

# Airport Surveying-GIS Program

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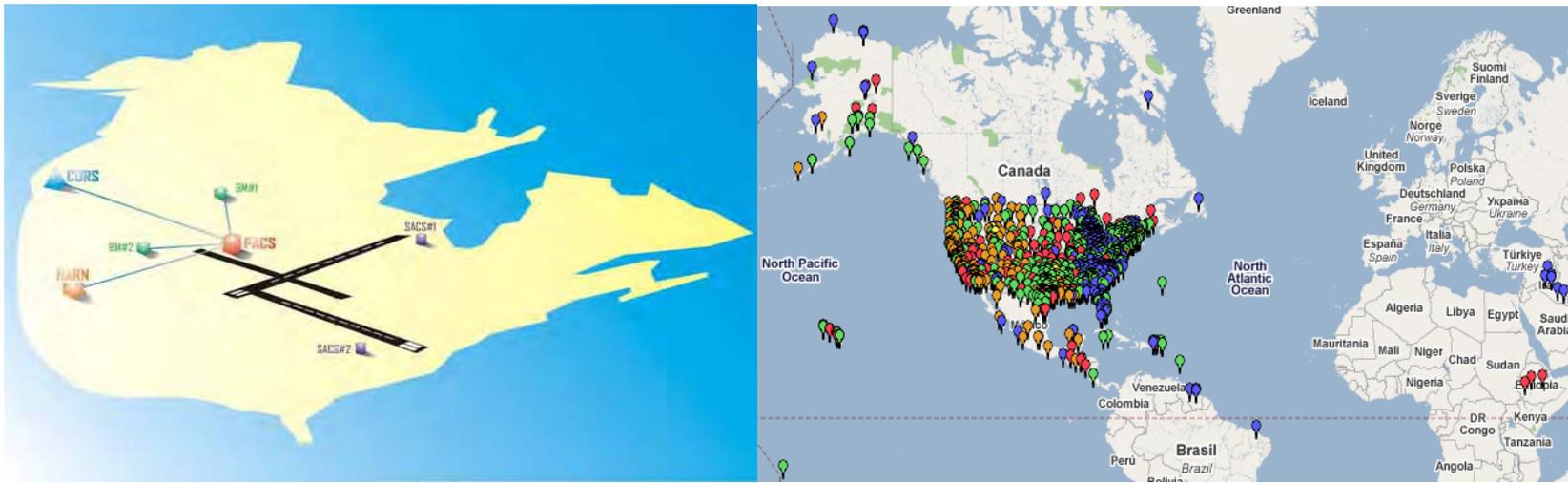
# FAA Advisory Circulars

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- ✓ AC 150/5300-16
  - ✓ Establishes the requirements for and how to install geodetic control
- ✓ AC 150/5300-17
  - ✓ Identifies the requirements for and how to collect the required imagery
- ✓ AC 150/5300-18
  - ✓ Identifies what to collect, required accuracy and how to provide the data



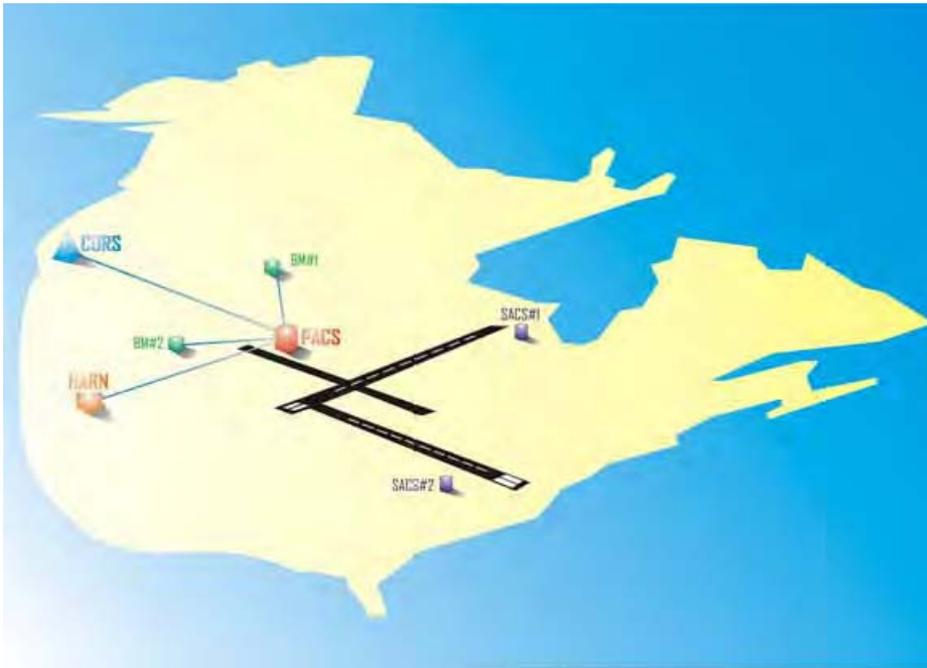
# What is Geodetic Control?



