



Introduction

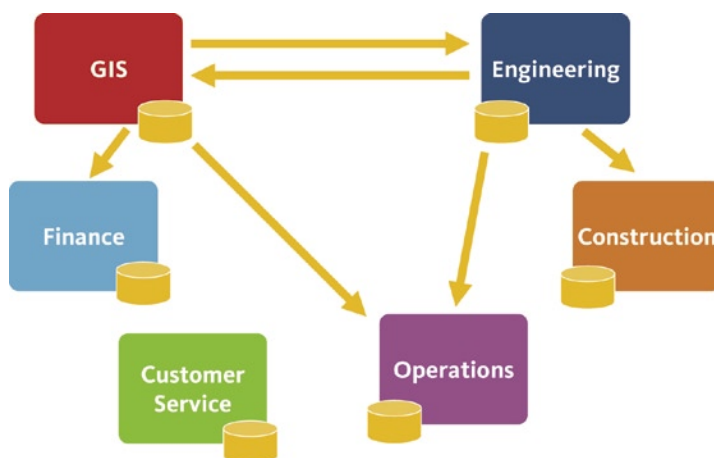
For many organizations, such as governments, utilities, telecommunication providers, engineering firms, and construction companies, geospatial data is critical to doing business. However, many of these organizations are not able to fully utilize their geospatial data because it is stored in many locations—desktops, file servers, CAD (computer-aided design) servers, GIS (geographic information systems) servers, and web servers. Similar data is managed redundantly by different people and across departments—engineers, GIS specialists, and information technology (IT) personnel; each functional entity using, storing, and managing the same data in a unique way.

In this environment, sharing data is a tedious process that often generates errors, reduces productivity, and sometimes leads to costly mistakes. For example, information used by a GIS team in planning and analysis is frequently recreated by engineers in the design phase. Similarly, GIS professionals find ways to import CAD information into their systems, but often find data stripped of much of its valuable engineering detail and attribution—such as text and dimensioning that exist in CAD drawings that isn't typically preserved or read by GIS applications. Because engineers must start designs and rebuild data rather than beginning from a common data source, such as a GIS, organizations lose time by failing to leverage existing and up-to-date data.

Organizations can make huge productivity gains and see cost savings by addressing redundancy, inaccuracies, data mismatches, currency issues, and versioning problems that result from siloed information. Geospatial CAD and GIS data is often not shared throughout an organization or made accessible to the personnel or applications that can utilize the information. It is also very common for professionals to analyze data from multiple sources. For example, on infrastructure projects, many decisions are made during the design process. The earlier a designer can test and modify design alternatives to determine which option is best, the better. To do this, the designer needs information such as the amount of private land that will need to be bought and its proximity to sensitive environmental areas or historic landmarks—information that is typically stored in both engineering and GIS departments and in both CAD and GIS formats.

This white paper details how organizations can fully harness the power of their geospatial data with Autodesk Geospatial. Autodesk Geospatial bridges CAD and GIS systems and extends the value of geospatial data by leveraging existing resources, reducing redundancy and error propagation, and increasing operational efficiency. Autodesk Geospatial grows with an organization, from enhancing CAD mapping with basic GIS functionality to integrating geospatial information with enterprise systems such as enterprise resource planning (ERP) and customer relationship management (CRM) applications.

Business processes are inefficient when data is not available, must be duplicated, or needs to be converted between systems.



With Autodesk Geospatial, organizations can:

