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Executive Summary

Name: Dwayne Honor

Company: Bundaberg Regional Council

Name of Project: Streamlining Workflows – The Integration of 12d, 12d Field and GIS

Awards Result: Third Place (Tied)

For many years engineers, surveyors and designers have worked together and relied upon static data for use in their everyday work flows. Specialist software is traditionally used by each party and data is manually shared among teams by import/export.

Dwayne and Bundaberg Regional Council demonstrated that by integrating 12d Model, 12d Field and Feature Data Object (FDO), it is possible to revolutionise the process, boost productivity and reform historical practice.

In the 2010 and 2011 Queensland floods that affected Bundaberg, 12d Model software with FDO technology along with 12d Field played an important role in not only helping to map catchments during the event, but also in the ongoing reconstruction that is underway and planned for some years yet.





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Entry Form

Name	Dwayne Honor
Position	Manager Design
Company	Bundaberg Regional Council
Name of Project	Streamlining Workflows – The Integration of 12D, 12D Field and GIS
Client	Bundaberg Community

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Relevant 12d screenshots and/or data attached.

Picture 1	One of the many council Roads that washed away in Bundaberg by the Queensland Floods. 12D Model with FDO technology was used extensively during the floods for catchment mapping and has been a large part of the recovery effort.
Picture 2	The FDO download panel built into 12D
Picture 3	The WMS download panel built into 12D
Picture 4	Network schematic of how Design and Survey staff connect to GIS using FDO technology.
Picture 5	Contours from ArcSDE connection
Picture 6	Same shot of Contours, but now with high resolution aerial imagery (using WMS).
Picture 7	Snapshot from 12D Model, typically all the info available to designers prior to this project.
Picture 8	Same snapshot from 12D Model but now using WMS to overlay a Topographic Map, Aerial Imagery and access 250K topo drainage catchments and stream centrelines from ArcSDE. More information at their fingertips means better decisions.
Picture 9	Concept designs can be completed quickly using GIS data, often avoiding expensive site visits.
Picture 10	Councils internal web mapping system. The magenta areas show engineering survey boundaries that have been "written" back to the GIS using the FDO technology
Picture 11	Council Surveyors use Panasonic Toughbooks loaded with 12D Field to run

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	the Robotic Total Stations.
Picture 12	Screen shot of the Toughbook with FDO download panel
Picture 13	Survey field trials using Toughbooks with 12D Field and FDO technology. Wireless broadband allows direct connection back to ArcGIS servers.
Picture 14	Toughbooks attached to survey pole
Picture 15	The surveyor can undertake single person operations. The toughbooks are running 12D Field which operates the robotic total station. The FDO technology allows them to connect to ArcGIS servers at council's main office (via wireless broadband) and quickly navigate to any asset using survey accurate precision.

Description of Project

The advent of new technologies such as 3D design models, high accuracy GPS, robotic total stations, GIS systems, portable computing and wireless broadband provides many tools to the modern engineer and surveyor. But it's the combination of 12D, 12D Field and Feature Data Object (FDO) technology in council that allows for their cost effective integration.

For many years engineers, surveyors and designers have worked together and relied upon static data for use in their everyday work flows. Specialist software is traditionally used by each party and data is manually shared amongst teams by import/export. By integrating 12D, 12D Field and FDO this project has revolutionized that process, boosted productivity and reformed historical practice.

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Description of problem faced / task undertaken

This project was developed as a result of challenging infrastructure delivery requirements following council amalgamations. More efficient methods of collecting and sharing accurate survey, design and “spatial” data were required due to a geographic area of 6500km², limited design and surveying resources, restructure of operations, information technology network capacity and file storage constraints along with increased community expectations.

Council had previously implemented ESRI ArcGIS as its corporate Geographic Information System (GIS). In doing so it provided a central geospatial data store in MGA94 coordinates of all essential data including:

- Contours
- LiDAR
- Aerial Imagery
- Water, Sewer and Stormwater Utilities
- Planning Scheme Mapping
- Flood Mapping

For our organisation, the move to the MGA94 coordinate system in detail surveys through to design enabled us to value add and integrate all of our geospatial data as well. The question was how this could be done without relying on traditional Shape File extractions? How could the surveyors operating in the field also access and utilise such vast spatial resources on demand?

In summary, councils spatial data file sizes were large:

- Aerial Imagery in excess of 550 GB;
- Over 1Tb of LiDAR covering in over 5000 km²;
- And growing each year....

