aGIS-a brief overview

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**NextGen**

**What is NextGen?**

NextGen is the transformation of how airplanes traverse the sky. It affects all of us: from the pilots that fly the planes, the passengers who enjoy the flights, and the controllers who ensure the safety.

The thousands of planes overhead right now are flying indirect routes over radar towers. For close to six decades we have used this World War II era technology to transit the skies. NextGen is an upgrade to satellite-based technology.

Piece by piece we are installing this new system. It is a consistent and persistent effort to bring airplanes and airports online with NextGen technology.

Satellite navigation will let pilots know the precise locations of other airplanes around them. That allows more planes in the sky while enhancing the safety of travel. Satellite landing procedures will let pilots arrive at airports more predictably and more efficiently. And once on the ground, satellite monitoring of airplanes leads to getting you to the gate faster.

Already we are starting to see benefits. By the year 2016 we are expecting to see savings of hundreds of dollars per flight. Multiply that by the millions of flights that occur in a typical year and savings become extraordinary.

But most importantly, NextGen enhances the safety of what is already the safest airspace in the world. And it ensures our stellar safety history will continue in the same tradition.

What is NextGen? A new era of flight.
Navigation Programs - Wide Area Augmentation System (WAAS)

Wide Area Augmentation System

WAAS is an extremely accurate navigation system developed for civil aviation. Before WAAS, the U.S. National Airspace System (NAS) did not have the potential to provide horizontal and vertical navigation for approach operations for all users at all locations. With WAAS, this capability is a reality.

WAAS provides service for all classes of aircraft in all phases of flight - including en route navigation, airport departures, and airport arrivals. This includes vertically-guided landing approaches in instrument meteorological conditions at all qualified locations throughout the NAS.

Navigation Programs - WAAS - Benefits

Wide Area Augmentation System - Benefits

The WAAS will allow GPS to be used as a primary means of navigation from takeoff through Category I precision approach. Other modes of transportation also benefit from the increased accuracy, availability, and integrity that WAAS delivers. The WAAS broadcast message improves GPS signal accuracy from 100 meters to approximately 7 meters.

The benefits of WAAS to civil aviation will be substantial. WAAS improves the efficiency of aviation operations due to:

1. Greater runway capability
2. Reduced separation standards which allow increased capacity in a given airspace without increased risk
3. More direct enroute flight paths
4. New precision approach services
5. Reduced and simplified equipment on board aircraft
6. Significant government cost savings due to the elimination of maintenance costs associated with older, more expensive ground-based navigation aids (to include NDBs, VORs, DMEs, and most Category I ILS)
Nav Aid Cost

- **VOR**
  - Install = $250,000
  - 20-year life cycle cost = $1,100,000

- **ILS**
  - Install = $1,200,000
  - 20-year life cycle cost = $2,700,000

- **Neither figure considers cost of real estate**

WAAS Capabilities

- **Why WAAS?**
  - Enhances en-route navigation performance over GPS alone
  - Enhances non-precision approach capability over GPS alone
  - Allows WAAS equipped users to fly more than 2,891 published LNAV/VNAV procedures to minimums as low as 300 feet
  - Allows WAAS equipped users to fly new LPV procedures
  - Can use GPS for an alternate (LNAV only)
  - Advanced missed approach

- **Better than 99.99% availability of system**
- **95% availability in CONUS of approach with vertical guidance**
  - 200’ minimum (maybe)

- **WAAS specific approaches (LPV)**
  - 646 LPV approaches published, with 300 new expected in 2007
RNP AR

RNP AR approach procedures offer design flexibility and enhanced performance, allowing us to de-conflict traffic, mitigate obstacles, and stabilize vertically-guided approaches as illustrated in the approach to Colorado’s Garfield County Regional Airport (RCL) depicted below.
Performance-Based Navigation

- Complete transition by 2025
- Consistent with ICAO global vision
- Operational capability based on GPS and augmentations
- Enhance safety, capacity, efficiency
- Reduce costs

What Is The Length Of This Runway?