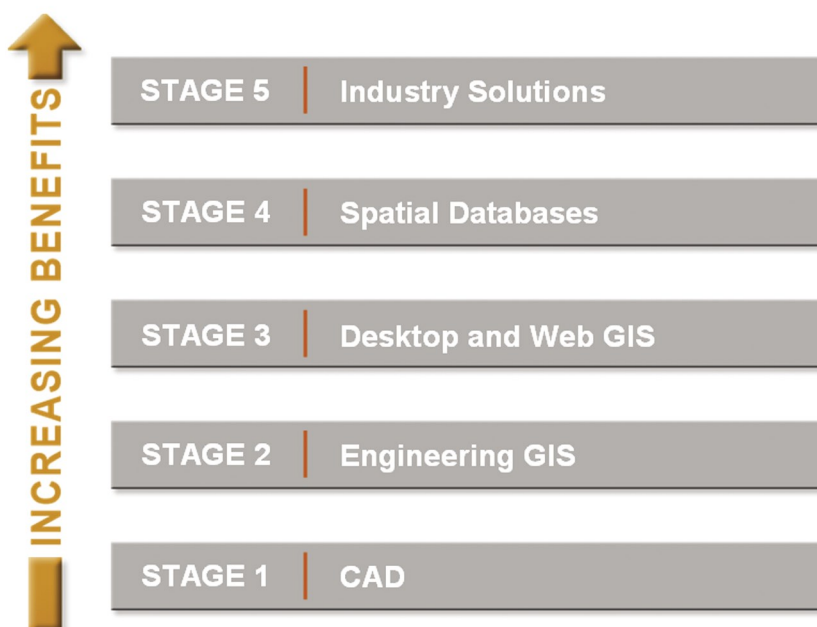
- Work with their existing systems and comply with industry standards.
- Facilitate access to essential information across the organization regardless of the format or location in which it is stored.
- Streamline processes by eliminating disparate systems.
- Create an environment where geospatial data can be constantly improved by leveraging CAD trained staff to maintain and manage asset information within GIS using familiar tools.
- Work with proven, easy-to-learn technology that is intuitive to both CAD and GIS trained professionals.

We will first look at the five stages of the Geospatial Value Chain to show how the value of an organization's information increases with each step up the value chain. Then, we will review the Autodesk Geospatial ecosystem, illustrating how the components of Autodesk Geospatial work together to remove barriers around geospatial data and help organizations to design, manage, publish, and integrate spatial data more efficiently.

The Geospatial Value Chain

CAD and geospatial technologies are developed and deployed in many different ways across industries and even within a single organization. Autodesk has identified five stages that represent how “spatially enabled” organizations typically work with their geospatial information. Together, these five stages are called the Geospatial Value Chain. The Geospatial Value Chain provides a useful model to understand how organizations use geospatial technology. It also provides a deliberate path for growing and extending their capabilities over time. Some organizations get limited value from their data—such as those where infrastructure information is only found on paper-based maps (or Mylar or vellum) or where data is locked in unstructured CAD files and stored in many file systems. Other organizations have more sophisticated, integrated geospatial systems that enable integration and collaboration organization-wide. The Autodesk Geospatial product line supports an organization at any stage, as well as facilitates easy transition from one stage to the other as the organization's needs evolve. By understanding the Geospatial Value Chain, organizations can identify the problems they can solve and the benefits they can realize by moving up the value chain. Let's take a quick look at each stage in the value chain.

The Five Stages of the Geospatial Value Chain



Autodesk Geospatial Product Line

- AutoCAD® Map 3D is the leading Engineering GIS platform for creating and managing geospatial data. AutoCAD Map 3D bridges CAD and GIS by providing direct access to data, regardless of how it is stored, and by enabling the use of AutoCAD® tools for maintaining geospatial information.
- Autodesk MapGuide® Enterprise is an advanced server-based platform for easily delivering spatial data and applications over the web. Autodesk MapGuide Enterprise helps organizations get the full value from existing data and reduces the cost of disseminating spatial information to customers, internal teams, the public, and other enterprise applications.
- Autodesk® Topobase™ is an infrastructure design and management solution that extends the power of the AutoCAD Map 3D and Autodesk MapGuide platforms. Topobase integrates design and asset information in a spatial information database so that departments across an organization can see the big picture and collaborate more efficiently.
- AutoCAD Raster Design, an extension to AutoCAD®-based applications such as AutoCAD Map 3D, unlocks the value of scanned engineering drawings and maps by enabling teams to manage and edit aerial photos, satellite imagery, and digital elevation models (DEMs).
- Autodesk® Design Review is the all-digital way to review, mark up, and track changes to 2D and 3D designs. View drawings, maps, and models with accuracy and fidelity, and then measure and annotate the DWF file before round-tripping the markups for revisions.
- FDO Data Access Technology is the mechanism that enables Autodesk Geospatial products and enterprise applications to work natively with spatial data stored in relational databases, files, and web-based services. FDO Data Access Technology is included in AutoCAD Map 3D, AutoCAD Civil 3D, Autodesk MapGuide Enterprise, and Autodesk Topobase.

