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INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY

WORKSHOP ON TERRAIN AND
OBSTACLE DATA (TOD)
CAIRO , EGYPT 26 - 27 FEB 24



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ICAO Provisions on Terrain and Obstacle Data sets

- BACKGROUND AND HISTORY
- ICAO TERRAIN AND OBSTACLES DATA REQUIREMENTS
- TOD COVERAGE AREAS
- TOD NUMERICAL REQUIREMENTS
- TOD APPLICATIONS
- DIGITAL DATA SETS CONSIDERATIONS
- TOD IMPLEMENTATION PLAN
- DEVELOPMENT OF NATIONAL TOD POLICY





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BACKGROUND AND HISTORY

2004: Amendment 33
Requirements for eTOD

2010: Amendment 36
Major revisions Area2




2013: Amendment 37
Small updates

2018: Amendment 40,
PANS-AIM and Data
Catalogue

GANP ASBU DAIM Thread



ICAO's highest air navigation **strategic** document and the **plan** to drive the evolution of the global air navigation system




DAIM-B1/1 Provision of quality-assured aeronautical data and information Information   

DAIM-B1/2 Provision of digital Aeronautical Information Publication (AIP) data sets Information   

DAIM-B1/3 Provision of digital terrain data sets Information   

DAIM-B1/4 Provision of digital obstacle data sets Information   

DAIM-B1/5 Provision of digital aerodrome mapping data sets Information   

DAIM-B1/6 Provision of digital instrument flight procedure data sets Information   

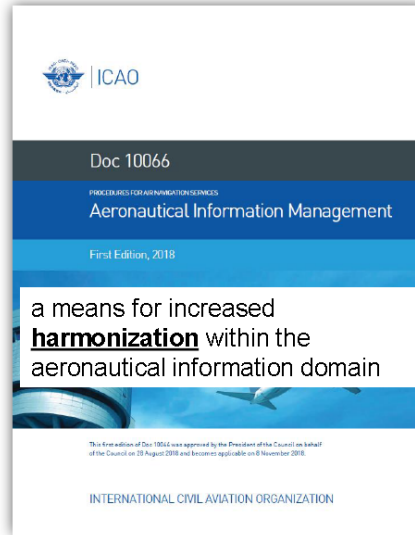
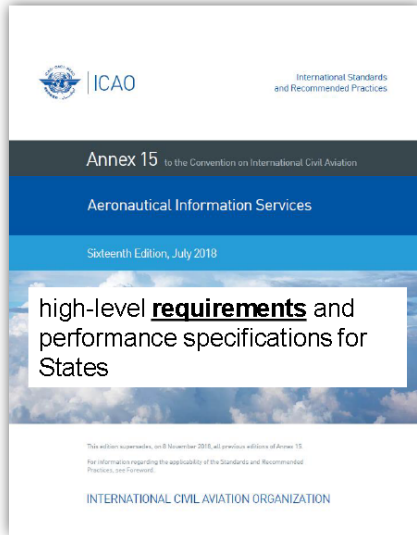
DAIM-B1/7 NOTAM improvements Information   



ICAO Terrain and Obstacles Data requirements



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- Annex 15 - Chapter 5. aeronautical information products and services
 - 5.3 Digital data sets
- PANS-AIM, Appendix 8 TOD requirements
- Doc 8126, AIS Manual 7th Edition
- Doc 9881 –Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information – **requires updates since Amdt 33**
- Annex 14 - 2.5 Aerodrome dimensions and related information - OLS
- Annex 4 - AOC



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ICAO Terrain and Obstacles Data requirements



PART I - Regulatory Framework for Aeronautical Information Services

PART II - Processing Aeronautical Data

PART III - Aeronautical Information in a Standardized Presentation and Related Services

PART IV - Digital Aeronautical Information Products and Related Services



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PART IV: DIGITAL AERONAUTICAL INFORMATION PRODUCTS AND RELATED SERVICES (under development)

- Provides guidance specific for the provision of digital data sets that are part of the AIS Products.
- Explains the type of digital data sets that are available as part of the aeronautical information products, their purpose and benefits
- Digital aeronautical information services
- *Coding specifications for digital AIS Data Sets*
- Distribution services



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MID Doc 002

INTERNATIONAL CIVIL AVIATION ORGANIZATION

MIDDLE EAST AIR NAVIGATION PLANNING
AND IMPLEMENTATION REGIONAL GROUP
(MIDANPIRG)

MID REGION
AIR NAVIGATION STRATEGY

EDITION MARCH, 2023

Thread	Element code	Title	Priority	Start Date	Monitoring		Remarks
					Main	Supporting	
<i>Information Threads</i>							
DAIM							
DAIM	B1/1	Provision of quality-assured aeronautical data and information	1	2021	AIM SG		
	B1/2	Provision of digital Aeronautical Information Publication (AIP) data sets	2				
	B1/3	Provision of digital terrain data sets	1	2021	AIM SG		
	B1/4	Provision of digital obstacle data sets	1	2021	AIM SG		
	B1/5	Provision of digital aerodrome mapping data sets	2				
	B1/6	Provision of digital instrument flight procedure data sets	2				
	B1/7	NOTAM improvements	2				

MIDANPIRG asked that support and guidance be provided to States and formed the Digital Data Sets Ad hoc Working Group (DDS WG) of the Aeronautical Information Management Subgroup.