The answer depends on who you ask !!!!
History of the Program

• Conceived to address the airport data problems the FAA was experiencing agency wide

• It was recognized that there had to be a better way of collecting, storing managing, and sharing the data about our airports

• Adopted as a FAA Flight Plan goal in 2006
Why Change?

UDDF (Universal Data Delivery Format) delivered data ... it was an outline, it did not tell the whole story!
This runway entry only shows the geographic position (latitude/longitude, true bearing, touchdown zone elevation, and four (4) elevation points on an 11,500 foot runway.

Justification for Airports GIS

- **Improve Efficiencies**: Single, authoritative, accessible data source
- **Reduce Costs**: Airports, FAA, consultants
- **Improve Safety**: Increased need for real-time data accuracy
- **NextGen**: A repository of airport information (not just survey data)
**e-ALP VISION | From There To Now**

What if... the FAA could capture and validate data against a defined standard, import it from and/or export it to an ALP, and make it available electronically for whoever needs it?

**Airports GIS and e-ALP make data ...information**

**WE CAN DO BETTER NOW! BY PROVIDING A RICHER DATA SET**

**THE RESULT: A COMPLETE PICTURE FOR NEXTGEN PLANNING**
How The Program Is Designed To Help

The Airport Surveying-GIS program provides a single portal for the collection and dissemination of standards based verified source data to support future design, mapping, surveying, and construction activities from a known good (independent verification and validation) and maintained data set.

Airports-GIS provides the foundation for connecting the airports, FAA, and other agencies

A central database for storing survey, charting, analysis, and planning data

How Ambitious?

- Complete Data for 825 Airports in the First Five Years
  - All large airports submitting as-built data through the system
- Medium and Large Sized Airports completed between 2012-2017
- Small Non-Primary Airports completed between 2013-2019
- Part 139 and Towered Airports completed between 2014-2020
- Relievers and Airports with <25 aircraft completed between 2013-2019
How Many Airports?

- About 547 airports have commercial service in the US.
- About 3,331 receive federal funding and are included in the National Plan of Integrated Airport System (NPIAS).
- There are about 13,450 airports and 5,856 heliports.
- Of those, about 8,377 airports and 5,508 heliports are private use landing facilities.
- About 19,782 landing facilities in the FAA database including seaplane bases, gliderports, balloonports and ultralight flightparks.

What are the Incremental Costs of FAA Airports GIS?

<table>
<thead>
<tr>
<th>Incremental Costs of FAA Airports GIS</th>
<th>Range of Unit Costs by Airport</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Large Hub</td>
</tr>
<tr>
<td>1. Full data collection including eALP and Airspace Analysis (one time cost)</td>
<td>$50-432k per airport</td>
</tr>
<tr>
<td>2. Future Vertically Guided Obstruction Survey and Airport Airspace Analysis assuming eALP data collection was completed</td>
<td>$50-455 per survey</td>
</tr>
<tr>
<td>3. Future Construction Projects (Final Design Plans and As-Builts)</td>
<td>$5-10k per project</td>
</tr>
<tr>
<td>4. Future AIP Updates (planned features and attributes only)</td>
<td>$45-352k per update</td>
</tr>
<tr>
<td>5. Data Verification Costs</td>
<td>$2-3k per verification</td>
</tr>
<tr>
<td>6. Program Overhead &amp; Training</td>
<td>$5.6m per year per entire program</td>
</tr>
</tbody>
</table>

- We anticipate the first four cost categories will be funded through the normal Airport Improvement Program (AIP) process (i.e., as projects are normally justified, programmed, and approved for AIP funding).
- Costs associated with the remaining two categories will likely be funded through other FAA sources.
- We expect the additional costs necessary to meet the Airports GIS requirements will decrease over time as implementation is completed and stakeholders gain experience with the program.
What Is the Airport Improvement Program?