STAGE 1

At Stage 1, organizations use a CAD product such as AutoCAD® and AutoCAD LT® to design and manage their infrastructure data. These organizations have often migrated from paper-based, Mylar, or vellum files and store their infrastructure data in CAD files—such as DWG™ drawings—in a file directory on a server. AutoCAD is a world-leading design tool used to create the majority of the world's infrastructure design data. However, AutoCAD does not support geo-referencing (geographic location in the real world), multi-user editing, or GIS data formats. When an organization using AutoCAD needs to add location intelligence to its data, bring in GIS data from other sources, or allow multiple users to edit the same data, it has outgrown Stage 1 and may be ready for Stage 2 or Stage 3.

STAGE 2

Autodesk Geospatial makes it easy for engineers and designers to manage and share mapping data—such as regional scale data sets, cadastral information, and utility network data including pipelines, transformers, and valves. At Stage 2, an organization uses CAD files as its primary data source and an engineering GIS solution such as AutoCAD Map 3D to collaborate and share this infrastructure information. With AutoCAD Map 3D, multiple people can easily access CAD data and work across multiple drawing files. Because more than one person can work on a drawing simultaneously, AutoCAD Map 3D makes it easier to share data or split the workload. Additionally, teams can import and export data sets from many different CAD and GIS file formats—such as ESRI® Shapefiles, MapInfo® TAB files, MicroStation® DGN, and raster data from multiple coordinate systems—and combine it with DWG files and have the information overlay properly. Using AutoCAD Map 3D, project teams can use their AutoCAD skills and training while taking advantage of traditional GIS tools and functions. When an organization wants to extend its CAD information to more people and leverage additional GIS capabilities—to know, for example, where there are undeveloped parcels or how many manholes are on new roads—they are ready to move to Stage 3.

STAGE 3

In Stage 3, an organization increases the value of its data by applying standards and organizing data. By structuring and cleaning up CAD and geospatial data, what is known as “classification,” an organization begins to define data as real-world features with standard allowable attributes. Classification ensures data consistency for all users and increases the value and potential uses of that data. This is where CAD and GIS truly work together. By classifying data and leveraging FDO Data Access Technology—Autodesk Geospatial's data access platform—organizations can enhance the performance of large data sets and use their CAD and geospatial data together to make business decisions; check inventories; or identify specific items, such as the number of cables, valves, or new roads they must maintain.

In Stage 3, organizations store feature data in a structured file format such as Autodesk spatial data file (SDF) or SHP. With SDF, organizations benefit from the power of a spatial database without the cost or management overhead. At Stage 3, organizations can easily extend the reach of their information by using a web mapping application such as Autodesk MapGuide® Enterprise to deliver powerful, easy-to-use online maps and related information to audiences of all sizes.

“With Topobase and Oracle Spatial, we no longer have to maintain multiple data sets, and we have reduced the risk of data entry errors. Our system is definitely helping us to deliver higher quality work, faster.”

—Juergen Biedermann
Documentation and Data
Processing Manager
Stadtwerke Augsburg

