



Esri Airport GIS Webinar Series
GIS in Airports: Best Practice

Airports Succeed with GIS

Terry Bills, Esri

Randy Murphy, Arora Engineers

David Grigg, Arora Engineers



esri

THE
SCIENCE
OF
WHERE

Introducing the Esri Airport GIS Webinar Series

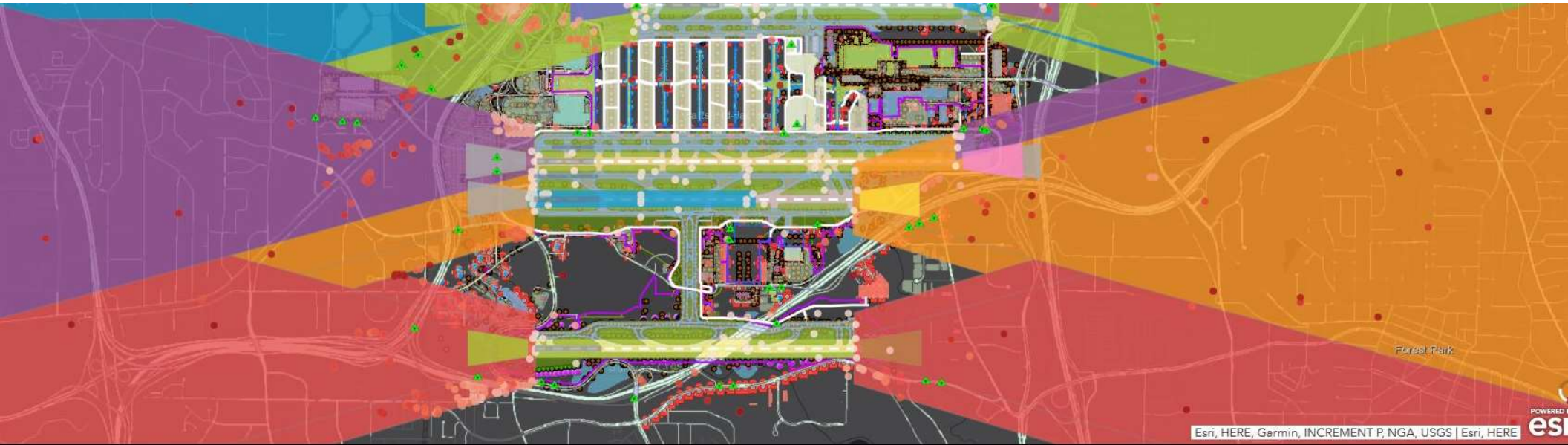
- **Designed for the Airport GIS and IT Community**
- **Thought Leadership**
- **Mix of Business Focus and Technical Presentations**
- **Strong Community**

The Connected Smart Airport

Interconnected Information, Processes, and Workflows . . .
. . . All Happening at the Same Time



Using the Power of Location to Integrate Everything



Esri, HERE, Garmin, INCREMENT P, NGA, USGS | Esri, HERE

POWERED BY esri

% of Light Types **Total Airfield Lights** **Data Layers**



- Survey_Control
- ATL_Runway_Pavement
- ATL_Pavement_Slabs
- Obstructions

Airports Succeed with GIS



Rethinking Infrastructure®



PRESENTING TODAY



David Grigg, GISP
*Vice President,
Geospatial Practice
Lead*



Randy Murphy
*Geospatial Technical
Practice Lead*

Agenda

- An Increasing Number of Airports are Using GIS: Why? How?
- What Airport GIS Professionals are Saying (Industry Survey Results)
- Successful Geospatial Solutions in Use at Airports
- Trends Related to GIS at Airports
- Success Stories
- How to Get Started Down the Roadmap to Success
- Resources Required (money, people, organizational support)
- Overcoming Common Challenges

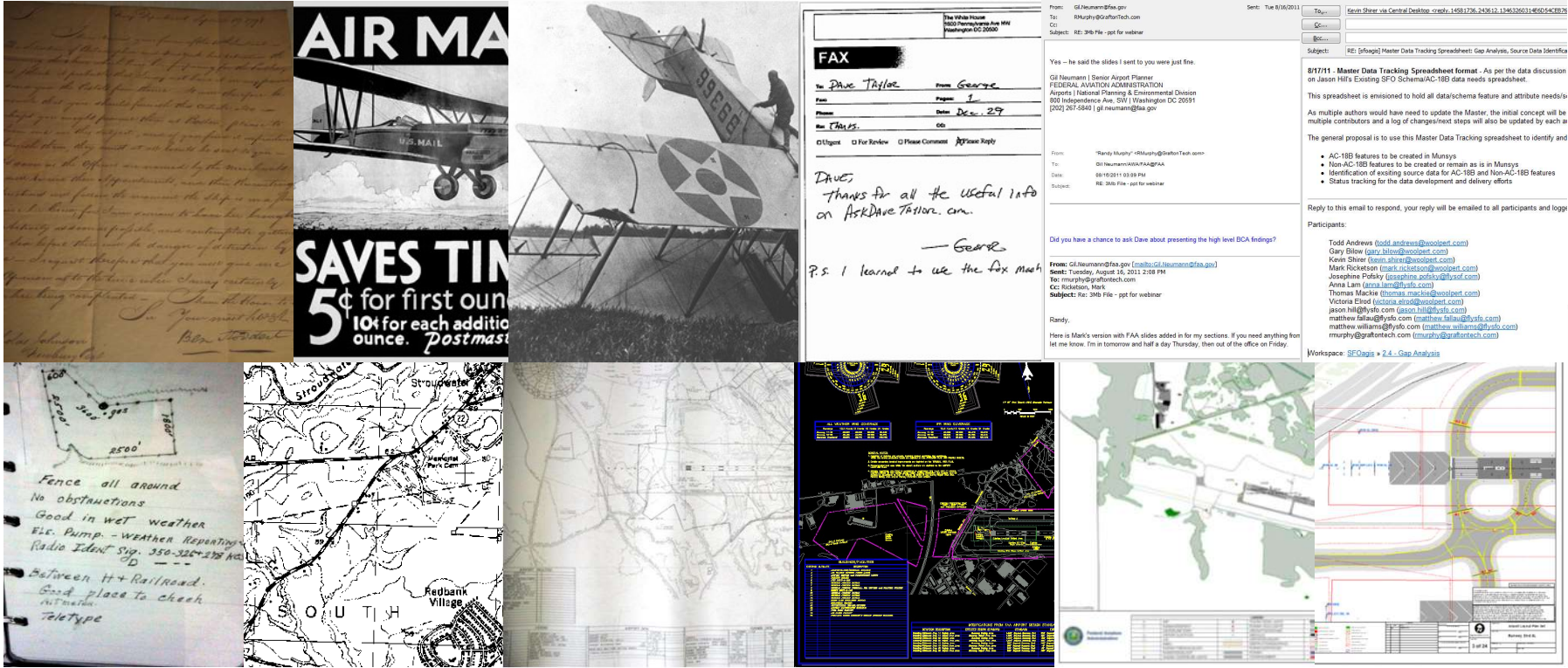
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GIS is an Inevitable Transition for Airports

Old Methods

Technological Advances



Airports Use GIS to Collaborate

Noise Mitigation Web App Builder

Search + Search Results

504233190150

Result Type: 1-9 of 9 results

Any Result Type

Phase: RG 3800K (4)

Eligible (1): RG 3800L (2)

Street Name: Argonaut Isle

Interior Space

Room-Lease Areas

LEASEDAREA	1,156.00
TENANTNAME	ZONA FRESCA
SPACENAME	40-2-006
NAME	TERMINAL 4
BUILDINGNAME	CONCOURSE G WEST
FLOORLEVEL	2
AGREEMENTNUMBER	000316
LEASEHOLDNUMBER	0075

ARORA ATLAS

Space: CHILLERS ROOM
Space Name: 40-1-130
Level: 1
Building: TERMINAL 4

SPACENAME	40-1-130
Abbrev	M100 A/B/C/D
Chiller Room HVAC Floor Plan	Chiller Room Abbrev
Emergency Plan	M100 Mech Schedule
Warranty	M100 Warranty
	M100 Electrical
	M101 HVAC Controls
	M102 Mech Schedule
	M103 Mech Schedule
	M104 Mech Schedule
TENANTNAME	CHILLERS ROOM
TYPE	Chiller
BUILDINGNAME	TERMINAL 4

Utilities

direction	0.00
Facility ID	
Installation Date	
Material	Ductile Iron
PipeLength	0
Notes	
Owner	
Quality Level	D
Source	
Top of Pipe	0.00
FootprintType	WATER_MAIN
SystemType	WATER_SYSTEM
Year	2005.0

OBJECTID	AGREEMENT_N	COMPANY_NAM	LEASEHOLD_N	COST_CENTER	L_Campus	SPACE_TYPE	SPACE_DESCR	FUNCTION_DESI	SPACE_COMMEI	SPACE_NAME	BILLING_QUANT	HLHOLD
171	000316	Lauderdale F&B Partners	0075	T4/G	FLL	CONCESSION	Concession	QSR	Opening	Zona Fresca	870	SQFT

Geospatial Data Drives Intelligence

Work Order
 Description: Monthly Generator Check
 Number: 11168
 Entry Type: FLEET
 Category: Airfield Ops
 Status: Open
 Date: 11/14/2018 11:49 AM
 Priority: Routine
 Projected Start: 11/14/2018 12:00 PM
 Projected Finish: 11/14/2018 12:00 PM
 Actual Start: 11/1/2018 12:00 PM
 Actual Finish: 11/23/2018 12:00 PM
 Stage: Actual
 Expense Type: Maintenance

FAA 14 CFR Part 139 Airfield Inspection Report
 Day Shift 11/23/2018
 OPS: Chris Morris, Kiel Duncan after 1300
 AOC:

AIRFIELD INSPECTION
 Logbook # 21712 Inspected by: MORRIS, CHRISTOPHER Inspection Date/Time: 11/23/2018 9:30:44AM

AIRFIELD DISCREPANCIES
 Discrepancies are indicated in red with a count of the associated discrepancies. Work Orders handled during this shift are listed below.

Pavement Areas
 A. Pavement Lip over 3" (0)
 B. Hole 5" w x 3" d (0)
 C. Cracks/Spalling/Bumps (10)
 D. FOD: gravel/debris/etc. (2)
 E. Rubber deposits (0)
 F. Ponding & Edge dams (1)

Safety Areas
 A. Ruts / Humps / Erosion (5)
 B. Drainage & Construction (0)
 C. Objects / Frangible bases (0)

MKE - FAA 14 CFR Part 139 Airfield Inspection Report
 10/28/2018 Day Shift
 AOC 1: ULRICH, MEZWINSKI(1330-2300)
 AOC 2: SPITZER

AIRFIELD INSPECTION
 Logbook # 138835 Inspected by: SPITZER, DONALD Inspection Date/Time: 10/28/2018 11:30:55AM

AIRFIELD DISCREPANCIES
 Discrepancies are indicated in red with a count of the associated discrepancies. Work Orders handled during this shift are listed below.

Pavement Areas
 A. Pavement Lip over 3" (0)
 B. Hole 5" w x 3" d (0)
 C. Cracks/Spalling/Bumps (10)
 D. FOD: gravel/debris/etc. (2)
 E. Rubber deposits (0)
 F. Ponding & Edge dams (1)

Lighting
 A. Obscured / Dirty / Faded (0)
 B. Damaged / Missing (10)
 C. Inoperative (6)
 D. Faulty Aim / Adjustment (0)

Fuel Farm
 A. Fencing / Gates / Signs (0)
 B. Fuel System Markings (0)
 C. Fire Extinguishers (0)
 D. Grounding clips (0)
 E. Fuel leaks / weeds (0)

Navigational Aids
 A. Rotating Beacon (0)
 B. Wind Indicators (0)
 C. REIL / PAPI systems (0)

Snow & Ice
 A. Surface Conditions (0)
 B. Snowbank Clearance (0)
 C. Lights & Signs obscured (0)
 D. NAVAIDS / Fire Access (0)

Obstructions
 A. Obstruction lights (0)
 B. Cranes / Trees (0)

Other
 A. Wildlife hazards (4)
 B. Miscellaneous (4)

Construction
 A. Visible / Standards (11)
 B. Hold Lines & Signs (0)
 C. Frangible

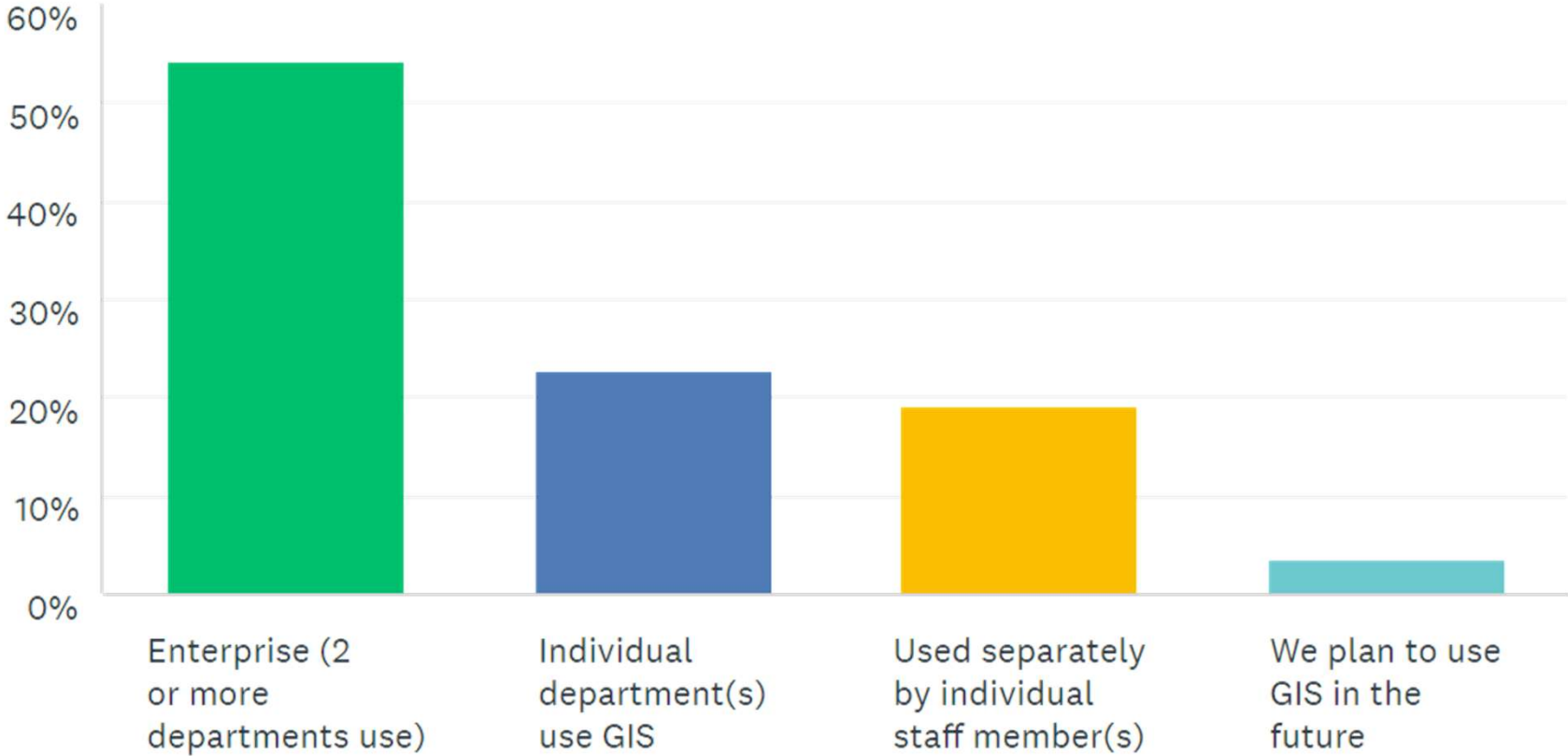


Potential Failure	Severity Ranking 1 to 10 (10-most severe)	Occurrence Ranking 1 to 10 (10-most likely to occur)	Detection Ranking 1 to 10 (10-no advance warning)	RPN Severity X Occurrence X Detection
Failure 1	7	1	3	21
Failure 2	10	8	8	640
Failure 3	2	10	5	100
Failure 4	7	8	6	336
Failure 5	4	7	10	280

