UT2526 - Migrating to AutoCAD® Map 3D Enterprise: A Real-World Experience

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Class Summary

This class will present the challenges that were encountered, the methods that were used to overcome the challenges, and the successes that were achieved while migrating a medium-sized municipal electric utility to AutoCAD Map 3D Enterprise software.

Independence Power and Light (IPL) in Independence, Missouri, underwent a full system migration with Autodesk Consulting this year. That migration included replacing many homegrown and legacy systems with modern Autodesk technology as well as integration with, and interfaces to, other systems vital to the utility. Autodesk Consulting performed a full system assessment and worked closely with IPL to develop a road map to successfully make these changes.

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Learning Objectives

At the end of this class, you will be able to:

- Describe how business needs drive migration needs
- Identify potential business areas where project problems might arise
- Explain how Autodesk GIS software and Autodesk Consulting services can help
- Start thinking about your own migration project

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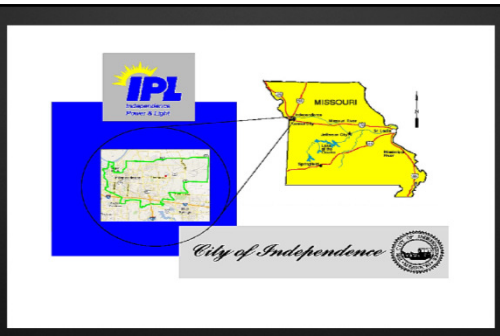
About Independence Power & Light

- IPL has provided electricity to the City of Independence, Missouri for over 100 years - a.k.a. Hometown of Harry S. Truman, 33rd President of the United States
- IPL service area is approximately 93 square miles
- Over 59,000 meters with approximately 5,600 being commercial
- 859 miles of transmission (73.43) and distribution (785.4) and 16 substations
- Generating capability of 262 MW power with coal fired, oil fired and natural gas fired plants - in addition IPL has 15 MW of wind generation



History of CAD and GIS at IPL

- All drawings were done off of sepia topo maps, walked out by IPL field personnel, digitized, then plotted on mylar until 1995.
- Missouri Gas Energy had aerials that they had made AutoCAD drawings of. IPL bought the base maps and added IPL facilities using GenMap software until 1999/2000.
- IPL chose to end its affiliation with Gentry Systems and turned to a private consultant in 2000.
- The consultant normalized the maps against state plain coordinates; resulting in 365 tiles maps.
- While at AU in 2008 the CAD/GIS supervisor attended a session featuring BPU's migration from a homegrown legacy system to AutoCAD Topobase.

History of CAD and GIS at IPL continued…

- On site visits resulted in realizing the benefits of changing systems.
- The decision by management to move to Topobase was made late 2009.
- Contracted with Spatial Network Solutions early 2010 to perform a "Deep Dive System & Software Assessment" of IPL's current systems. IPL also procured SNS as its "eyes & ears" for upcoming Topobase projects.
- By late 2010 IPL signed a contract with Autodesk to participate in the Topobase Quick Start/Pilot program.
- A gap analysis was conducted to identify where IPL had data gaps that did not meet the functionality of Topobase.

Summary of Systems at IPL Integrated with GIS

- Autodesk Topobase client runs on top of AutoCAD and all of the Topobase Server spatial and aspatial information is stored in Oracle and Oracle Spatial
- A customized Fastlook based web GIS system is accessible company-wide. All map information is read directly from the native SQL Spatial data and provides searching and reporting capability
- SQL based customer information
- SQL based Work Order Management system
- SQL based home grown Outage Management
- Limited Osmose field inventory data stored in Oracle

Client Perspective on Migration

Where We Started

- The current GIS was not fully functional. i.e. different landbases, bad and duplicated data & home grown "programming", etc.
- Current GIS/CAD Supervisor found out about Topobase while at AU and began preliminary discussions with BPU.
- I learned more about GIS & mapping in several sessions than an entire week of training on our then current system
- The seed was planted that there was something out there other than our home grown system.
- The decision was made to participate in the Quick Start program.
- We secured the services of an outside consultant to help guide us through the processes that were to follow.

Hatching The Plan – Phase I

- The first CSO/Phase I with Autodesk was inked – Autodesk would provide 328 hours of consulting services to IPL i.e., technical support for IPL planning, deployment, design and training – plus PM and on site work/training.
- Phase I was more geared toward the user and much more helpful. Autodesk provided assistance in the following areas: symbol libraries & templates, Topobase rules and modification, database back-up strategies, license & software deployment strategies, assisting in implementing Topobase Web and MapGuide Enterprise (AIMS).
- Autodesk continued working on discrepancies and requests from us to bring us up to speed.