STAGE 4

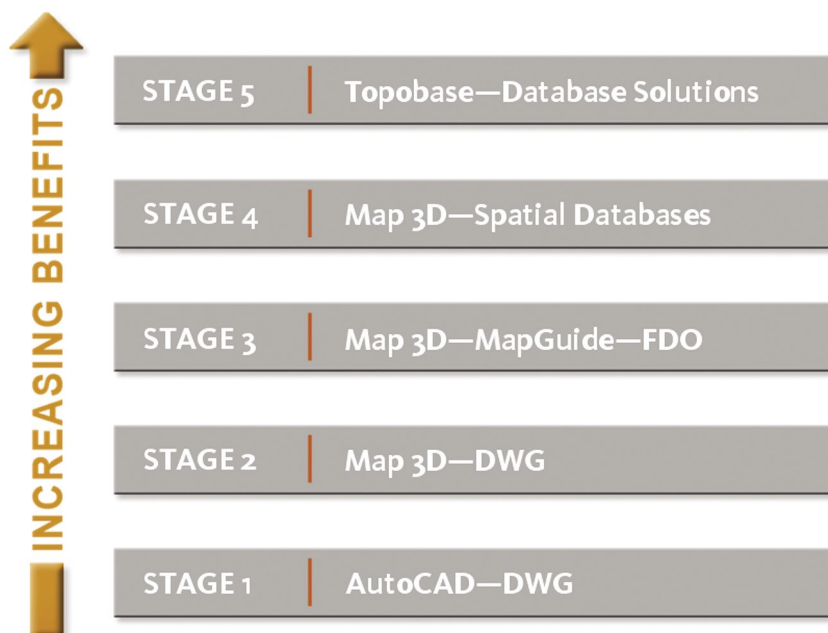
To extend the use of their information, organizations transition from Stage 3 to Stage 4. They move from a file-based environment using DWG, SHP, or SDF to a spatial database environment using the full functionality of a relational database management system (RDBMS). With an RDBMS, hundreds or even thousands of people can create, edit, and manage the same data. With a full RDBMS, organizations get more scalability, as well as added security and the ability to create more sophisticated data models. Using FDO Data Access Technology, Autodesk Geospatial products work natively with spatial data stored in Oracle®, Microsoft® SQL Server™, and MySQL®, as well as with ESRI's ArcSDE® middleware. As a result, organizations are able to fully use the security, scalability, sophisticated data models, and multi-user read/write power of an RDBMS. AutoCAD Map 3D provides tools that make data and schema migration from SDF or SHP files to a full-scale RDBMS easy. While the information in Stage 3 and Stage 4 may be the same, organizations in Stage 4 leverage the added power of an RDBMS to scale the availability and management of their geospatial information.

STAGE 5

When an organization moves from Stage 4 to Stage 5 it shares spatial data with other departments and applications, making spatial data a central part of its IT ecosystem. In this stage, GIS data and functionality get woven into other business systems, integrating with assessor databases, permitting systems, ERP systems, and more. The spatial application server supplies geospatial intelligence and data to these other applications. Autodesk, resellers, partners, and system integrators build powerful solutions to meet the organization's specific business goals and processes. Autodesk Topobase provides sophisticated solution modules that make it easy for organizations to establish and manage a Stage 5 deployment.

By moving up the Geospatial Value Chain, organizations increasingly leverage their geospatial data for a variety of business functions. By making the transition from Stages 1-3, organizations gain the ability to organize data effectively, implement real-world coordinate systems, and work with larger data sets. Moving from Stages 3-5 delivers increased scalability and security, ability to complete long transactions, and integration with other systems.

Autodesk Solutions Support The Geospatial Value Chain



What is SDF?

Autodesk Spatial Data File (SDF) is a GIS-oriented alternative to DWG that is optimized for storing large classified data sets. The SDF file is the native file format for FDO Data Access Technology and leverages all of its strengths: open API (application programming interface), high performance, database-like table architecture, and larger data set sizes. By using SDF files, organizations combat the problem of putting too much information into a DWG—such as regional GIS-scale vector data and attributes (in object data tables)—potentially making the file unwieldy—and lowering its performance. People used to working with DWG files will find SDF an easy format to use. Like DWG, it can store multiple features in a single file, it is portable, and it stores arcs. While it is not a database, it does act like a database in that it stores data, both geometry and attributes, in tables. With SDF, organizations get many of the benefits offered by a database without adding database cost or complexity.

Now let's look deeper into the Autodesk Geospatial product line to see how organizations can use Autodesk Geospatial to leverage their data across departments and applications.

