FAA Airport Surveying - GIS Program

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ABSTRACT:

There is an increasing demand for accurate airport survey data for use in developing runway approach procedures; determining maximum takeoff weights; and ensuring the overall safety of the National Airspace System. Airport survey data meeting the specifications in FAA No. 405 has traditionally been collected by NOAA, for the FAA, under an inter-agency agreement. Due to government down sizing and business model to partnership with private industry, and the increase demand for more data, the FAA Airport Surveying--GIS Program was developed to encourage airports to hire private surveying firms and consultants to perform these surveys. The FAA Airport Surveying--GIS Program will standardize geospatial vector features and provide one source for multiple GIS end users.

For nearly 60 years, the National Oceanic and Atmospheric Administration (NOAA) have provided aeronautical survey data to the Federal Aviation Administration (FAA). This aeronautical survey data help ensure the safety of the National Airspace System and are used in, but not limited to, developing instrument approach and departure procedures; determining maximum takeoff weights; certifying airports for certain types of operations, and providing accurate locational information for features and obstructions on, and near, airports. The emergence of GPS-based navigation has increased the demand for accurate aeronautical surveyed data. NOAA and FAA are currently developing a new approach to aeronautical surveying in response to this need. This approach considers the current climate of government downsizing and changing business model, which encourages partnerships between government and private industry.

Collaboration between NOAA and FAA has resulted in the development of a new Data Content Standard for a geospatial digital version of the Airport Obstruction Chart (AOC). This conforms to standards previously developed by the Air Modeling Advisory Team (Air MAT), that were based on the model for FAA's Electronic Airport Layout Plan (eALP). These standards are also in harmony with the American National Standard for Information Technology Geographic Information Framework Data Content Standards; Transportation: Air (Part 7a), July 2004. The new geospatial digital AOC Data Content Standard will help standardize the collection and dissemination of airport feature and obstruction data throughout the government and private industry.

What is an Airport Obstruction Chart (AOC)?

An Airport Obstruction Chart is a 1:12,000-scale graphic, depicting Federal Aviation Regulations Part 77 (FAR-77) Obstruction Identification Surfaces (OIS); a representation of objects that penetrate these surfaces; aircraft movement and apron areas; navigational aids; prominent airport buildings; and a selection of roads and other planimetric details in an airport vicinity. Tabulations of runway and other operational data are depicted in an Airport Plan, Runway Plans and Profiles, Tabulated Operational Data, and Notes and Legends. Refer to figure 1 for the layout of a graphic AOC.

Most source data is acquired by ground and remotely sensed surveys. Source data is currently imported into the NOAA Obstruction Chart Data Base, which exports a Computer-Aided Design (CAD) file. This non-georeferenced CAD file is cartographically manipulated onto a template, and then sent to FAA's National Aeronautical Charting Office (NACO) for printing a check plot. The check plot is returned to NOAA for quality review. Once verified, the AOC is queued on NACO's printing schedule. It is printed onto 30 inch x 42 inch, or 30 inch x 48 inch format E50 or equivalent chart paper. The graphic AOC may be ordered from NACO by contacting them directly, or purchased from an authorized aeronautical and nautical chart sales agent.

