IFAIMA

INTERNATIONAL FEDERATION OF AERONAUTICAL INFORMATION MANAGEMENTS ASSOCIATIONS

THE GLOBAL VOICE OF AIM

Generation of Digital Datasets, Digital Terrain Models and Obstacle datasets (eTODS) according to Annex 15 and PANS-AIM (Doc 10066) for the Aeronautical Data Chain.

Ciudad de México, Febrero de 2020

Following an assessment of **Annex 15** and the Aeronautical Information Services Manual (**Doc 8126**), it was accepted by the Air Navigation Commission, that specifications published as Procedures for Air Navigation Services (**PANS**) would provide a means for standardization and harmonization of Technical requirements of AIM.

Consequently, was development of the **PANS-AIM** using material currently contained in Annex 15 and Doc 8126.

The PANS-AIM includes detailed requirements for the collection, management and provision of aeronautical data and aeronautical information as well as aeronautical information products and services specifications.

Efficiency + Accuracy (QC) + Productivity =

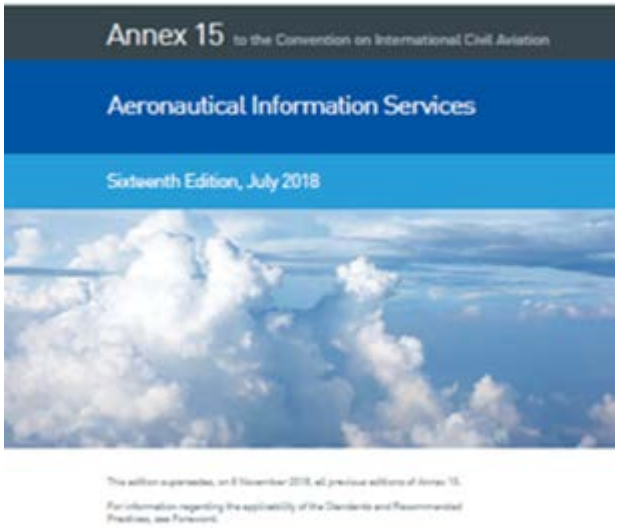
Aeronautical Datasets
and
Aeronautical Information

ICAO

ICAO

ICAO

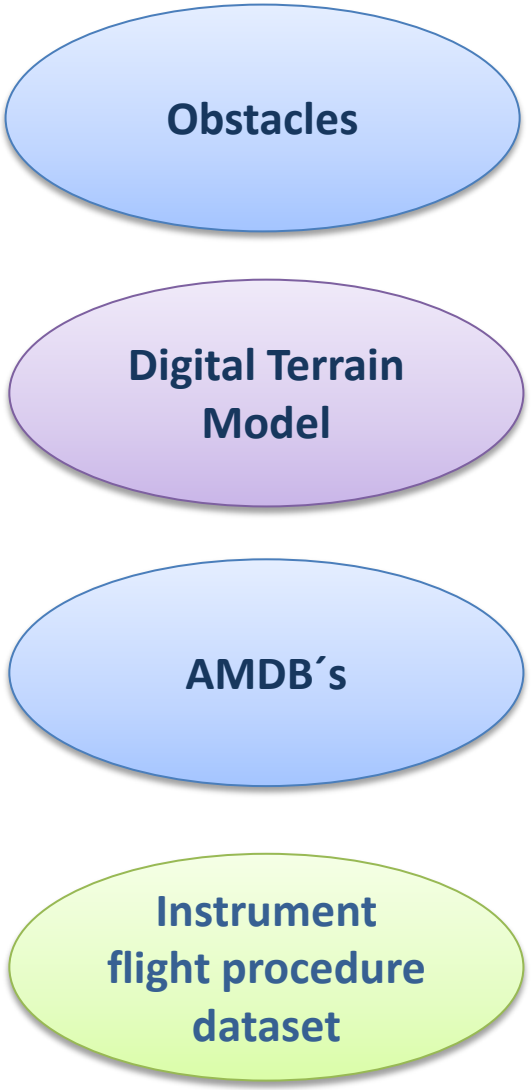
International Standards and Recommended Practices



One of the objectives of AIM is to ensure that the integrity of the aeronautical data is maintained from the collection / origin of the data to the distribution to the last intended user, validating the accuracy and quality in the data sets and in the aeronautical information.

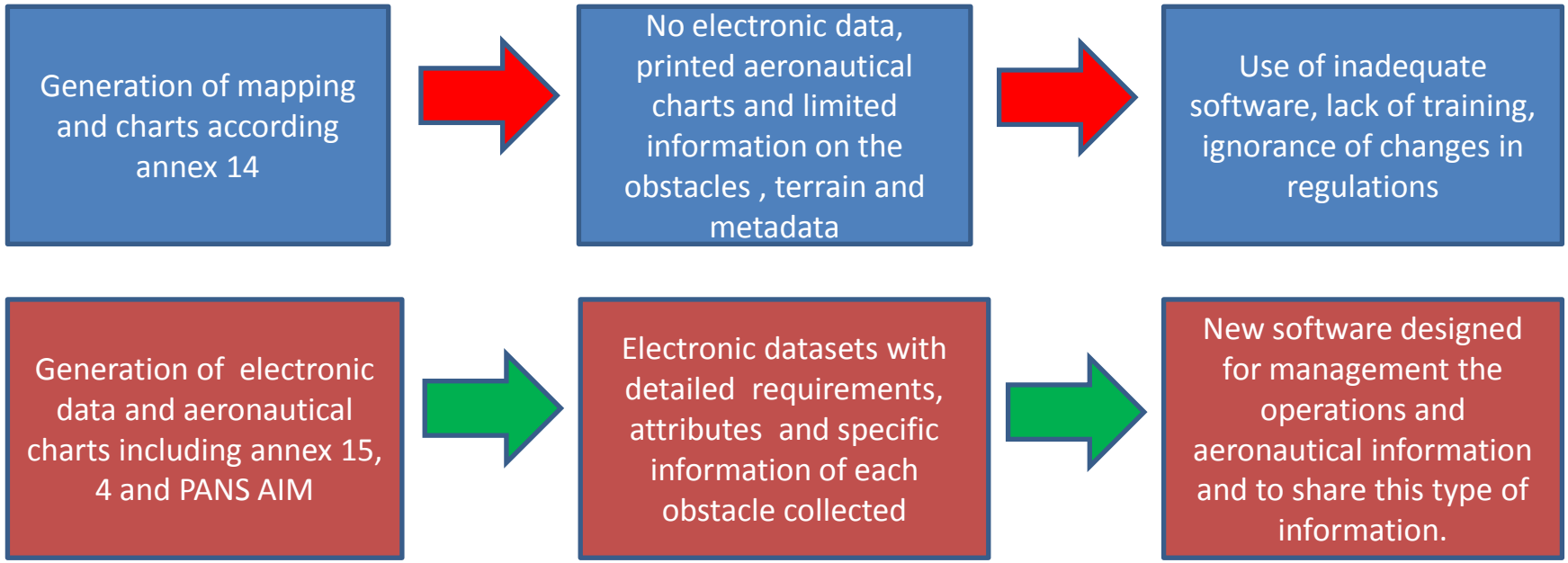
Specific types of aeronautical Information Products:

- Aeronautical charts,
- AIP,
- eTODS,
- Aerodromes & heliports
- NOTAMS
- AIC



How most be use the different datasets today?

Previous procedures vs New procedures.

