

Esri Aeronautical Solution: Implementing eTOD in the AIS Data Model



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Esri Aeronautical Solution: Implementing eTOD in the AIS Data Model

An Esri White Paper

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Overview of eTOD

According to the International Civil Aviation Organization's (ICAO) new requirement (Amendment 33) in Annex 15, all ICAO participating states are to ensure the availability of terrain and obstacle data in electronic format between November 20, 2008, and November 18, 2010. This data shall be defined by four coverage areas around any airport, collected according to specific numerical requirements for each area, and stored in a geodatabase with ICAO-defined attributes for the obstacle and terrain feature classes. Obstacle features can be represented as points, lines, or polygons, and terrain data can be added as a raster dataset. Reliable and precise obstacle and terrain data for in-flight and ground-based applications can provide significant safety benefits for international civil aviation. To facilitate compliance, Esri has added Electronic Terrain and Obstacle Database (eTOD) capabilities to Esri® Aeronautical Solution.

Terrain and Obstacle Coverage Areas

The coverage areas for collecting and recording sets of electronic terrain and obstacle data in the database are defined as follows:

- Area 1—Entire territory of the state
- Area 2—Terminal control area per Aeronautical Information Publication (AIP) or not exceeding a 45 km radius from the airport (ARP) (whichever is smaller) (For aerodromes without a legally defined terminal control area, a 45 km radius applies.)
- Area 3—At instrument flight rules (IFR) aerodromes/heliports, from runway edge to movement areas
- Area 4—120 m wide and 900 m long area at precision approach category II and III runways

The Challenge

Identifying the coverage areas and storing the data with the specified requirements have posed major challenges to the aviation community. ICAO member states are struggling to find a solution for managing this large collection of inherently spatial data in the most reliable and cost-efficient way. Aeronautical Solution meets these challenges by extending the Aeronautical Information System (AIS) data model to include eTOD feature classes and integrating a simple workflow to create the coverage areas.

eTOD Feature Classes in the AIS Data Model

The new AIS data model schema can now accommodate data to meet the eTOD requirements in Amendment 33. To accomplish this, the model has been upgraded to include four new feature classes—*PointObstacle*, *LineObstacle*, *PolygonalObstacle*, and

ObstacleArea. There are also three new many-to-many relationship classes—*PointObstacleArea*, *LineObstacleArea*, and *PolygonalObstacleArea*. The relationship classes are created to show the association between each obstacle feature (in *PointObstacle*, *LineObstacle*, and *PolygonalObstacle*) contained within a particular obstacle coverage area (in *ObstacleArea*). All feature classes have been modeled according to the feature catalog in ICAO Doc 9881. The data exchange standard maintained is Aeronautical Information Exchange Model (AIXM) 4.5. The schema upgrade will work on any Esri-supported geodatabase including personal/file, workgroup, and enterprise. Thus, the upgraded AIS model provides a storage bin once the terrain and obstacle data has been collected for each coverage area.

eTOD Workflow

A major part of the current challenge faced by the aviation industry is defining and visualizing the coverage areas for terrain and obstacle data collection. Aeronautical Solution makes this a seamless process by utilizing a Task Assistant workflow called *eTOD Tasks.xml* in Esri Aeronautical Solution 10. The entire workflow consists of step-by-step instructions utilizing Feature Builder and core ArcGIS® Desktop ArcMap™ editing functionality to accomplish the following broad tasks:

- eTOD Obstacle Area Creation—Construct each coverage area (included as subtasks) according to the specifications in ICAO Doc 9881 and store each area in the *ObstacleArea* feature class.
- Populating Relationship Classes—Create the relationship between each obstacle feature and its related coverage areas to populate *PointObstacleArea*, *LineObstacleArea*, and *PolygonalObstacleArea*.

The following figures provide examples of Area 1 (ICAO member state—Spain), Area 2, Area 3, and Area 4 (for a sample airport—Salinas Muni, California), created using the Task Assistant workflow inside the ArcMap application of ArcGIS Desktop.