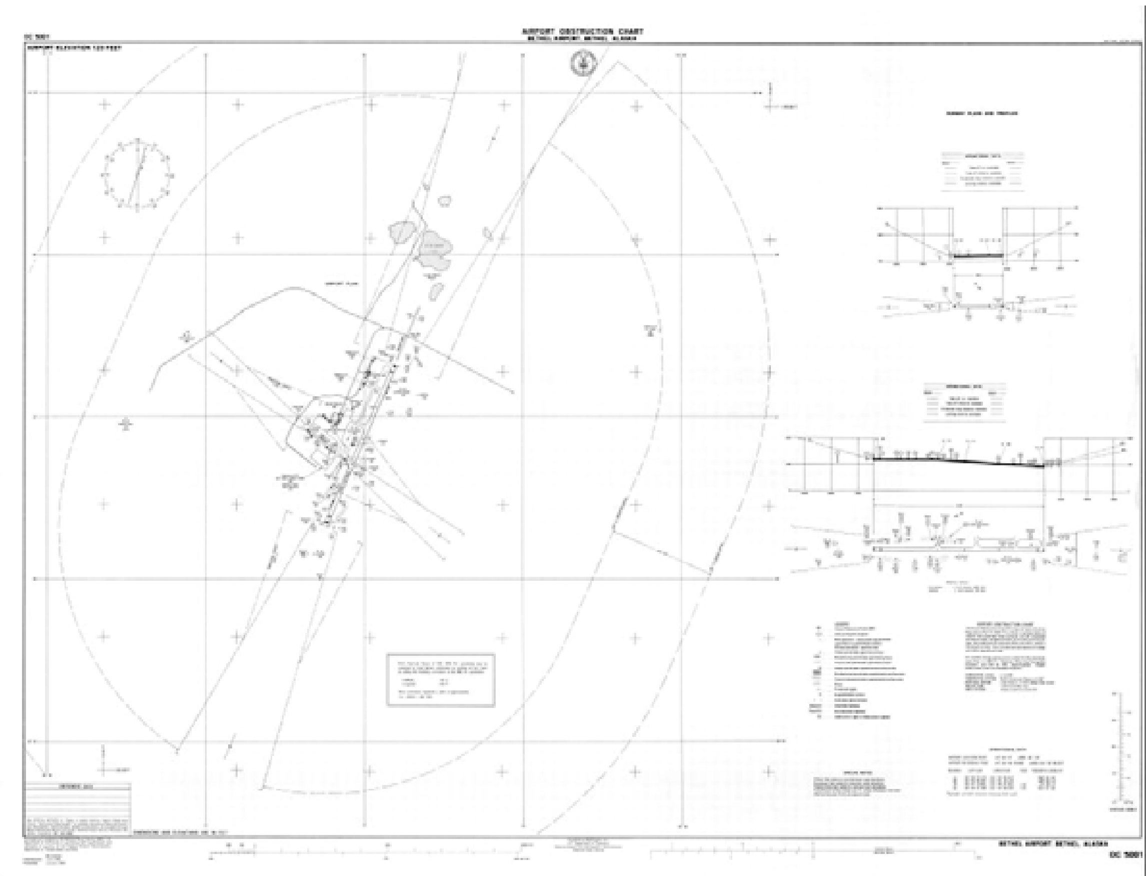


Figure 1
AOC Graphic

What is a geospatial digital Airport Obstruction Chart (AOC)?

The ‘new’ AOC is a collection of geospatial data that has been determined to be relevant to air transportation on and near airports. Several techniques are used in obtaining these data, including ground survey, remote sensing (data derived from either aerial imagery or Light Detection And Ranging -LiDAR), manual entry or calculated values. The types of information typically collected include the layout of an airport, features found at and near an airport of landmark value, reference data, and data relating to imaginary surfaces that define safe altitudes for approaches and landings (Obstruction Identification Surfaces or OIS as specified in the FAA’s Federal Aviation Regulations Part 77 or FAR-77). Refer to figure 2 for an illustration of a 3D model of the FAR-77 OIS surfaces. All data are collected and stored in 3D.

What is the Data Content Standard for the geospatial digital AOC?