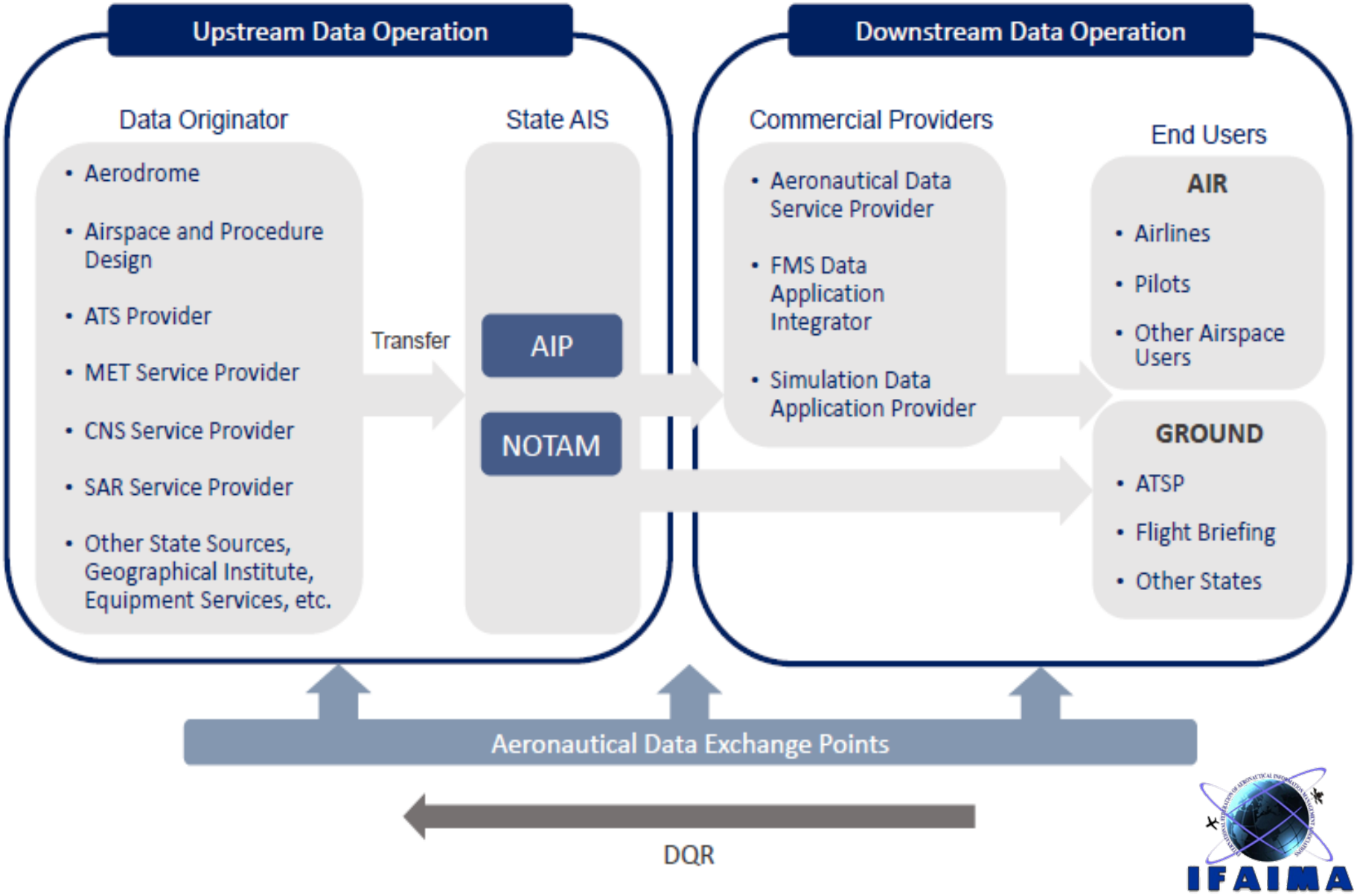


IFAIMA

Aeronautical Data Chain

It includes:

- Generation of aeronautical data and information to ensure that the percentage of error (accuracy) is low enough to ensure the safe use of aeronautical data (minimize risks).
- Protection during the processing of aeronautical data and information avoiding involuntary or deliberate modifications (quality control) and preserving its integrity (monitoring and traceability).
- Publication and transfer of aeronautical data through a secure, direct and appropriate connection.


Upstream Data Operation
Data Originator
Aerodrome
Airspace and Procedure Design
ATS Provider
MET Service Provider
CNS Service Provider
SAR Service Provider
Other State Sources, Geographical Institute, Equipment Services, etc.
Transfer
State AIS
AIP
NOTAM
Downstream Data Operation
Commercial Providers
Aeronautical Data Service Provider
FMS Data Application Integrator
Simulation Data Application Provider
End Users
AIR
Airlines
Pilots
Other Airspace Users
GROUND
ATSP
Flight Briefing
Other States
Aeronautical Data Exchange Points
DQR

Benefits of Using Digital Datasets

- Processing and validation, ensuring the provision of correct, complete and updated data.
- Information on airspace, **Obstacle/terrain data collection surface** (topography) and obstacles of all kinds (temporary and permanent, static and mobile).
- Will be available in graphic format with its complete information (**attributes**).
- Increase efficiency at all levels.
- Increased capacity of pilots, dispatchers and air traffic controllers to exploit / maximize operations.
- Warning messages (NOTAMS, AIC, etc) will be presented graphically for the pre-verification process.
- Area dedicated especially to Aeronautical Information Management.
- Easy and fast distribution of validated aeronautical data to end users

Generation and updating of data

PHASES:

1. **Survey,**
2. **Processing,**
3. **Evaluation (quality control),**
4. **Validation (metadata)**
5. **Publication**

Surveyors are specialists in data acquisition, however, they have little or no understanding about their use, so it is imperative to define in detail the specifications and the level of quality of the data to be collected.

AIS staff must fully know the specifications required for each data set before they are acquired and once the collection is completed; verify its quality in accordance with ISO standards; Verification must be documented and supported by the metadata of each data set collected.

Areas of coverage requested in annex 15.

Area 1.- All the territory of each state.

Area 2.- Now include 2abcd

Area 3.- Aerodromes (AMDB´s)

Area 4.- Cat II and III operation area.

eTODS.- Obstacle/terrain data collection Surface.