J-9765

Figure 1
Obstacle Coverage Area 1



Figure 2
Obstacle Coverage Area 2

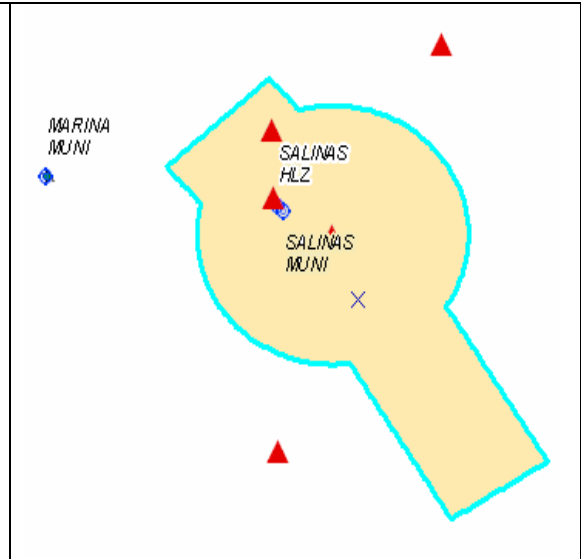


Figure 3
Obstacle Coverage Area 3

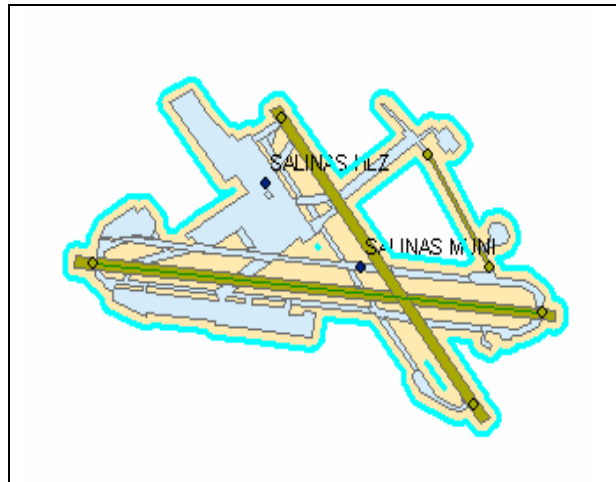
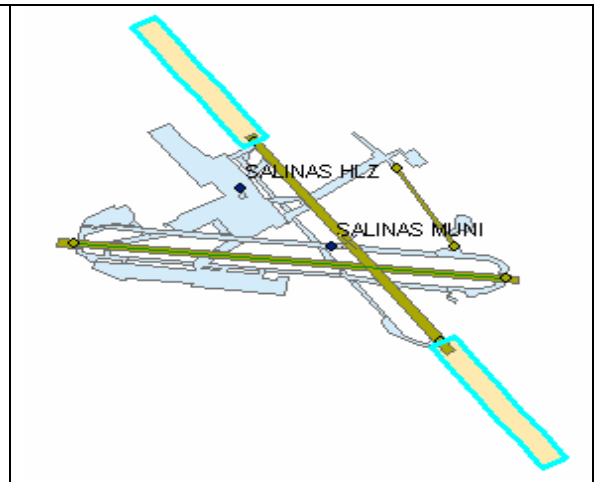
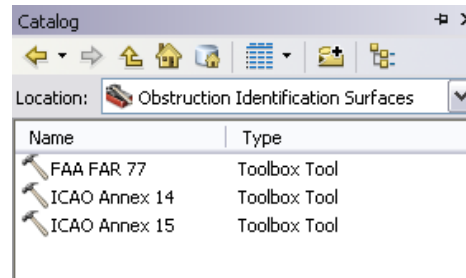