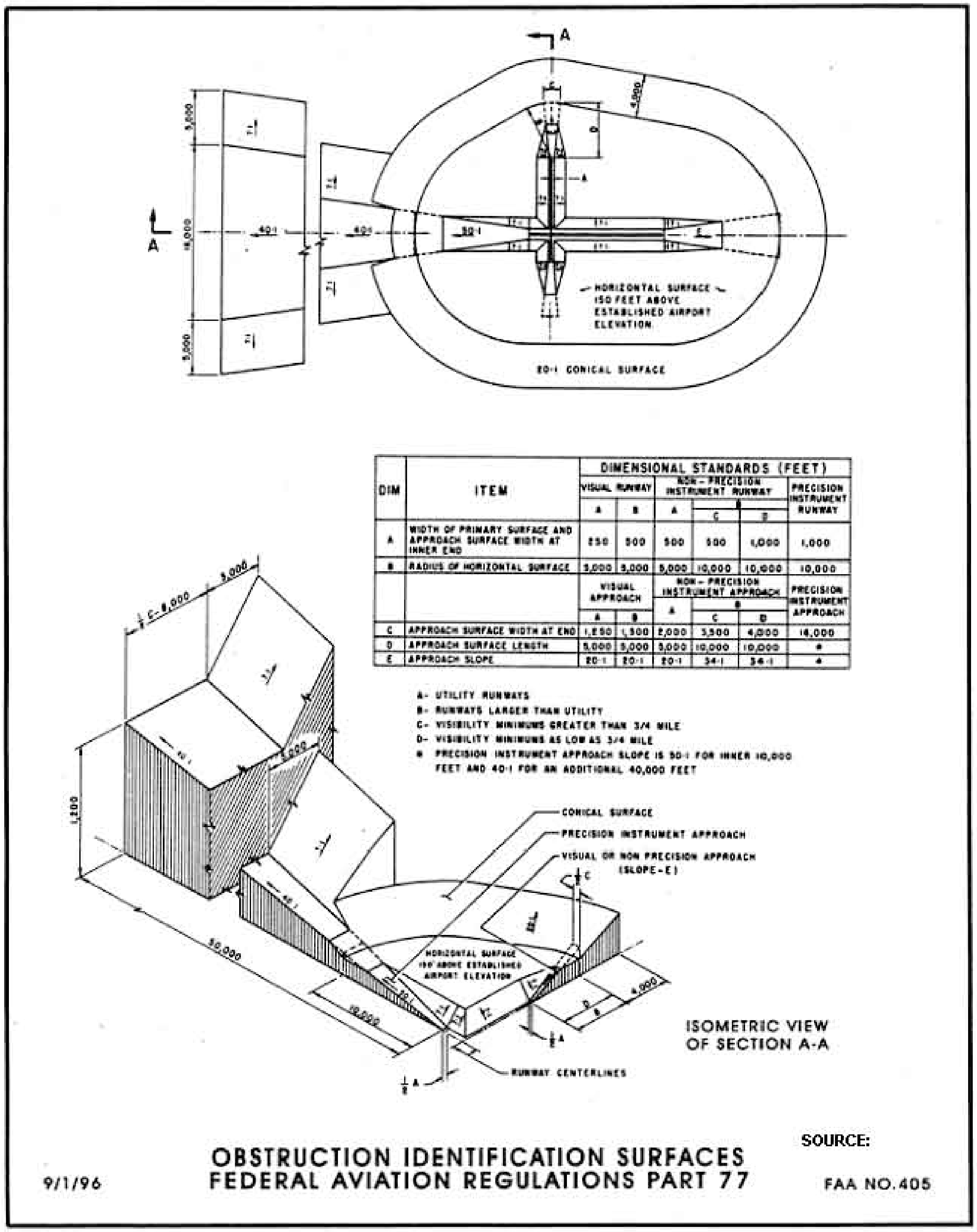
NOAA has developed a Data Content Standard, or data dictionary, for the geospatial AOC that defines all of its features and attributes. The features included in the geospatial AOC can be separated into four main categories:

1. Airport layout features

    a. Aircraft movement areas: Runway, Runway End, Stopway, Blast Pad, Taxiway, and Apron
    b. Designated areas: Restricted Access Boundary, Construction Area and Heliport touchdown and lift-off area (TLOF)
2. Landmark objects on and near an airport, used for spatial reference by pilots
    a. Prominent buildings and the shoreline of bodies of water such as lakes and ponds collected as polygons.
    b. Linear features of landmark value such as roads, railroads, fences, utility lines, shoreline when best collected as a linear feature, levees, quarries, etc,
3. Reference data
    a. Airport Control Point: a geodetic control point in the vicinity of the airport which is tied into the National Spatial Reference System.
    b. Airport Reference Point (2D): the geometric center of the airport
    c. Runway threshold positions
    d. Navaid Equipment (there are 39 different types of equipment listed in the standard, including radar, beacons, guidance lights, and many others).
4. OIS related features and obstructions
    a. Obstruction Identification Surface: the FAR-77 surfaces
    b. Obstacle: an object that has a vertical element to it that may or may not penetrate (be taller than) an OIS such as individual trees, poles, masts, etc.
    c. Obstruction Area: an area that has a higher elevation than the OIS such as a group of trees, buildings, mobile cranes, an urban area, agricultural area or ground (hills or mountains).