Part 1 – General Aspects of Digital Aeronautical Data Sets

Part 2 – Provision of Terrain and Obstacle Data Sets

Part 3 – Provision of Aerodrome Mapping Data Sets (AMD)

Part 4 – Provision of Aeronautical Information Publication (AIP) Data Sets

Part 5 – Provision of Instrument Flight Procedure Data Sets

Part 6 – Database Driven Charting Implementation in MID Region

Part 7 – Coordinated Deployment of the Digital Data Sets in Mid Region



MID Region Implementation Plan for Digital Datasets

First Edition — 2024

International Civil Aviation Organization
MIDDLE EAST Air Navigation Planning and Implementation Regional Group
(MIDANPIRG)

TERRAIN AND OBSTACLE DATA: ANNEX 15 COVERAGE AREAS

With the introduction of TOD in Amendment 33 to ICAO Annex 15, ICAO has defined four coverage areas where different numerical requirements apply for terrain and obstacle Data.

- Area 1 The entire territory of a State
- Area 2 The vicinity of an aerodrome
- Area 3 An area bordering the movement area on an aerodrome
- Area 4 The radio altimeter area operating in front of a precision approach runway, Category II or III.

With Amendment 36 to ICAO Annex 15, Area 2 was broken down into four sub-areas. The areas are defined in ICAO Annex 15 and ICAO PANS-AIM.

Terrain Data Sets

- (AN15) 5.3.3.3.2 Terrain data shall be provided for Area 1.
- (AN15) 5.3.3.3.3 For aerodromes regularly used by international civil aviation, terrain data shall be provided for:
 - a) Area 2a;
 - b) the take-off flight path area; and
 - c) an area bounded by the lateral extent of the aerodrome obstacle limitation surfaces.
- (AN15) 5.3.3.3.8 For aerodromes regularly used by international civil aviation, terrain data shall be provided for Area 4 for all runways where precision approach Category II or III operations have been established and where detailed terrain information is required by operators to enable them to assess the effect of terrain on decision height determination by use of radio altimeters.

Obstacle Data set

- (AN15) 5.3.3.4.2 Obstacle data shall not be included in terrain data sets.
- (AN15) 5.3.3.4.3 Obstacle data shall be provided for obstacles in Area 1 whose height is 100 m or higher above ground.
- (AN15) 5.3.3.4.4 For aerodromes regularly used by international civil aviation, obstacle data shall be provided for all obstacles within Area 2 that are assessed as being a hazard to air navigation.
- (AN15) 5.3.3.4.5 For aerodromes regularly used by international civil aviation, obstacle data shall be provided for:
 - a) Area 2a for those obstacles that penetrate an obstacle data collection surface outlined by a rectangular area around a runway that comprises the runway strip plus any clearway that exists. The Area 2a obstacle collection surface shall have a height of 3 m above the nearest runway elevation measured along the runway centre line, and for those portions related to a clearway, if one exists, at the elevation of the nearest runway end;
 - b) objects in the take-off flight path area which project above a plane surface having a 1.2 per cent slope and having a common origin with the take-off flight path area; and
 - c) penetrations of the aerodrome obstacle limitation surfaces.
- (AN15) 5.3.3.4.10 For aerodromes regularly used by international civil aviation, obstacle data shall be provided for Area 4 for all runways where precision approach Category II or III operations have been established.



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Applicability of TOD

Terrain Dataset						
Area 1	Area 2a	Area 2b	Area 2c	Area 2d	Area 3	Area 4
SHALL	SHALL (For aerodromes regularly used by international civil aviation)	Should	Should	Should	Should	SHALL (all runways where precision approach Category II or III operations)
Obstacle Dataset						
Area 1	Area 2a	Area 2b	Area 2c	Area 2d	Area 3	Area 4
SHALL	SHALL (For aerodromes regularly used by international civil aviation)	Should	Should	Should	Should	SHALL (all runways where precision approach Category II or III operations)



TERRAIN AND OBSTACLE DATA: AREA 1

Area 1: The entire territory of a State (2008)

Terrain dataset for whole State

- Mostly available from civ/mil national geodetic agencies
- No format defined by ICAO
- User preferred format:
 - GeoTIFF or shape
 - + metadata





TERRAIN AND OBSTACLE DATA: AREA 1

Area 1: The entire territory of a State (2008)

