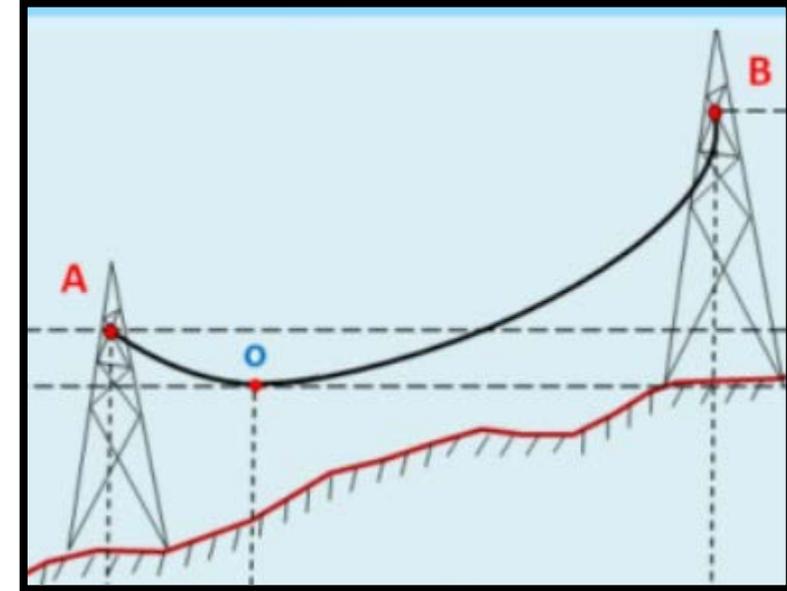
- a) Ground proximity warning system with forward looking terrain avoidance function and minimum safe altitude warning system;
- b) Determination of contingency procedures for use in the event of an emergency during a missed approach or take-off;
- c) Aircraft operating limitations analysis;
- d) Instrument procedure design (including circling procedure);
- e) Determination of en-route "drift-down" procedure and en-route emergency landing location;
- f) Advanced surface movement guidance and control system; and
- g) Aeronautical chart production and on-board databases.

The data may also be used in other applications such as flight simulator and synthetic vision systems, and may assist in determining the height restriction or removal of obstacles that pose a hazard to air navigation.



CHALLENGES

- Standard formats not defined for Terrain
- Format for DPS and Metadata
- Maintenance period (reasonable / ideal)
- Access to regulated Areas
- Capturing high tension transmission lines (Complex)





LESSONS LEARNT

- Agile – ready for uncertainty during initial project phase
- Education – educate supplier throughout the project phase
- Scope for changes –
 - Not possible to foresee all scenarios
 - Have contingency plan and budget
- Engage – Regulator & Stakeholders (Guidance and Support)



THANK YOU