✓ A network of carefully measured points used as a reference for other surveys or to establish or measure accuracy in map making whose precise positions and/or heights are known and take into account the shape and size of the Earth.



# At airports we call them PACS/SACS



- PACS = Primary Airport Control Station
- SACS = Secondary Airport Control Station

•A stainless steel rod three-dimensional (3-D) drivable survey monument is the recommended survey marker producing the stability required for most conditions.



# ARP Policy on Permanent Geodetic Control (PACS/SACS)

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**AC 150/5300-16,  
paragraph 2.2**

## **Airports Requiring Geodetic Control Monumentation**

- **Permanent Control.** FAA Regional Airports Divisions will determine which airports require permanent geodetic control monumentation in the form of PACS or SACS based on the activity (operational or proposed future construction) at the airport. However, for all airports in the National Plan of Integrated Airport Systems (NPIAS), we strongly recommend that at least the PACS be established.



# PACS and SACS considerations for Airports

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- Permanency with appropriate geographic location and spacing.
- Ease of recovery, location should allow efficient use by surveying community.
- Accessible by public. Public property should be utilized where feasible.
- Minimal multi-path.
- No known potential conflict with future development.
- Aerial-photo identifiable.
- **Protect the monuments ... they are important and expensive!**



# Geodetic Control Required Deliverables

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- Use the FAA Deliverable Checklist to guide the production and delivery of project deliverables.
- Survey Work Plan (Prior to starting ... more later)
- Quality Control Plan (Prior to starting ... more later)
- Project Status Reports (more later)
- Final Project Report



# Final Project Report

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- Used by NGS to verify the information provided by the surveyor
- Contains such things as ...
  - Description of the Project
  - Copies of Field Logs
  - Original Data
  - Descriptions of PACS and SACS location
  - Photographs of PACS and SACS
- All required elements are listed in the FAA deliverables checklist!
- Submitted through Airports GIS web site



# FAA Advisory Circulars

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# Why Do We Require Imagery?

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- The role and importance of airport and aeronautical data in meeting the safety, regularity and efficiency of air navigation changed significantly with the implementation of area navigation (RNAV), required navigation performance (RNP) and airborne computer based navigation systems.
- There are 2 reasons we require imagery.
  - The primary reason we require imagery for projects involving safety critical data is to ensure the **quality of the aeronautical information** collected.
  - Secondly, we feel that the use of imagery is an accurate and potentially cost saving method of collecting this type of data.
- Current initiatives within aviation industry (moving maps, electronic flight information, advanced avionics) require a data centric airport environment, as opposed to the traditional product based environment.

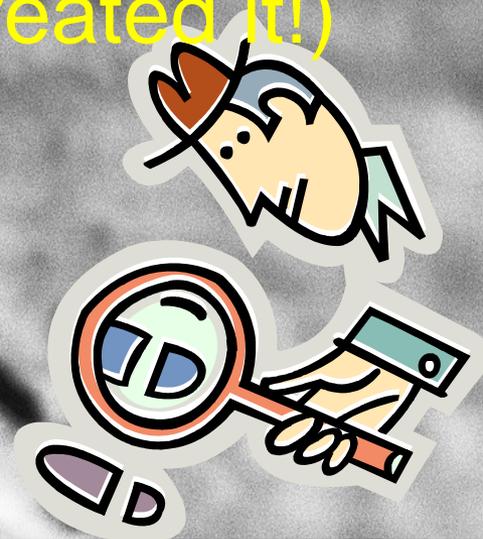


# NGS Verification



***“leaving footsteps ...”***

Others should (read as must) be able to retrace the original surveying or mapping product (without having to contact the person who created it!)



# Required Deliverables (for NGS)

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- The airport sponsor must provide NGS with digital stereo imagery of the area of analysis. The dimensions of this area depend on the type of survey the contractor is requested to perform.
- Acquire the imagery within at most 6 months prior to the ground survey (AC 150/5300-18 survey).
- Submit the imagery well in advance of the survey deliverables for NGS review and approval.
- Upon imagery approval, the final survey deliverables may be submitted.
- Submit the imagery and associated deliverables directly to NGS for review.



# Required Deliverables (for FAA)

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- Provide the FAA with digital orthoimagery of the area(s) flown.
- Develop the orthoimagery using the specifications defined by the Federal Geographic Data Committee in FGDC-STD-008-1999, except the imagery should not be resampled, they should be developed at the resolution of the original imagery used for analysis.
- Provide metadata for the orthoimagery as described in the FGDC standard. Submit the digital orthoimagery to the FAA on similar media as that used to provide the imagery to NGS. Include on the delivery media FGDC compliant metadata for the orthoimagery.