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The following key outcomes were essential to success of this project:

- Establishment of partnership with councils civil engineering software provider 12D Solutions to incorporate FDO technology into their 12D Model product for design and survey;
- Implement a GIS “central data store” with direct linkages to design/survey software for raster and vector data;
- Eliminate need for G.I.S. staff to provide spatial data to Designers and Surveyors;
- Eliminate GIS data duplication and processing issues during civil design and survey, in turn reducing file server storage;
- Provide surveyors on the ground with real time access to all survey, design and geospatial data in council regardless of location.

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How the problem was solved

For many years engineers, surveyors and designers have worked together and relied upon static geospatial data for use in their everyday work flows. They tend to use their own specialist software to manually import spatial data from a GIS system which often includes property boundaries, storm water networks, water and sewer utilities. This often results in establishment of complicated management systems to control data quality and avoid duplication problems when sharing amongst project teams.

FDO Data Access Technology is an application for "...manipulating, defining and analyzing geospatial information regardless of where it is stored...and is free open source software" under a Lesser General Public License (<http://fdo.osgeo.org/>). For council it supported direct access to ESRI ArcSDE data store for vector data and a Web Map Service (WMS) of spatially referenced raster maps. It allows for sharing of spatial information regardless of operating platform.

A staged approach was taken to the implementation of FDO technology in council software to address the GIS connectivity issue. There were three (3) key stages of delivery implemented in partnership with 12D Model software, in order of complexity:

1. FDO provider for WMS – To connect to spatially referenced raster images
2. FDO provider for ArcSDE - "read only" connections for vector data
3. FDO provider for ArcSDE - "write" connections for vector data

Councils more urgent requirements stemmed from access to aerial imagery, this was a logical starting point and proved simplest to implement. All three stages of implementation were in place by late 2010 and are now common use amongst design and survey staff in council.

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The implementation of FDO technology in councils work flows has increased the return on investment (ROI) in our corporate ArcGIS system and 12D Model technology. It has revolutionized how we conduct our operations and is likely to shift those of the wider industry experiencing similar problems.

While data connectivity between the GIS and 12D was resolved, the problem of how surveyors can use the data remotely to the office still existed? Council's old fleet of non robotic total stations had come to their end of life. This provided us a unique opportunity to rethink how we deliver survey to the community and better interact with the spatial data at our fingertips. 12D Field was implemented with new Topcon GPT-9003A robotic total stations to address this problem.

Council surveyors now use Robotic Total Stations and GPS operated by 12D Field software on portable all weather computers (Panasonic Toughbooks). In basic terms this means:

- Conventional survey reductions in the office are no longer required as all data is collected and reduced on the fly, in the field, and instantly viewable on the surveyors screen.
- The visual reference enables instant error checking.
- Surveyors have access to the designer's entire 3D model for stake out, eliminating any requirement for manual data imports and data entry of coordinate tables.
- Full windows functionality and access to remote file servers using NextG wireless broadband connections.

More importantly, it provides one of the only systems in the world that allows us to complete detailed survey using Robotic Total Station accuracy, and from the survey pole, instantly connect to and view any vector or raster data in real time from the ArcGIS system, regardless of our location in the region. This of course is on the proviso that we have wireless broadband coverage. Using FDO connections, a central GIS data store, portable computers and wireless broadband means that as long as the data exists in the ArcGIS system, the

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surveyor can connect to it and stake it out. If they need to access aerial images in the field to see “what’s over the next hill” they can. If they are asked on site by our construction crews to re-identify a water hydrant they just buried with asphalt (even though it wasn’t picked up in their original survey), they can. They can now do these things because council assets such as water hydrants have already been collected accurately by RTK GPS and loaded into the GIS as part of our asset maintenance programs. This makes them locatable using 12D Field by connecting directly to the ArcGIS system. In theory, if the data already exists in the GIS or file server then council can better deal with the “While you’re here can you set this out?” question which haunts the best of surveyors.

Opportunities explored

By using 12D with FDO technology Designers can achieve all the advantages as well, being able to independently access any vector or raster data from the ArcGIS system. It improves efficiencies in investigation and detail design work. The FDO technology also allows “write” access back to the GIS, enabling any CAD/Design work, or survey data for that matter, to be written to ArcSDE. This makes it instantly viewable on our corporate web mapping system to hundreds of staff, or externally to the public through council’s internet mapping if required.