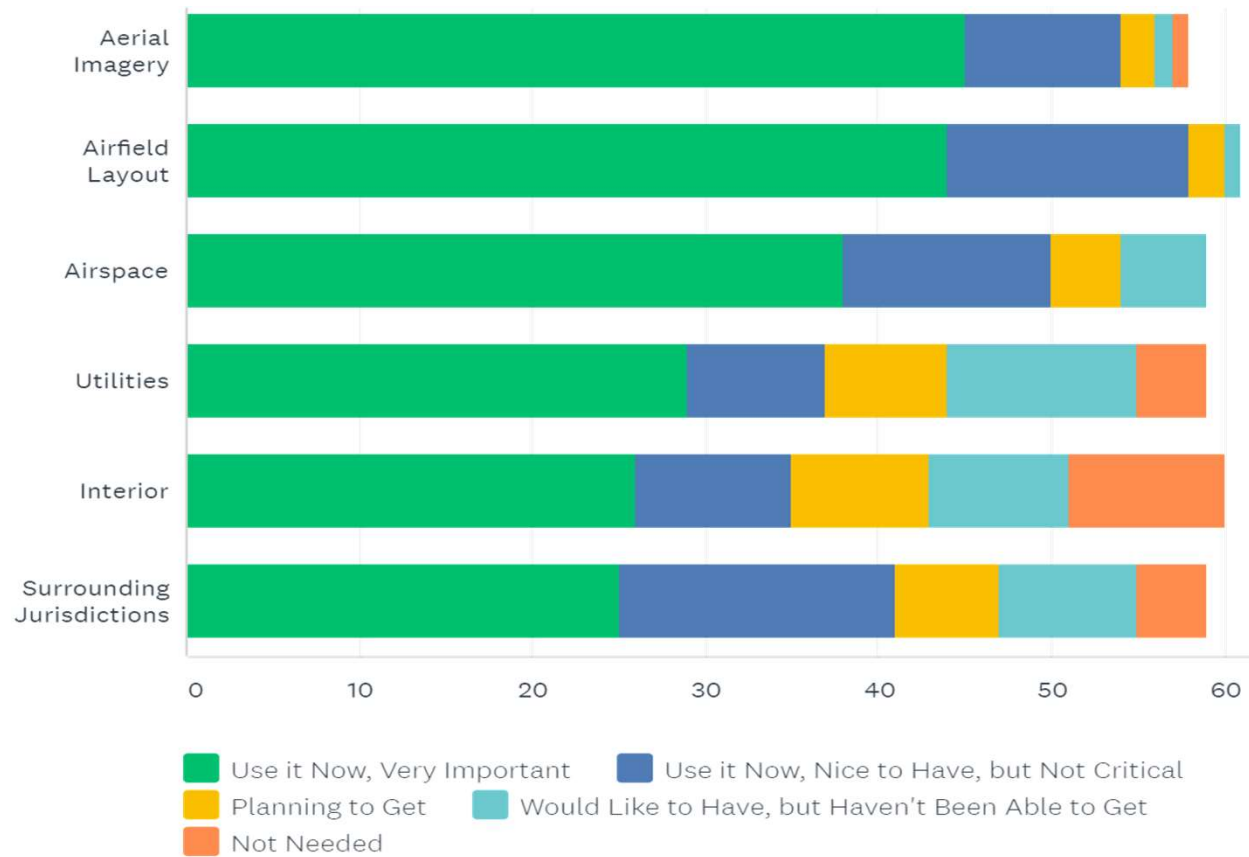
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Level of GIS



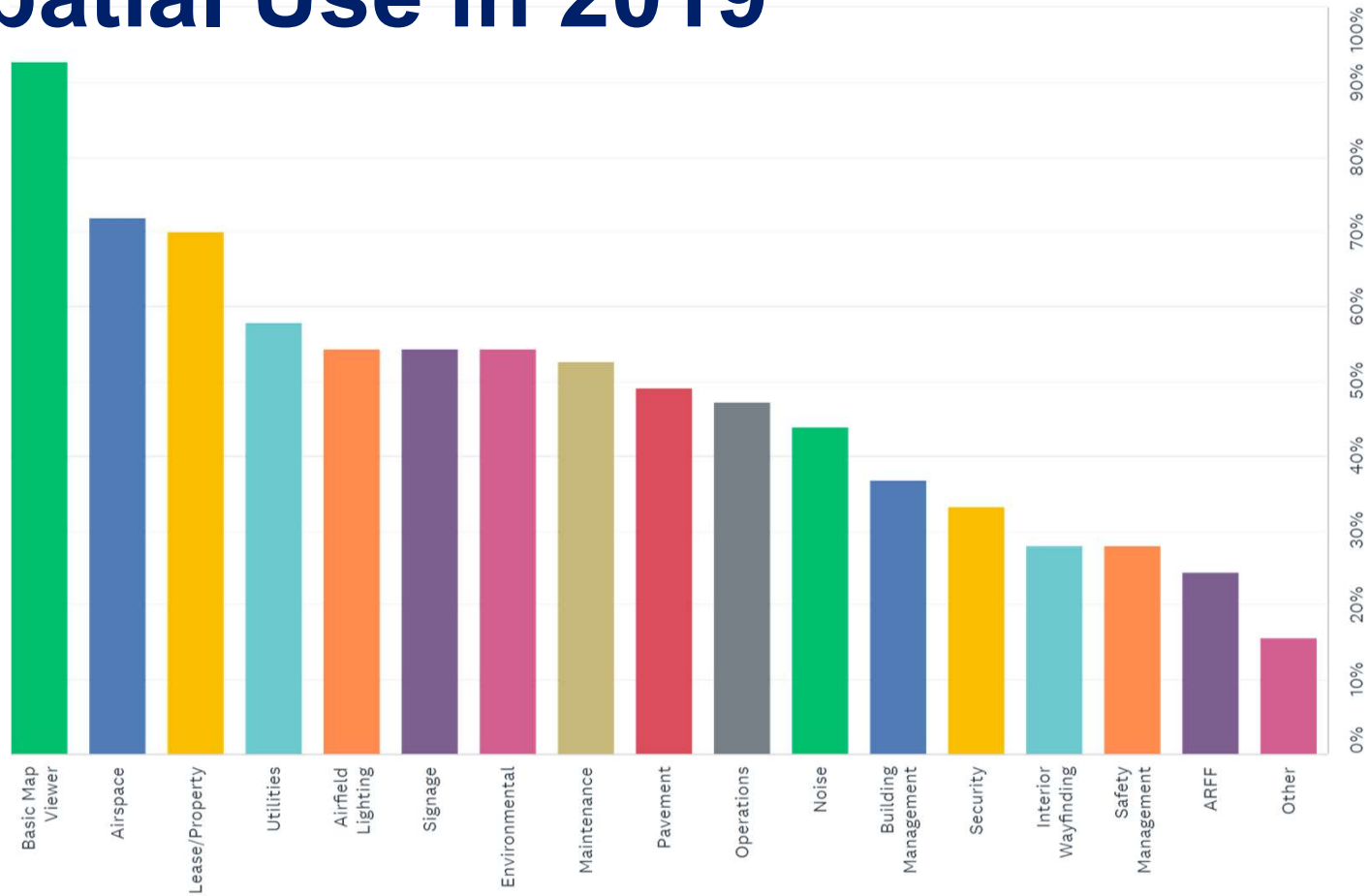
Important Data Sets



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Geospatial Use in 2019

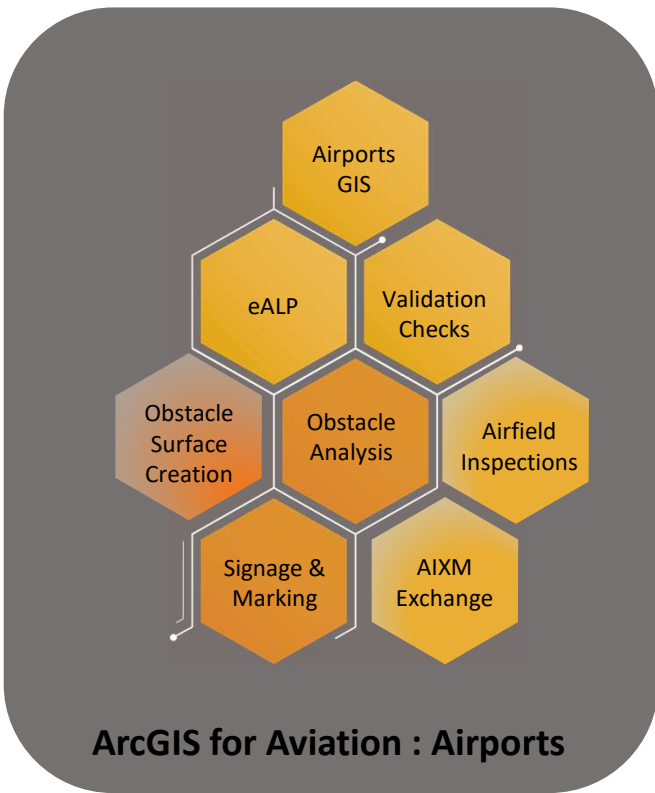


Importance of Geospatial for Airspace

- Demand for Air Travel Continues to Grow
- Pavement Continues to Age
- Few New Airports or Runways are Being Constructed
- “Second” most popular app in industry survey



ArcGIS for Aviation : Airports

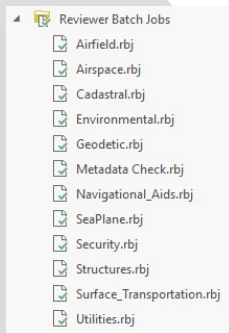


ArcGIS for Aviation : Airports

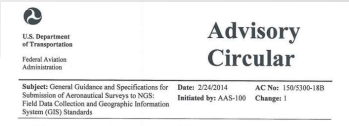
Airports GIS



Data Collection



Validation

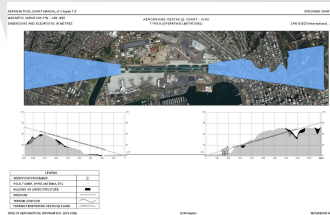


Standards Driven

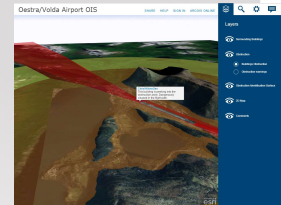
Obstacle Analysis



Obstacle Surface Creation & Analysis



Obstacle Planning Charts



3D Scenes

Signage and Marking



Templates

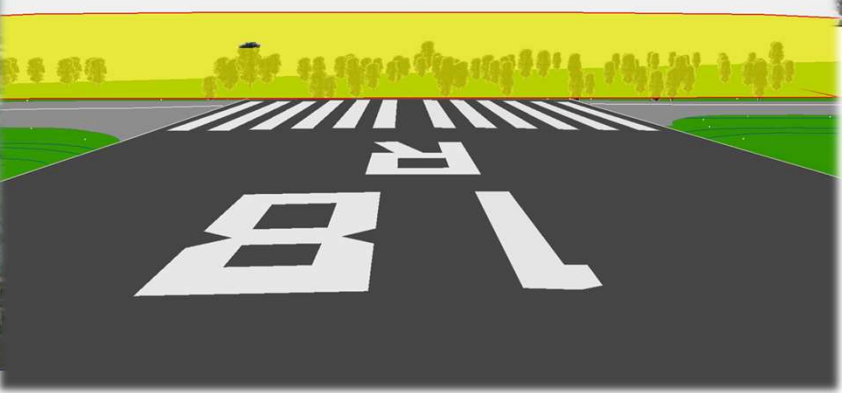
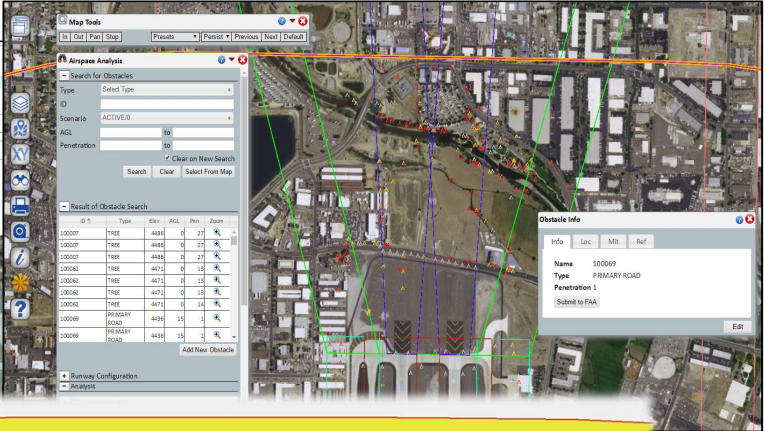
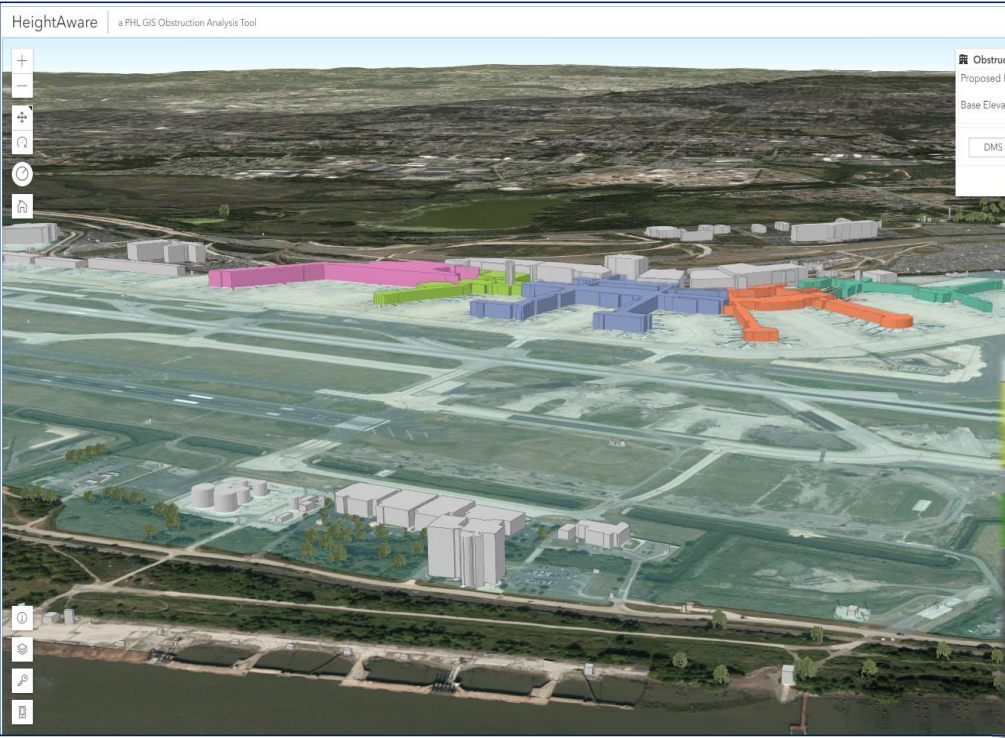