The Airport Improvement Program (AIP) provides grants to public agencies — and, in some cases, to private owners and entities — for the planning and development of public-use airports that are included in the National Plan of Integrated Airport Systems (NPIAS).

How Much of the Project Cost Does the Grant Cover?

For large and medium primary hub airports, the grant covers 75 percent of eligible costs (or 80 percent for noise program implementation). For small primary, reliever, and general aviation airports, the grant covers a range of 90-95 percent of eligible costs, based on statutory requirements. Please contact your local Airports Office for more details.

What Airports are Eligible?

AIP grants for planning, development, or noise compatibility projects are at or associated with individual public-use airports (including heliports and seaplane bases). A public-use airport is an airport open to the public that also meets the following criteria:

- Publicly owned, or
- Privately owned but designated by FAA as a reliever, or
- Privately owned but having scheduled service and at least 2,500 annual enplanements.

Further, to be eligible for a grant, an airport must be included in the NPIAS. The NPIAS, which is prepared and published every 2 years, identifies public-use airports that are important to public transportation and contribute to the needs of civil aviation, national defense, and the Postal service.

Recipients of grants are referred to as "sponsors." The description of eligible grant activities is described in the authorizing legislation and relates to capital items serving to develop and improve the airport in areas of safety, capacity, and noise compatibility. In addition to these basic principles, a sponsor must be legally, financially, and otherwise able to carry out the assurances and obligations contained in the project application and grant agreement.

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What are the Incremental Benefits of FAA Airports GIS?

The primary benefits we expect Airports GIS to provide include:

1. Increased labor productivity due to improved coordination
2. Earlier completion of projects due to improved coordination
3. Better information for more efficient planning and preliminary design
4. Broader use of GIS at airports due to FAA standards and funds for data collection
5. Elimination of redundant airport mapping and survey costs

These benefits closely correspond to other major IT investments in other venues. They were identified by interviewing a broad range of stakeholders—including both supporters and opponents of the program—from the FAA, airports, consultants, and GIS vendors.
Data Distribution Before Airports GIS

- No aerial photography
- Airport Layout Plan @ ADO
  - Paper
  - PDF
  - CAD
- Modification of Standards @ ADO
- Obstruction Surveys to National Geodetic Survey (NGS)
- No airport Data @ HQ
- 5010 safety data to National Flight Data Center (NFDC)

Data Distribution After Airports GIS

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- 5010 safety data to National Flight Data Center (NFDC)
- Aerial Photography to Cloud Server
- Digital data eALP derived from feature extraction from photography
- Modification of Standards digital tracking in Airports GIS
- Obstruction Surveys in Airports GIS
- All data airport data in Airports GIS including the 5010 data (starting 2013)
Airport Sponsor Benefits

- Provides a single point of entry for the submission and maintenance of AIRPORT DATA and to communicate the changes electronically to the FAA
- Provides non-GIS Equipped Airports with a GIS Foundation for:
  - Airport Layout Plans,
  - Obstruction Charts,
  - Construction plans, and other airport mapping products
  - Planning
  - Zoning
- Improves Response to Airport Changes
- Provides On-line Access to Electronic Obstruction Charts and Airport Layout Plan Data to FAA, Airports, and Consultants
- Provides the sponsor access to FAA data
- Speeds Production and Currency of FAA Charts and publications

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eALP | On-line Viewer

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eALP | Background Imagery

AGIS web survey viewer
AGIS Work Flow - Regulations and Plans

SOW - Statement of Work
 Defines the Project Scope

AC150/5300-16A
 Primary and Secondary Airport Control only if Necessary

AC 150/5300-17C
 Remote Sensing and Survey

AC 150/5300-18B
 Survey Standards, Formats and Accuracies
Airports GIS

**INPUT**
- Survey Data Collection
  - Geodetic Control
- Photography Control
- Data Standards
  - Collection
  - Input
- Aerial Photos
- Airport Planning