Autodesk Geospatial Product Line: Breaking Down Barriers

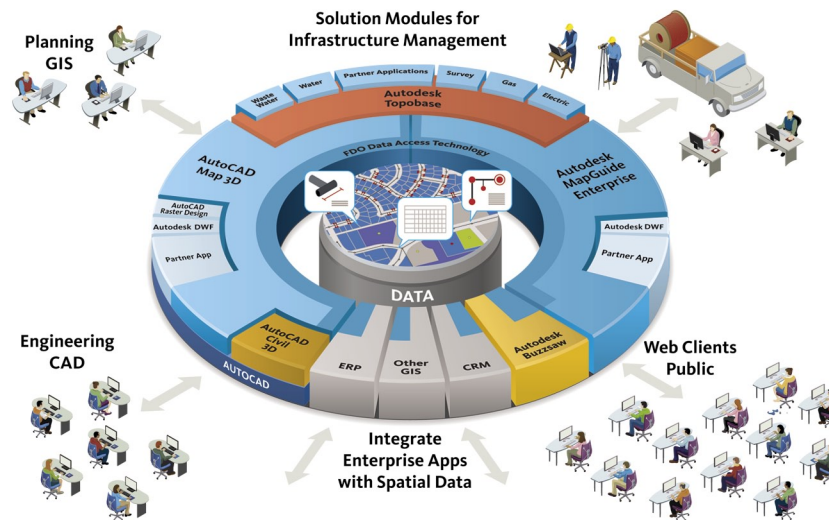
With the Autodesk Geospatial product line, organizations are no longer hamstrung by the historic division between the CAD and GIS worlds. In the past, CAD provided smart graphics characterized by sophisticated, accurate representations of the world and excellent tools for geometry creation, editing, and dimensioning. However, tools for linking external data tables or creating data attributes in CAD files have not been that robust. GIS provided a very robust connection to databases, but less sophisticated graphics. Autodesk Geospatial brings together CAD and GIS by combining the powerful, smart graphics of CAD with direct, native access to the world's most common GIS databases and files.

One of the underlying technologies that Autodesk Geospatial uses to break down barriers between data is a common data access platform called Feature Data Objects (FDO) Data Access Technology. FDO technology supports the creation of data-store-neutral applications and facilitates direct information exchange. To make it easier for developers to extend the capabilities of FDO, Autodesk, in partnership with the Open Source Geospatial Foundation™ (OSGeo™), has released FDO as an open source project. Because this underlying technology is based on open standards, it eliminates many of the difficulties commonly encountered when working with proprietary systems. FDO Data Access Technology:

- Enables organizations to use best-of-breed software because they are not locked into one vendor's software, data format, or API. In contrast, organizations that adopt proprietary systems pay a "toll road" to get to their own data.
- Leverages the Open Source community for rapid product development and evolution. For example, there are new FDO providers such as the OSGeo FDO Provider for OGR.
- Extends access of an organization's information to other systems. For example, Oracle Spatial provides access from non-spatial applications.
- Reduces training, support, and development costs associated with proprietary systems.

Using FDO Providers, organizations can connect directly to a variety of data stores including ESRI ArcSDE and SHP, Oracle, Microsoft SQL Server, and MySQL, as well as leverage public data sources via Web Map Services (WMS) and Web Feature Services (WFS). Since FDO Data Access Technology is available in the open source community, other enterprise applications such as ERP or GIS systems can leverage FDO to access the same data without the additional expense of legacy middleware. The result is a seamless experience for accessing and integrating data from multiple sources, regardless of format or storage location. By standardizing on FDO as its data access technology for spatial data, an organization can easily add support for new storage formats in a consistent fashion across all Autodesk Geospatial and other business applications.

The benefits of Autodesk Geospatial are numerous. By bringing CAD and GIS together, Autodesk Geospatial enables organizations to use their existing CAD-trained design engineers and existing CAD software as well as access existing GIS datasets (DWG, SHP, ArcSDE, Oracle Spatial) in a native format. With native data access, no data is lost in translation thereby reducing error propagation and duplicate data sets. Organizations contend with fewer silos of information and reduce out-of-date data snapshots. In short, they manage and access the most current information.



“For us, AutoCAD Map 3D is the heart of our complete end-to-end solution. It just seems natural to have GIS and engineering functions connected. Our engineers and designers have instant access to all the information they need, and our Oracle database contains up-to-date information.”

—J.R. Smith
Senior GIS Analyst for the
Public Works
City of Tacoma

Finally, Autodesk Geospatial increases an organization’s operational efficiency and enables it to adopt more efficient workflows. Teams no longer undertake time-consuming data conversion routines. Extended teams can use CAD and GIS functionality together in the same workflows without having to move or duplicate data. For example, team members using other applications, such as ArcGIS® or GeoMedia™ software, can access the same information managed using AutoCAD Map 3D. With FDO Data Access Technology as its common data access platform, Autodesk Geospatial makes it easy for organizations to share information across applications, so geospatial information is integrated into workflows wherever it’s needed. And, as the Geospatial Value Chain illustrates, Autodesk Geospatial easily evolves as an organization grows. As an organization changes and requires additional functionality and resources, it need not purchase new applications. Autodesk applications are flexible and extendable to address an organization’s evolving needs.