3D Editing




3D Content and Visualization

GIS Solutions: 3D Airspace Analysis



GIS Solutions: Obstacle Action Plan (OAP)



Federal Aviation Administration

MEMORANDUM

Date: August 18, 2015

To: Regional Airports Division Managers
610 Branch Managers
620 Branch Managers
Airports District Office Managers

From: Director, Office of Airport Safety and Standards (AAS-1)
Director, Office of Airport Planning and Programming (APP-1)
Director, Office of Airport Compliance (ACO-1)

Subject: **Reminder of Responsibilities for FAA Personnel and Airport Sponsors for Protecting Approach and Departure Surfaces**

Introduction

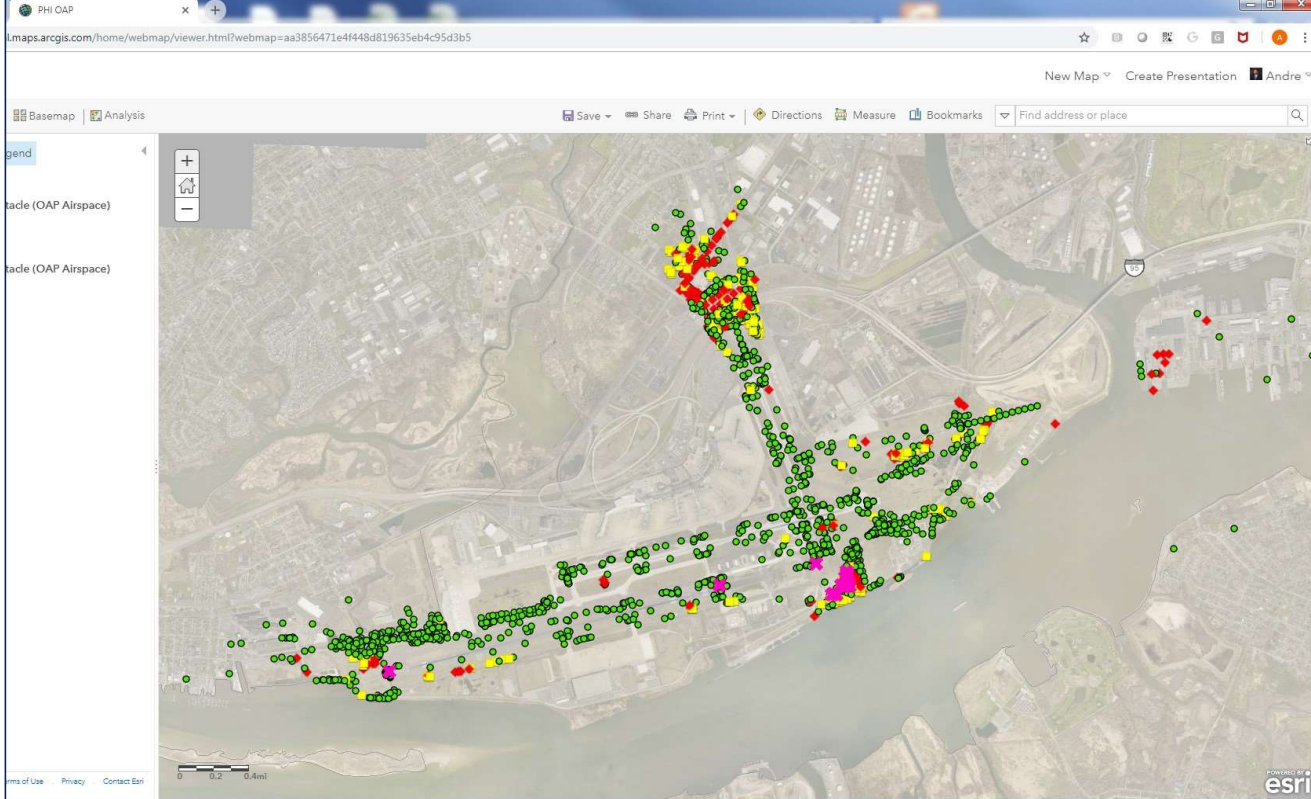
The purpose of this memo is primarily to remind FAA Office of Airports staff about their responsibilities (as well as the responsibilities of airport sponsors) in establishing and maintaining clear approach and departure surfaces at airports. We encourage personnel in all Regions and ADOs to relay this memorandum to all Federally obligated airports and any that are certificated under 14 CFR part 139, as well as all state aeronautical agencies. This memorandum will also be available on the FAA's public website under Safety, Planning and Compliance.

The airport sponsor is ultimately responsible for ensuring clear runway approach and departure surfaces. However, ARP plays an important role in this process. This role is detailed in a separate section below.

The approach and departure surfaces required to be maintained are those identified by Advisory Circular (AC) 150/5300-13A, Airport Design and FAA Order 8260.3B, The United States Standard for Terminal Instruments Procedures (TERPS). The focus of this document is on the TERPS 20:1 surface. While Part 77 civil airport imaginary surfaces are important, they are not the surfaces discussed in this document as they do not directly affect procedures.

Role of the Office of Airports (ARP)

- A core part of ARP's mission is to help maintain and enhance the safety, capacity



PHI OAP

lmaps.arcgis.com/home/webmap/viewer.html?webmap=aa3856471e4448d819635eb4c95d3b5

New Map Create Presentation Andre

Basemap Analysis Save Share Print Directions Measure Bookmarks Find address or place

Legend

- Obstacle (OAP Airspace)
- Obstacle (OAP Airspace)

0 0.2 0.4mi

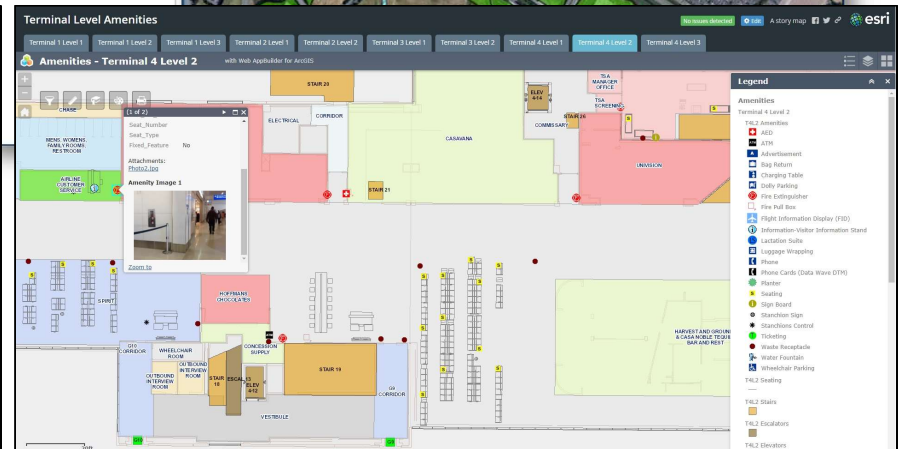
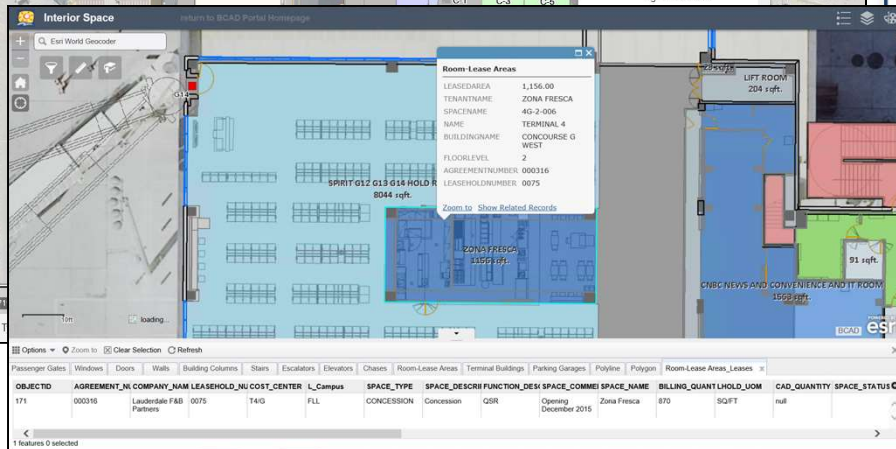
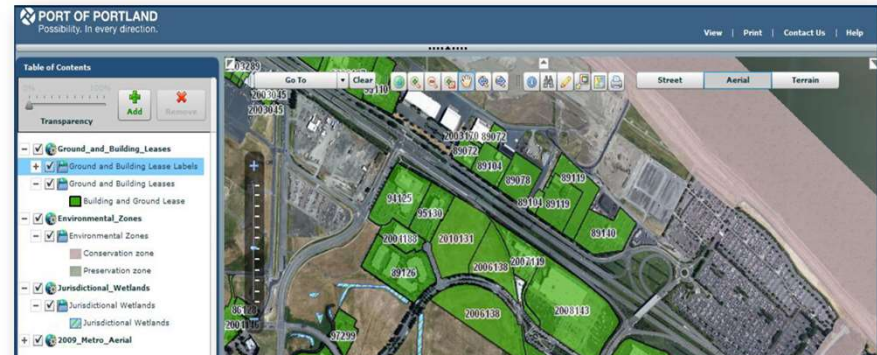
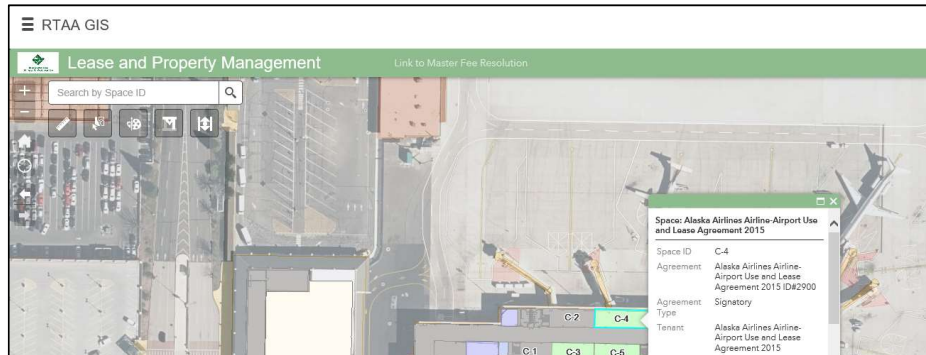
powered by esri

GIS Solutions: Land Use Compatibility

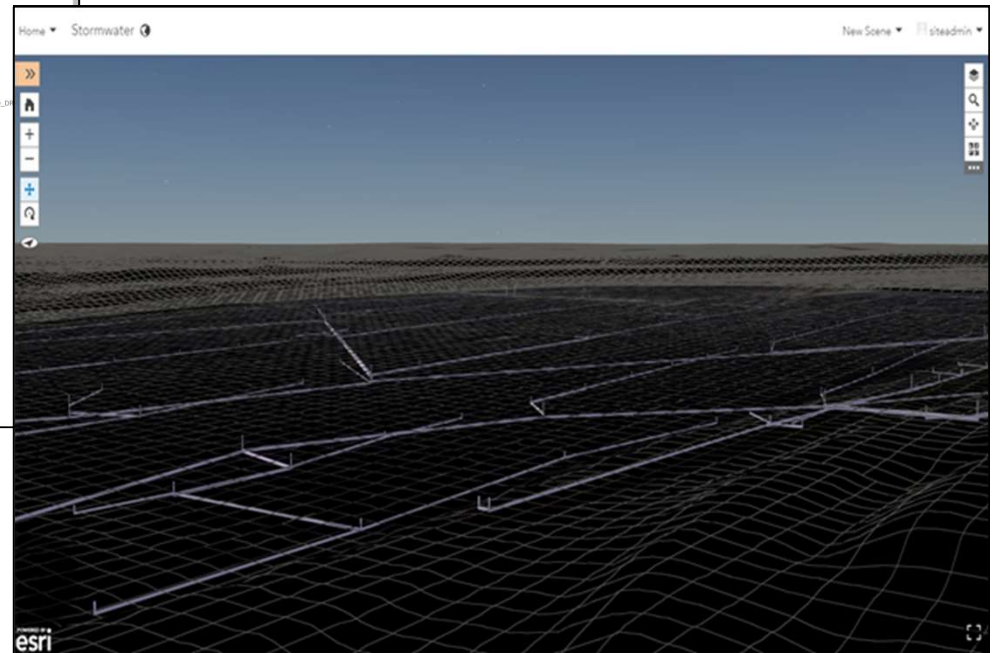
- Applications for Airspace, Noise, and Other Factors
- Based on Research (ACRP Reports 200 & 206)
- Policy guidance on effective land use compatibility planning