For example, being able to “write” data back to the GIS directly from the surveyor’s pole in the field allows them to collect accurate spatial data and instantly publish to ArcSDE where it could be viewed on the internet using web mapping applications. This type of scenario was impossible for council to achieve previously but the integration of 12D, 12D Field and FDO technology has now given council the flexibility to do so whilst removing redundancy of data in the process.

Since FDO technology has been implemented in council many other applications for its use are being found. The most recent has highlighted significant benefits in data validation of spatial information. As designers connect and view the data, they are also able to validate it against survey accurate information that has been collected. It adds to the process of

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continuous improvement as more eyes looking at the data often leads to errors being found quicker and rectified faster to the benefit of the whole organization and wider community.

Spatial views are another development that council has applied within ArcSDE. By using unique ID's attributed to vector data, features such as road centrelines, water, sewer and stormwater utilities are "linked" to the corporate asset management database and now accessible via the FDO technology. Many thousands of attributes describing the asset can be viewed within 12D. This includes basic information such as pipe diameters, material type and condition assessments through to more detailed info such as remaining useful life (RUL), road pavement and surface types, widths and roughness values. Strategically, it satisfies the "single point of truth" issue and means that Asset Officers can be independently updating data which is refreshed through the GIS and ultimately 12D ensuring data is current.

Queensland Floods

Bundaberg like many Queensland towns flooded twice during the 2010 and 2011 floods. Hundreds of houses were inundated and many roads washed away. The damage bill to Bundaberg Regional Councils road network is estimated at \$60M. Queensland wide the cumulative bill is in the order of \$7.5 billion making the floods of 2010-2011 the largest and most expensive series of natural disasters in Australia's history. 12D Model software with FDO technology along with 12D Field has played an important role not only helping to map catchments during the event, but also in the ongoing reconstruction that is underway and planned for some years yet.

Key benefits of the project:

- Council design and survey staff can independently access current spatial data in real time without the need for asking GIS personnel. If a dataset is updated on the GIS, it can be simply refreshed within 12D;

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- Value adding of existing software licenses by allowing access to spatial data without having to learn or understand another software package. E.G. From 12D Model Designers can connect to and manipulate data in ArcSDE;
- Single point of truth for GIS data is established avoiding currency problems with multiple “versions”, especially on large projects;
- Reduction of data duplication and file server storage (no export of static datasets and saving them to project files);
- Better decision making in design with access to unlimited geospatial data;
- Reduced strain on wireless networks because staff don't have to import and export 100Mb+ files anymore;
- New ability to access topographic maps and large volumes of aerial mapping which can be overlaid on designs making them easier to interpret;
- Better error checking and validation of spatial data.
- Preliminary designs and initial investigations can now be done direct from GIS data such as high resolution aerial photography, utility schematics, contours and LiDAR point clouds saving time in field trips.
- New ability to “publish” design and survey data to the GIS for display internal or external to the organisation.

Benefits are extensive to our council as this project now provides spatial data from a GIS directly at the fingertips of those staff who use it most, better still it can be remotely accessed from the survey pole, on demand, in the field!

Commitment to Sustainable Practice

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Sustainability is about reducing long term cost through collaborative development. FDO technology is an open source solution; as such its ongoing development is driven by a worldwide user group.

During field trials and ongoing use council has been able to make significant productivity gains when considering the difference in time to access spatial data manually versus independently using FDO connections.

Many of the efficiency gains can be difficult to quantify as they aren't always tangible. This includes:

- Savings in file server storage and archival;
- Risk of poor decisions from using old versions of static data;
- Time delays waiting for other staff to provide crucial information for your project;
- The cost of site visits that may not have been required with access to spatial data; and
- Surveyors "return to office" for on-demand requests for data not already pre-loaded to their controllers, but could easily have been sourced remotely from the GIS.

Reduction in Environmental Impact

For councils survey staff, FDO technology and the use of 12D Field provides for less vehicle trips to the office for setting out data previously unknown to them. Along with reducing energy consumption for file server storage and archival processes, it ensures that council's environmental impact is less than historical practice.

Less site inspections are required by designers and surveyors combining the use of 12D, 12D Field and FDO technology. As an example, driving vast distances to ground truth some rural drainage catchments is now replaced using LiDAR point clouds in ArcSDE. Given usage

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over the last 18 months, council has estimated 90km per week in travel savings directly from the use of 12D Field and FDO technology. This equates to an annual reduction of about 1062kg in CO2 emissions for the environment!

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