Hatching The Plan – Phase II

- Working with SNS we developed a Project Charter which identified IPL's Project Vision, top 3 project goals, implementation questions, stakeholders and win conditions, references of current maps & drawings, project scope, project processes and executive sign offs.

Vision & Strategy

- We met with Autodesk Consulting representatives, IPL Director's, Managers and Supervisors to discuss our project vision which is:

  Implement a system that will allow IPL to maintain an accurate spatial and electric network that will support interoperability with other IPL systems and support IPL business processes including Outage Management.

- The outage management system is currently slated as the next project in IPL's conversion strategy with AUD to follow.

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Phase III & Continued Work

- Phase III CSO was initiated with Autodesk (Fall 2012) to deliver Map 3D Electrical and Landbase implementation.
- Currently we are have developed the use cases, are working on developing test cases, conducting weekly status meetings, coordinating quarterly executive management meetings, addressing data, symbology elements and other issues as they arise.

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Overall Impression -

- Ease of use and to adapt to since we are an AutoCAD work shop; familiarity of commands, ribbons and other Autodesk functions.
- Connectivity is currently very problematic – with the new system this will be cleared up.
- The new system will encourage interaction between divisions of P&L department – eventually between other departments of the city.
- The web viewer (AIMS) will give access to internal customers with limited or no knowledge of AutoCAD.
- The new system is helping to push Mobile MapGuide to personnel out in the field.
- As-builts will now be expected to help keep the system pristine and up-to-date.
- Regular AutoCAD tools can be used in conjunction with Map 3D.

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Overall Impression continued…

- Since I and my section know and use AutoCAD, working with Autodesk only programs makes us all fortunate and satisfied. We understand it.
- Map 3D will allow the GIS/CAD team to eliminate most problems that occur on a daily basis with our current system – this has not been the case for several years.
- Other division members at IPL are starting to ask questions about the new system and mobile applications.
- Since attending AU networking opportunities and professional relationships have grown and prospered.
- I am impressed with the program and with my implementation team – they are all very professional and knowledgeable. This first phase (of 3) will be a huge leap forward for IPL.

Consultant Perspective on Migration

Migration To Map 3D – Overall Project Structure

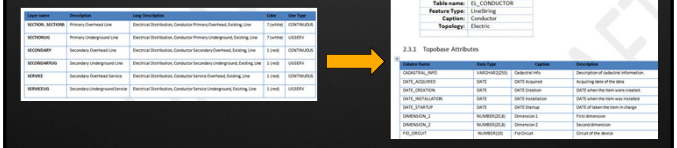
1. Implement Pilot Project
2. Perform Gap Analysis
3. Create IPL Project charter and full Autodesk Implementation Requirements
4. Execute full migration project
   1. Create very detailed migration specifications
   2. Develop initial data migration in tandem with interface development
   3. Deliver initial build
   4. Perform User Acceptance Testing (UAT)
   5. Deploy final migration
   6. Deliver full system including Autodesk Infrastructure Map Server and Mobile MapGuide application
   7. Provide training and support

Migration To Map 3D – Pilot Project

- A small-scale pilot project was undertaken for multiple reasons:
  - To determine if the data could successfully be migrated to Map 3D
  - To determine if all foreseen functional requirements could be met with Map 3D
  - To determine the level of effort for a full migration project
  - To determine the level of effort of integration with existing IPL systems

Migration To Map 3D – Pilot Specifications and Documentation

- A pilot level quantitative analysis was done on the primary feature classes in the old system and all migration specifications documented prior to any pilot migration work occurring

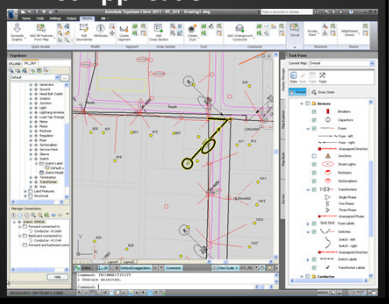


Migration To Map 3D – Pilot Migration

- One substation worth of data was chosen for pilot migration
- The data was cleaned-up prior to migration since we knew that connectivity would not automatically build the way the data was organized.
- The data was migrated using the same basic methodology described for the full migration
- The display model was created to replicate the existing system look and feel
- Some new data, such as GIS data from Community Development, was introduced

Migration To Map 3D – Pilot Application

- Pilot application delivered to IPL
- End-user client application training and administrator training were completed
- Review functionality and display
- Discussion on feasibility of integrating with other IPL applications



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Migration To Map 3D – Gap Analysis

- The pilot system was carefully examined and compared to the full future requirements
- A gap analysis document was created
- This gap analysis together with the initial migration specifications were used to develop the full requirements and migration specifications
- Due to other system dependencies and production state of the systems, two proposed future architectures were developed