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

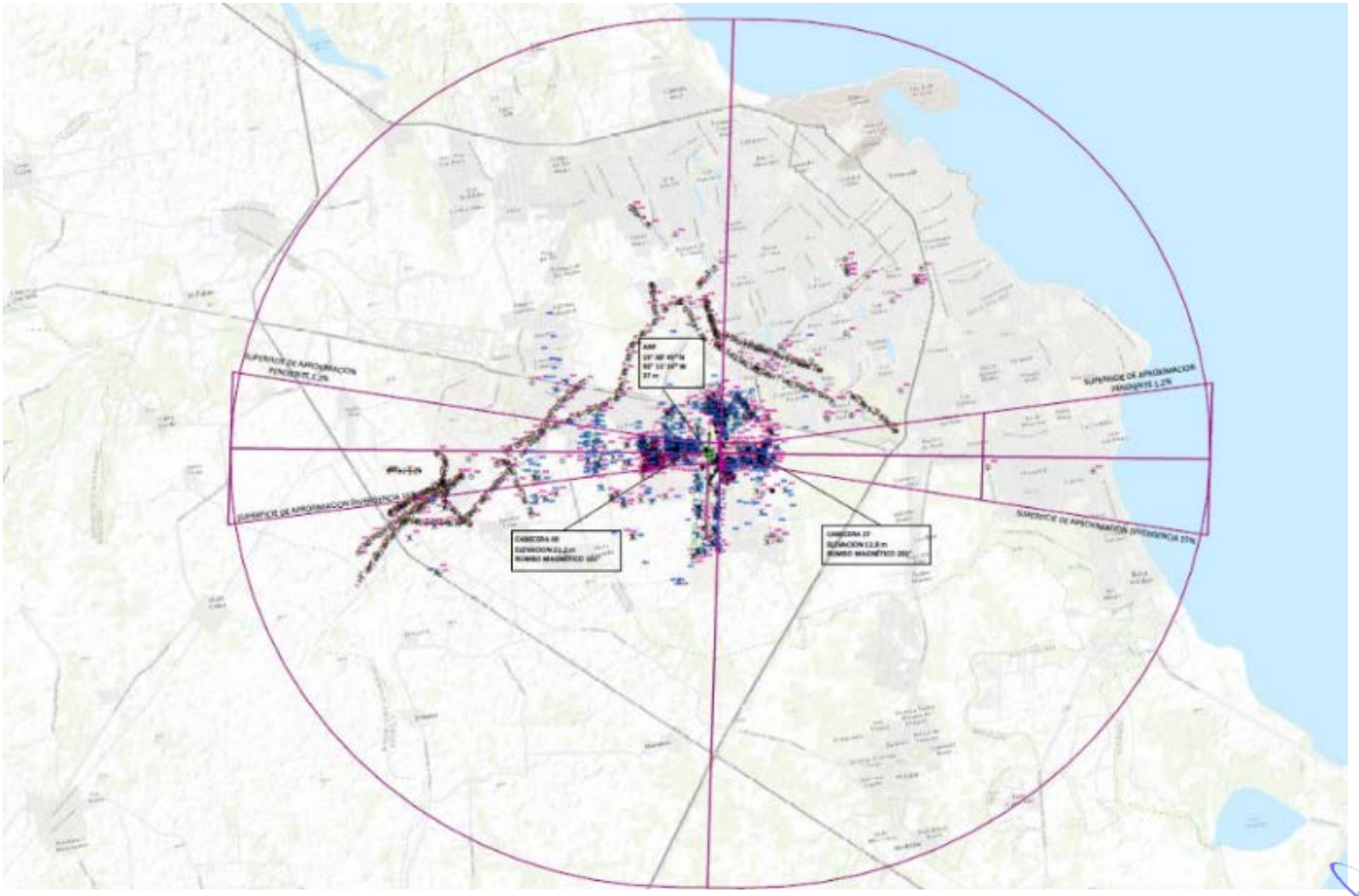
Requirements for terrain data

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

Requirements for obstacle data

IFAIMA

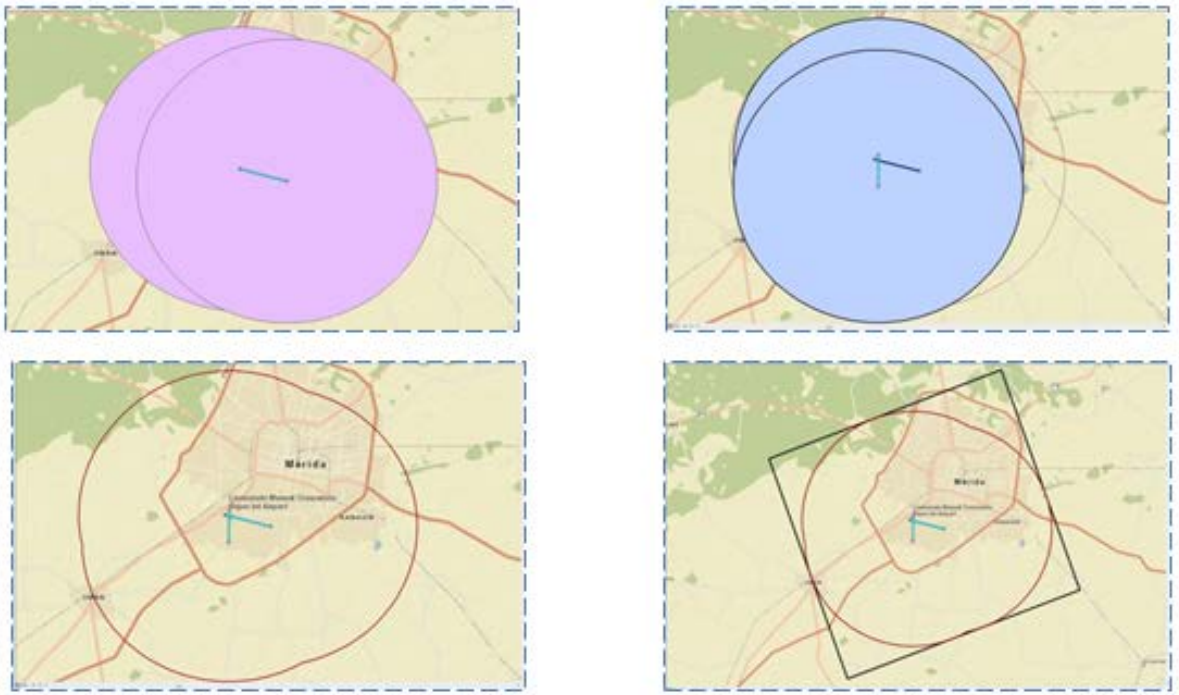
New surfaces to create digital datasets



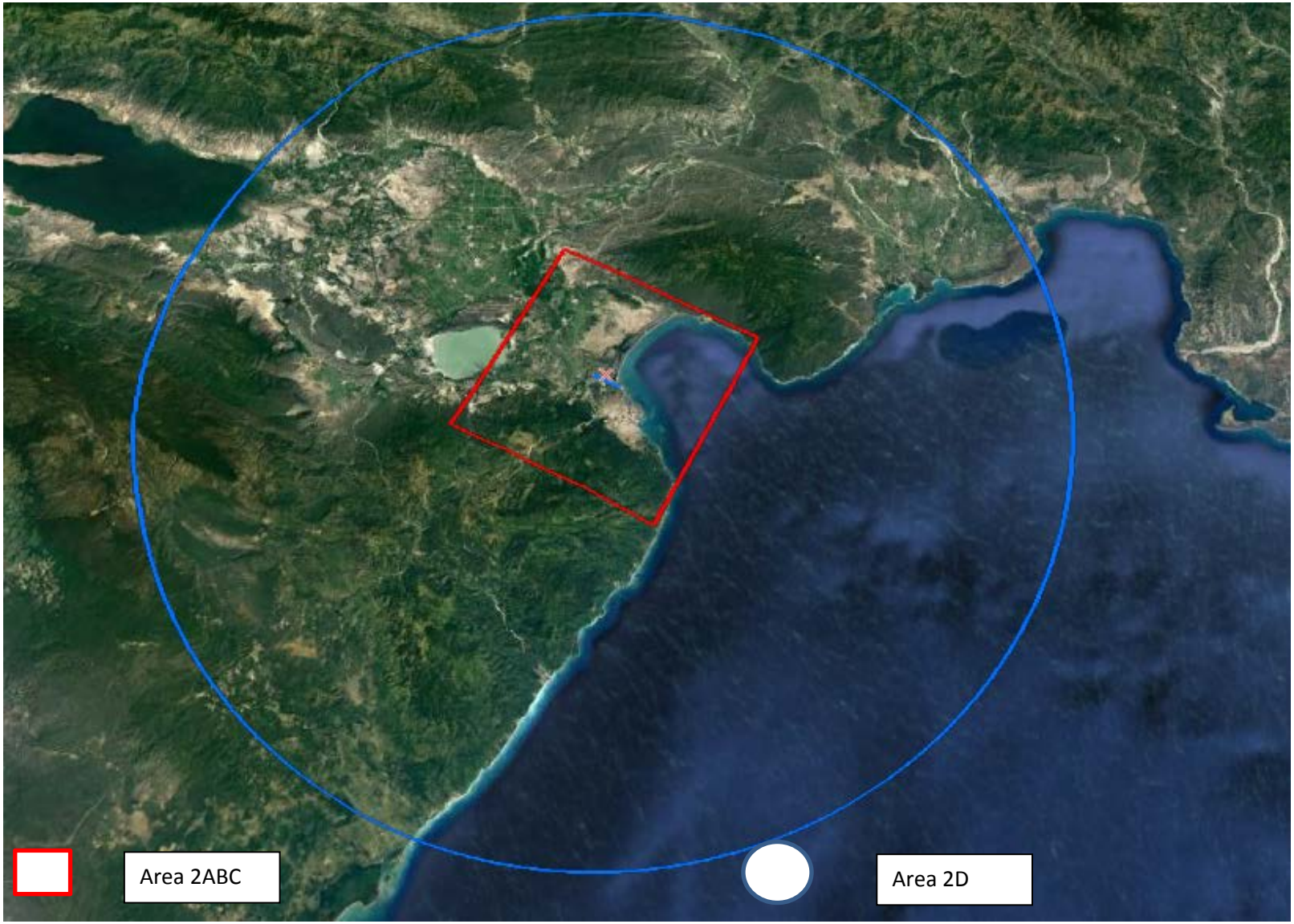
Definition of coverage

To guarantee the total coverage of each area, the AIM unit will plan and determine the different coverage polygons to guarantee that the products required to generate each of the datasets are obtained and that all the requirements that each type of data requires according to The standards.

The supplier will determine the type of sensor to be used, according to the characteristics of each data set and its requirements.



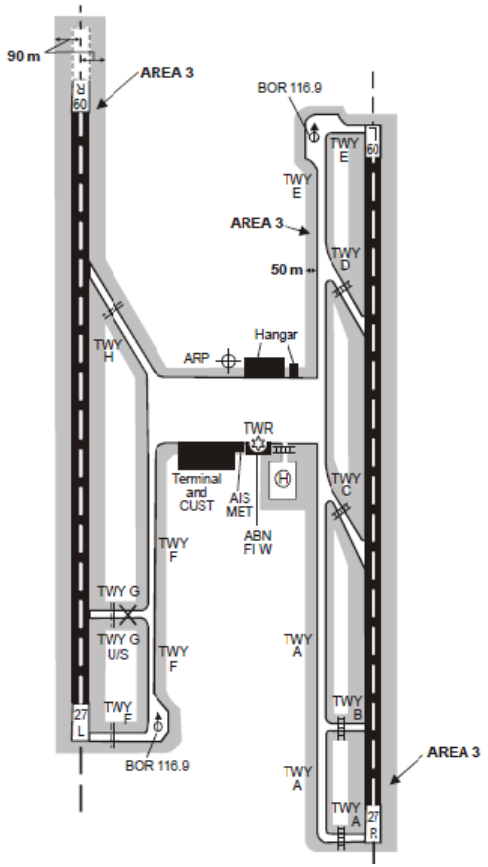
Example of new area 2.