Compatible Land Use Impact Issue	Stakeholders (Impacted or Influencers)	Information Required	Relevance to Airports	Breadth of Use	GIS Can Help
Fauna that is Hazardous to Aircraft Operations	Airport Planning, Engineering, Environmental Agencies	Habitat Areas; Wetlands; Species Types; Migration Patterns; Location of Control Devices; Incident Locations; Drainage and Physical Characteristics of Detention Ponds and Other Storm Water Best Management Practices (BMPs)	✓	👤👤👤	Helpful
Degradation of Air Quality	Airport Environmental, Planning, Operations; FAA Environmental;	Access to Airport and Fuel Facilities; Fuel Utilities; Vehicle Circulation Routes;	✓	👤👤	Limited

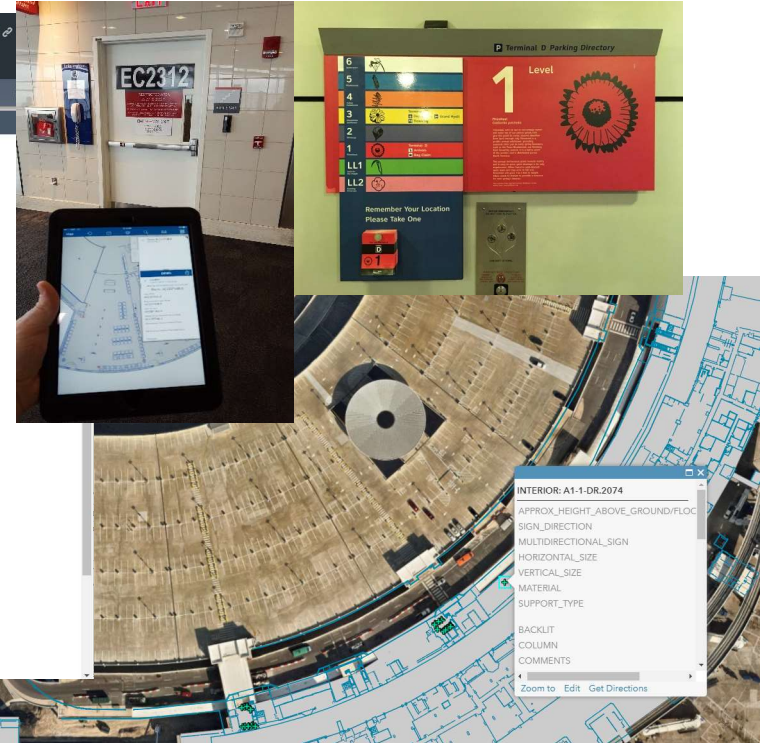
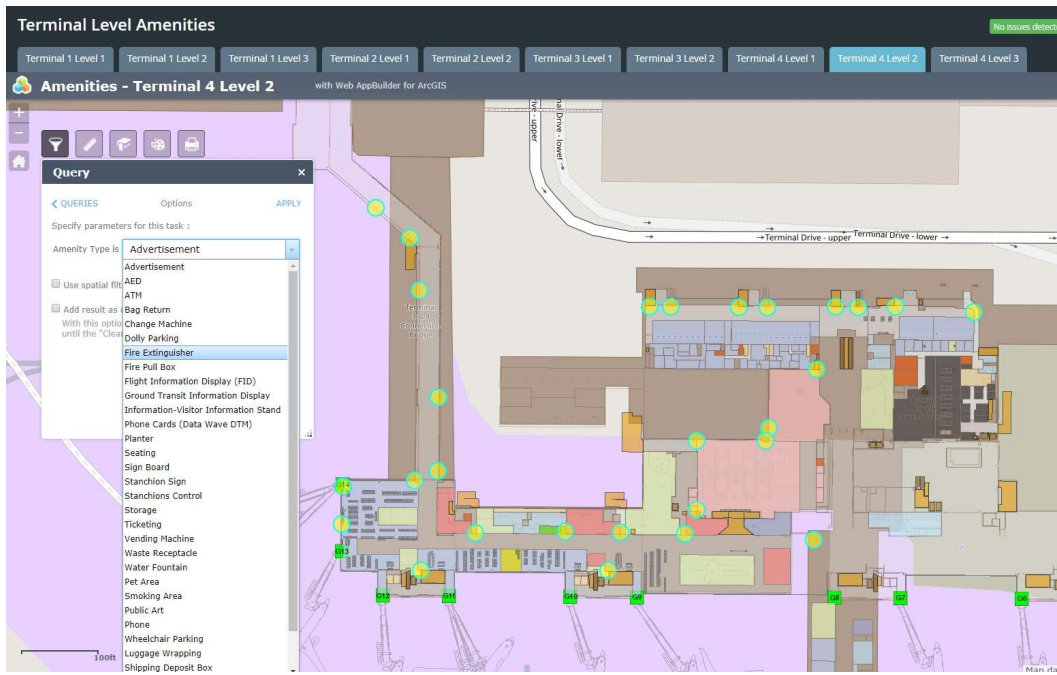
GIS Solutions: Leasing & Properties



GIS Solutions: Utilities



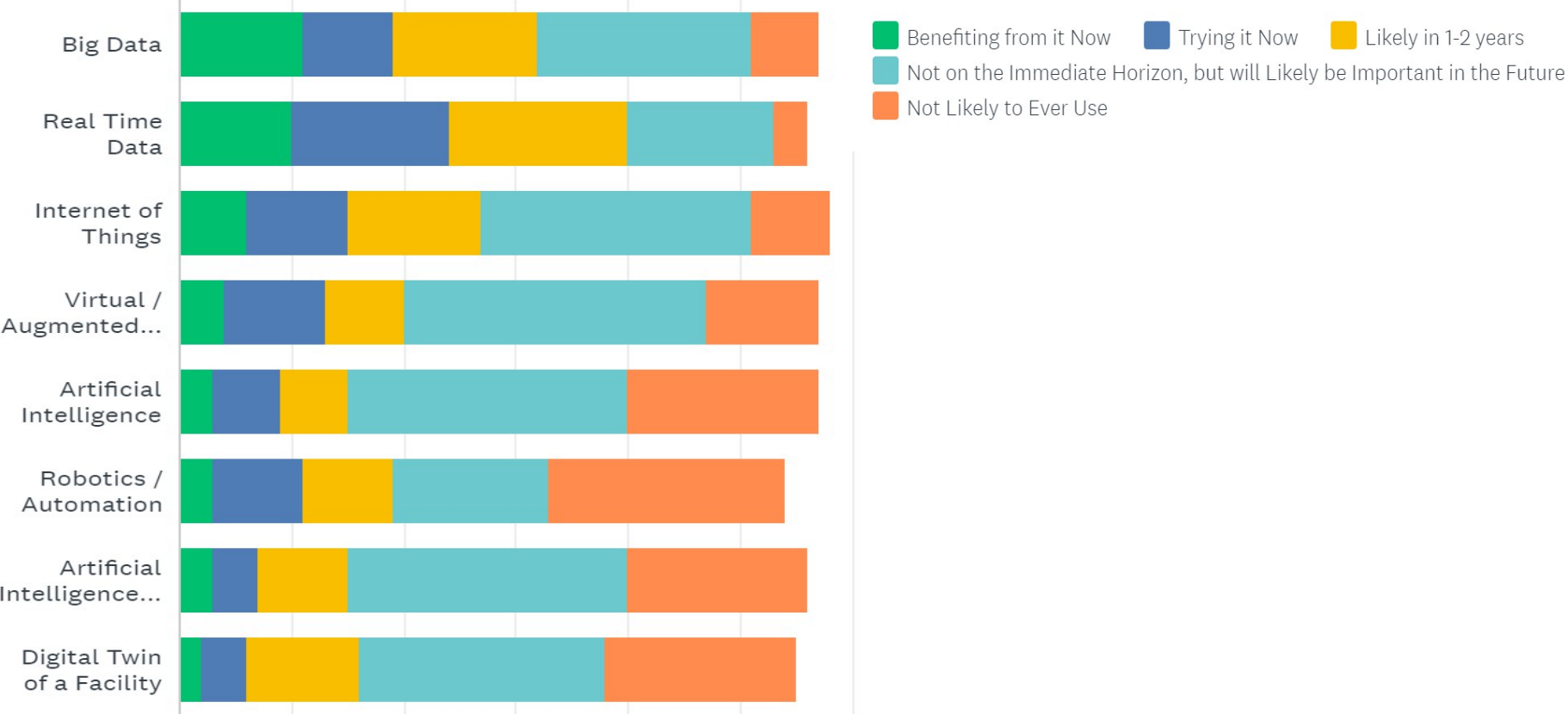
GIS Solutions: Asset Management



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Emerging Technologies



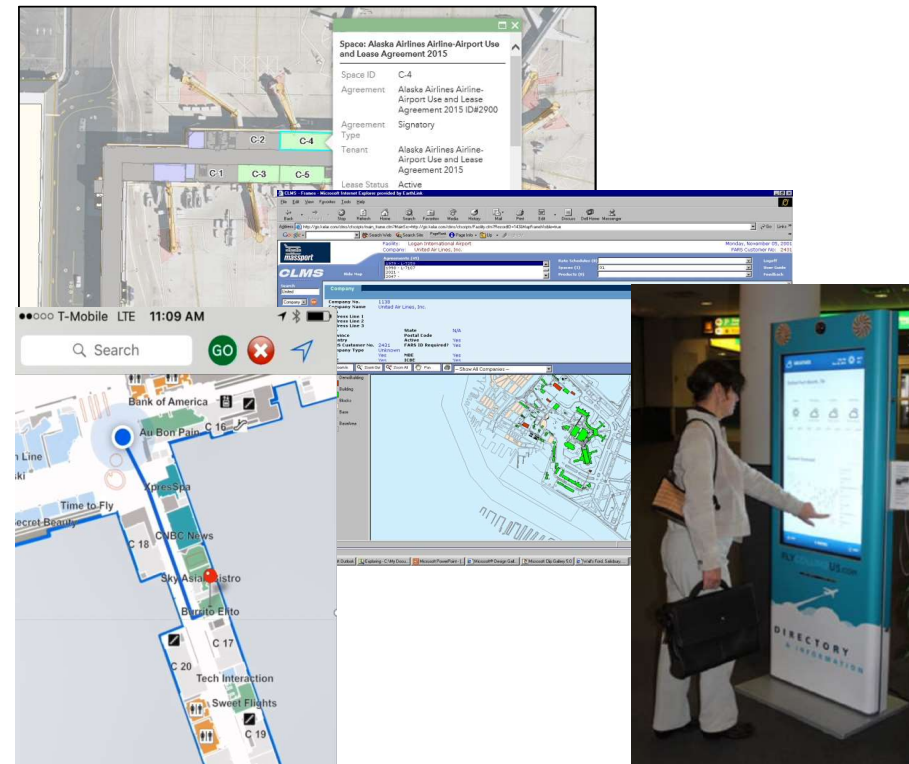
The Importance of Geospatial Indoors

- We spend 90% of our time indoors
- Interior space generates significant revenue for airports
- Terminal space is constantly changing
- “Third” most popular app in industry survey



Growing Demand for Indoor Apps

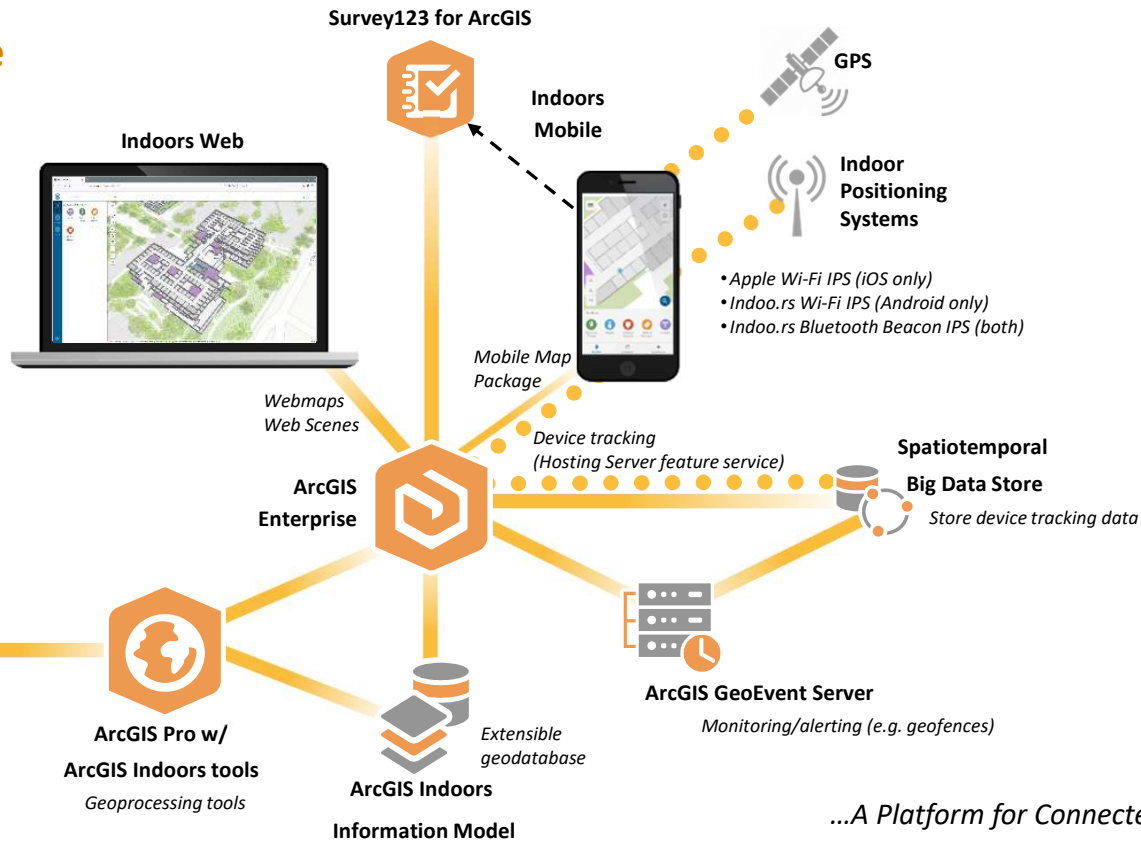
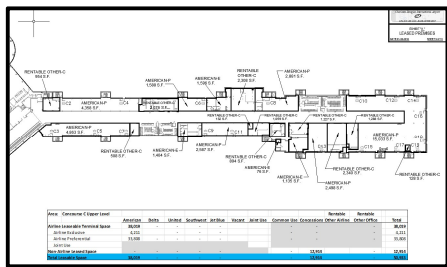
- Basic Viewer
- “Who is Where”
- Asset Management Systems
- Lease Management Systems
- Wayfinding on Mobile Devices
- Computer Aided Dispatch
- Kiosks