# FAA Advisory Circulars

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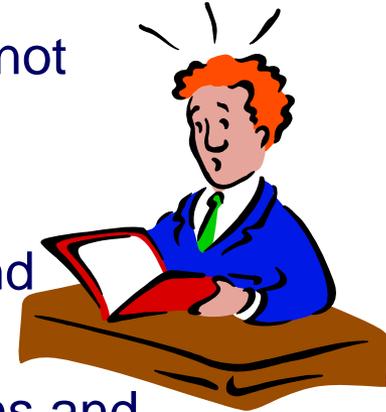
- ✓ AC 150/5300-16
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- ✓ **AC 150/5300-18**
  - ✓ **Identifies what to collect, required accuracy and how to provide the data**



# Organization of AC 150/5300-18B

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- Though it looks daunting from the outside ... it's not really that bad!
- The AC has five (5) chapters and appendices
- Chapter 1 discusses general survey guidance and specifications
- Chapter 2 discusses specific survey specifications and standards
- Chapter 3 discusses geospatial standard and specifications (GIS rules)
- Chapter 4 discusses data translation and existing data
- Chapter 5 discusses specific about the airport features
- Chapter 1 – 4 cover about 100 pages the rest is chapter 5!



# Types of Surveys

- Surveys are on completed on airports for many different reasons
  - Boundary
  - Construction
  - Utilities
  - Obstruction
- Each served a single purpose, each was not coordinated sometimes collecting similar or the exact same data
- Some even happening at the same time!



# New Philosophy on Airport Surveys

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- AC 150/5300-18 is designed to collect data about the airport as a whole rather than as a group of individual projects.
- Since most everything on an airport is interconnected or has a relationship to other things and these relationships should be preserved.
- Data collection projects should build on one another.
- Data provided as part of a design should be incorporated into the airport data set and later verified rather than collected new.