AMDB

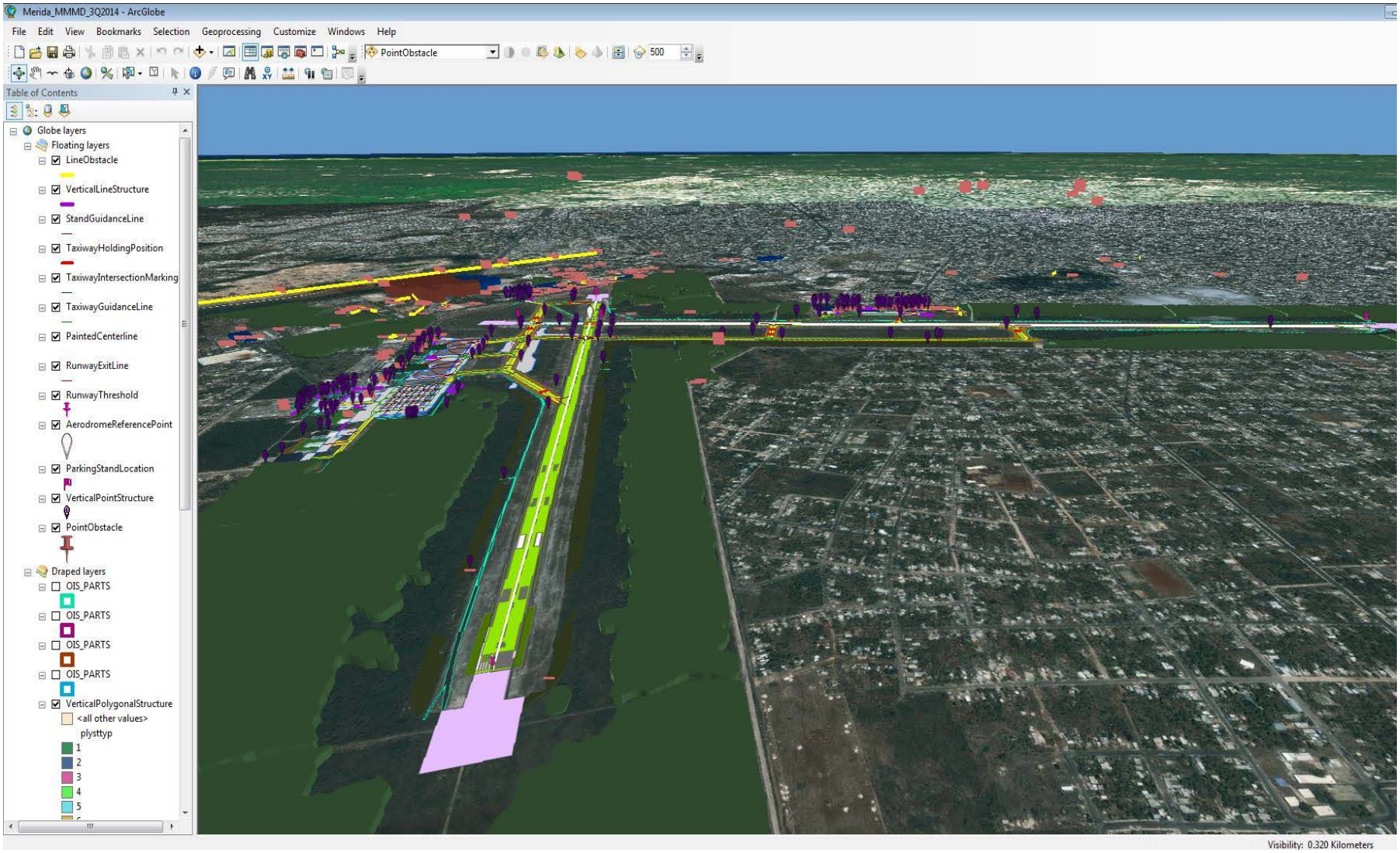
General area of the aerodrome

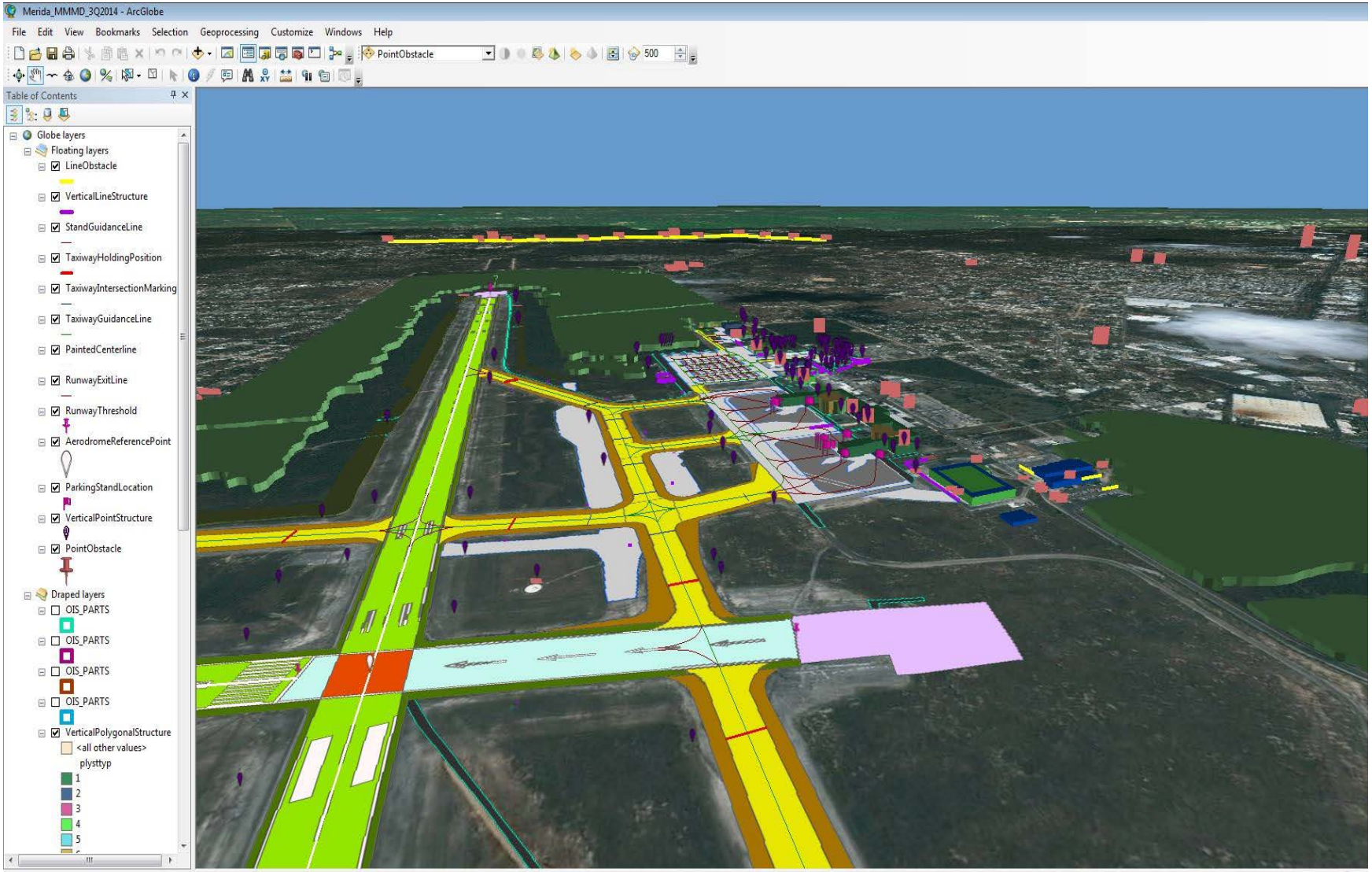
Track areas, parking, taxiways, buildings and structures.



IFAIMA

eTODS


Merida_MMMD_3Q2014 - ArcGlobe
File Edit View Bookmarks Selection Geoprocessing Customize Windows Help
PointObstacle
500
Table of Contents
Globe layers
Floating layers
LineObstacle
VerticalLineStructure
StandGuidanceLine
TaxiwayHoldingPosition
TaxiwayIntersectionMarking
TaxiwayGuidanceLine
PaintedCenterline
RunwayExitLine
RunwayThreshold
AerodromeReferencePoint
ParkingStandLocation
VerticalPointStructure
PointObstacle
Draped layers
OIS_PARTS
OIS_PARTS
OIS_PARTS
OIS_PARTS
VerticalPolygonalStructure
<all other values>
plysttyp
1
2
3
4
5
Visibility: 0.320 Kilometers

