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**Agenda Item 7: Implementation of systems for the exchange of aeronautical information and aeronautical data**

**Implementation of the GEOAISWEB website**

(Presented by Brazil)

**SUMMARY**

The purpose of this working paper is to present the GEOAISWEB used by Brazil for providing aeronautical information directly in a map, allowing for simultaneous use of AIS information and aeronautical charts, in addition to accessing files.

**1. Introduction**

1.1 The purpose of this working paper is to present the GEOAISWEB website used by Brazil for providing aeronautical information directly in a map, enabling simultaneous use of AIS information and aeronautical charts. The information provided accompanies the amendments to aeronautical publications (AIRAC cycle).

1.2 Through the map visualizer, it is possible to relate the data and access aerodrome or fix coordinates. It is also possible to see the airspace and download terrain and obstacle data.

1.3 The map visualizer was developed in HTML5, *Bootstrap*, *JQuery* and *Openlayers* 4, all free software. Through the GeoSERVER software, the geographical information or data set is displayed or downloaded in various vector and raster formats, and AIS data is captured through the WFS (*Web Feature Service*) geo service.

1.4 The GEOAISWEB website was developed by the *Instituto de Cartografía Aeronáutica – ICA* (Aeronautical mapping institute) and may be accessed at no cost at: <http://www.aisweb.aer.mil.br/geoaisweb/>.

**2. Geographical data**

2.1 The difference between geographical data and other types of data is its space component and its location in space (latitude, longitude and altitude). Thus, based on this information, it is possible to analyse the geographical space through specific database queries, for example, listing aerodromes contained in a given flight information region (FIR).

2.2 Geographical data is grouped in two representation models, namely: vector and raster.

2.3 Geographical data stored in the vector model is represented in the form of dots, lines and polygons (areas), just like e-TOD obstacle data.

2.4 Dots are used to represent, for instance, the location of fixes and obstacles. Lines represent airways. Polygons can represent airspace and flight information regions (FIR).

2.5 Vector-type file formats: KML (Keyhole Markup Language), SHP (ERSI shapefile format), CSV (Comma-Separated Values), XLS (Microsoft Excel format) and GeoJSON (JavaScript Object Notation), among others.

2.6 For geographical data stored in the raster model, the representation is through a matrix made up by a number of columns and lines, where each cell has a value that corresponds to the attribute and can be found in the convergence of lines and columns. Satellite images, aerial photographs, digital terrain model and aeronautical charts are widely represented in raster format.

2.7 Raster file formats: GeoTIFF (Tagged Image File Format), GeoPDF (Portable Document Format) and Binary Terrain (BT), among others.

### 3. **Aeronautical information**

3.1 The GEOAISWEB website offers downloads of the following aeronautical information and its attributes: Aerodromes, heliports, airways, fixes, flight information regions (FIRs), airspaces, NDBs, VORs and NAVAIDS.

3.2 The aeronautical information can be downloaded in the following vector formats: KML (Keyhole Markup Language), SHP (ERSI shapefile format), CSV (Comma-Separated Values), XLS (Microsoft Excel format) and GeoJSON (JavaScript Object Notation), among others.

3.3 The aeronautical information that can be downloaded in KML (Keyhole Markup Language) format can be seen in Google Earth and in SHP (ERSI shapefile format), in the ARCGIS geographical information system or in the Quantum GIS.

### 4. **Aeronautical charts**

4.1 The GEOAISWEB website offers the following aeronautical charts for display and downloading: area chart (ARC), en-route navigation chart (ENRC) and world aeronautical chart (WAC). Charts may be downloaded in GeoTIFF (Tagged Image File Format) and GeoPDF (Portable Document Format) raster formats.

### 5. **Terrain and obstacle data**

5.1 The GEOAISWEB website contains obstacle and terrain data for ten Brazilian airports, free of charge. The ten airports are: SBBR, SBCF, SBCT SBRJ, SBGL, SBGR, SBSP, SBPA, SBRF and SBSV.