# Obstruction Surveys

## Alphabet Soup Eye Chart or Survey Requirements ???



- ANA-LPV
- ANAPC
- PIR
- CGR
- BV
- NP-D
- AV
- C
- D



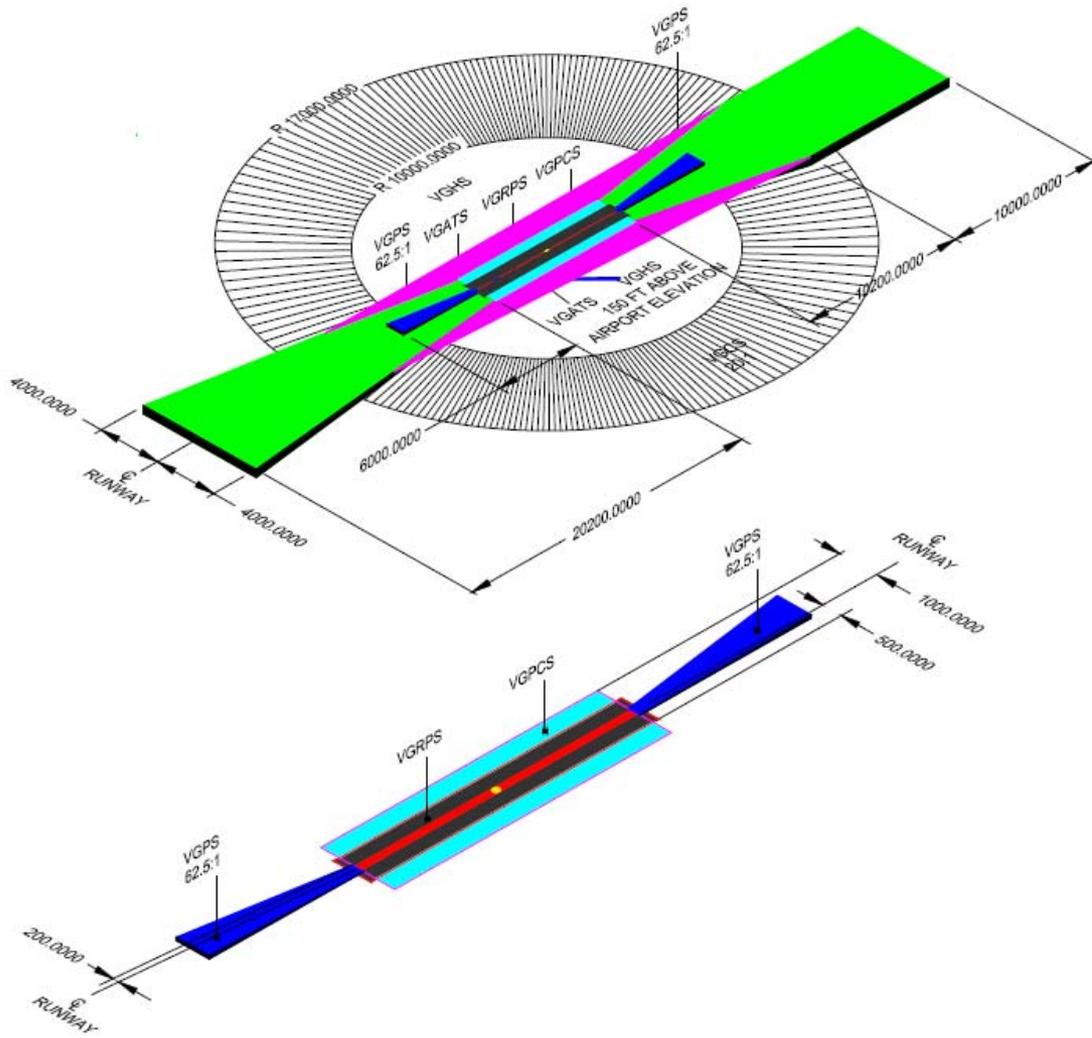
# Airport Airspace Analysis

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- Under the previous standard (FAA 405) there were as many different types of surveys
- These multiple types did not always provide the information required and most were incorrectly based on 14 CFR 77
- AC 150/5300-18B has only two types of “obstruction surveys” ... it is a single multifaceted surface not individual pieces
  - Vertically Guided
  - Non-Vertically Guided



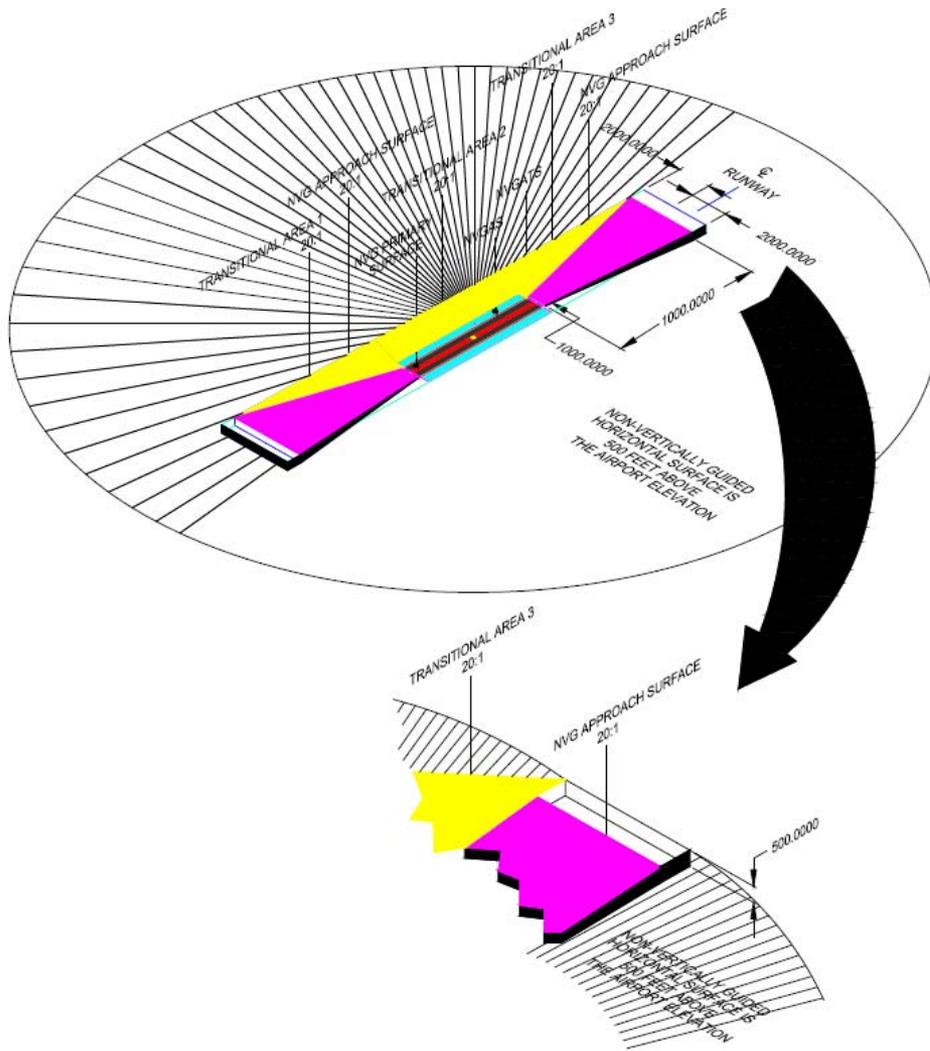
# Vertically Guided Airport Airspace Analysis Surface



These specifications support the airport's planning and design activities for the development of vertically guided instrument approaches such as ILS, PAR, MLS, LPV, TLS, RNP and Baro/VNAV



# Non-Vertically Guided Airport Airspace Analysis Surface



Use the following specifications and associated figures to complete object identification on and surrounding airports to runways designed for visual or non-vertically guided (NVG) operations (Lateral Navigation (LNAV), Localizer Performance (LP), VOR, NDB, Localizer, Localizer Directional Aid (LDA), etc.)



# Other Types of Surveys

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- 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



# Acceptable Datum's

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- With regard to spatial data, a datum is a reference to an approximation of the earth's surface or a Datum. Use the following Datum's for spatial data submitted in compliance with this standard:
- All horizontal data must be submitted referenced to the North American Datum of 1983
- All vertical data must be referenced to the North American Vertical Datum of 1988 (NAVD88).



