ArcGIS for Aviation

David Wickliffe
What is ArcGIS for Aviation?

- Part of a complete system for managing data, products, workflows, and quality
- ArcGIS for Desktop extension
  - Specialized Aviation data models, data management and cartography tools
- Integrates with ArcGIS for Server and with other Desktop extensions
  - ArcGIS Data Interoperability
  - ArcGIS Workflow Manager
  - ArcGIS Spatial Analyst
  - ArcGIS 3D Analyst
ArcGIS for Aviation
Two Extensions

• ArcGIS for Aviation: Charting
  
  *Efficiently create, maintain and publish aeronautical products*
  
  - Focus: aeronautical charts
  - Audience: aviation agencies, air navigation service providers, airlines, and commercial aviation businesses

• ArcGIS for Aviation: Airports
  
  *Manage, review and analyze airport operations infrastructure data*
  
  - Focus: airport facilities
  - Audience: airport authorities, contractors
• 2002 NGA came to Esri with concept of database-driven Aeronautical charts

• 2005 (v9.1) PLTS Aeronautical Solution – 1st release
  - NGA-centric, some EUROCONTROL chart functions

• 2006 (v9.2) AIS data model introduced

• 2010 (v10.0) Renamed Esri Aeronautical Solution
  Airports GIS Package @ Resource Center on ArcGIS.com

• 2013 (10.2) ArcGIS for Aviation = 2 extensions
  - ArcGIS for Aviation: Charting
  - ArcGIS for Aviation: Airports
ArcGIS for Aviation: Airports
ArcGIS for Aviation: Airports

- Improves data quality and supports regulatory compliance
- Ready to Use Airport Geodatabase
- Automated Airport Data Quality Tools
- Template-based Editing Environment
- Preconfigured Templates
- Obstruction Identification Surface Tools
Supports regulatory compliance
ArcGIS for Aviation: Airports

- FAA Airports GIS Program
  - Collect comprehensive airport spatial data rather than paper airport plans or non-standardized CAD from Airport authorities
  - FAA AC 150-5300 18B specification
- Data model based on FAA Airports GIS, 18B spec
  - Feature Datasets
  - Domains
  - Metadata
- Automated Export for Submission to FAA Airports GIS
Automated Airport Data Quality Tools
ArcGIS for Aviation: Airports

- ArcGIS Data Reviewer
- 450+ Automated 18B schema data checks
  - Reviewer batch jobs (.rbj files)

- Report Quality Information
- Document QC Review Process
  - Data Accountability

Submit quality data for faster acceptance and less rework!
Preconfigured Templates
ArcGIS for Aviation: Airports

• Preconfigured Group Layer Files
• Feature Template editing interface
  - Preset attribution and geometry tools
  - Drop Down Domain Selection
    - Reduces Data Entry Errors
• Sample Airport Layout Plan map documents
  - Airport Land
  - Airport Overview
  - Runway Environment
  - Data Editing
• Customize to support Planning and Operations Activities
Obstruction Identification Surfaces Tools
ArcGIS for Aviation: Airports

- Automated and efficient generation
- Parameter-based feature construction
- Domestic and International Specifications
  - FAR Part 77
  - AC 150/5300-18B
  - ICAO Annex 14 & 15
- Use on the Desktop or Deploy as a GP Service
ArcGIS for Aviation: Charting
ArcGIS for Aviation: Charting

- True GIS-based platform to manage aeronautical data

- One of the Mapping and Charting Solutions
  (Along with Production Mapping, Defense, Maritime)
  Includes:
  - Esri Production Mapping
  - ArcGIS Data Reviewer for Desktop
  - Task Assistant Manager
ArcGIS for Aviation: Charting

- Data-driven aeronautical charting solution - streamlines chart production
- Configurable to support industry and organization-specific requirements
- Improves data quality and supports regulatory compliance
ArcGIS for Aviation: Charting

• Create all types of Aeronautical Charts
  - Enroute
  - Sectional
  - Terminal Procedure Charts
  - Airport Diagrams
  - Various other products
Key Features of ArcGIS for Aviation: Charting

Centralized Data
- Features
- Metadata
- Rules
- History
- Replication
- Services
- Products

Specialized Tools
- Manage Products
- Create and Edit Data
- Custom Callouts
- Detailed Cartography
- Variety of Chart Elements

Workflow
- Manage jobs
- Assign Jobs
- Attach Documents
- Receive Assignments
- Keep Tasks Organized

Quality Control
- Rule-Based Editing
- History
- Validation
- Multi-User Environment
Data-Driven Production
Centralized Data

- Data lives in a central location = Production Database
- Not ‘living’ in separate products
- Not having to be edited in many separate products
- Data is updated once and applied to all chart products via rules.
Aeronautical Information System (AIS)
Centralized Data

- Data model based on Aeronautical Information Exchange Model (AIXM)
  - World standard for management and distribution of
digital Aeronautical Information System data.