- Obstacle dataset for >100m above ground
- Obstacle collection policy should exist for AIP ENR 5.4 'Air Navigation Obstacles'
- Dataset requires additional attributes (meta data) to ENR 5.4
- Dataset to be provided with caveat if some attributes are missing (annotate the limitation of use of the published information until resurveyed data is available).
- Synergies possible between CIV and MIL



Area 1 : Why coordination with MIL is beneficial

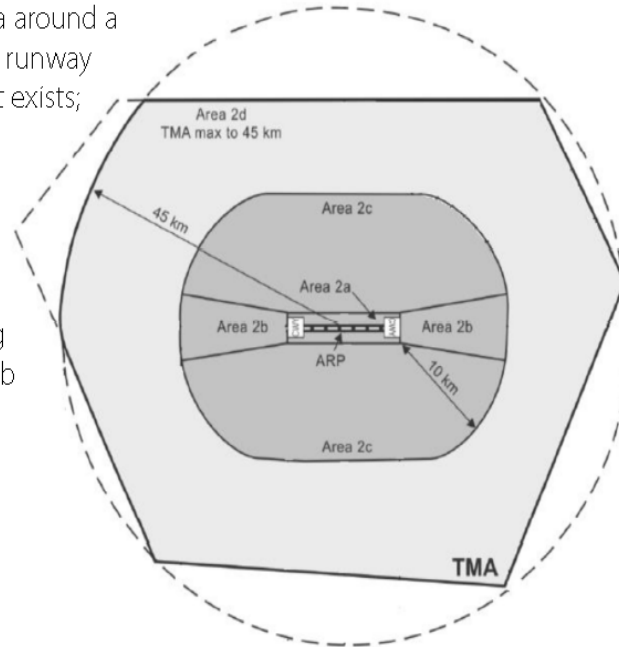
- MIL requirements: all obstacles >60m AGL for whole territory of State
- ICAO requirements: all obstacles >100m AGL for whole territory of State
- Synergies - saving costs for data collection/storage/maintenance/ verification and validation
- Advantages:
 - single entry point for obstacle owners
 - no duplication for submission of same type of information to different authorities
 - notification on any changes (e.g. light out of order) immediately available for both CIV/MIL users
 - Single repository/storage/etc
 - Similar approach adopted in other States



TERRAIN AND OBSTACLE DATA: AREA 2

Area 2a: A rectangular area around a runway that comprises the runway strip plus any clearway that exists;

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



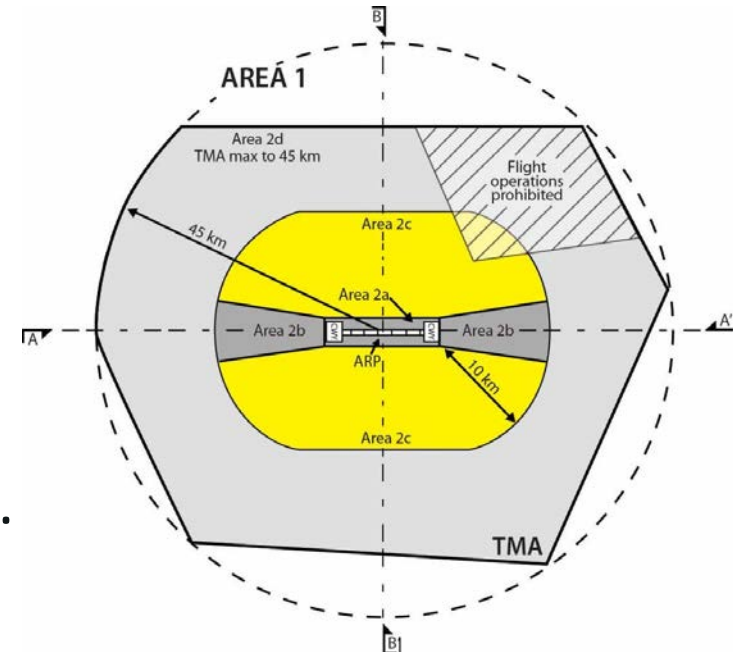
Area 2b: An area extending from the ends of Area 2a in the direction of departure, with a length of 10 km and a splay of 15% to each side

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



TERRAIN AND OBSTACLE DATA: Area 2

- Applicable from 12th November 2015
- Provision of Area 2 split into two parts:
- Standard (shall):
 - Area 2a;
 - Take-off flight path area surface; and
 - Aerodrome obstacle limitation surfaces.
- Recommended Practice (should):
 - Area 2b, 2c and 2d.