# Data Translation and the Use of Existing Data

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- Many airports have developed and collected data over the years through different projects or planning efforts. This data exists in many forms from drawings in a CADD system, to individual records in databases or through a hardcopy management system.
- Since the 1980's the form of the data has evolved from a totally paper-based product to where many airports have some if not all the data available electronically. As the tools and technology changed from linen to Mylar and finally to digital CADD and GIS formats, only a few airports made the effort to ensure the quality of the data set.
- In some cases, the user performed data transformations from one datum to another without regard to the actual accuracy of the data. With the availability of more digital data and its associated detail, the expectations of those charged with maintaining this information also increased.



# Data Translation and Use of Existing Data

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- However, no real effort or process related the data values to the true value and associated data accuracy by tracing the data back to its source. When considering the reuse of this data in a current or future project, the quality of the data is the first and most important factor determining its usability.
- ICAO) defines data quality as, “A degree or level of confidence that the data provided meets the requirements of the data user in terms of accuracy, resolution and integrity”. One of the first steps in determining the quality of a data set is determining its origin
- What is the data source, and is it traceable to the time and point of collection? If the data is not traceable to the source, then the data provider should implement a defined and repeatable process to determine the spatial accuracy and reliability of the data before the data is used.



# Maintenance of Data

- Purpose is to ensure the data quality remains at an acceptable level.
- Make updates to airport object and obstacle data as soon as practical with sufficient lead-time to ensure the information is available when required to meet the AIRAC cycle amendment schedule.
- Terrain and obstacle require updating to account for uncovered errors as well as to change appropriate data (e.g. due to construction activities or vegetation growth).



# GIS Data Features

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- 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.



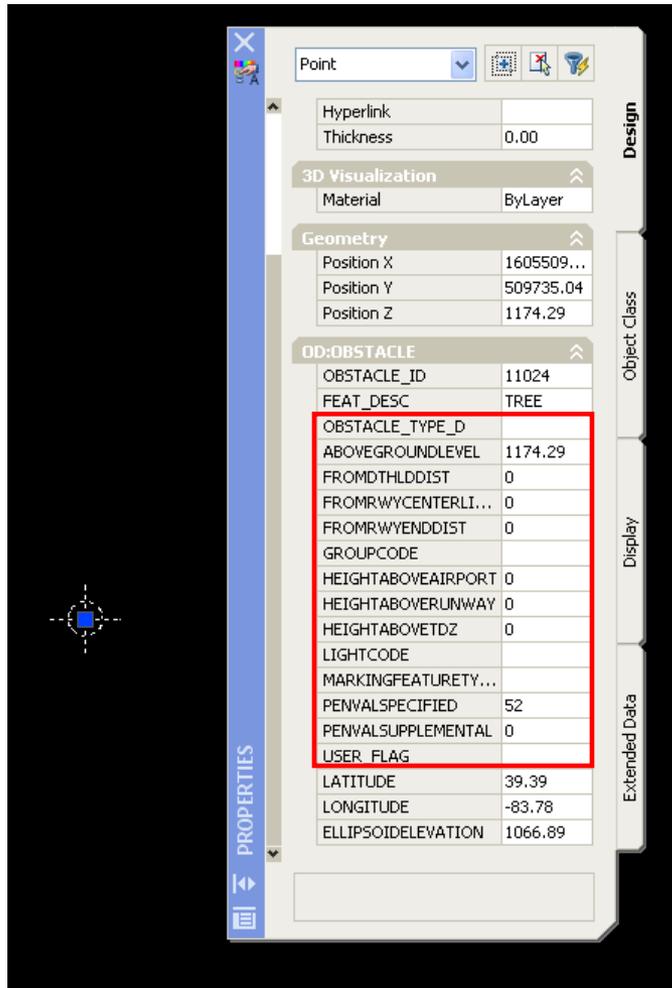
# Airport Features

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- There are eleven feature groups in the standard
  - Airfield
  - Airspace
  - Cadastral
  - Environmental
  - Geospatial
  - Manmade Structures
  - Navigational Aids
  - Sea Plane
  - Security
  - Surface Transportation
  - Utilities
- In each Feature Group are the individual features.