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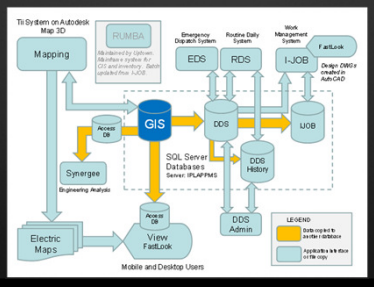
Migration To Map 3D – Gap Analysis. Existing System Architecture



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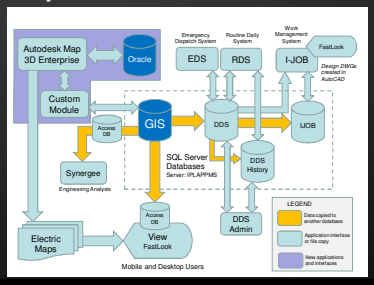
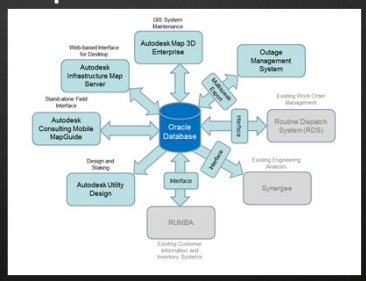
Migration To Map 3D – Gap Analysis. Future System Architecture Proposal 1

Replace only the current mapping system with Autodesk Map 3D Enterprise while keeping all other existing systems intact. SQL Server would be retained and interfaces developed between the new and old systems.



Migration To Map 3D – Gap Analysis. Future System Architecture Proposal 2

Replace the current mapping system with Autodesk Map 3D Enterprise and also replace most other pertinent systems. This option would utilize as many Commercial Off The Shelf (COTS) products as possible and utilize the Oracle database as the primary "Single Point of Truth" for all data with little or no data duplication between systems.



Migration To Map 3D – Full Migration Specifications

Use cases were developed by IPL and utilized as part of a full data migration specifications document. This document is the blue-print for how all existing feature classes are migrated and how new feature classes will be created.

2.10.6 SQL Server Attribute Mapping

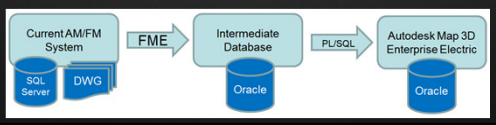
Source	Target	Relationship
EQUIP_NUM	NAME_NUMBER	
AMPS	ID_CUTOUT_CURRENT	EL_CURRENT_TBD.FID
PHASE	ID_PHASE	EL_PHASE_TBD.FID
SECTIONNUM	IPL_SECTIONNUM*	
UPSECTION	IPL_UPSECTION*	
DEV_TYPE	ID_FUSE_TYPE	EL_FUSE_TYPE_TBD.FID
FEEDER	FID_CIRCUIT	EL_CIRCUIT.FID
MAPNAME	IPL_FID_MAPNAME*	IPL_MAPS.FID
X	IPL_X*	SDO_GEOM.X
Y	IPL_Y*	SDO_GEOM.Y
DEV_DESC	IPL_FUSE_DESCRIPTION*	
SECT	IPL_SECT*	

2.10.7 Form Specification

Field Name	Field Type	Data Type	Allowed Values
Job Order Number	Free entry	Char	Any
Fuse Number	autoassignfree entry	Char	Fuse number auto assign with auto assigned number, with ability to free entry for dig numbers
Amperage	Picklist	Char	5, 6, 7, 10, 12, 15, 18, 20, 25, 30, 40, 50, 60, 65, 80, 100, 101, 120, 125, 150, 200, 390
Phase	Picklist	Char	A, B, C, AB, AC, BC, ABC
Circuit Number			
Equipment Status	Picklist	Char	NO, NC, E
Fuse Type	Picklist	char	Lateral, Riser pole, Line
Left or Right Orientation	Picklist	Char	Left, Right
Location			
Installed date	Date	Date/Time	Date/Time
Maintenance date	Date	Date/Time	Date/Time
Comments	Free entry	Char	Any

Migration To Map 3D – Full Migration Methodology

- Data is migrated from the existing DWG files to an intermediate Oracle database
- PL/SQL Scripts are written to migrate the feature geometries to the Map 3D Electric Industry Model feature class while pulling in attributes from the existing GIS SQL Server database.
- Domain tables are also populated in Map 3D based on existing values



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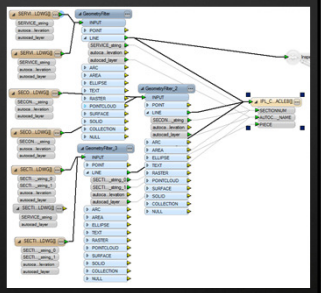
Migration To Map 3D – DWG's to Oracle via FME

Safe Software Feature Manipulation Engine (FME) is used to write the feature geometries and attributes from the 350 individual DWG's into the Oracle intermediate database. This is done on a feature class by feature class basis.