For each feature, the geospatial AOC Data Content Standard includes a description, the geometry type (3D point, line or polygon), and an abbreviation, if one exists. In addition, the attributes of each feature are listed and defined. Information about the attributes varies according to the specific type of attribute, but typically includes the name, a description, the data type (float, string, etc.), the specific format, the domain and range, units of measure, the maximum length, and an example.

The Data Content Standard provides the framework to structure and store airport and aeronautical navigational data. It standardizes these data, enabling a range of providers to supply consistent, complete airport and aeronautical information to FAA.



DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B		
					C	D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B		
					C	D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

A- UTILITY RUNWAYS
B- RUNWAYS LARGER THAN UTILITY
C- VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D- VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
* PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET

Figure 2
FAR-77 OIS

What are the benefits of a geospatial digital AOC?

There are many advantages to moving the AOC to a geospatial format. The Data Content Standard required for defining a geospatial AOC serves to standardize a product, ensuring the same data will be collected at all public airports. This will facilitate the development of hardware and software necessary to fully utilize an airport layout and aeronautical obstruction data, contained in a geospatial AOC. The AOC may be viewed, queried, and printed using a wide variety of GIS software or freeware, such as ESRI's ArcReader, enabling a broad audience to benefit from its GIS-ready data format. Data standardization also simplifies and streamlines the data collection process, enabling more private businesses to participate in airport surveying. This process will result in an increase in the volume of aeronautical survey data collected.

Current plans are to distribute the geospatial AOC in a GIS-ready format (ESRI shapefiles) as well as Adobe's Portable Document Format (PDF), to address the needs of GIS users and those who prefer a paper copy that is similar to the previous paper Airport Obstruction Chart. Refer to figures 3a and 3b for examples of a geospatial AOC, as viewed in ArcGIS and figure 4, for an Adobe PDF with hyperlinked Universal Data Delivery Format file.

The new 3-D geospatial digital format translates easily to a GIS environment and will increase the usefulness of these data to airport authorities, FAA, and the larger GIS community. Since the data are stored in a geospatial database, paper AOCs can still be formatted and produced as needed (Print On Demand). Users who prefer a paper copy of the AOC may download and print a PDF version. A single master database is planned for storing geospatial AOC information, ensuring that updates and validation can be easily accomplished and that data disseminated is accurate and reflects the most recent changes. The GIS-ready format allows a user to create attribute and geographic queries to explore AOC data. Since a geospatial, digital format is scaleless, no data will be lost due to cartographic generalization or congestion; this was typical of analog AOC products. Plans call for hyperlinks that will automatically display supporting information for AOC features, and be available online through NOAA's Universal Data Delivery Format and Aeronautical Data Sheets.