# What Attributes are required and Which are Optional?

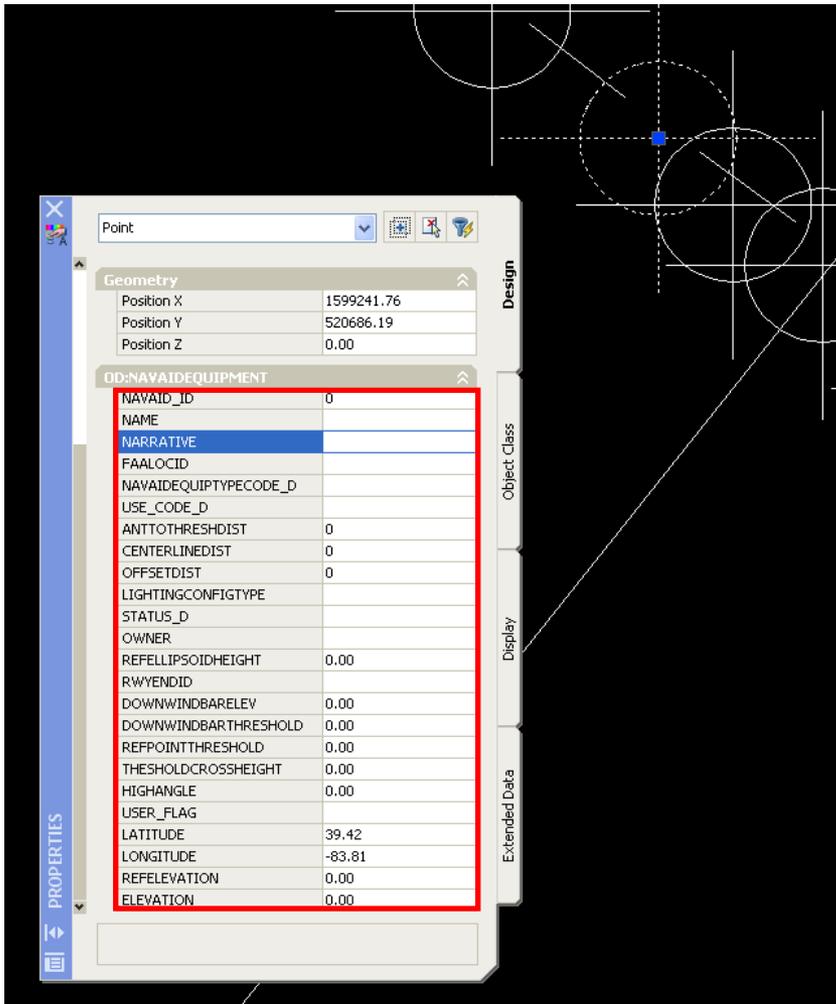


Airport Surveying-GIS program looks at the airport as a whole rather a group of disconnected individual parts...so it should be attributed as a whole.

The SOW determines who does what.



# What Attributes Are Required and Which Are Optional?



✓ All attributes and features located on the airport are required ...