TERRAIN AND OBSTACLE DATA: ANNEX 14 OLS

The obstacle limitation surfaces comprising:

- Outer horizontal surface
- Conical surface
- Inner horizontal surface
- Approach surface
- Inner approach surface
- Transitional surface
- Inner transitional surface
- Balked landing surface
- Take-off climb surface





TERRAIN AND OBSTACLE DATA: ANNEX 4 TOFP areas

The take-off flight path area

- a) it commences at the end of the area declared suitable for take-off (i.e. at the end of the runway or clearway as appropriate)
- b) its width at the point of origin is 180 m (600 ft) and this width increases at the rate of $0.25D$ to a maximum of 1 800 m (6 000 ft), where D is the distance from the point of origin
- c) it extends to the point beyond which no obstacles exist or to a distance of 10.0 km (5.4 NM), whichever is the lesser.

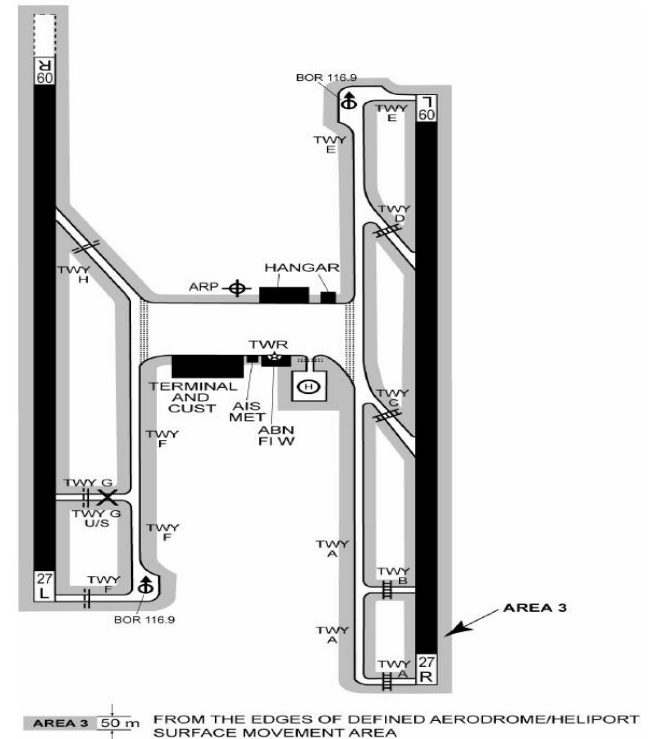




TERRAIN AND OBSTACLE DATA: AREA 3

Area 3 = Aerodrome/Heliport (Recommendation)

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

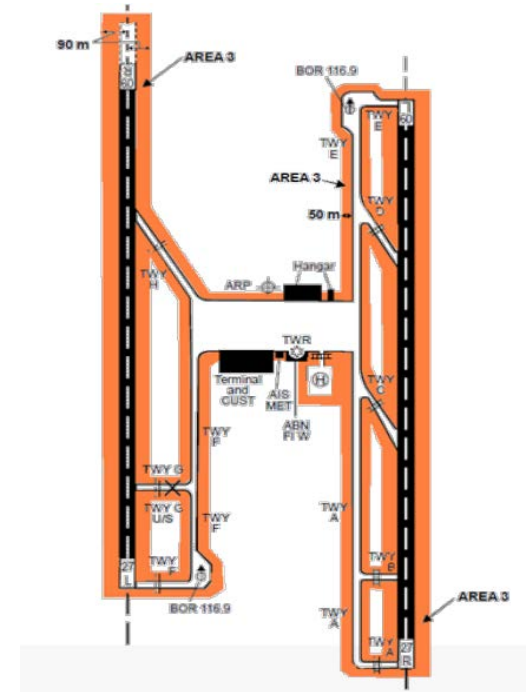




TERRAIN AND OBSTACLE DATA: AREA 3

Area 3 = Aerodrome/Heliport (Recommendation)

- Recommendation in Annex 15
- To be provided only together with the digital aerodrome mapping information (e.g. AMDB) in order to ensure the consistency and quality of all geographical data related to the aerodrome.

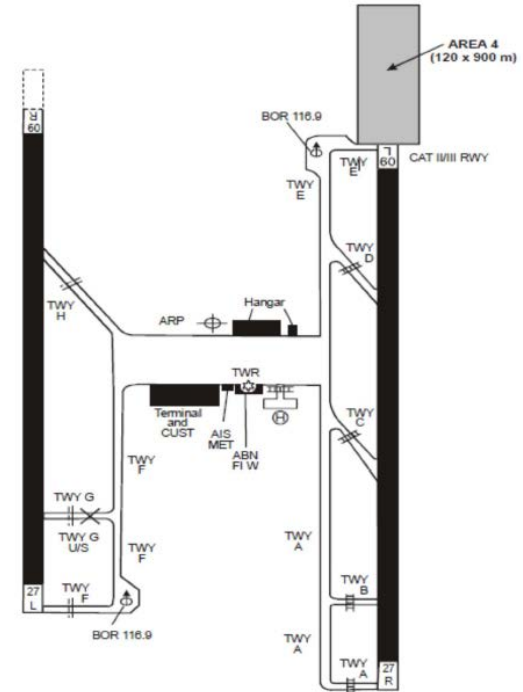




TERRAIN AND OBSTACLE DATA: AREA 4

Area 4 = CATII/III RWY

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





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TERRAIN AND OBSTACLE DATA: AREA 4