What is Esri's ArcGIS Indoors



High Level Architecture

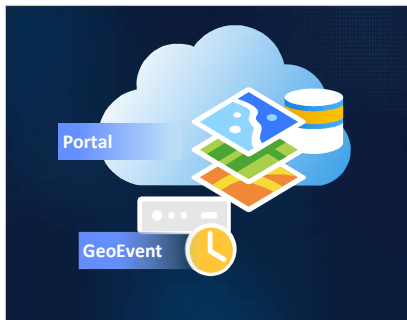


...A Platform for Connected Buildings and Workplaces

Implementation of ArcGIS Indoors



Getting Started



Infrastructure

Cloud/On Premise

ArcGIS Enterprise

ArcGIS Event Server



Indoor Maps

2D/3D

POIs

Site Plans



Indoor Positioning

Wi-Fi

BLE

Deployment & Survey



Indoor Software

Configuration

Integration

Extension

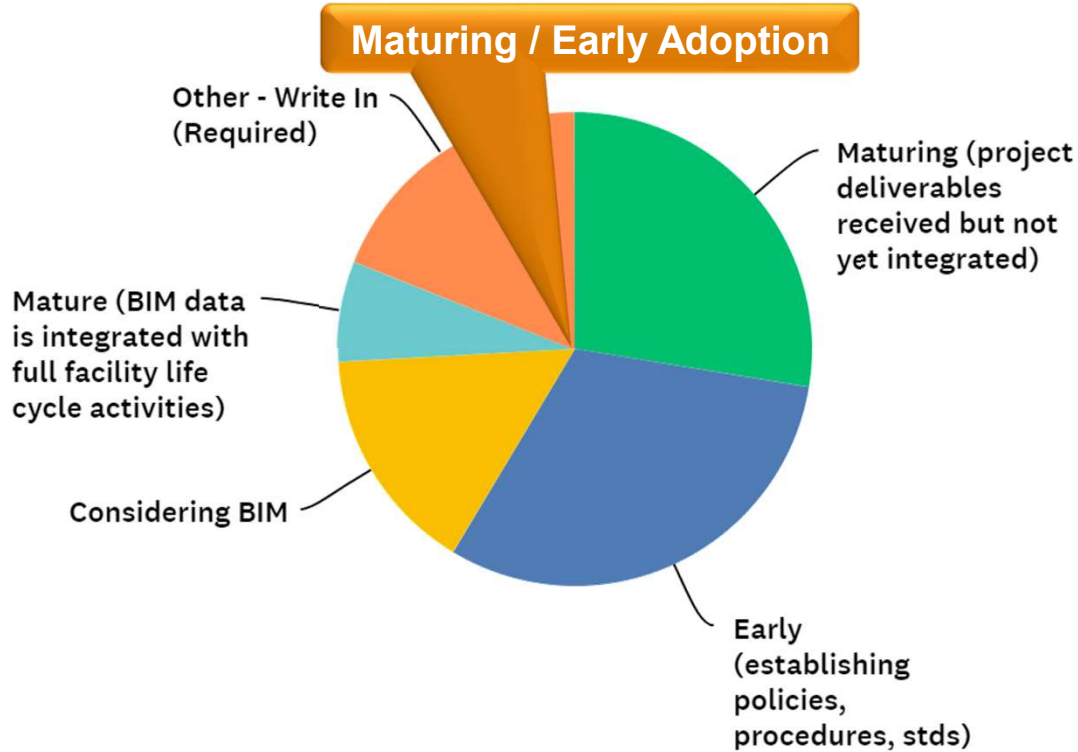
BIM Implementation at Airports

2016

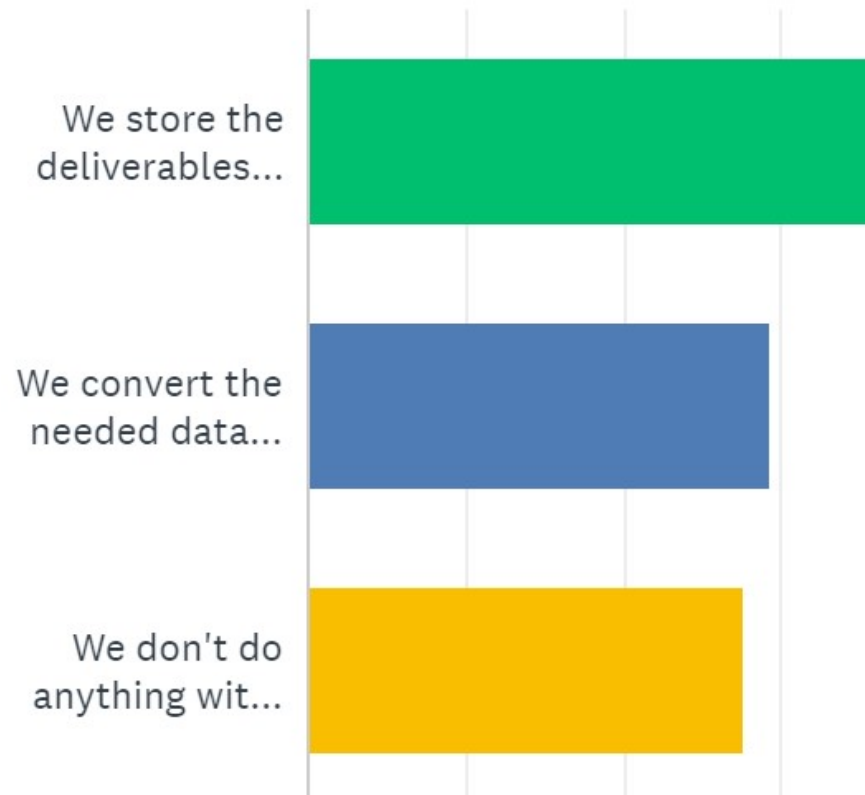


- Early adoption
- Considering
- Maturing
- Other
- Mature

2019



What Happens with BIM Deliverables?



Geospatial Data Interoperability

- Estimates that the world will need to spend \$57 trillion on infrastructure through 2030 to keep up with global GDP growth ¹
- Large construction projects typically take 20 percent longer to finish than scheduled and are up to 80 percent over budget ¹
- Construction industry is ripe for disruption and two of the technologies that it believes will be key in that anticipated transformation are geospatial and BIM ¹
- The big payoff of a digital model will be during operations and maintenance, which typically represents 80% of the cost of a facility ²
- It can take the operator of the facility a year to go through this information to find the information required to operate the facility ³
- For many types of equipment the highest probability of failure is in month 1-2 of operation ³
- Integration of geospatial and BIM essential to address the challenges of the 21st century ³

Sources

¹ McKinsey Global Institute | ² United Kingdom BIM Initiative | ³ Growing evidence of the benefits of an integrated BIM+geospatial full lifecycle approach to construction
<https://geospatial.blogs.com>, January 02, 2019

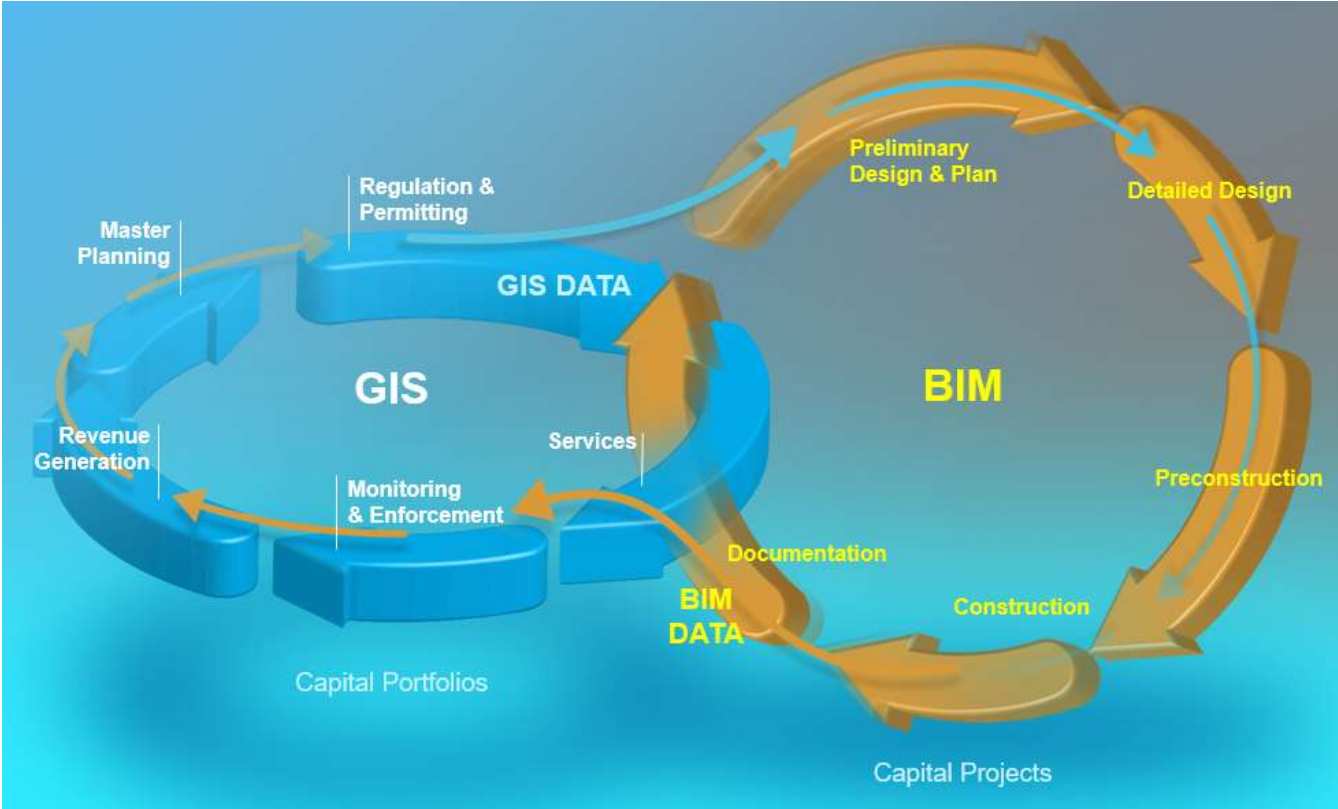
Geospatial Data Interoperability

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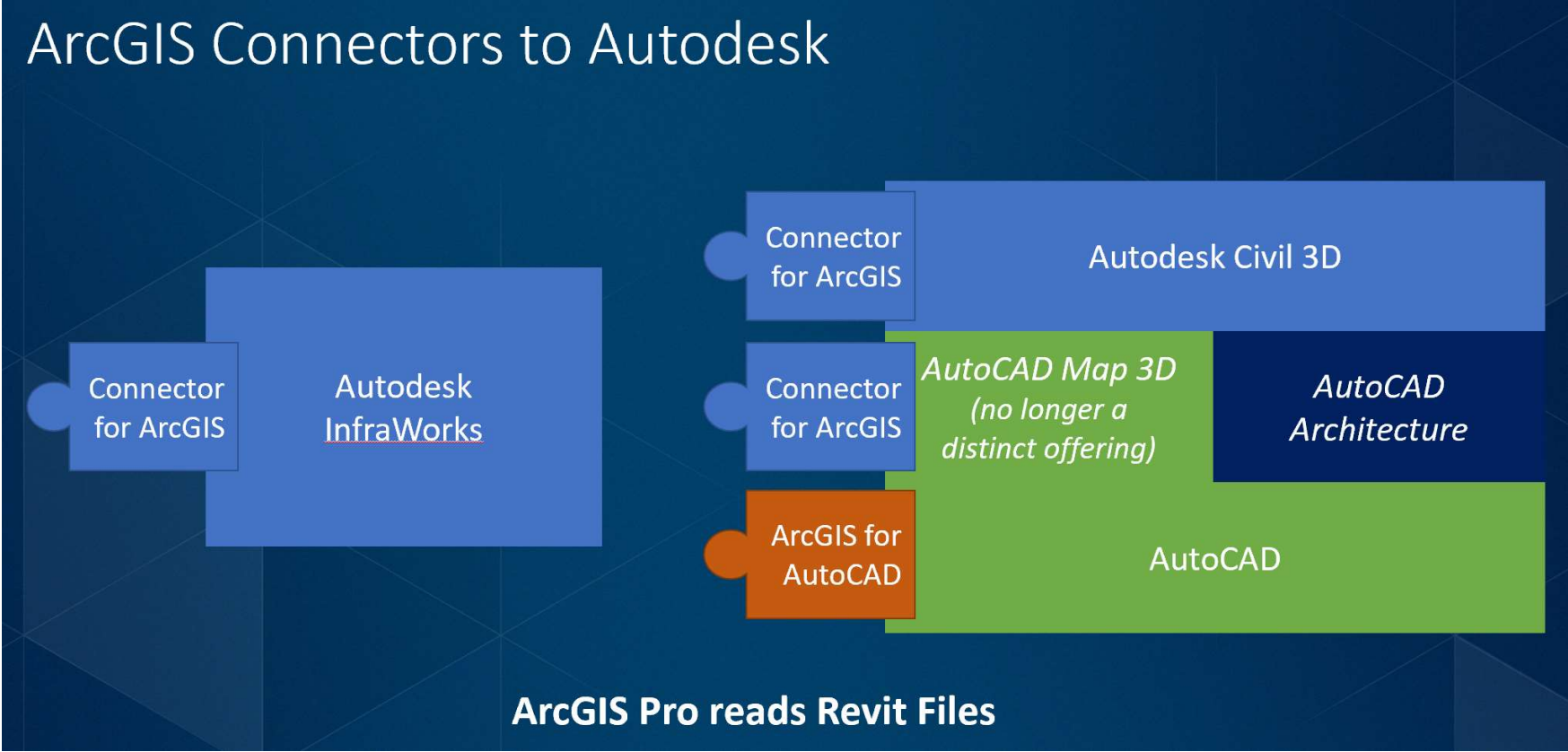
Sources

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Evolution of BIM and GIS (Esri's View)