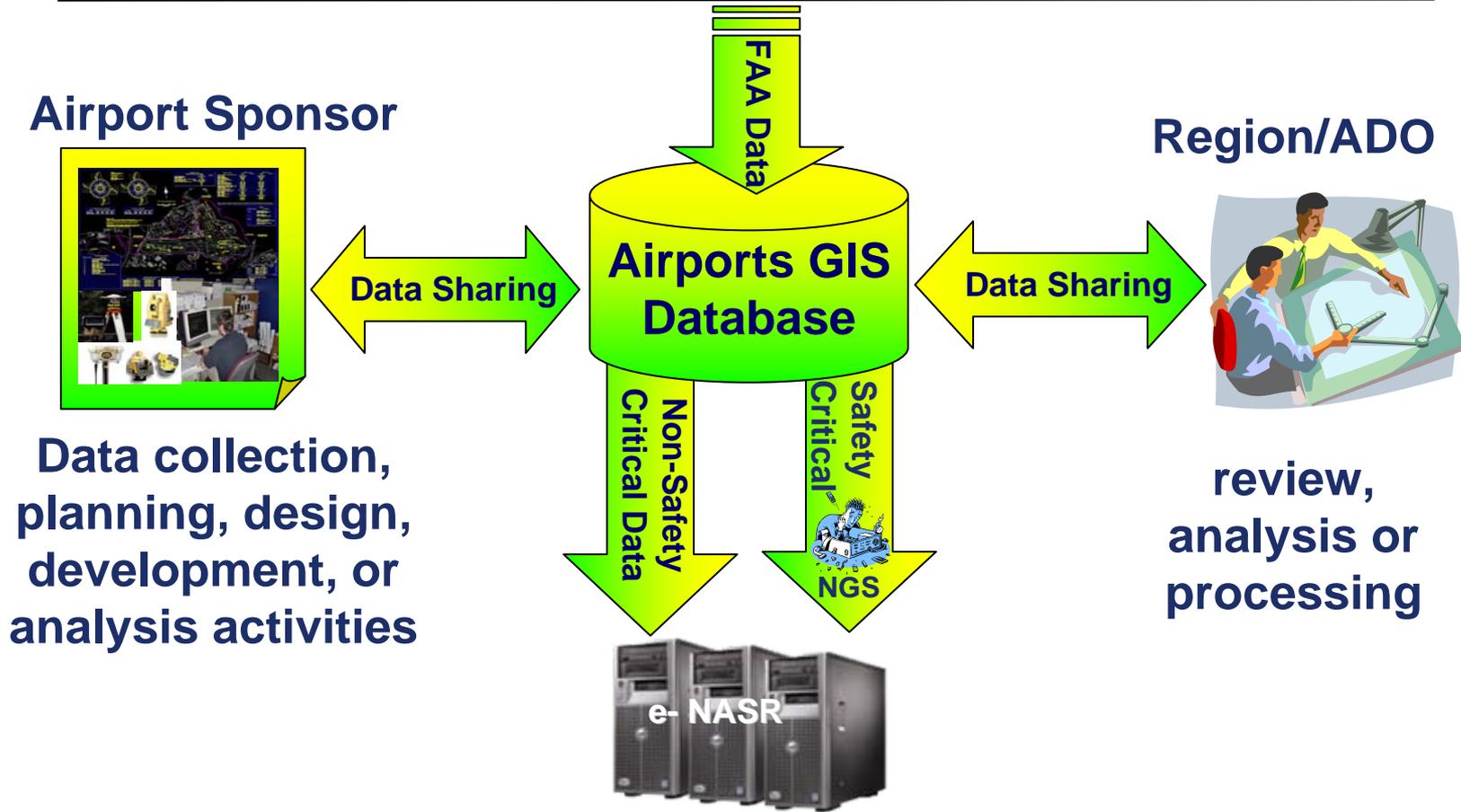
✓ Some are required from the surveyor

✓ Others are required of the sponsor or their consultant

✓ The SOW determines who does what



# Integrating Airports GIS into Our Business Processes



Airports GIS is being designed to provide the data and tools airports and the FAA need to accomplish their work collaboratively in an all digital format.



# What is the purpose of a SOW?

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- “A narrative description of products, services, or results to be supplied.”
- The SOW should indicate ...
  - A business need
  - Document the product or service requirements that they project is undertaken to create
  - All projects should support the organization’s strategic goal
    - Get a new approach procedure
    - Improve access to larger aircraft
    - Plan for future improvements
- Citation: A Guide to the Project Management Body of Knowledge, Third Edition, 2004



# What Elements Should A Good SOW Contain?

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- A good SOW should detail ...
  - What is needed ... why are we doing the project
  - What standards should be applied
  - What deliverables are required
  - What audits can or will be conducted
  - When the deliverables are required.
  - What scope verification will be used



# What is Needed?

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- ✓ Under the Airport Surveying-GIS Program, the collection of airport data consists of ...
  - ✓ The use of existing data
  - ✓ The collection of new data or verification of existing data
- ✓ How do you (or the airport sponsor) determine what data is required?
  - ✓ AC 150/5300-18B, Table 2-1 provides information on what is required.



# Data Collection Requirements Matrix

Table 2-1. Survey Requirements Matrix

This table is designed for use in two ways. First, it defines in a general fashion the task required to meet a specific objective. Each task listed is generalized and the process to complete it many contain many other pieces. Users should refer to the text of the referenced AC to ensure that all the required subtasks are completed. The second way to use this matrix is as a checklist to ensure all the required data is collected either before leaving the field or submitting the data to the FAA.

Intended End Use of the Data ➤ Required Tasks ▼	AC Reference	Category II or III Operations	Navigational Aid Siting			Airport Layout Plan (ALP)	Airport Obstruction Chart	Construction		Instrument Procedure Development	Pavement Design, Construction, Rehabilitation or Roughness	Airport Mapping Database
			Non-Precision	Precision	Visual			Airside	Landside			
Provide a Survey and Quality Control Plan	150/5300-16/17/18	•	•	•	•	•	•	•	•	•	•	•
Establish or validate Airport Geodetic Control	150/5300-16	•	•	•	•	•	•	•	•	•	•	•
Perform, document and report the tie to National Spatial Reference System (NSRS)	150/5300-16	•	•	•	•	•	•	•	•	•	•	•
Survey runway end(s)/threshold(s)	150/5300-18	•	•	•	•	•	•	• <sup>1</sup>	•	•	•	•
Monument runway end(s)/threshold(s)	150/5300-18	•	•	•	•	•	•	• <sup>1</sup>	•	•	•	•
Document runway end(s)/threshold location(s)	150/5300-18	•	•	•	•	•	•	• <sup>1</sup>	• <sup>1</sup>	•	• <sup>1</sup>	•
Identify and survey any displaced threshold(s)	150/5300-18	•	•	•	•	•	•	• <sup>1</sup>	•	•	•	•
Monument displaced threshold(s)	150/5300-18	•	•	•	•	• <sup>1</sup>	• <sup>1</sup>	• <sup>1</sup>	•	•	•	•
Document displaced threshold(s) location	150/5300-18	•	•	•	•	•	•	• <sup>1</sup>	•	•	•	•
Determine or validate runway length	150/5300-18	•	•	•	•	•	•	• <sup>1</sup>	•	•	•	•
Determine or validate runway width	150/5300-18	•	•	•	•	•	•	• <sup>1</sup>	•	•	•	•
Determine runway profile using 50 foot stations	150/5300-18	•	•	• <sup>2</sup>	•	•	•	• <sup>1</sup>	•	•	• <sup>2</sup>	•
Determine runway profile using 10 foot stations	150/5300-18	•	•	• <sup>2</sup>	•	• <sup>2</sup>	• <sup>2</sup>	• <sup>1</sup>	•	•	• <sup>2</sup>	• <sup>2</sup>
Determine the touchdown zone elevation (TDZE)	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Determine and document the intersection point of all specially prepared hard surface (SPHS) runways	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Determine and document the horizontal extents of any Stopways	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Determine any Stopway profiles	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Determine if the runway has an associated clearway	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Survey clearway to determine objects penetrating the slope	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Determine and document the taxiway intersection to threshold distance	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Determine runway true azimuth	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Determine or validate and document the position of navigational aids	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Determine or validate and document the position of runway abeam points of navigational aids	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Determine potential navigational aid screening objects	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Collect and document VOR receiver checkpoint location and associated data	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Perform or validate and document an airport airspace analysis	150/5300-18	•	•	•	•	•	•	• <sup>1</sup>	•	•	•	•
Collect and document helicopter touchdown lift off area (TLOF)	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Collect and document helicopter final approach and takeoff area (FATO)	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Collect or validate and document airport planimetric data	150/5300-18	•	•	•	•	•	•	•	•	•	•	•
Determine or validate the elevation of the Air Traffic Control Tower Cab Floor (if one is on the airport)	150/5300-18	•	•	•	•	•	•	•	•	•	•	•