**OUTPUT**
- Aeronautical Charting data
- Instrument Procedures data
- Obstruction data
- Planning Application
- Engineering Applications

Federal Aviation Administration
May 8, 2012
https://airports-gis.faa.gov/

Table 3.1: Survey Requirement Table

<table>
<thead>
<tr>
<th>Feature</th>
<th>Airport Number</th>
<th>Description</th>
<th>Updated</th>
<th>Requirement</th>
<th>Review Required</th>
<th>Applied Features</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>12345</td>
<td>Aerial Photos</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>2</td>
<td>67890</td>
<td>Planning Application</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>3</td>
<td>112233</td>
<td>Engineering Applications</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>4</td>
<td>445566</td>
<td>Obstruction</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Note: All features must be reviewed and applied as required...
GIS Data Features

- The bulk of AC 150/5300-18B details the airport feature descriptions defining the specifications for each feature group and class.
- Utilize the specifications defined to ensure the data delivered is accurate and meets standards.
- Each feature is described by ...
  - Feature group
  - Geometry type,
  - Sensitivity, requirements,
  - Positional accuracy
  - Data capture rule,
  - Attributes required to provide the data to the FAA.
Airport Features

- There are eleven feature groups in the standard
  - Airfield
  - Navigational Aids
  - Airspace
  - Sea Plane
  - Cadastral
  - Security
  - Environmental
  - Surface Transportation
  - Geospatial
  - Utilities
  - Manmade Structures

- In each Feature Group are the individual features.
Topology

Features
Location and Accuracy

<table>
<thead>
<tr>
<th>Accuracy Requirements (in feet)</th>
<th>Horizontal</th>
<th>Vertical</th>
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</thead>
<tbody>
<tr>
<td>Geodetic</td>
<td>7.19'</td>
<td>19.30'</td>
</tr>
<tr>
<td>Ellipsoidal</td>
<td>7.19'</td>
<td>19.30'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Geodetic Coordinates</th>
<th>Distant and Elevations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swathwidth of arc second</td>
<td>Nearest one foot</td>
<td></td>
</tr>
</tbody>
</table>

Attribution

<table>
<thead>
<tr>
<th>Feature Attributes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name (VARCHAR(100))</td>
<td>A description of the feature or other unique information concerning the coastal zone.</td>
</tr>
</tbody>
</table>
Obstruction-Analysis

Figure 14. Obstruction in the VAC2FL Area.

Obstruction-Attribution

[Table and text from the presentation]
Other Types of Surveys

- AC 150/5300-18B for the first time discusses standards for other types of surveys relating to or happening on Airports, most of which you are familiar with
  - Boundary/Land Use
  - Sub Surface Utility Engineering
  - Topographic
  - Airport Mapping Database
  - Construction
  - Airport Pavement

Utility Points-Page One
Utility Points-Page Seventeen

Third Party Tools

GIS Best Practices
Aeronautical
ESRI Aeronautical Validation Tools

Third Party Tools

GIS Best Practices
Aeronautical
Runway End Point Possibility Number 6 - Easy!

3D Feature Collection Directly into ESRI ArcGIS using DAT/EM Systems Summit Evolution Digital Stereoplotter
DAT/EM Stereo Capture for ArcGIS Overview

Stereo Capture collects 3D image features directly from the SUMMIT EVOLUTION stereoplotter into ArcView, ArcEditor and ArcInfo and allows for:

- Real-time panning and zooming in 3D viewing environment
- 3D digitizing and editing directly into ArcMap
- GIS data superimposed onto 3D stereo imagery
- Real-time automated field updating
- DTM loading, distribution, and editing
- Load orientation control data
- Automatic contour generation
- 3D editing tools
- Tool to covert 2D shapefiles and feature classes to 3D based on a DTM distribution
- **Automatic Field Updates**
Completed Chart