5.2 Obstacle data is available for display and downloading in KML (Keyhole Markup Language), SHP (ERSI shapefile), CSV (comma-separated values), XLS (Microsoft Excel), GeoJSON (JavaScript Object Notation) and other formats.

5.3 Terrain data can only be downloaded in GeoTIFF (Tagged Image File Format) raster format and obstacle and terrain metadata can be downloaded as PDF.

### 6. **WFS (*Web Feature Service*) Geoservice**

6.1 The Web Feature Service (WFS) is the format created by OGC (Open Geospatial Consortium), an international non-profit organisation that creates geographical data exchange patterns with a view to promoting the development of technologies that will facilitate interoperability among different space information and location systems. These standards allow entities to make their geographical data openly available. (Source: <http://www.opengeospatial.org/>).

6.2 The WFS service specification defines a service whereby clients can retrieve geographical data stored in the server in two versions: basic (query functions) or transactional (the entire service, including insertion, deletion, edition and query of space objects). The WFS service available in GEOAISWEB is of the basic type, only allowing for queries.

6.3 The Web Feature Service (WFS) represents a change in the way in which geographical information is created, modified and changed, instead of sharing geographical information at the file level through FTP (for example, WFS offers direct and detailed access to geographical information and allows for the exchange of information between clients and servers).

6.4 In practical terms, through the WFS GeoService, it is possible to access information available in map servers and visualize it on the GEOAISWEB website, together with aeronautical information and charts. External users may consume the data available on the GEOAISWEB website.

6.5 The WFS represents a change in the way in which geographical information is created, modified and changed, instead of sharing geographical information at the file level through FTP (for example, WFS offers direct and detailed access to geographical information and allows for the exchange of information between clients and servers).

## 7. Information technology infrastructure

7.1 The information technology infrastructure used by GEOAISWEB, made up by several software and service levels, is as follows:

Name	Description
Tomcat	To respond to requests and manage connections with the GeoServer, GeoNetwork and Map Visualizer servlets.
GeoServer	Used for managing vector and raster data.
PostgreSQL	Database server that stores the vector data that makes up the GeoServer service layers and other data structures needed for the GEOAISWEB website.
GeoNetwork	Metadata catalogue server that follows the ISO 19115:2003 and 19139:2007 pattern.
Map visualizer	FRONT-END layer for visualizing geographical data, whether in vector or raster format.

7.2 The minimum hardware configuration for the server is: 16 GB RAM memory, 2 TB HD, two 64bit 2Ghz CPUs, preferably with more than two processing cores for concurrent operations.

7.3 GeoTIFF aeronautical chart files occupy 69 GB, totalling 109 files. Obstacle and terrain data of the ten airports occupy 1 GB. The vector files of aeronautical information layers occupy 930 MB.

## 8. Types of users

8.1 There are three types of users in GEOAISWEB:

Type	Description
Administrator	The administrator user is responsible for system registration, configuration and support.
Producer	Manages aeronautical information provided by the system, as well as the aeronautical charts, following the AIRAC cycle.
User	Professionals that use the system, query AIS data or download files.

## 9. Conclusion

9.1 Within the context of AIM (Aeronautical Information Management) and the growing demand for geographical information, the WEB is a means for effective exchange, and requires the use robust tools and data structures. Accordingly, GEOAISWEB becomes an ideal tool to access AIM geographical data in a fast, easy and dynamic manner.

9.2 It is interesting that States can share AIS data and aeronautical charts in a digital geo-referenced format, since they can be used by different users for query, analysis and downloading, increasing the possibilities of use of the information and even opening the possibility of its use in other areas, such as AGA, air traffic, drone licensing, transportation, logistics, the environment, urban planning, among others.

## 10. Suggested action

In addition to sharing data in the AIXM standard, States should share AIS data and aeronautical charts in a digital, geo-referenced format.

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