- Enables aeronautical information management, charting, and data exchange

- AIS is required to support the charting tools in ArcGIS for Aviation: Charting
Product Library
Centralized Data

• Separate from AIS Production Database
• Store and manage chart products
  - Browse by tree structure
  - Version controlled
    - chart mxds, additional files of any type

• Ancillary Info
  - Spatial references
  - Visual Specifications
  - Masking rules
ArcGIS for Aviation

Tour the Product Library
David Wickliffe
Data Management and Editing Tools
Specialized Aeronautical Tools

- Data Management
- Editing
- Annotation
- Layout
- Terminal Procedures
- Obstruction Identification Surfaces and Analysis

…and many more Production Mapping and core ArcGIS tools
Feature Builder
Specialized Aeronautical Tools

- Create, derive and edit complex geodesic features
- Geodetic, Cartesian and Compsys spatial functions
  - Several for creating Airspace and aeronautical procedure legs

Creating a holding pattern procedure leg
Aeronautical Map Surrounds
Specialized Aeronautical Tools

- Chart leads (anno outside the data frame)

- Aviation North Arrow

- Cruising Altitude Diagram

- Aviation Scale Bar
Database Driven Map Surrounds
Specialized Aeronautical Tools

• Graphic Table Elements (GTE)
  Highly customizable to show a variety of map surrounds
  pull data from the production database
  • tables
  • titles
  • legends
Database Driven Map Surrounds
Specialized Aeronautical Tools

- **Database Elements**

  Chart surrounds can be saved to Database Elements database
  Can be inserted into other chart products as needed
  Used ‘as is’ or as template
AIXM Toolset
Specialized Aeronautical Tools

- Import AIXM 4.5 and 5.1 data to AIS
- Export AIXM 4.5 xml messages from AIS
- Customize/extend with ArcGIS Data Interoperability
Reviewing Quality and Reporting Changes

Quality Control

• Change Reporter Tool
  • Traceability
  • Reports adds, mods and deletes to feature classes, tables, and data-driven chart elements
    • Single feature class or entire Geodatabase
    • Between specified dates or versions
      • Can track changes per charting cycle
  • Changes are committed to the Data Reviewer table for verification

ArcGIS Data Reviewer
• Review, Correct and Verify
Workflow-based Operations

Workflow Support

ArcGIS Workflow Manager
- Manage GIS and Non-GIS Tasks
- Construct logical workflow ‘jobs’
- Assign jobs to resources
- Track job status

• Stores a job history
  - Use for chart maintenance log

Standardize Your Best Practices – Structured, Repeatable and Efficient
Workflow-based Operations

Workflow Support

- **Task Assistant Manager**
  - Workflows within ArcMap
  - Chains procedures and tools together
    - guides users through defined processes
  - Execute ArcMap commands or geoprocessing tools
  - Embedded Help window
    - Excellent for training
  - Supports standardization and best practices
Solution Key Concepts
Leveraged to support database driven charting

- Spatial ETL – ArcGIS Data Interoperability
- Cartographic Features
- Visual Specifications
- Feature-Linked Annotation
Spatial ETL – ArcGIS Data Interoperability

- Extract, Transform, Load (ETL)
- Used to make Custom Spatial ETLs for automated data updates
- Required for AIXM Import/Export tools
Cartographic Features

Carto Commander

- Cartographic Features = Geometric copies of master aeronautical features
- Attributes control symbology, annotation and visibility on chart-by-chart basis
- Cartographic features can be modified while maintaining the integrity of the master features
  - can be moved to support cartography
    - Deconflict coincident features
    - Include Not-to-scale features
Visual Specifications

- Automated approach to define chart symbology and label expressions
- Specification Rules can be maintained in Product Library
- Rules are composed of relational queries and VB expressions
- Output are Calculated Fields and/or Calculated Representations
- Support complex logic
  - Calculated Fields can be used as Annotation source – or as inputs to other Rules
  - Processing Order is important
Creating Visual Specifications

**SQL Statement**
Pulls attributes from related tables

**Expression (VB)**
Outputs result as Calculated field or Rep value
Visual Specifications

- Calculate Visual Specifications GP tool
  - applies representation symbology and calculates label fields for multiple layers.
Feature-Linked Annotation

Aviation Create Feature Linked Annotation

• Creates chart specific annotation for cartographic features

• Extends annotation creation behavior:
  - Appends new annotation features to existing feature classes.
  - Creates annotation for specific products based on input product library instances.
  - Supports Visual Specifications (VST) expressions assigned to fields.
  - Creates advanced annotation such as advanced callouts and Vertical Morse Code
Basic Charting Workflow

David Wickliffe

ArcGIS for Aviation
FAA Enroute Automation
Data-Driven Charting

FAA AeroNav Products and Esri

...Starting from textual and tabular aeronautical data to press ready exports that meet spec
FAA Enroute Automation