- Applicable from Nov 2008
- Digital representation of area covered today by Precision Approach Terrain Chart (PATC)
- Mostly available with AD authorities and used for PATC production
- Used to determine decision height when using Radio Altimeter





TOD NUMERICAL REQUIREMENTS

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



TOD NUMERICAL REQUIREMENTS

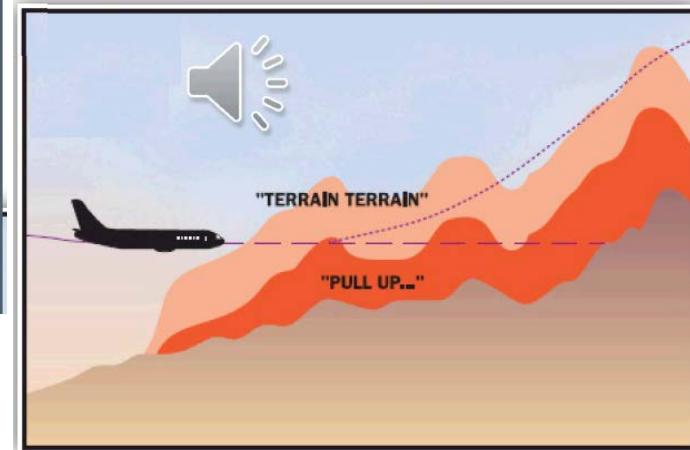
Table A1-6 Obstacle data

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		
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	