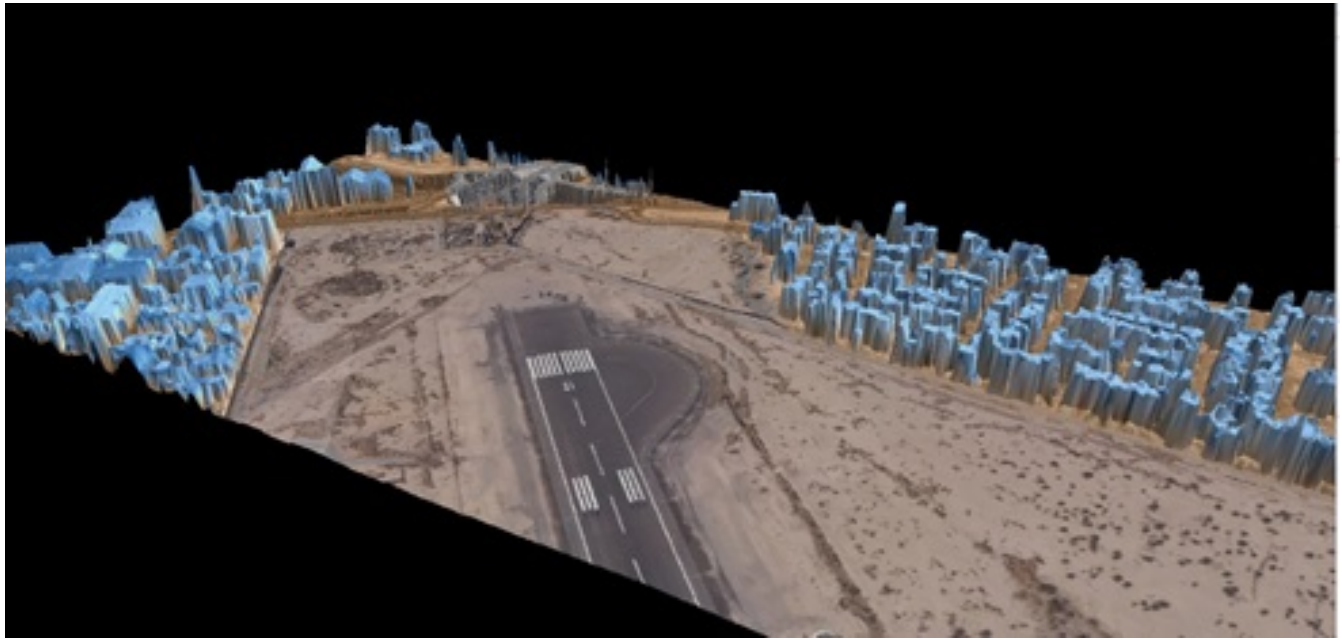

Merida_MMMD_3Q2014 - ArcGlobe
File Edit View Bookmarks Selection Geoprocessing Customize Windows Help
PointObstacle
500
Table of Contents
Globe layers
Floating layers
LineObstacle
VerticalLineStructure
StandGuidanceLine
TaxiwayHoldingPosition
TaxiwayIntersectionMarking
TaxiwayGuidanceLine
PaintedCenterline
RunwayExitLine
RunwayThreshold
AerodromeReferencePoint
ParkingStandLocation
VerticalPointStructure
PointObstacle
Draped layers
OIS_PARTS
OIS_PARTS
OIS_PARTS
OIS_PARTS
VerticalPolygonalStructure
<all other values>
plysttyp
1
2
3
4
5

IFAIMA

Attributes


1
1
FID 34
feattype 1
idarpt MMMD
source
vacc 3
hacc 5
vres 0
hres 0
integr 0.00001
vconf 90
hconf 90
revdate 8/8/2014
revtime 12:00:00 AM
efstdate 12:00:00 AM
efsttime 12:00:00 AM
efendate 12:00:00 AM
efentime 12:00:00 AM
ZV7 13.54
height 3.95
obstype 30
status 2
lighting $UNK
marking $UNK
hextent -32765
hposition $UNK
elevref $NE
featsource 3
imagery 2

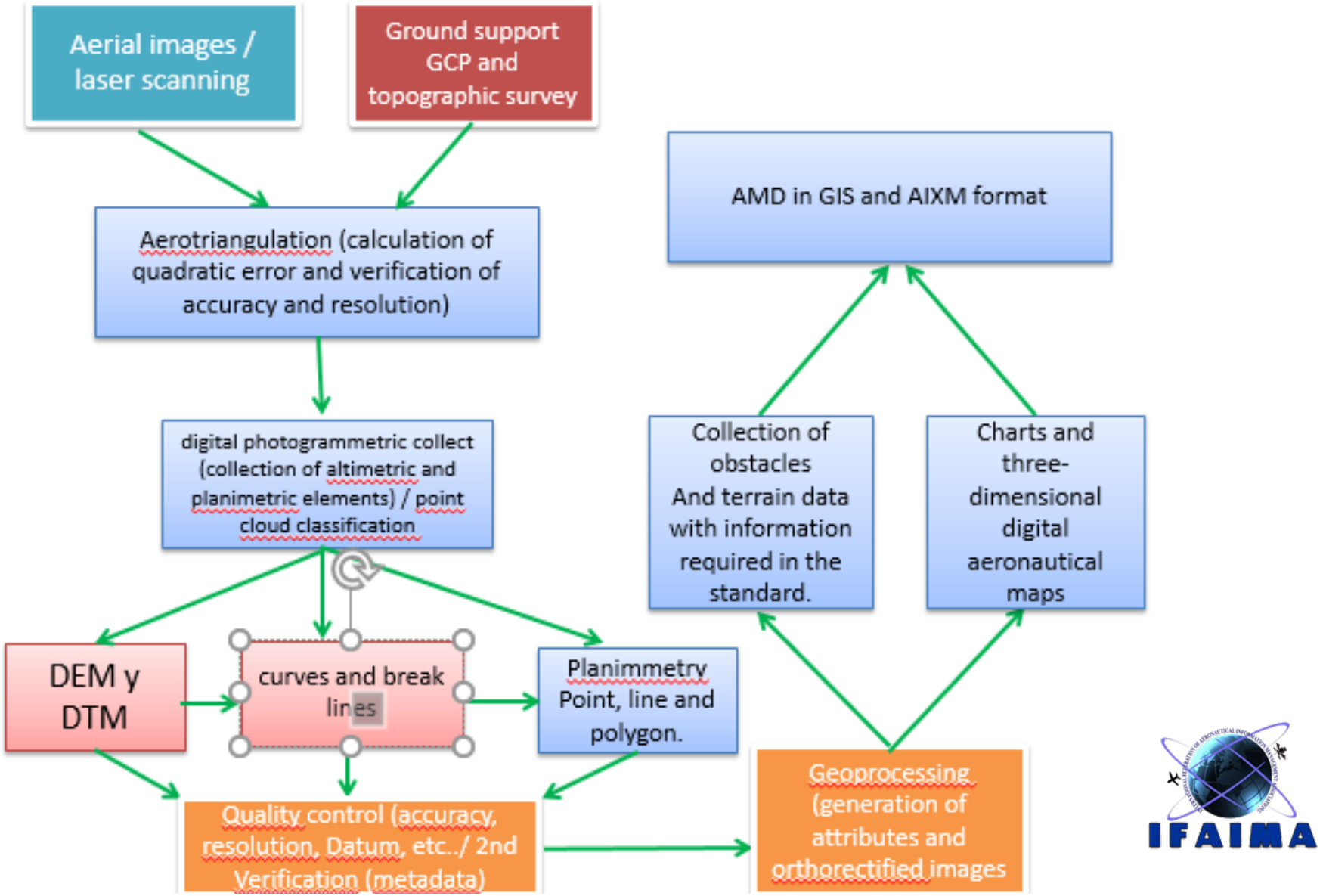
Use of new technologies and sensors for the collection of data sets, obstacles (eTODS) and terrain data.



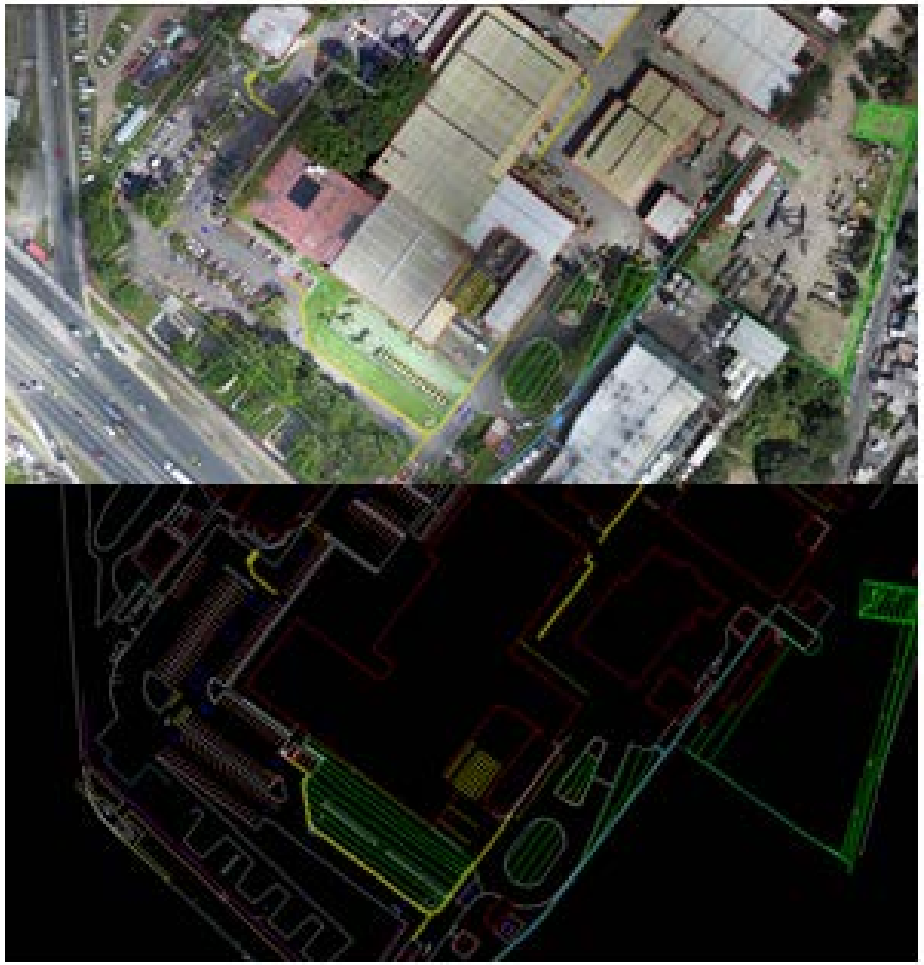
RESOURCES AND METHODOLOGIES

With through the combination of resources as satellite images of high and medium resolution, aerial images, LiDAR and the use of RPAS, the surveys are designed for each of the surfaces taking into account the characteristics of the region where the airport or interest's polygon.