SAFE SOFTWARE

Desktop



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Migration To Map 3D – Populating Domain Tables

- Domain tables are populated using PL/SQL to extract unique values for attributes from the existing GIS system
- Oracle Heterogeneous Services was used to connect directly to the SQL Server database

```
insert into IPL_MAP3DE_ELECTRIC.EL_CONDUCTOR_MATERIAL_TBD (SHORT_VALUE,VALUE)
(select distinct CONDUCTOR,CONDUCTOR from
(SELECT CONDUCTOR FROM dbo.sections@gis where CONDUCTOR is not null
UNION
SELECT CONDUCTOR FROM dbo.secondary@gis where CONDUCTOR is not null
UNION
SELECT CONDUCTOR FROM dbo.service@gis where CONDUCTOR is not null));
```

Key	Value
1	unknown
2	1000_AL/CN_UG
3	2
4	2/0_ACSR
5	2_AAC
6	2_CU
7	350T
8	350_CU/CN_UG
9	477_ACSR

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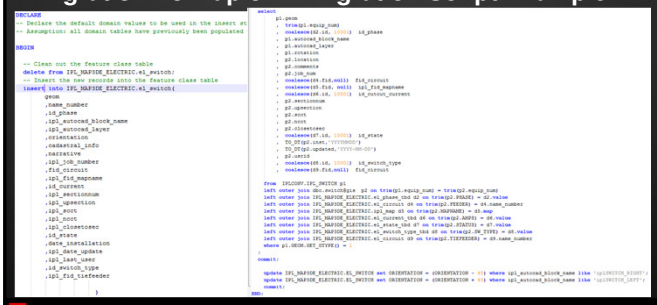
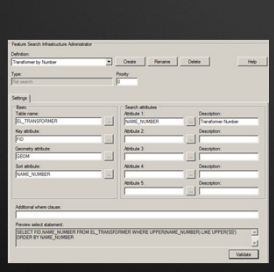
Migration To Map 3D – Migration Scripts

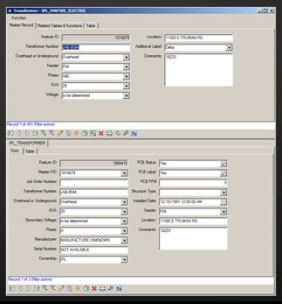
- Out-of-the-box Map 3D Electric Industry Model feature classes were used where they existed. Custom feature classes were created where necessary.
- Custom attributes were added to feature classes where necessary.
- Migration scripts must be written to be re-run during the final migration. They are initially developed based on a snapshot of data.
- They must take into all domain table relationships in the feature classes when the data is populated via the scripts.
- All incoming and outgoing data was analyzed closed and migration statistics gathered for QA/QC purposes.

Migration To Map 3D – Migration Script Example

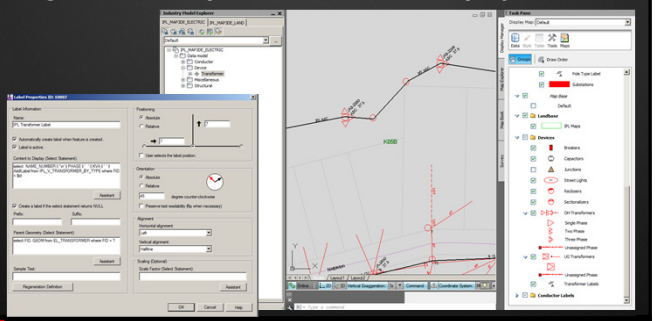


Migration To Map 3D – Forms and Searches.





Migration To Map 3D – Labels and Display Model.



Migration To Map 3D – Data Clean-up

- Majority of data clean-up is being deferred until the final migration is complete. This includes any geometry changes that need to be made for physical connectivity to be built.
- Data problems with the existing GIS that are discovered during migration are forwarded on to IPL so that they can clean-up the data before final migration takes place. This includes invalid data entries in date fields and normalization of domain values.

What's Next?

- Complete initial data migration
- Interfaces workshop in December
- Interface and report development
- Delivery of migrated data
- User Acceptance Testing (UAT)
- Changes to migration scripts where necessary
- Production system frozen and final migration
- Develop and deliver Autodesk Infrastructure Map Server (AIMS) application
- Develop and deliver Autodesk Consulting Mobile MapGuide application


AU