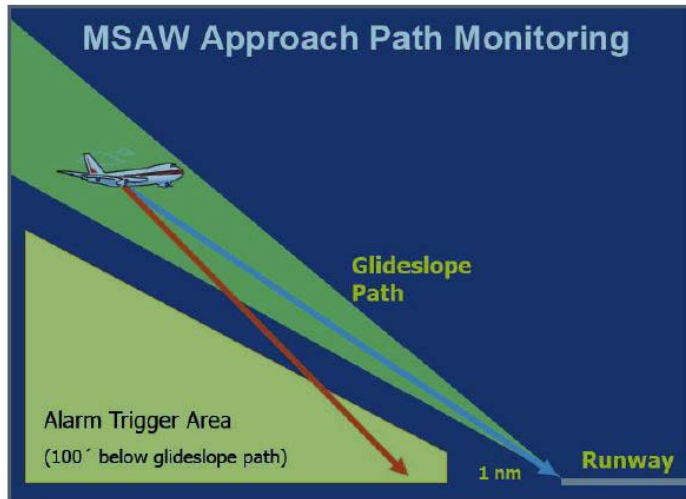
TOD APPLICATIONS: SAFETY NETS

Terrain Awareness and Warning Systems

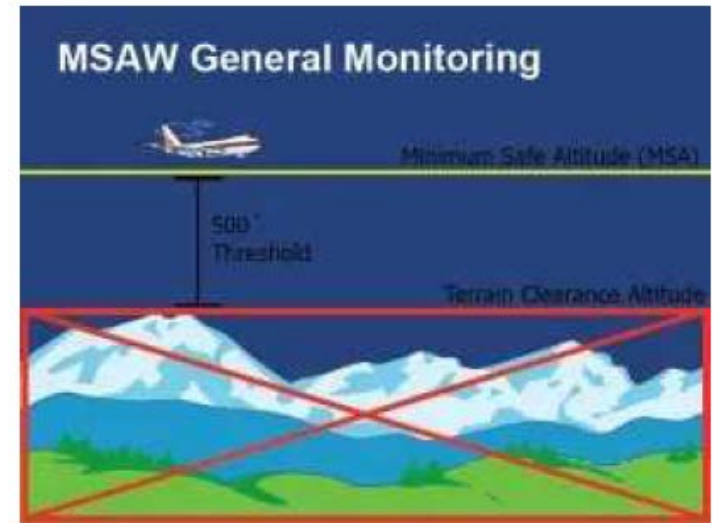




TOD APPLICATIONS: SAFETY NETS



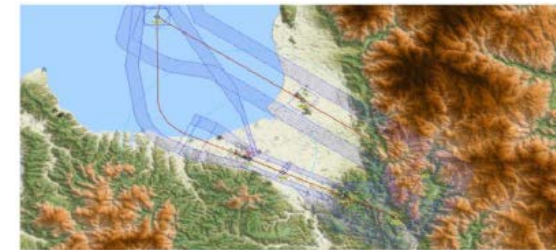
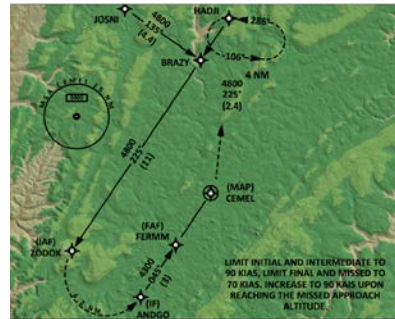
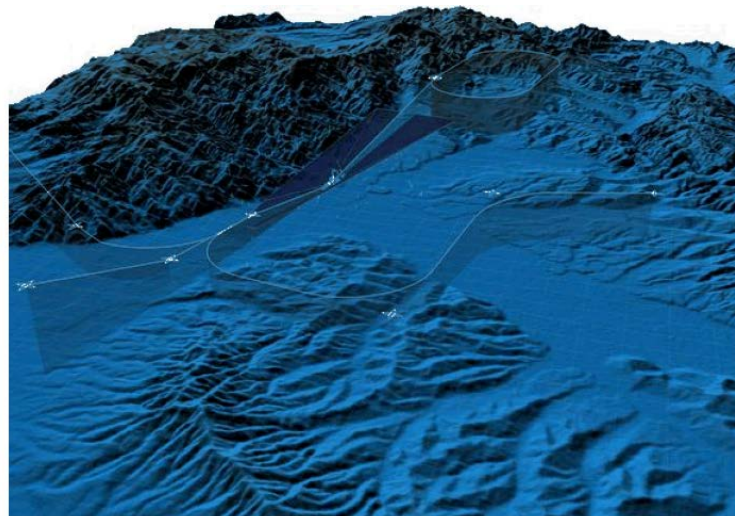
Minimum Safe Altitude
Warning
Approach Path Monitor