Photogrammetric and LiDAR methodology

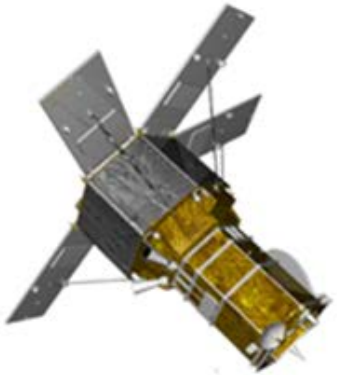


Collection of 3D data, to generate eTODS and attributes with values from the collection.



Polygons, lines and resulting points according to resolution and the accuracy required.

Sensors:



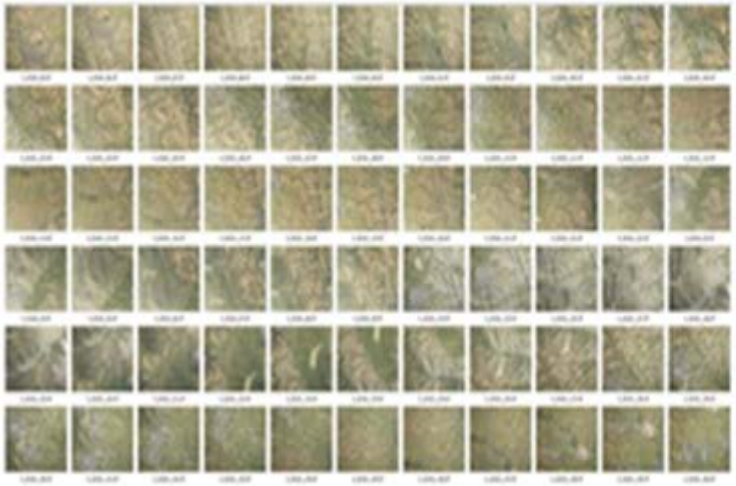
Satellite Images:

High resolution

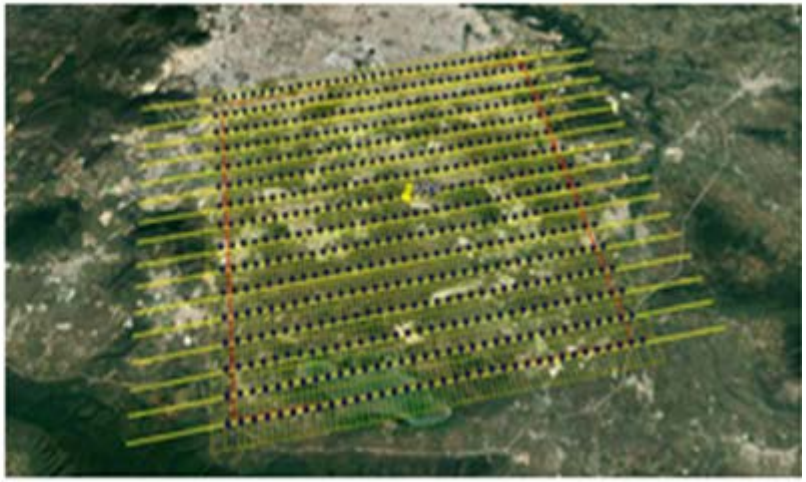
Medium resolution

Aerial photographs

Digital camera



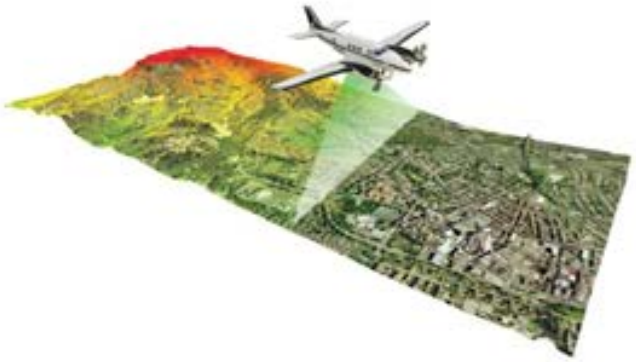
Photographs

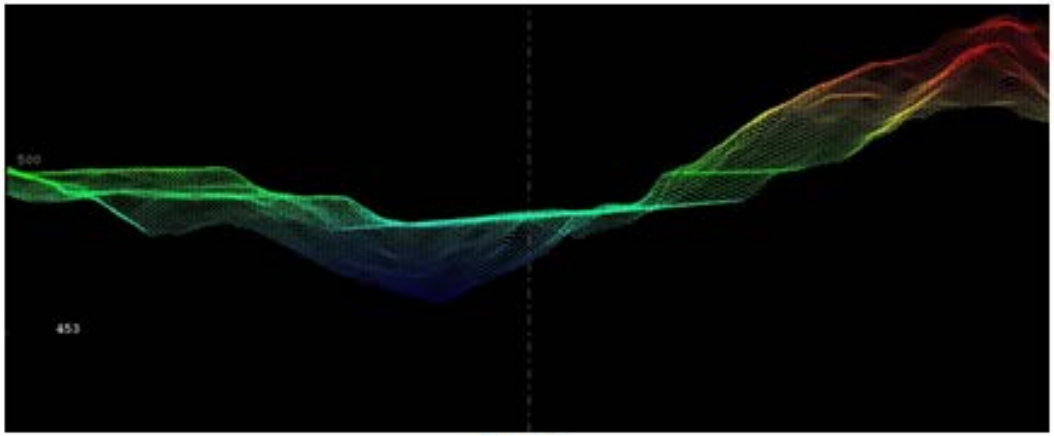


flight plan

LiDAR
Terrain Data Elements

LiDAR.





MDT

RPAS

Detailed description of methodology for data sets, eTODS collection and terrain data

Activities	Description
1.-Planning	1.- Definition of coverage polygons for verification and approval. 2.- Planning for surveys of land control points (GCP) and their distribution.
2.-Geodetic League and Connection to Intl-GNSS Reference Stations	Location of banks in the existing active geodetic network and references for the transformation of coordinates to DATUM WGS84
3.- Programming and taking images	1.- Determine the type of sensors to be used for each area. 2.- Generation of flight plans specifying height, resolution, number of lines, approximate number of photographs (depending on the sensor or equipment to be used). 3.- Programming and taking high-resolution Stereo satellite images (30cm - 50cm)

Type of sensor	area where you can use	conditions for your selection
Satellite images (high and medium resolution, always in stereo pairs)	They are used for the collection of the 2D area and depending on the season of the year and depending on the climatic conditions of the region, they can also be used for the area 2C.	2D area: Medium resolution satellite images (1.5 to 6 m) Its cost is lower, it covers the required precision and it can be worked with the DEM's that are currently commercialized to generate the DTM's. Area 2C: High resolution satellite images (30 to 60 cm). This option works very well in arid regions with little cloudiness; also depending on the season of the year in which they are programmed, they can be used in general in areas located in wind corridors and with little cloudiness.
Aerial images with photogrammetric aircraft	Area 2 A and 2 B.	When the weather permits and the airport operations are not too many, they are the ideal resource for a quick collection, as they allow us to obtain resolutions ranging from 7 cm to 30 cm.
LiDAR	Area 2 A and 2 B.	It is recommended when the region has too much vegetation and is more used to obtain the MDE and land.
Drones and RPAS (with generation of stereoscopic pairs)	Area 2 A and area 3 to generate the facility plans.	They are used for airports with a high number of operations and are the ideal option when the "Climate" factor and air traffic delay or stop the taking of images in conventional aircraft. The resolutions to obtain range from 3 cm to 7 cm.

Recommended coverage ranges for each type of technology

Area type by APTO	Survey type / sensor	Range in km2	
Area 3	Drone / aerial metric camera	1- 7 km2	
Area 2 ABC	A B C 10 a 15 cm	480 km2	
Area 2 ABC	Satellite images 50 – 60 cm	480km2	
Area 2 D discounting area ABC 420 km2	Satellite images 2 to 6 m	6,400 km2 (radio 45 km)	
Area 1	Satellite images 2 to 6 m	According of each country	

IFAIMA

VALIDATION = QUALITY

&

ISO STANDARDS

Objetive

The objective is to establish the principles to determine the quality of a data set and how validated.

General vision:

Establish quality ranges for a set of data, according to the requirements of each of them, depending on the area to which they correspond, analyzing two types of information:

1.- Non-quantitative quality information: It is general information, of great interest to know the purpose and history of an information (traceability), as well as to consider other possible uses in applications other than those originally considered.

2.- Quantitative quality information: It is considered that there are aspects such as values, precision, resolution, average error (RMSE), etc., which can be measured in the different data sets**.**

This information is described by the so-called "quality elements" (Data Quality Elements), which are traditionally referred to as components of the geographic data quality according ISO standards

Verification and validation process

VALIDATION

Verified (Validate) that the data contains the required values and elements according to the AIM PANS and the annex 15.

- Trazability
- Metadata
- Attributes
- Accuracy

VERIFICATION

Verify the integrity of each element of the data

- CRC
- ISO standards
- Completion
- Logical Consistency

Elements to verify Quality

The supplements considered by the standard are:

1. Completion: Commission and omission, that is, the presence in the data sets of elements that should not be present or the absence of others that should be present.