# What Deliverables Are Required?

- Each AC has a specific set of deliverables identified in them.
- We have developed a form to assist you and the sponsor in making sure the appropriate information to complete the project is provided.
- If this checklist and the appropriate forms completed the correct data will be collected and provided for most projects.

OMB Approved 2120-0567  
Expires 3/31/2010

Federal Aviation Administration		Airport Surveying-GIS Program	
Airport and Aeronautical Data Submission Deliverables Checklist			
1. Airport Name:		Location Identifier:	
2. Type of Submission(s)		<input checked="" type="checkbox"/>	Date Submitted
a. Survey and Quality Control Report			Data Approved
b. Imagery and Photo Control			
c. Observational Data			
d. Final Project Report			
3. Project initiated on Airports GIS web site ( <a href="http://airports-gis.faa.gov">http://airports-gis.faa.gov</a> )?			Yes No
4. Airport Interviews			Yes No
a. Airport Manager/Operations Manager			
b. Air Traffic Control Tower Chief (if airport has a control tower)			
c. FAA Airway Facilities Personnel			
d. Airport Engineering			
5. Data			Yes No
a. Feature data provided in an appropriate geospatial vector format			
b. Observational Data			
i. GPS Observations: provide the original raw GPS data files (in both the manufacturers download format and in RINEX II format) also provide the binary files containing ionosphere modeling information.			
ii. Outputs from field instruments or data recorders providing actual measurements observed.			
iii. Field notes, sketches, diagrams or plans scanned and provided in a non-editable format such as PDF.			
c. Final processed digital data files (results of processing in a digital file)			
d. Any other electronic files containing data related to the survey project (charts, checklists, notes, etc.).			
6. Forms			Yes No
a. General Information Checklist			
b. GPS Observation Log Sheet(s)			
c. Facility Abstract(s) (for projects requiring survey of navigational aids)			
d. Navigational Aid Facility or Runway End Sketch(s)			
e. Station Description and Recovery (for all control stations used)			
f. Pencil Rubbing Form (for all control stations used)			
g. Station Location Sketch and Visibility Diagram (for all control stations used)			
h. Runway Data Sheet(s)			
i. Airport Airspace Analysis Checklist(s)			
<p><b>Paperwork Reduction Act Statement:</b> This form is used to document source information about an airport or aeronautical facility which is part of the National Airspace System (NAS). This information is used to document airport data relating to the safety, security, or capacity of the national air transportation system. It is estimated that it will take approximately 5-80 hours to fill out the all of the necessary forms for a project depending on the complexity. No assurance of confidentiality is necessary or provided. It should be noted that an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control number associated with this collection of information is 2120-0569. Comments concerning the accuracy of this burden and suggestions for reducing the burden should be directed to the FAA at: 800 Independence Ave. SW, Washington, DC, 20591, Attn: Information Collections Clearance Officer, AIC-20.</p>			

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# What Should Be Addressed in the Plans?

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- We have already discussed the requirements for the Geodetic Control and Imagery Plans
- The Survey and Quality Control Plan is the overall plan addressing the total effort.
- It should address such items as what is the purpose of the survey?
- How will the data be used in the end ?
- What requirement of the airport is the survey meant to address?



# Submitting the Plans

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- Submit all plans for evaluation using the Airports GIS system.
- This allows for everyone (the airport sponsor, the ADO/Region, State DOT, FAA HQ, NGS) to see the plans in a single place.
- It provides a system for tracking when something was received and when it was reviewed and approved.
- It provides traceability of the information for use in future projects.



# Last Words ...

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- It really doesn't matter how they collect the data, what coordinate system or unit of measure they use, as long as they tell us what it is.
- It follows the old adage of instruction ...
  - Tell them what you are going to tell them (Survey and Quality control Plan).
  - Tell them (The data and associated deliverables)
  - Tell them what you told them (Final Report)



# Questions

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