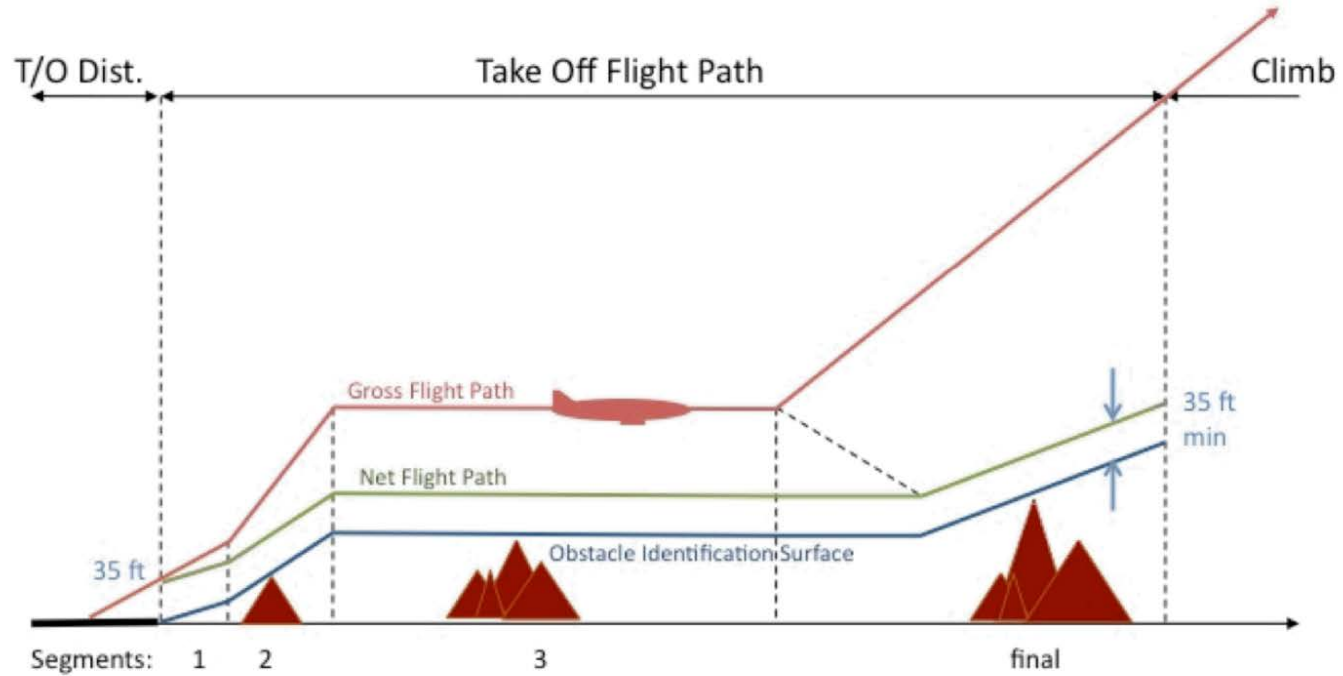
TOD APPLICATIONS: PRODECURE DESIGN

Instrument Flight including Circling Procedures



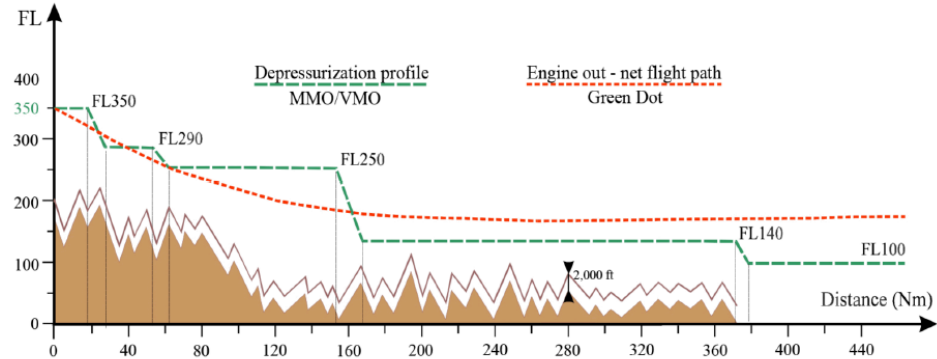
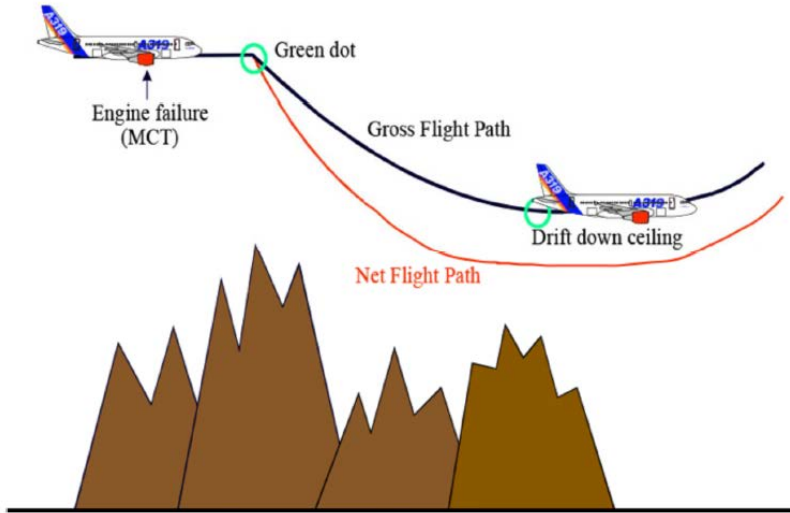


TOD APPLICATIONS: CONTINGENCY PROCEDURES



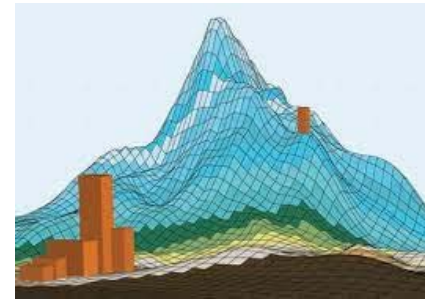
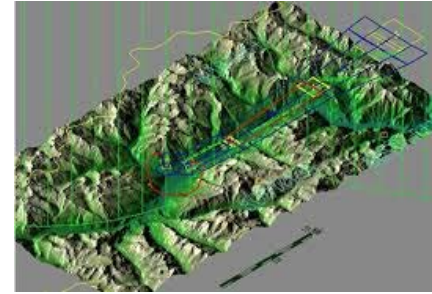
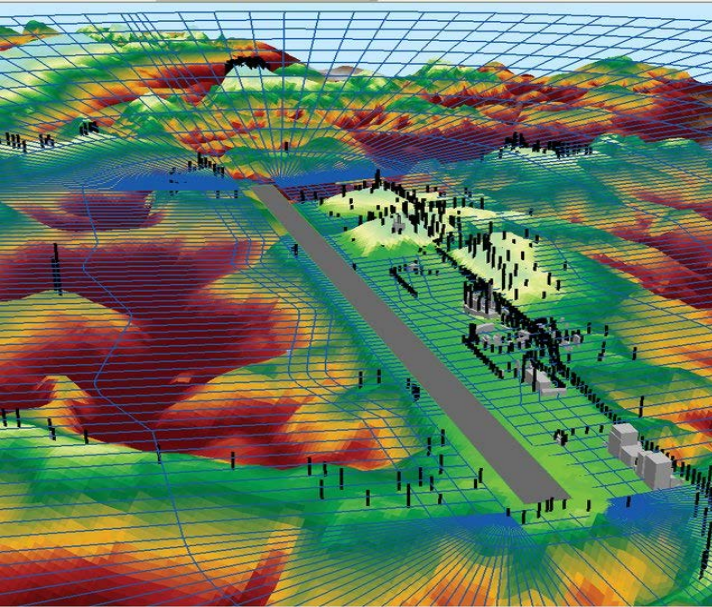