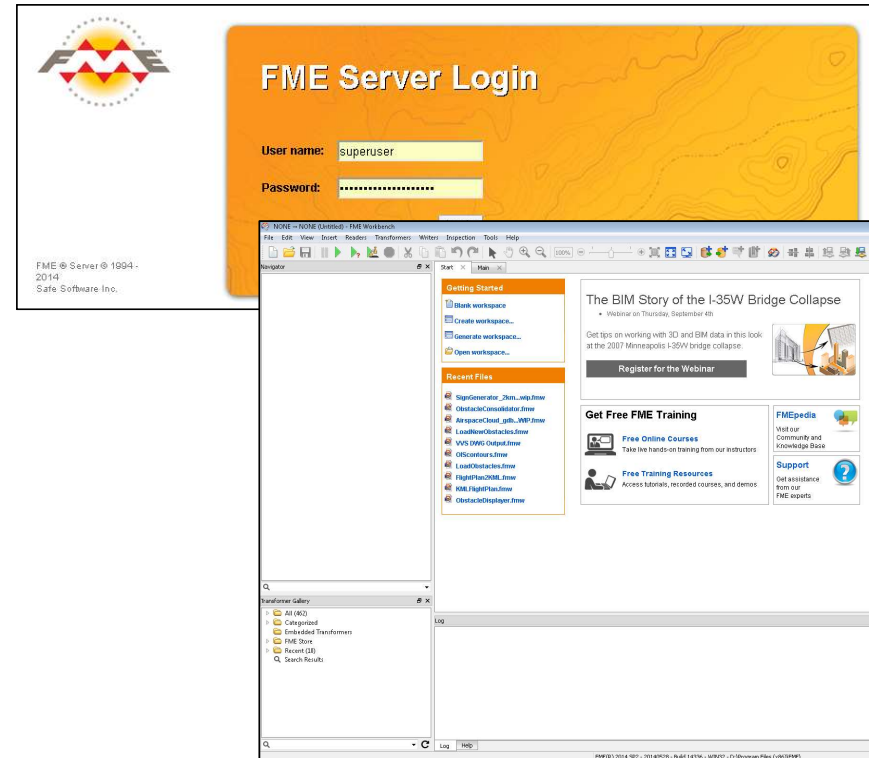


Esri's Integration with Autodesk

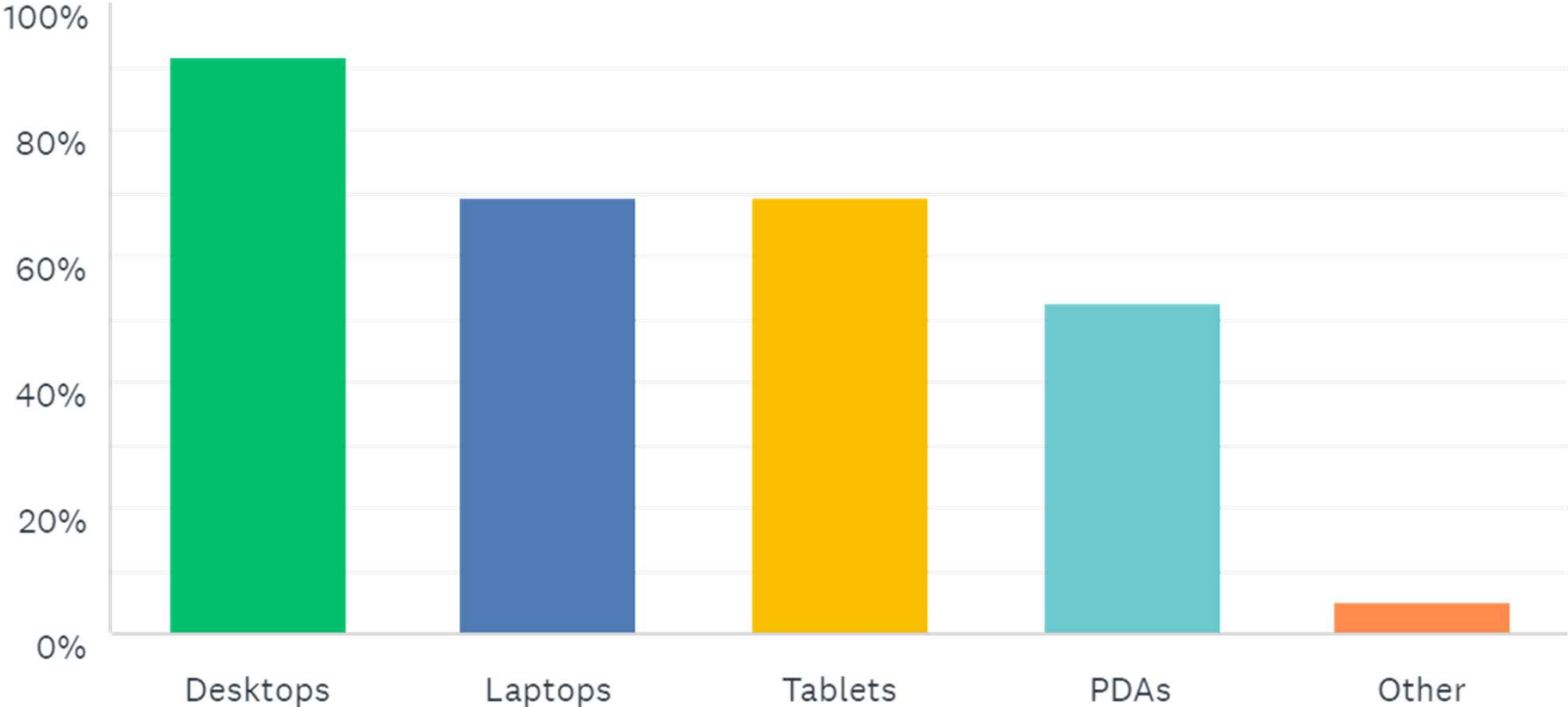


Safe: Feature Manipulation Engine (FME)

- Tool for transforming geospatial data into what we need
- Also a great tool for visualizing and checking data
- Not just for geospatial data anymore
- Comes in 3 flavors
 - Desktop, Server, and Cloud)



Types of Devices



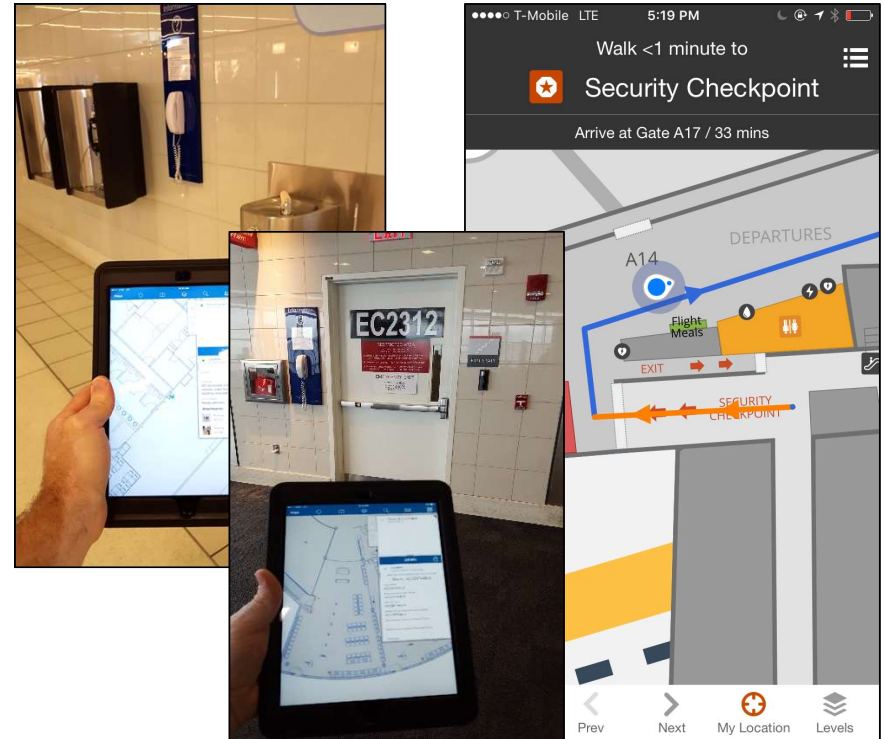
Mobile Access to Geospatial Data

Availability

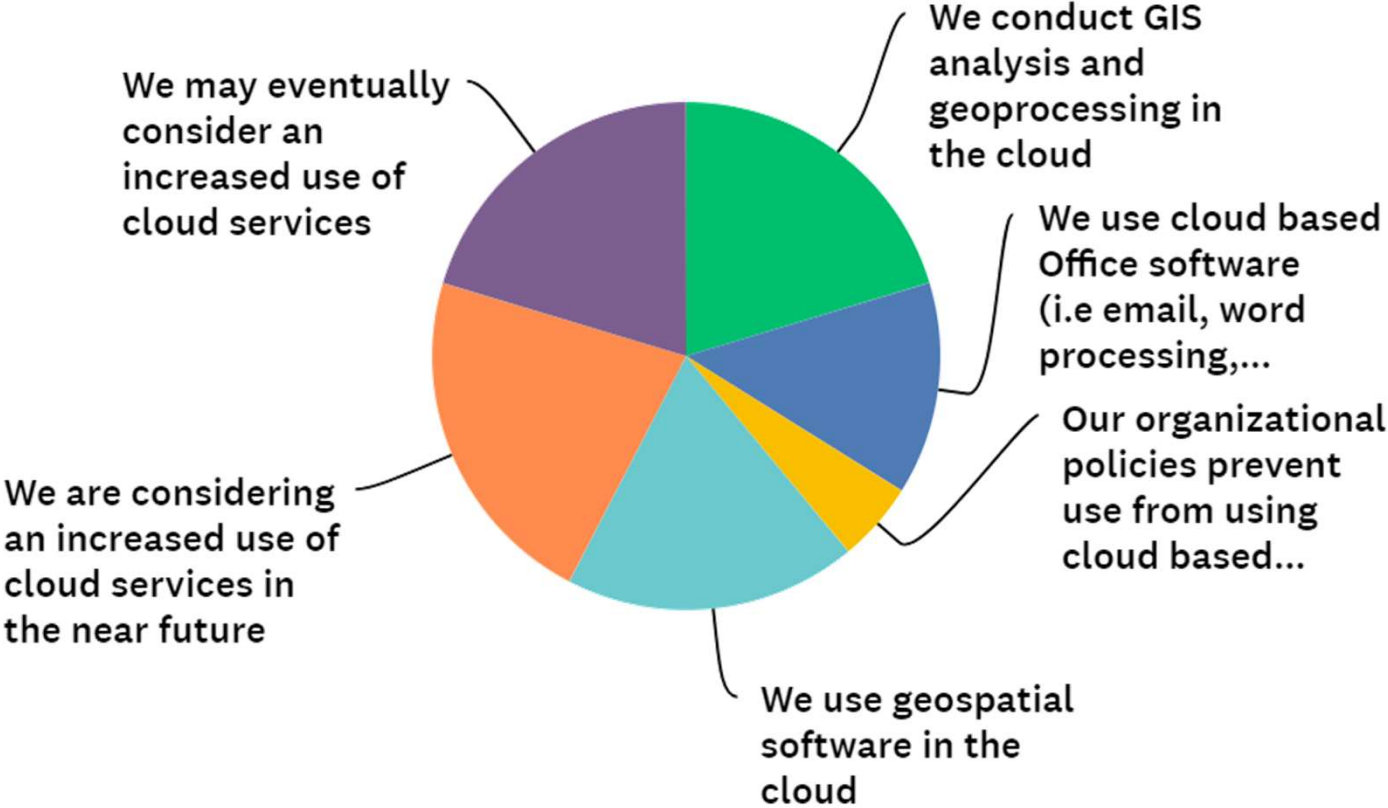
- Where and When Needed
- On a Variety of Devices
- If Disconnected

Support

- Operations
- Maintenance
- Inspections
- Revenue Management



Use of Cloud Based Services



Comparing the Alternatives

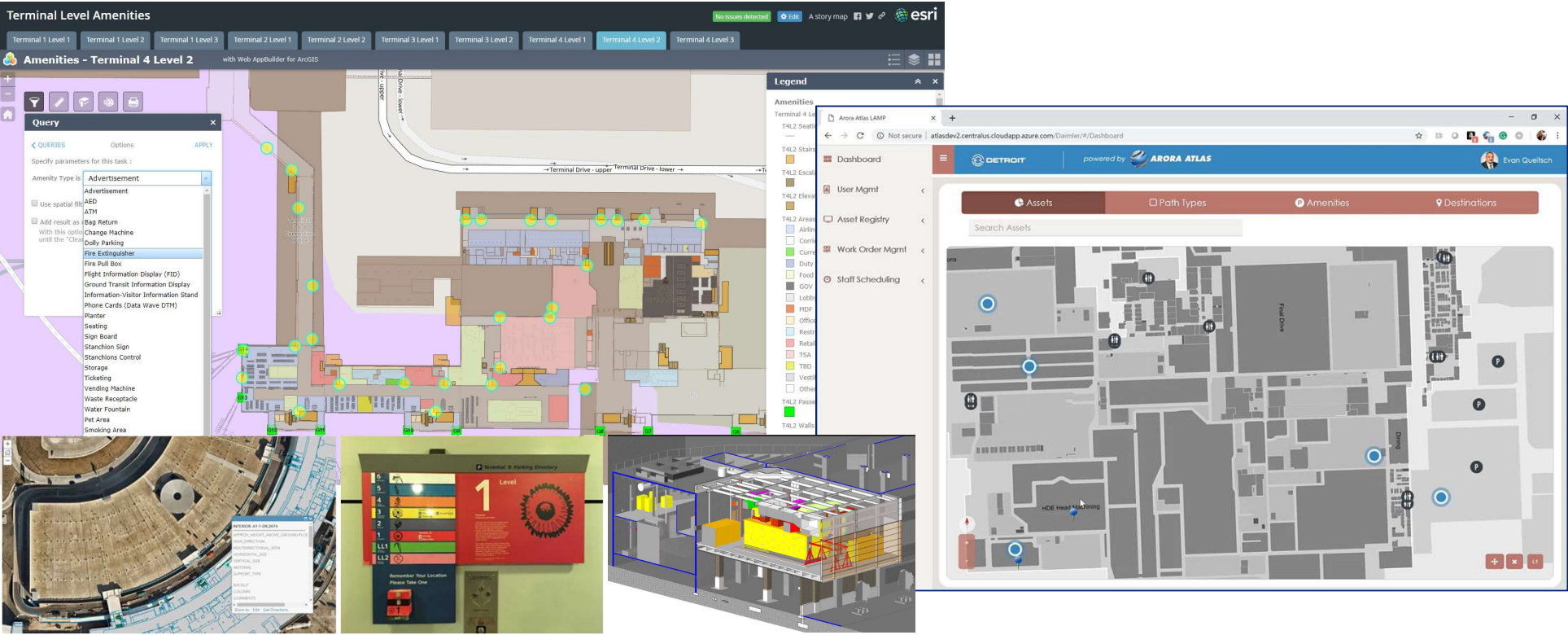
Cloud

- Low Entry Cost
- Quick to Implement
- Easy to Scale
- Mobile Access
- Current Trend
- Increasing Capabilities