Now let’s take a deeper look at the Autodesk Geospatial platform and product line.

Data Layer

The first layer of the platform is the data, one of an organization’s most valuable assets. An organization’s data outlives the applications and people that manage it. While people change jobs and companies reinvest in software, an organization’s data is a permanent fixture. Autodesk does not put data into a proprietary format that locks organizations into using one vendor’s applications to access or manage it. Rather, Autodesk provides tools to increase the value of data assets by ensuring that they are maintained, usable, and accessible in an open, scalable, and secure manner.

Desktop Platform

AutoCAD Map 3D, the leading engineering GIS platform for creating and managing spatial data, serves as the desktop-based core of the Autodesk Geospatial platform. AutoCAD Map 3D provides direct access to the leading data formats used in design and GIS—no matter how the data is stored. It also makes maintaining and editing spatial data efficient by providing users with a familiar AutoCAD-based working environment. As a result, CAD-trained personnel can populate GIS data stores with engineering data and keep information up-to-date as they carry out design projects. AutoCAD Map 3D also enables design processes to utilize integrated GIS functions, such as spatial queries, thematic mapping, and buffer and network analysis, in a single environment for more efficient workflows. Based on AutoCAD software, AutoCAD Map 3D has all the powerful tools of AutoCAD and supports common workflows important to both GIS professionals and engineering staff such as:

- Creating and maintaining maps and geospatial data
- Converting existing CAD drawings into geospatial data
- Cleaning up and improving existing GIS content
- Linking CAD design projects with geospatial asset management work
- Managing utility assets
- Publishing CAD and GIS data to the Internet and to hard copy maps, DWF™ (Design Web Format), GIS data types, and map books

AutoCAD Map 3D enables engineers to access data previously locked up in the GIS department, while providing the best CAD tools available to edit native geospatial data. With FDO Data Access Technology, AutoCAD Map 3D enables team members to work with large GIS-scale data sets and directly access, without translation, advanced geospatial databases. This allows organizations to store both spatial and attribute data in one place without expensive and proprietary middleware. Since most organizations have hybrid software environments, AutoCAD Map 3D offers direct read/write capabilities for most popular GIS formats, helping to ensure information accuracy by eliminating data conversion.

By enabling design processes that utilize integrated GIS functions in a single environment, AutoCAD Map 3D helps organizations institute a more informed design process, increase productivity, and enhance data quality. GIS specialists no longer have to spend time converting and uploading design information into the GIS, freeing their time for data discovery and geoprocessing.

Web Mapping Platform

The server-based core of the Autodesk Geospatial platform, Autodesk MapGuide Enterprise, enables organizations to share spatial data over the web on dynamically generated maps. Autodesk MapGuide Enterprise delivers powerful, easy-to-use online maps and related information in a development environment that leverages the advantages of open source technology. Autodesk MapGuide Enterprise and AutoCAD Map 3D share a unified geospatial application programming interface (API) as well as unified FDO data access technology that can be used to build custom applications that share business logic and common code. With the same access architecture and common code, AutoCAD Map 3D shares information easily with Autodesk MapGuide Enterprise. Autodesk MapGuide Enterprise server-based technology delivers rich, web-based capabilities such as dynamic data visualization, feature selection and attribute display, data query and update, and geometric analysis. Because Autodesk MapGuide Enterprise can use any web browser, organizations can use it to distribute data and spatial functionality to a large number of people and applications.

Engineering GIS

The problem: CAD professionals are unable to access the GIS data they need from within their design tools. Consequently, GIS data is either not utilized or, if it is, GIS departments must translate and send this data to CAD professionals before they start a project. Conversely, organizations often fail to use CAD design personnel and data to manage and update the GIS. As a result, GIS data is often out of date, failing to include the latest as-built design information, and CAD and GIS departments end up maintaining separate, redundant information.

The solution: Engineering GIS software, such as AutoCAD Map 3D, combines the precision and familiarity of CAD software with powerful GIS functionality. CAD-trained professionals can use their design tools to work directly against GIS files and databases and integrate GIS functions to create a more informed design process.