TOD APPLICATIONS: DRIFT DOWN





TOD APPLICATIONS: EMERGENCY EN-ROUTE LANDING





TOD APPLICATIONS: A-SMGCS





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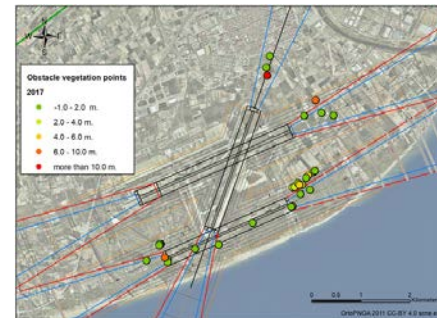


TOD APPLICATIONS: ELECTRONIC FLIGHT BAG





TOD APPLICATIONS: AERODROME/HELIPORT OBSTACLE RESTRICTION/REMOVAL





TOD APPLICATIONS: RADIO ALTIMETER HEIGHT DETERMINATION



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TOD APPLICATIONS: SYNTHETIC AND ENHANCED VISION SYSTEMS





TERRAIN AND OBSTACLE DATA: DIGITAL DATA SETS CONSIDERATIONS

- Annex 15 states that “Each data set shall be provided to the next intended user together with at least the minimum set of metadata that ensures traceability.
- Annex 15 stipulates that “A checklist of valid data sets shall be regularly provided.”
- Form of such a checklist has not been provided
- DPS is mandatory
- AIXM 5.1 for obstacle data
- ICAO Annex 15 requires to amend or reissue data sets at “regular intervals as may be necessary to keep them up to date”
- Removal of tables should be evaluated by States availability of TOD sets has to be announced in the AIP GEN 3.1.6.



Metadata



Checklist



Data Product Specification



Aeronautical Information Model



Aeronautical Data Exchange Model



Data Set Updates



Removal of obstacle tables from the AIP



Announcement of the TOD availability in the AIP



TERRAIN AND OBSTACLE DATA: IMPLEMENTATION ACTIONS

Identification of Responsible Body

Identification of Stakeholders

TOD Awareness Day

State Working Group

Focal Points and Functions

State Policy with Regard to TOD

Assessment of Regulation

State Policy on Aerodrome Safeguarding

Obstacle Permission Process

Data Sources and Originators

Data Acquisition

Cross-border Provision of Data

Data Validation and Verification

Data Maintenance

Obstacle Identification

Data Provision

Monitoring/Audit of Implementation

Cost Recovery and Charging



DEVELOPMENT OF NATIONAL TOD POLICY

Why late/no TOD implementation? Main identified issues:

- The root cause of delay with TOD implementation: absence of national regulations defining the roles and responsibilities of all parties
- Other:
 - Additional complexity for TOD: non-ATM data origination
 - Aerodromes eligible for provision of Area 2
 - Cross-border Harmonisation
 - Area 2 in one State is Area 1 for another
 - Cost-allocation



SOLUTION

- Establish National TOD Policy
- Define responsibilities within the State - WHO, WHAT, HOW, by WHOM, who OWNS, who PAYS and LIABILITY
- National TOD Policy: not a regulation, but a course, plan or principle of action adopted and agreed by all affected parties (e.g. REG, ASP, APO & Geodetic agencies)
- Important!: ASP and APO participate in the definition of the National TOD policy





National TOD Policy template

- Developed to assist the regulators with the outline structure of the National TOD policy
- Based on TOD manual - TOD Implementation Plan Template
- Additions based on implementation experience from the TOD WG formed by Eurocontrol

Appendix A National TOD Policy template

(The contents of the National TOD Policy template are not intended to be mandatory or enforceable. It shall not change its results under any circumstances and no modification or deletion is permitted.)

Not to be used as a template of the text which could be included in the policy. The colour of text indicates the needs to be replaced by the jurisdiction of the ICAO/Doc of the State. Text in green has to remain in position in developing the policy.)

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A.2.1 Scope definition	3
A.2.2 Definition of responsibility	3
A.2.3 Data sources and changing	10
A.3 Electronic obstacle data	11
A.3.1 Scope definition	14
A.3.2 Definition of responsibility	14
A.3.3 Data sources and changing	17
A.1 INTRODUCTION	
A.1.1 Purpose and scope of this document	
<small>This document provides the policy for (Name of State) relating to the collection, processing and provision of obstacle terrain and obstacle data (TOD). This document is not a regulation, but an approach, based on a set of actions simple and agreed by the parties concerned and included in this policy.</small>	



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THANK YOU!