Internal

- Within Firewall
- Customization Options
- Less Upgrade Issues
- Control & Flexibility

Geo-centric Asset Management



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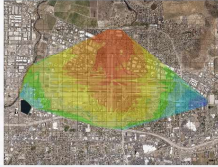
Success Story: Reno-Tahoe (RNO)

RTAA GIS Web Resources Help GISAPPS\GIS_QC

Reno-Tahoe Airport Authority Web Application Portal


GIS Data Viewer

Browse published layers and interact with data



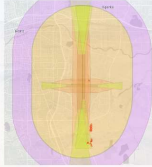
eDoc Search Tool

Search, Retrieve, and Catalog Engineering Documents




Airspace

Browse and interact with Airspace data




Lease and Property Management

View and Interact with GIS Data for Lease and Property Management




Airfield Signage

View and Interact with the airfield signage data

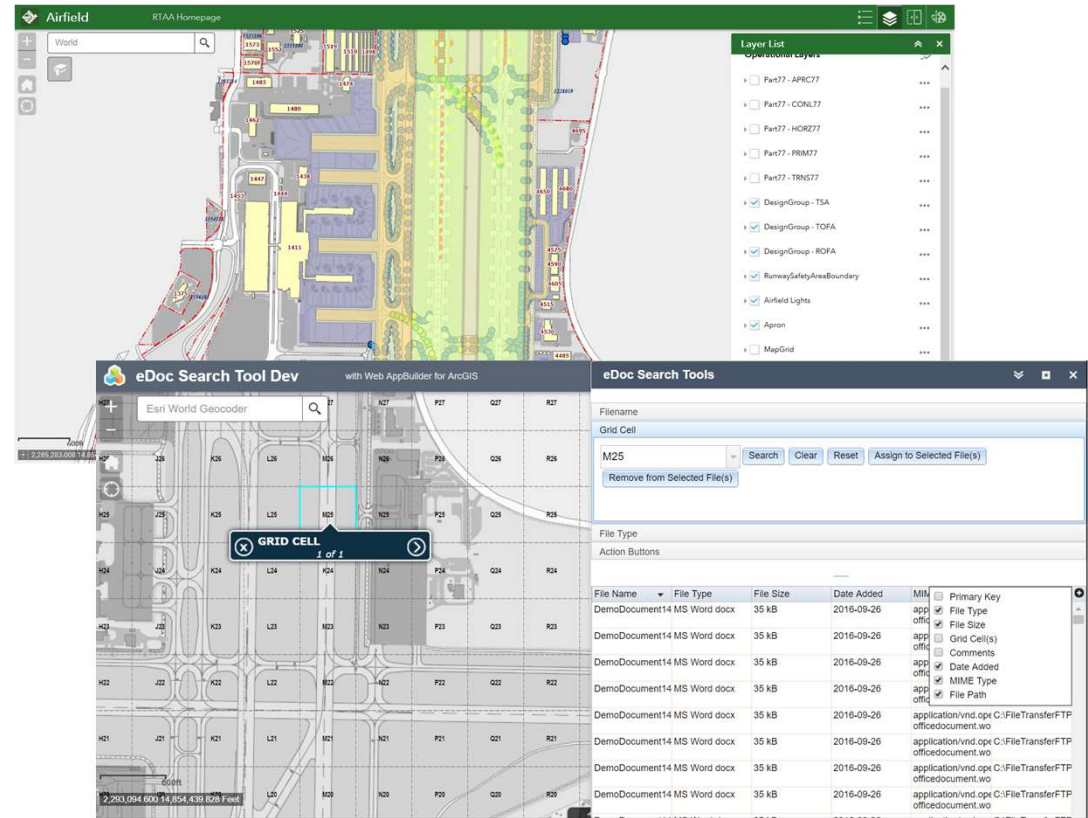
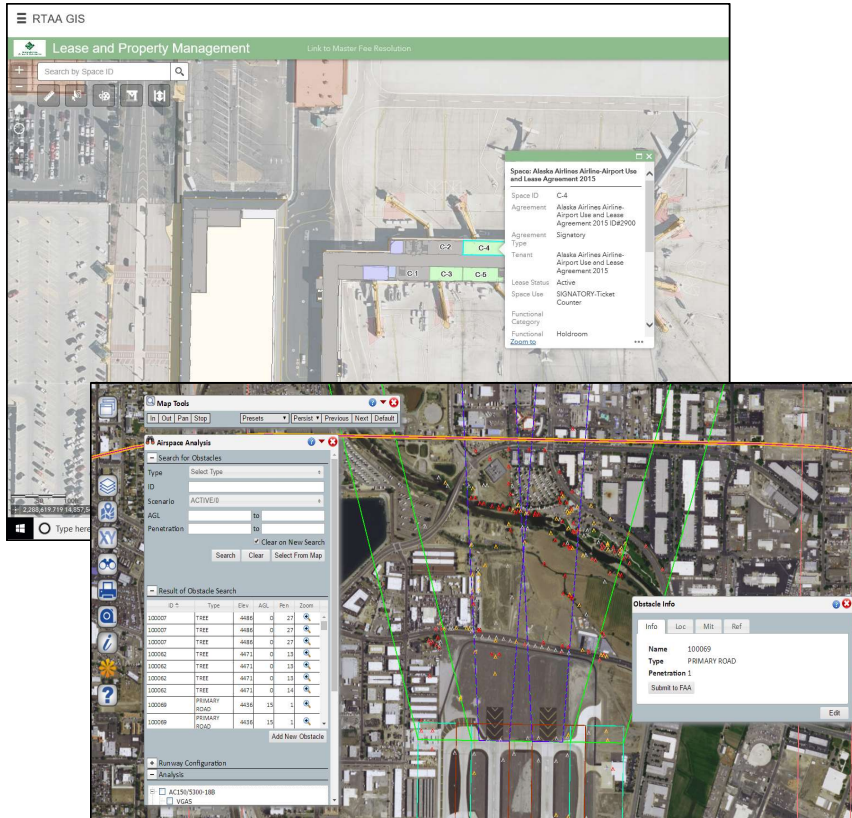


Mobile Apps

Guides and Tips for mobile apps



Success Story: Reno-Tahoe (RNO)



Success Story: Fort Lauderdale (FLL)

Parcel 1146 Details:

- Parcel Number: 1146
- Folio ID: 504229080110
- Authority: Charles E & K Reich
- Acquisition Notes:
 - Date Acquired: 19930430
 - Previous Owner: Bavier (Deeded to Reich with reservation of easement)
 - Easement Owner: Broward County Bavier (Deeded to Reich OR 20637-168)
 - Current Ownership Type: AV EAS
 - Inventory Type: Easement
 - Calculated Area: 0.19
 - Deed Reference: AV EAS OR 20637

Room-Lease Areas Details:

- LEASEDAREA: 1,156.00
- TENANTNAME: ZONA FRESCA
- SPACENAME: 4G-2-006
- NAME: TERMINAL 4
- BUILDINGNAME: CONCOURSE G WEST
- FLOORLEVEL: 2
- AGREEMENTNUMBER: 000316
- LEASEHOLDNUMBER: 0075

OBJECTID	AGREEMENT_N	COMPANY_NAM	LEASEHOLD_NU	COST_CENTER	L_Campus	SPACE_TYPE	SPACE_DESCR	FUNCTION_DES	SPACE_COMME	SPACE_NAME	BILLING_QUANT	LHOLD_UOM	CAD_QUANTITY	SPACE_STATUS
171	000316	Lauderdale F&B Partners	0075	T4/G	FLL	CONCESSION	Concession	QSR	Opening December 2015	Zona Fresca	870	SQFT	null	

Success Story: Fort Lauderdale (FLL)

The screenshot displays the 'Noise Mitigation Web App Builder' interface. On the left, a map shows a residential area with various colored overlays. A pop-up window for '818 Argonaut Isle' provides details: Phase 2 - Sound Insulation, Phase Name: DEEMED COMPATIBLE, Folio ID: 504233190150, and Structure Type: HOUSE. On the right, the 'Search Results' panel shows a search for '504233190150' with 9 results. The results list includes:

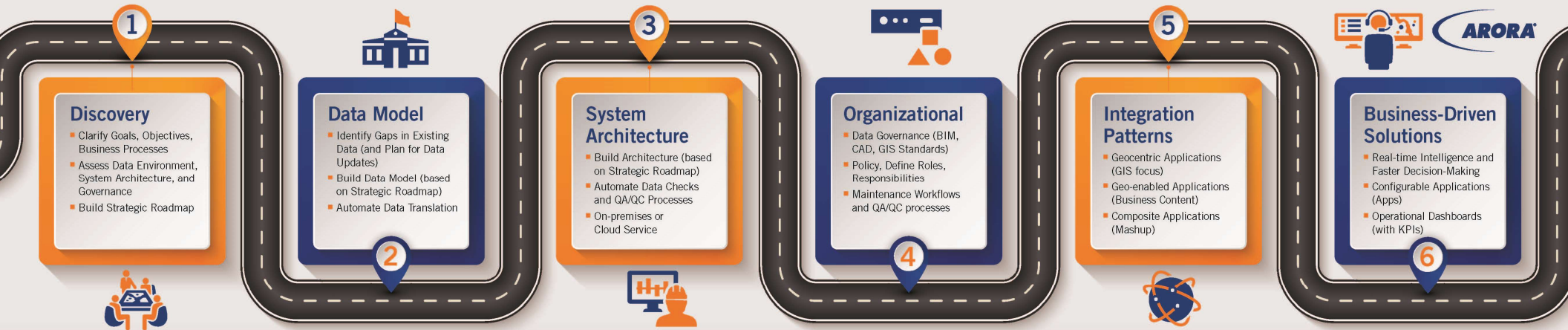
- 818 Argonaut Isle Invitation for Acoustical Retesting 02-22-16**
Phase: Eligible
Street Name and Owner: 818 - Robert D. Sorrentino
File Code: 7.3.3
Doc Type: Property Document Set (by File Code Title: Homeowner Correspondence)
http://airportal/nmp/Sound Insulation Program/CH-041516-004.pdf
- 818 Argonaut Isle Homeowner Program Application - Deemed Compatible**
Phase: BG 3800K
Street Name and Owner: 818 - Robert D. Sorrentino
File Code: 7.3.3
Doc Type: Property Document Set (by File Code Title: Homeowner Applications property)
http://airportal/nmp/Sound Insulation Program/CH-122315-017.pdf
- 818 Argonaut Isle_09-23-15 Email Re: Letter of Compatibility**
Phase: BG 3800K
Street Name and Owner: 818 - Robert D. Sorrentino
File Code: 7.3.3
Doc Type: Property Document Set (by File Code Title: Homeowner Communications)
http://airportal/nmp/Sound Insulation Program/CH-103015-013.pdf

Agenda

- An Increasing Number of Airports are Using GIS: Why? How?
- What Airport GIS Professionals are Saying (Industry Survey Results)
- Successful Geospatial Solutions in Use at Airports
- Trends Related to GIS at Airports
- Success Stories
- **How to Get Started Down the Roadmap to Success**
- Resources Required (money, people, organizational support)
- Overcoming Common Challenges

Follow a Proven Path for Success

Whether your organization is just getting started or a mature trend setter, our team can help you reach your geospatial business goals by leveraging our national reputation for delivering high quality and innovative products and services.



Adopt/Adapt a Data Model

- GIS Data Structure
- CAD Data Structure
- BIM Delivery Guidelines
- Data Quality
- Remote Sensing
- Identification and Addressing
- Data Security



Data Model

- Identify Gaps in Existing Data (and Plan for Data Updates)
- Build Data Model (based on Strategic Roadmap)
- Automate Data Translation

2

This diagram shows a blue-bordered box with a white background. At the top, it says 'Data Model'. Below that, there are three bullet points: 'Identify Gaps in Existing Data (and Plan for Data Updates)', 'Build Data Model (based on Strategic Roadmap)', and 'Automate Data Translation'. At the bottom right of the box is a blue circle with the number '2' inside.