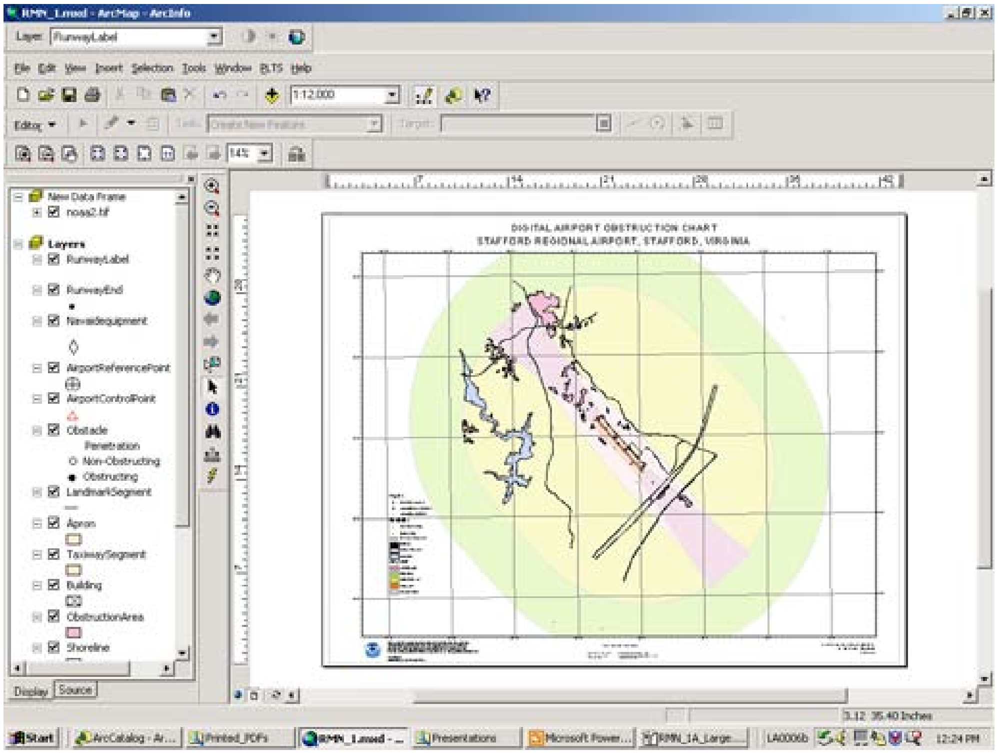


Figure 3a
Small-scale ArcMap Display

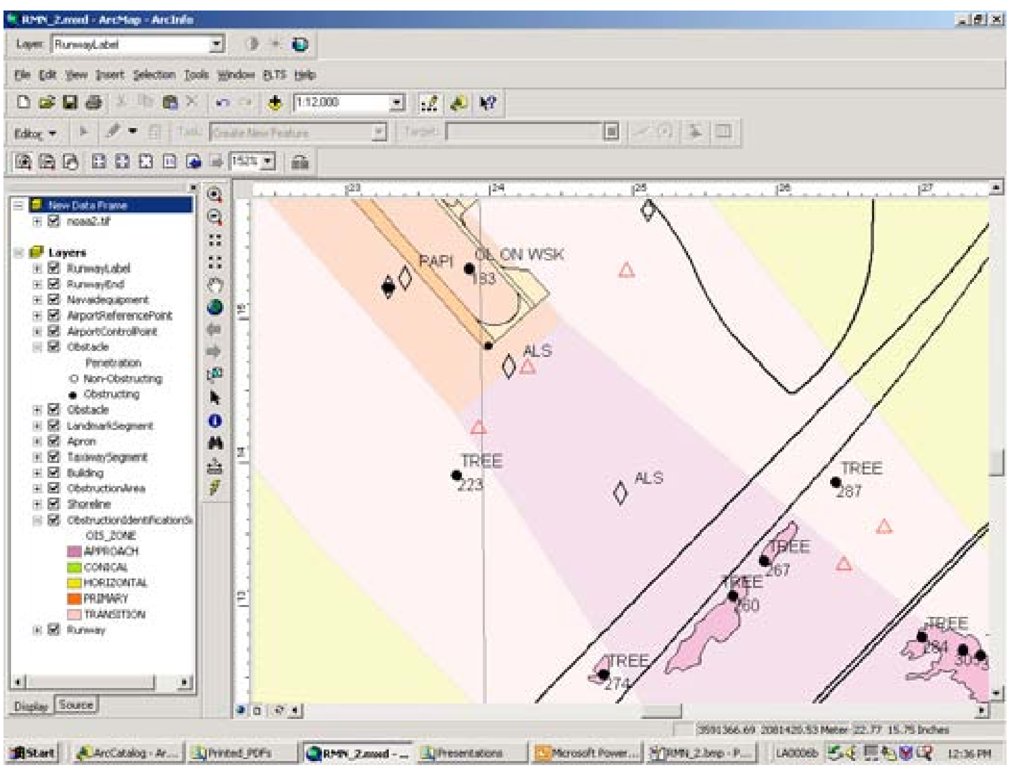


Figure 3b
Large-scale ArcMap Display

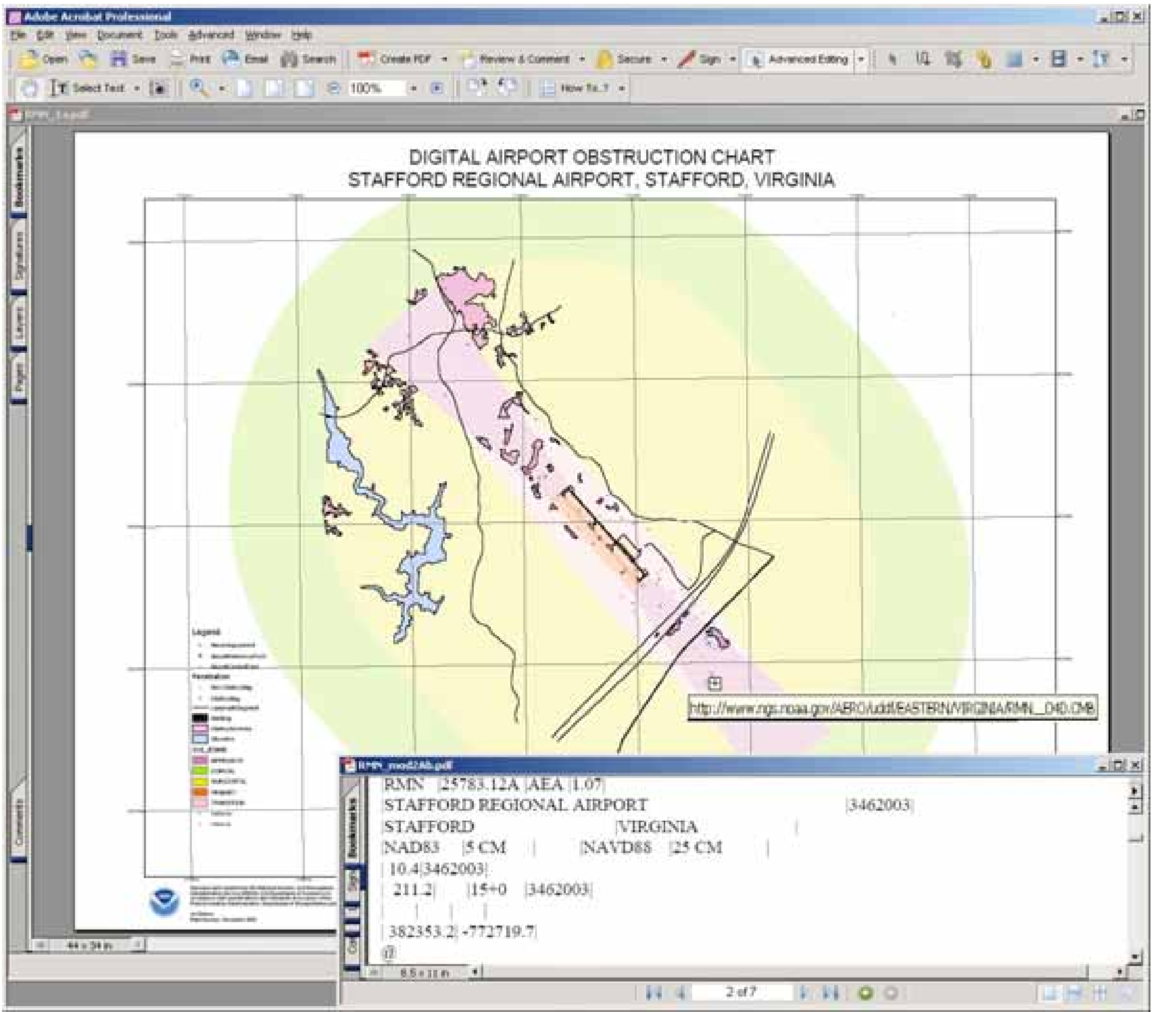


Figure 4
Adobe PDF with UDDF Hyperlink

By moving to an all-digital geospatial product, NOAA has brought the Aeronautical Obstruction Chart into the 21st century. A well maintained central database of geospatial AOC data, along with GIS software to fully utilize these data, will facilitate data gathering, utilization, and dissemination as it helps ensure accuracy of information critical to the safety of the National Airspace System.

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