2. Logical consistency: Domain consistency, format consistency, topological consistency. Adherence to logical rules of the model, data structure, attributes and interoperability between them

3. Positional accuracy: External or absolute accuracy, internal or relative, accuracy for mesh data.

4. Temporal accuracy: Accuracy of time measurement, temporal consistency, indicate, and the validity of the data with respect to time.

5. Thematic accuracy: Correction of classification, correction of qualitative attributes, accuracy of quantitative attributes.

Metadata according PANS -AIM

***Metadata:** It is the data of data

Meta quality: It is the information about the quality of an element in relation to the requirement and the ISO standard included in the DOC 10066.

Catalog of data quality measures:
They are catalogs of quality measures associated with metadata to fully describe the measures referenced in the report on the quality of the evaluated data.
*For datasets, the generation of metadata is mandatory as indicated in ISO 19115

Results evaluated:
- Confidence: Accuracy of the quality result.
- Representativeness: Degree of representativeness or trust according to standards.
- Homogeneity: Proven or expected uniformity of the results obtained.

.

ISO Standards for Digital Datasets

- 8601 — *Data elements and interchange formats — Information interchange — Representation of dates and times*
- 9000 — *Quality Management Systems — Fundamentals and Vocabulary*
- 19101 — *Geographic information — Reference model*
- 19104 — *Geographic information — Terminology*
- 19108 — *Geographic information — Temporal schema*
- 19109 — *Geographic information — Rules for application schema*
- 19110 — *Geographic information — Feature cataloguing schema*
- 19115 — *Geographic information — Metadata*
- 19117 — *Geographic information — Portrayal*
- 19131 — *Geographic information — Data product specification*

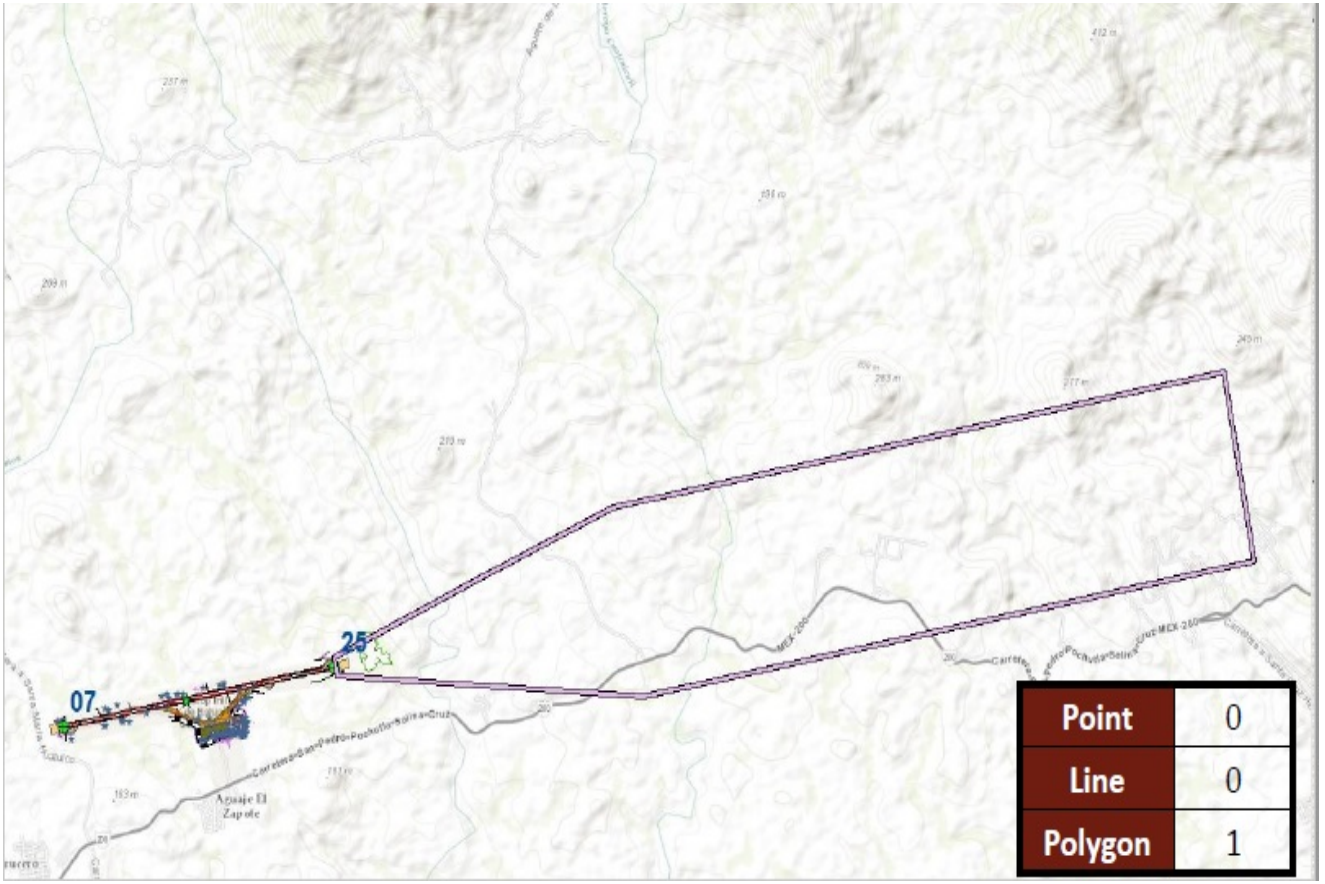
Example of Obstacle collection according to the new annex 15 amendment 16 and the PANS AIM

Comparative Analysis

It was detected that the procedures of annex 14 vol. 1 and the requirements of Annex 15, showed different information on the quantity and quality of the obstacles and terrain data and that it was even necessary to generate notifications for the modification of the AIP.

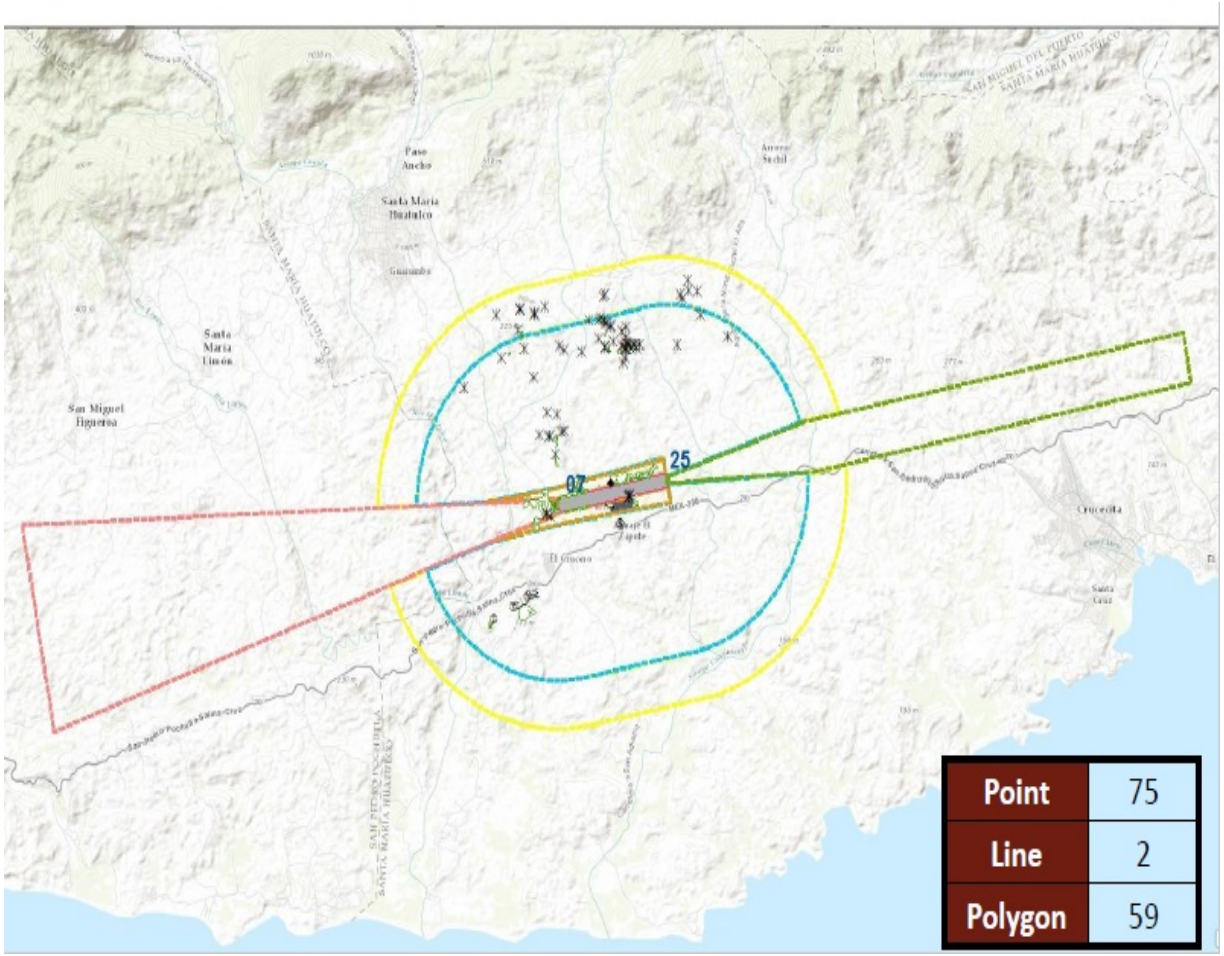
Compilation of obstacles according to Annex 4:

Total of obstacles compiled: 1



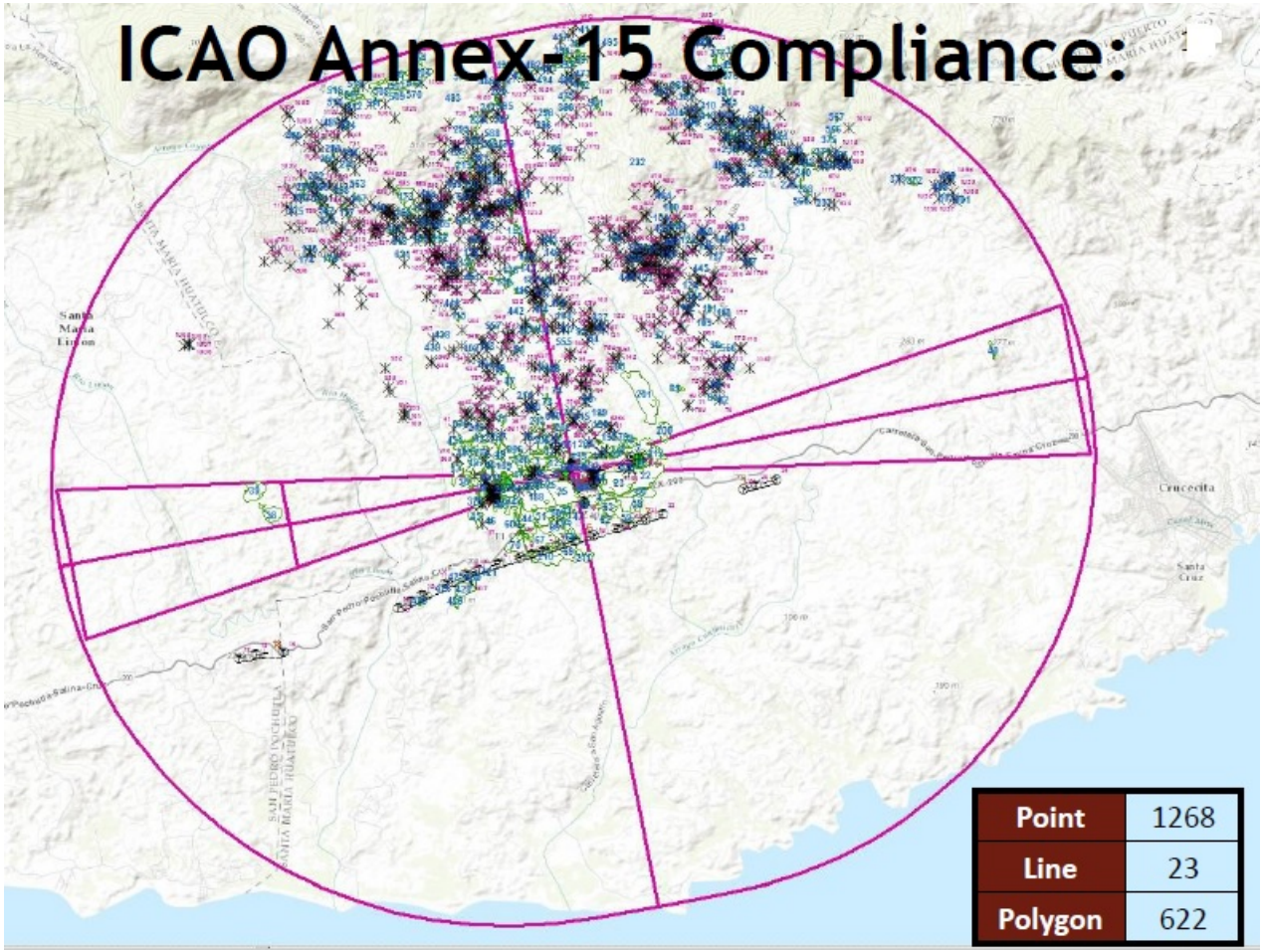
Compilation of obstacles according to Annex 14:

Total of Compiled Obstacles: 136

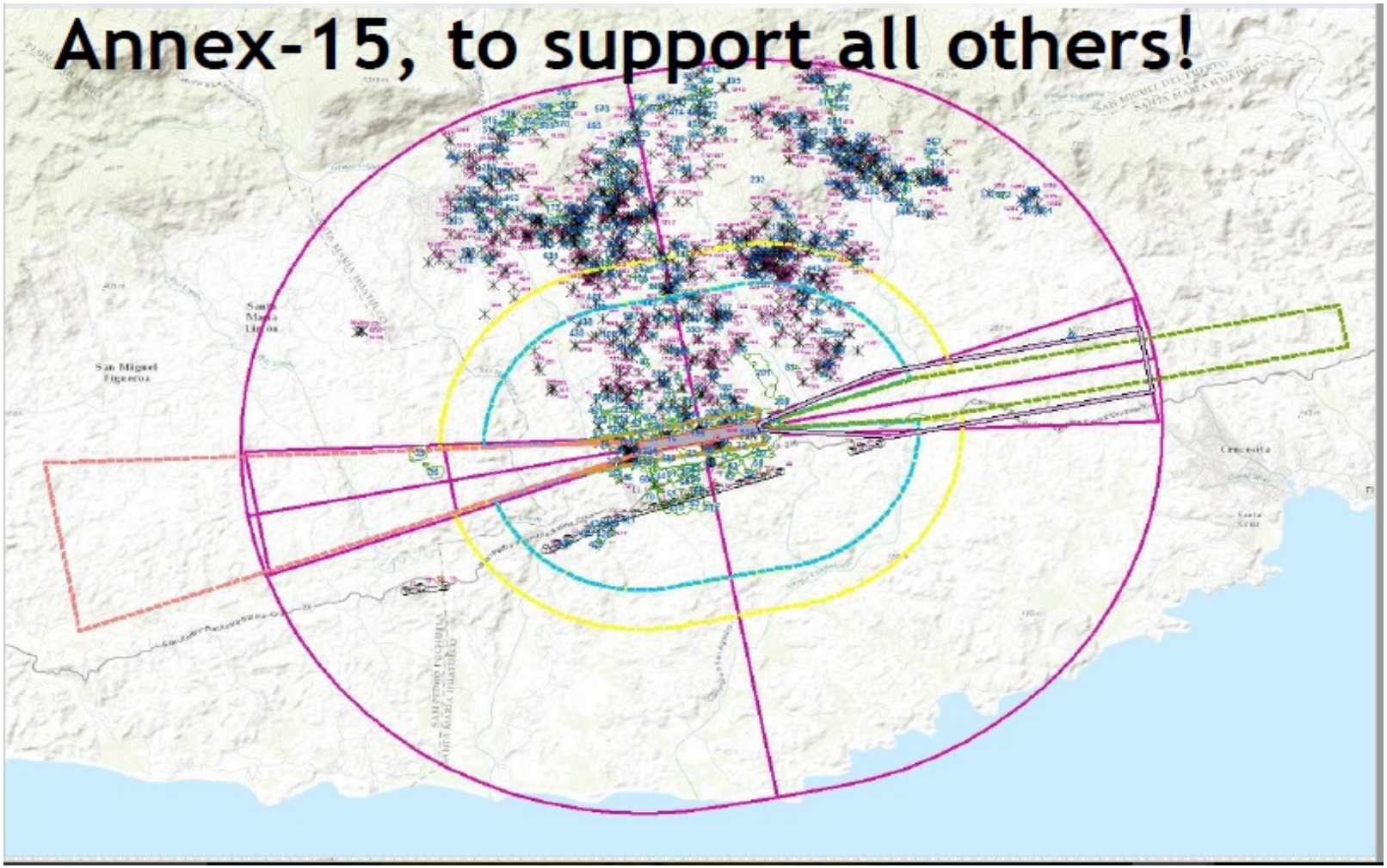


Compilation of obstacles according to Annex 15:

Total of Compiled Obstacles: 1,913



CONCLUSION



Thank you!

C.p.a. Iliana Sánchez Navarro
IFAIMA / México
Email: isn@gadoling.mx
ilianasanchez.din@gmail.com

Webpage: https://ifaima.org

IFAIMA

INTERNATIONAL FEDERATION OF AERONAUTICAL INFORMATION MANAGEMENTS ASSOCIATIONS

THE GLOBAL VOICE OF AIM

We will wait for you at the 2020 global meeting!

IFAIMA

INTERNATIONAL FEDERATION OF AERONAUTICAL INFORMATION MANAGEMENT ASSOCIATIONS

WARSAW 2020

GLOBAL AIM

26 - 28 MAY

IFAIMA

Follow this link for more information:
https://ifaima.org/index.php/global-aim/item/192-global-aim-warsaw-2020