The benefits: Design and GIS professionals no longer need separate products to work with geospatial information and engineering designs or to create useful and informative maps from CAD and GIS data. This allows organizations to build efficient workflows that leverage the best CAD and GIS technologies without additional costly GIS software suites, database middleware, or complex data translation scripts and applications. By using engineering GIS, organizations can eliminate data redundancy and leverage CAD-trained workforces to manage asset information within GIS using familiar tools.

In addition, Autodesk MapGuide Enterprise provides a platform for building partner or in-house applications using FDO Data Access Technology. Because Autodesk MapGuide Enterprise is also an application server, it can directly integrate with other business applications. It effectively spatially enables enterprise systems, such as CRM and ERP, in a “machine-to-machine” manner. For example, a team member can use it to perform a spatial analysis—such as validating a location in a specific zone—prior to accepting a record in a database without needing to generate and view a map.

Through the use of FDO, Autodesk MapGuide Enterprise technology can be used as a Web Mapping Service (WMS) and a Web Feature Service (WFS). As a WMS, Autodesk MapGuide Enterprise supports a client/server environment. It can retrieve geospatial data from WFS and WMS sites, enabling the use of data from other organizations that share their geospatial data. Used as a WFS, Autodesk MapGuide Enterprise allows organizations to share their data, in vector form, with authorized outside organizations. Autodesk MapGuide Enterprise has been certified by the Open Geospatial Consortium (OGC) as compliant with its WMS 1.1.1 specification. With Autodesk MapGuide Enterprise, organizations can easily publish data from AutoCAD, AutoCAD Map 3D, AutoCAD Civil 3D, and Autodesk Topobase as well as from popular GIS easily accessed by FDO.

Autodesk, in partnership with The Open Source Geospatial Foundation, has released MapGuide as an open source project called MapGuide Open Source. Built on MapGuide Open Source, Autodesk MapGuide Enterprise benefits from the advantages of open source technology, including rapid innovation and a large development community, but adds commercial-grade quality and support from Autodesk. More information about the open source version can be found at <http://mapguide.osgeo.org/>.

Infrastructure Design and Management

The Autodesk Geospatial product line includes Autodesk Topobase, an open and flexible solution that extends the power of the AutoCAD Map 3D and Autodesk MapGuide Enterprise platforms. Autodesk Topobase addresses the challenges faced by organizations that design and manage infrastructure projects by integrating Autodesk design software with an Oracle spatial database, enabling teams to manage and share a single source of information across departments. Topobase customers can see the big picture with a more integrated view of all of their enterprise data, as well as improve productivity and bottom-line results by completing projects faster and maintaining assets more efficiently.

Topobase offers modules for managing specific types of infrastructure systems, including water, wastewater, gas, and electric networks. Each module provides a detailed data model that organizations configure to capture exactly the infrastructure asset information they need. Topobase workflows reduce steps when designing new infrastructure, and provide security and consistency as people in separate departments work with and update the database. Finally, Topobase's multiple display models enable each user of the system to view information with the scale, symbols, and formatting most relevant to them.

A unique feature of Topobase is its ability to leverage tools and data from the design and construction phases of an infrastructure asset through its ongoing management. For example, as an engineer designs a water network using familiar Autodesk software, business rules are applied to ensure data quality, and detailed asset data is automatically stored in the central spatial information database. This information is then available for use in operations, customer service, and compliance reporting, and can be accessed securely over the web without requiring special CAD or GIS expertise.

Two other advanced features of Topobase are topology and long transactions. Topobase automatically updates network and area topology relationships as new assets are added to the infrastructure system. By keeping track of which water pipes and valves are connected to each other in a water network, for example,

Autodesk Integrates With Enterprise Applications

Autodesk Geospatial products are based on an open data model, work with open standards such as OpenGIS®, and integrate easily with Oracle. By adopting FDO Data Access Technology and open architecture, organizations can spatially enable enterprise applications such as ERP and CRM applications, powering more streamlined, efficient workflows.