Figure 4
Obstacle Coverage Area 4



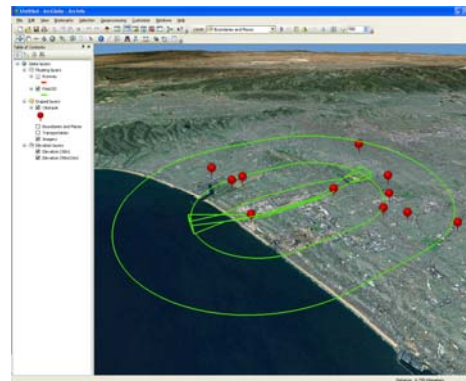
**What's New in Esri
Aeronautical
Solution 10**

In Esri Aeronautical Solution, eTOD support is further enhanced at the ArcGIS 10 release with the addition of Obstruction Identification Surfaces (OIS) geoprocessing tools. These OIS tools support Federal Aviation Administration (FAA) FAR 77 and ICAO's Annex 14 and Annex 15 specifications.



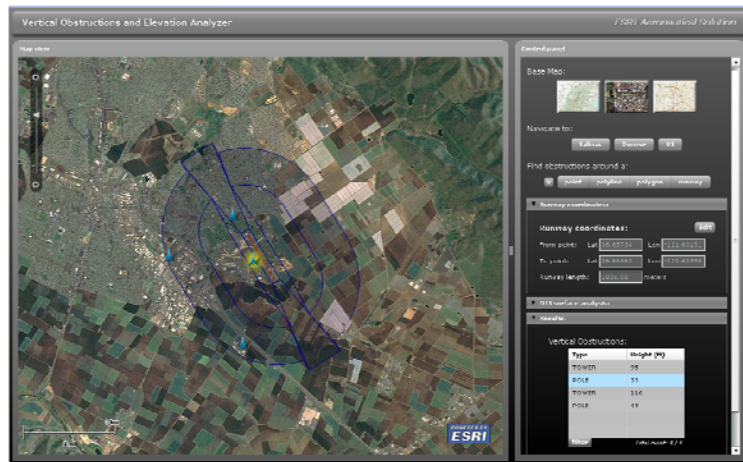
Toolbox Showing the Three New Available OIS Tools

The OIS tools provide simple and automatic generation of the associated OIS imagery surfaces for any runway in the world. Those surfaces can be used to visualize and analyze terrain and obstructions in both 2D and 3D in the vicinity of the runway.



Resultant 3D Shapes and Intersecting Obstacles Generated by the New OIS Tools

Harnessing the enterprise capability of Esri technology, the OIS tools can be integrated into custom thin-client applications via ArcGIS Server geoprocessing services. These types of applications can be designed to support specific business operations such as airport planning and management.



Online Flex application publishes the new OIS tools as Web services and resultant layers for obstacle analysis.

- Notes**
- ICAO's Amendment 33 integrated a new Chapter 10—Electronic Terrain and number of revisions to Appendix 1—Contents of Aeronautical Information Publication (AIP) and Appendix 7—Aeronautical Data Quality Requirements. Additionally, ICAO has also released Doc 9881—Guidelines for Electronic Terrain.
 - The upgraded AIS model does not include any cartographic copies of the new feature classes, which are required for charting purposes. However, they can be created from the master feature classes.

More Information

For more information, visit <http://www.esri.com/aeronauticalsolution>.



About Esri

Since 1969, Esri has been helping organizations map and model our world. Esri's GIS software tools and methodologies enable these organizations to effectively analyze and manage their geographic information and make better decisions. They are supported by our experienced and knowledgeable staff and extensive network of business partners and international distributors.

A full-service GIS company, Esri supports the implementation of GIS technology on desktops, servers, online services, and mobile devices. These GIS solutions are flexible, customizable, and easy to use.

Our Focus

Esri software is used by hundreds of thousands of organizations that apply GIS to solve problems and make our world a better place to live. We pay close attention to our users to ensure they have the best tools possible to accomplish their missions. A comprehensive suite of training options offered worldwide helps our users fully leverage their GIS applications.

Esri is a socially conscious business, actively supporting organizations involved in education, conservation, sustainable development, and humanitarian affairs.

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