The Goals for Pipeline Survey

• Take Survey Shots
• Keep Track of the Shots and Shot Codes
• Convert Survey Shots into
  – Line lists
  – As-built & pipe tally reports (spread sheets)
  – CAD drawing files
• Keep Pace with the Project
• Report Daily Progress
Other Survey Challenges

- Mobilize and Demobilize Surveyors
- Manage Multiple Crews
- Merge Data Files from Multiple Crews
- Keep Field Note Books Consistent with Pipe Tally and As-Built Reports
- Coordinate with other contractors
- Quick delivery after project is finished
Wouldn’t it be Nice if

• Construction/Survey Status Was Simple
Data Management Options

• Spreadsheet and CAD
• Use a Desktop GIS Product (Arc View)
• Use an Enterprise Database (Arc SDE)
• Use an Enterprise Database with a Web Based Service (ArcGIS Server)
For Long Pipelines

• A Spread Sheet won’t cut it
Justification for ArcGIS Server

• **As the Length of a Pipeline Increases**
  - The effort required to manage records and documents increases

• **As the Number of Contractors Increases**
  - The effort required to manage and communicate all parties increases

• **As Project Size Increases**
  - The need to have multiple data editors on the project increases
What ArcGIS Server Provides

- Easier Record Management
- Easier Document Management
- Multiple Stakeholders Accessing the Current State at Concurrently
- Multiple Editors Scrubbing the Data at One Time
- Ease of Producing Reports
  - Pipe tally and As-built
- View Status Map via Web Browser
Who are the Stakeholders?

- Financial Institutions (Funding Source)
- Pipeline Companies
- Project Manager
- Individual Sub-Contractors
  - R.O.W. Agents
  - Environmental Assessment Scientist
  - Surveyors
  - Engineers
  - Welding Companies
  - Inspectors
Pipeline Construction Challenges

- ROW Agents and Tract Management
- Field Book Notes
- Pipe Tally
- Control Stations
- Documents
- Permitting
- Environmental Assessment
- Inspections
- Survey Shots

Right of Way Information Management System

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Motivation to Alter Process

• Internal and External Clients were Requesting Help with Data/Records Management

• Surveyors and Engineers Realize the Benefits of a Database Approach

• GIS and the Web has Long Been Viewed as an Integration Technologies
The Importance of Speed, Accuracy

• **Speed** -
  - Depending on length of construction the pipeline operators can lose up to $70K per day from the time the funding is acquired to the time of moving product through the pipeline.
  - Backfilling the pipeline occurs soon after the pipe is welded together.

• **Accuracy**
  - DOT requires operators to know their pipeline and prove its integrity.
Phases of Pipeline Construction

- **Preliminary Survey**
  - R.O.W. Acquisition
  - Survey Preliminary Alignment
  - Prepare Drawings to Secure Permits
  - Perform Environmental Assessment

- **Construction Survey Staking**
  - Stake the R.O.W., work areas, pipe alignment

- **Construction (As-Built)**
  - Collect points along the constructed pipeline
Survey Process for Each Phase

- Collect Survey Points with Codes and Record Surveyor Notes in Field Books
- Export Points and Upload Points to Database
- Verify Points and Notes
- Produce Deliverables
Start with Line List and Tracts

- Line List and Tracts
- Linked Image and Table
Why Utilize a GeoDatabase?

- Link Survey Shots to Database Records
- Create Graphics using Python Code
- Link Graphics to Database Records
- Use Standard Database Technology to Enforce Data Integrity
- Easily Served to the Web
The Technical View

- Right of Way Information Management System

- .NET Silverlight / Web Map App

- ArcGIS Server

- SQL Server

- ArcSDE

- ArcPy – Python Scripting

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As-Built

• **As-built Graphics in Sync with As-built Table**

• **Edit As-built Table to Create Map Graphics**

• **Post Editing - Records are converted to feature classes**
As-Built and Pipe Tally

- Shots Synched with Graphics and Tally
Document Links

• Any Document Such as
  - Survey exhibits,
  - Engineering drawings,
  - Photos and scans of field note book pages
  - X-rays

• Can be linked to any feature
  - Tracts
  - Survey Points
  - Crossings
  - Joints
Access Documents & Drawings

- **Shot Table and Map linked to Field Book PDF**
Some Challenges

• Surveyor Standards Not Always Followed
• Performance on Large Data files
• Client Specs Vary from Project to Project
• Workflow Varies from Project to Project
• Multiple Project Managers with Different Views
Conclusions

• **ArcGIS Server is a Very Useful Tool to use Store and View Field Data through a Web Browser**

• **SQL Server is an excellent tool to manage, store and retrieve survey data and associated documents**

• **Allows Data Integrity and Data Lineage from the Field to Delivery.**

• **Export Graphics into Clients Data Format**
Are Clients Satisfied?

- **Web Access to Daily Work**
- **Engineers and Surveyors working off the Same Data Set**
- **Download Tables or Maps any Time**
- **Alerts and Notifications to Daily Progress**
Questions?

Tim Sosinski
SKW, Inc.
Sosinski@skw-inc.com
816.392.7366