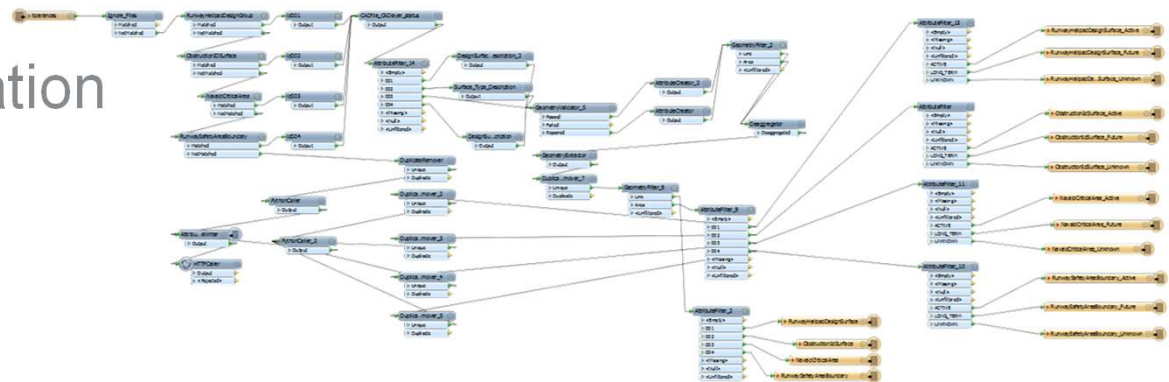
Migrate Existing Data

- Data Interoperability and Exchange
- Quality Assurance
- Data Publishing
- Reporting and Visualization

Data Model

- Identify Gaps in Existing Data (and Plan for Data Updates)
- Build Data Model (based on Strategic Roadmap)
- Automate Data Translation

2



Deploy Applications

- Leverage Roadmap from Discovery Phase
- Provide Real-time Intelligence and Faster Decision-making
- Use Esri Web App Builder for “Quick Win” configurable solutions
- Integrate to Provide Access to “unseen” Business Content
- Engage Leadership Through Operational Dashboards

Integration Patterns

- Geocentric Applications (GIS focus)
- Geo-enabled Applications (Business Content)
- Composite Applications (Mashup)

Business-Driven Solutions

- Real-time Intelligence and Faster Decision-Making
- Configurable Applications (Apps)
- Operational Dashboards (with KPIs)

6

Establish Organizational Support

- Establish Data Governance
 - Geospatial Data Standards (CAD/GIS/BIM)
- Define Policies & Procedures
 - Data Development & Maintenance Procedures
 - Data Submittal Requirements & 3rd Party Requests
- Document Workflows
 - Resources
 - Roles and Responsibilities
 - QA/QC



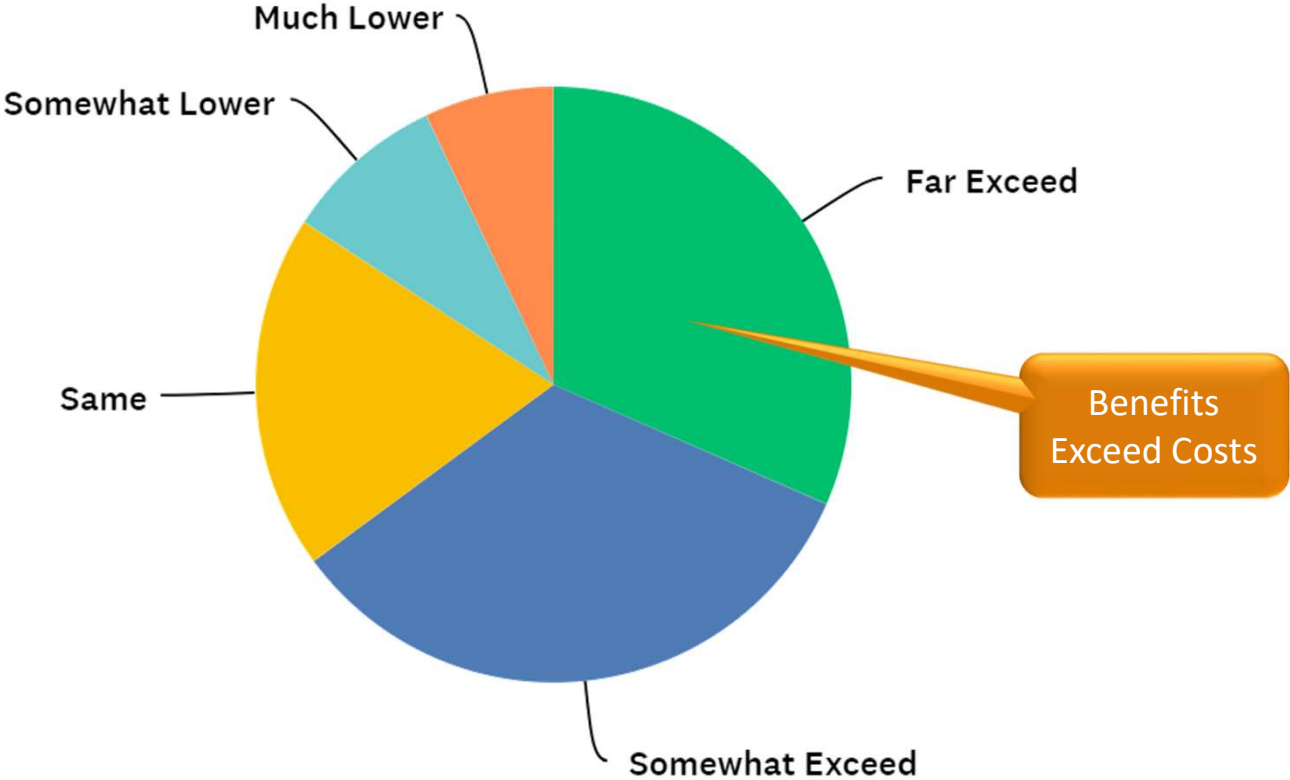
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What Does it Cost?

- “It costs millions and requires a lot of staff to support” ... an unfortunate and common misconception
- Costs vary depending on an airport’s needs and resources
 - Some have leveraged existing airport, city, or country staff; acquired minimal software licenses sometimes through an existing ELA; and engaged consultants on limited or on-call contracts to help them get started for **under \$100k**
 - Some have several people on staff; established enterprise systems; and engaged multiple consultants on on-going support tasks for **\$1-2 million**
- Seeking grants of \$50-250k for FAA AGIS data collections is a great way to get started

Benefit's Exceed Costs



Staffing a Geospatial Program

- Identify Tasks and Processes
- Group into Roles
- Describe Skills Required
- Estimate Level of Effort
- Cross-check with Peers

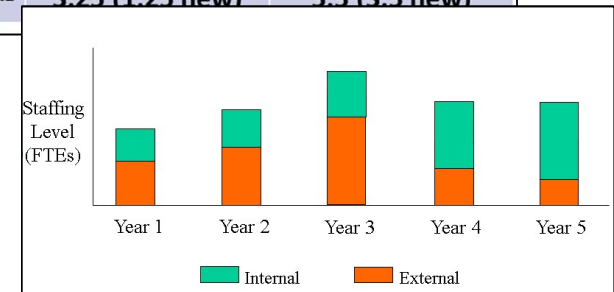
Airport Integrated Mapping Program (AIMS) Cost/Benefit Model

Costs Over Time

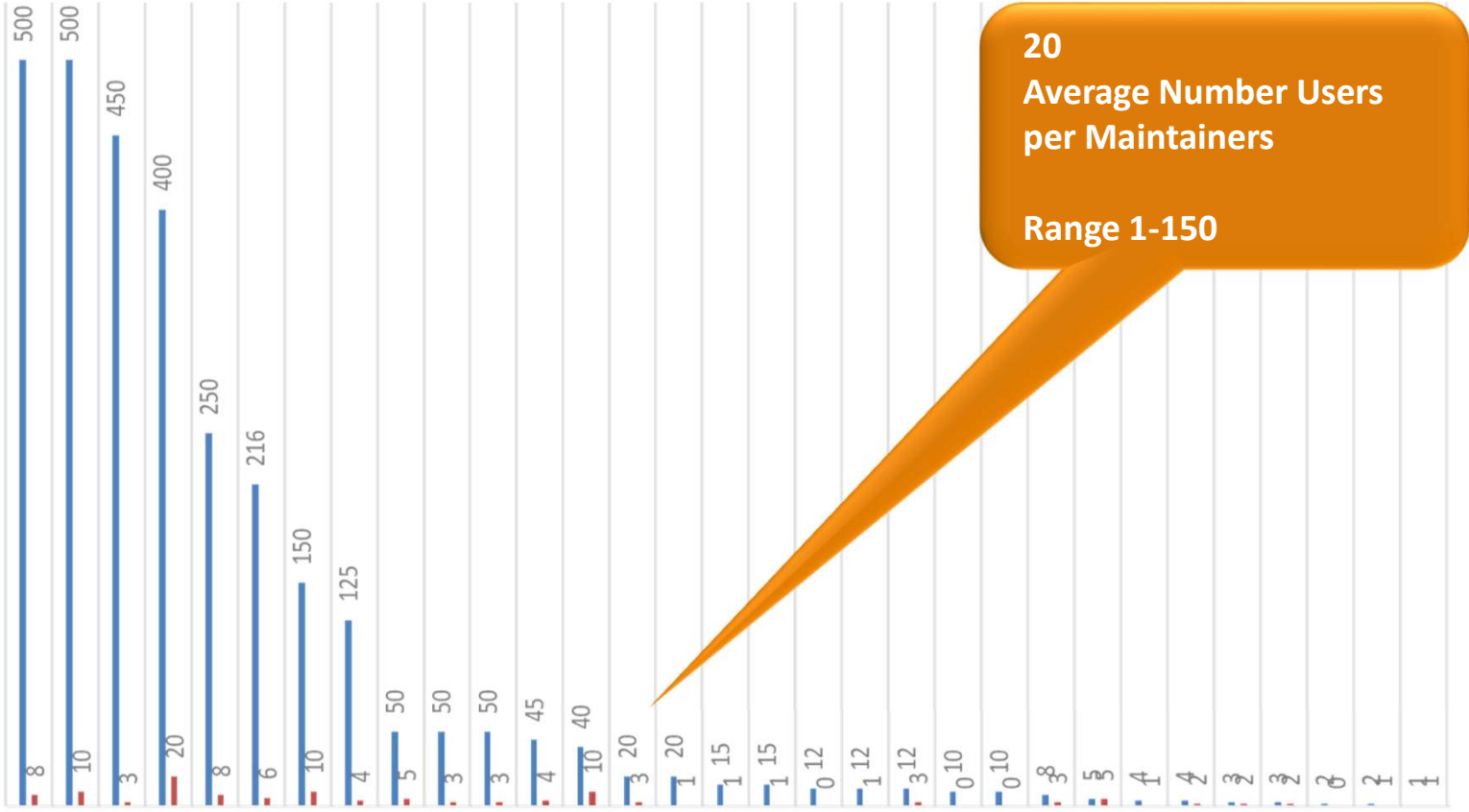
WBS Activity/Item	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL	NPV
0 Add SJC AIMS Custodian Staff													
0.1 Training													
0.2 Check O&A Systems Integration Web Programmer													
0.3 GIS Analyst													
0.3.1 EDMS Librarian													
0.4 GIS Analyst													
0.6 GIS Analyst													
Staff Related Costs													
TOTAL AIMS RELATED COSTS													
0 New Fiscal Year AIMS O&M Bur													
0.1 Year 1													
0.2 Year 2													

Staff Role	FTE Years 1-2	FTE Years 3-5
Data Coordinator	1.0	1.0
Data Maintainer- GIS	1.0	2.0
Data Maintainer- CAD	1.0	2.0
Data Maintainer- BIM	0.25	0.5
TOTAL	3.25 (1.25 new)	5.5 (3.5 new)

	Internal Resource	Potential for Outsourcing
Program Manager	★	★
Visionaries	★	★
The Integrator		★
Champions	★	★
Module Leads		★
System Administrators	★	★
Software Developers		★
Database Designers		★
Distribution & Operations	★	★



Number of GIS Users & Maintainers



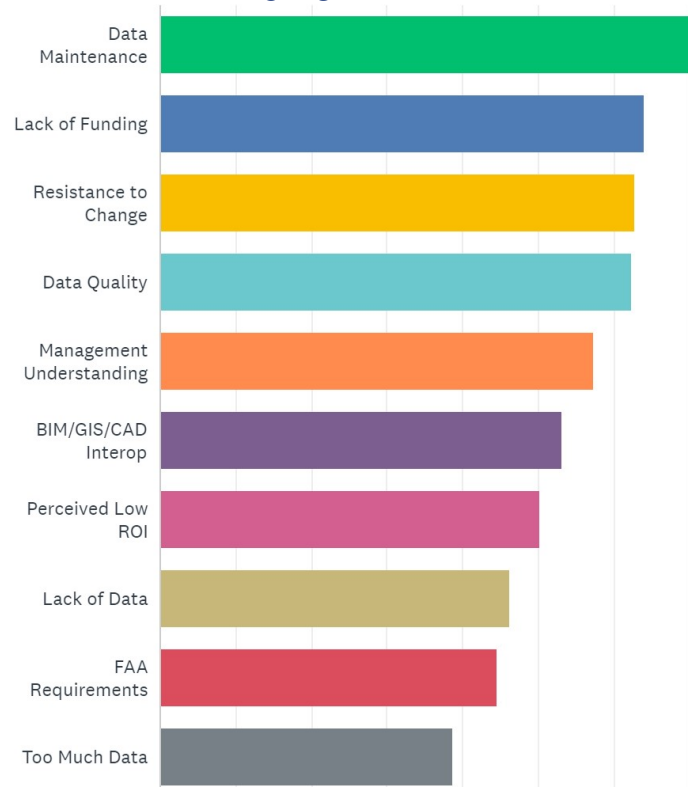
20
Average Number Users
per Maintainers
Range 1-150

Agenda

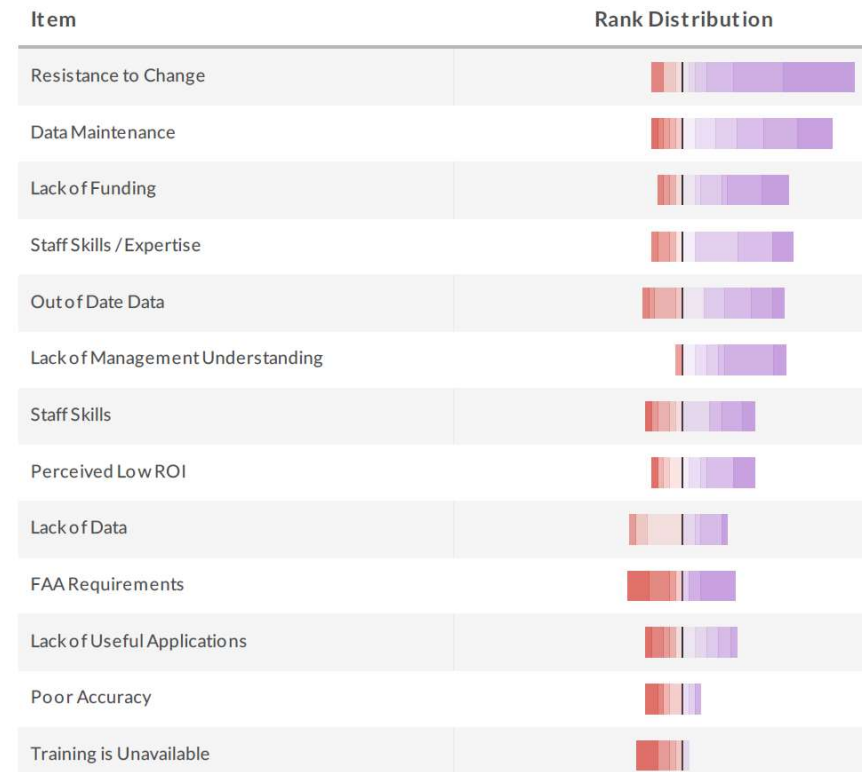
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Challenges Faced

2019



2016



Challenges Overcome

Organizational Placement

- Not Unanimous
- Often Fragmented
- Typical Options:
 - IT, Planning, Engineering
- Factors to Consider
 - Staff Skills and Interest
 - Managerial Support
 - Organizational Roles

Acceptance of Change

- Change Models
- Important Strategic Questions
 - What is the impact to IT?
 - Structure of Group
- Staffing, End Users
- Support Users with New Tools
- Training and Development
 - People Before Technology

Questions & Answers



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