Data-Driven Charting

- Data Loading
- Charting Logic and Symbology
- Chart Product Specs
- Initializing Prototype charts
- Press Ready Output

+ Tool Development

...Starting from textual and tabular aeronautical data to press ready exports that meet spec
Data Loading

FAA Enroute Automation

- Data mapping FAA & NGA Source to AIS Destination
### Data Loading

**FAA Enroute Automation**

![Image showing a computer screen with a text editor and geographic data]

#### Geographic Data

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L AN 0015 00524 A19</td>
<td>Airport Reference Point Latitude (Formatted)</td>
</tr>
<tr>
<td>L AN 0012 00559 A195</td>
<td>Airport Reference Point Latitude (Seconds)</td>
</tr>
<tr>
<td>L AN 0015 00551 A20</td>
<td>Airport Reference Point Longitude (Formatted)</td>
</tr>
<tr>
<td>L AN 0012 00566 A202</td>
<td>Airport Reference Point Longitude (Seconds)</td>
</tr>
<tr>
<td>L AN 0001 00578 A1A8</td>
<td>Airport Reference Point Determination Method</td>
</tr>
<tr>
<td>L AN 0001 00556 A21</td>
<td>Airport Elevation (Nearest Tenth of a Foot MSL)</td>
</tr>
<tr>
<td>L AN 0005 00587 E28</td>
<td>Magnetic Variation and Direction</td>
</tr>
<tr>
<td>L AN 0004 00590 E28</td>
<td>Magnetic Variation Epoch Year</td>
</tr>
</tbody>
</table>

![Image showing text editor with data entry and geographic data]

**Excerpt from the data:**

```
RMK90950. A40-08/26 FIXED INTST AVBL ONLY ON REQ.
RMK90950. B100 NORTH CAICOS INFO SVC.
APT90950. A1 9209 148ASPM TURKS AND
ATT90950. A110-1 BIRD AND ANIMAL HAZ.
RMK90950. A110-2 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 7,585 GALS
RMK90950. A110-3 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 3,025 GALS
RMK90950. A110-4 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 7,585 GALS
RMK90950. A110-5 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 3,025 GALS
RMK90950. A110-6 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 7,585 GALS
RMK90950. A110-7 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 3,025 GALS
```

![Image showing data loading process]

**Notes:**

- **RMK90950.** A40-08/26 FIXED INTST AVBL ONLY ON REQ.
- **RMK90950.** B100 NORTH CAICOS INFO SVC.
- **APT90950.** A1 9209 148ASPM TURKS AND
- **ATT90950.** A110-1 BIRD AND ANIMAL HAZ.
- **RMK90950.** A110-2 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 7,585 GALS
- **RMK90950.** A110-3 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 3,025 GALS
- **RMK90950.** A110-4 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 7,585 GALS
- **RMK90950.** A110-5 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 3,025 GALS
- **RMK90950.** A110-6 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 7,585 GALS
- **RMK90950.** A110-7 FIREFIGHT EQUIP: THREE FOAM TENDERS, EACH 3,025 GALS
Data Loading
FAA Enroute Automation

- Custom Spatial ETLs developed
- Workflow Manager
Charting Logic and Symbology Specs
FAA Enroute Automation

- FAA provided Specs for Symbology and anno
- Charting Logic Flowcharts
Charting Logic and Symbology Specs
FAA Enroute Automation

• Logic and Chart Specs worked into
  - VST Specifications
  - Representation Rules
Chart Product Specs
FAA Enroute Automation

• FAA specs also included:
• Chart Layouts
• Surround elements
• Spatial reference info
Chart Product Specs
FAA Enroute Automation

• Worked into a Product Library
New Tool Development
FAA Enroute Automation

- Throughout Charting Phase
- Better automate FAA charting requirements
- Enhance existing tools

- Esri Staff used for chart initialization
Press Ready Output
FAA Enroute Automation

- Production PDF enables Press Ready PDF export from ArcGIS for Desktop.
  - screen to Spot color mapping
  - %Tint and Overprint control
- FAA provided screen to spot color names for use with their commercial printer
Press Ready Output

FAA Enroute Automation

- FAA requires export to multiple formats
- Batch Export Products was developed
- Can export all or selected Products from the Product Library tree
- Simultaneously Export:
  - PDF
  - Layout GeoTIFF
  - Production PDF for commercial printing
FAA Enroute Charting

Enroute Low Alaska Chart

Location: Alaska L-1 Juneau and Vancouver Areas
Location: Alaska L-1 Vancouver Area
FAA Enroute Charting

Enroute Low US Chart

Location: US L-34 New York Area
FAA Enroute Charting

Enroute High/Low Pacific Chart

Location: Pacific
Further Info

Visit the ArcGIS for Aviation Resource Center

Thank You!

Next: Demo by William Reynolds