For example, organizations such as Industrielle Werke Basel (IWB)—a utility delivering electricity, natural gas, drinking water, heating, and telecommunication services in Basel, Switzerland—depend on Autodesk's platform to integrate geospatial, design, and alphanumeric data. By integrating its Topobase solution directly with its SAP business system, IWB is able to maintain its water and gas documentation in half the time and with two-thirds the resources.

organizations can perform functions such as determining which houses are affected if a particular valve is shut off. Long transactions, also known as jobs or versioning, enable organizations to select an area of their infrastructure that is being built or modified, keep the modifications separate from the base information, and have an approval process for completed jobs. Team members can even set up two jobs for the same project so that they can evaluate design and cost alternatives. Once completed, all jobs are kept in a history status and can be rolled back to provide a view of the infrastructure at any point in time. Long transaction functionality is useful for managing spatial information in multi-user environments.

Since Topobase stores data in native database formats, the spatial information that it creates can be integrated with existing business systems using standard IT tools, without the need for expensive proprietary tools or middleware. With Topobase, it is easy for a water utility, for example, to view how many pipes, manholes, and hydrants are in its water network and to integrate spatial information with data from CRM or other enterprise systems. Because Topobase is designed to be open and flexible, customers, Autodesk Consulting, or certified partners can use the Topobase framework to create custom applications to support an organization's unique data models, processes, and system interfaces.

Additional Autodesk Geospatial Product Line Applications

In addition to the core Autodesk Geospatial platform applications detailed above, there are several applications built on the platform as well as applications that bring additional value to Autodesk customers.

Included within the Autodesk Geospatial platform are AutoCAD Civil 3D and Autodesk® Utility Design. AutoCAD Civil 3D integrates with AutoCAD Map 3D by sharing data directly with it using the SDF data format. As Autodesk's high-end, model-based design tool, AutoCAD Civil 3D enables organizations to quickly evaluate multiple design alternatives for engineering projects such as subdivisions, pipeline networks, and road rehabilitation and highway projects. Designs produced in AutoCAD Civil 3D can then be incorporated into an organization's central data store, becoming part of the enterprise data set using AutoCAD Map 3D.

Built on AutoCAD Map 3D is Autodesk Utility Design, which is completely compatible with the wide range of peripherals and data exchange formats supported by AutoCAD Map 3D. Available only in the United States, Autodesk Utility Design software's Project Explorer module and Workorder Interface lets organizations integrate work order data from SAP® R/3 Enterprise 4.7. With Autodesk Utility Design, organizations more easily and accurately design, engineer, order materials, and estimate costs for residential, commercial, and industrial gas and electric systems. The application provides design tools with true rules-based automation, allowing organizations to configure it using their individual design and construction standards.

Partner applications built on the Autodesk Geospatial platform include the following:

- **StellarMap®** by StellarRAD Systems—Built on AutoCAD Map 3D, this facilities mapping application for the telecommunications industry provides cost estimating, work order management, and reporting functionality. With it, organizations can easily manage and direct cable throws, loop connectivity, continuing property records, work orders, and construction prints.
- **Civil and Survey applications** by Carlson Software—Carlson Software offers a variety of applications built on Autodesk technology. For example, Carlson GIS runs on AutoCAD, AutoCAD Map 3D, AutoCAD® Land Desktop, or AutoCAD Civil 3D. Designed for surveyors and engineers, Carlson GIS provides tools for data capture and linking, data labeling, polygon topology creation and analysis, and more.

"AutoCAD Civil 3D has already saved us three full days on a small project, and we anticipate even more time savings on our upcoming projects. And with Civil 3D, we can present better, more detailed options in half the time. Plus, we continue to connect our civil engineering and GIS data seamlessly by using Civil 3D with Map 3D."

—Shawn McLeod
GIS Manager
District of North Vancouver

- Mobile Resource Management (MRM) solutions by @Road—Built on top of Autodesk MapGuide, @Road's MRM solutions combine Internet services with applications that leverage on-demand global positioning systems (GPS), dispatch software, wireless capabilities, fleet management tools, and transaction processes to help organizations maximize the productivity of their mobile workforces.
- GEOMAP GIS solutions by GEOMAP GIS—Based on AutoCAD Map and Autodesk MapGuide, GEOMAP GIS software and web-based solutions enable organizations to edit and create graphic and alphanumeric data via the Internet. Solutions are tailored for facility management, transportation, networks, and municipalities.

Products that extend the value of the Autodesk Geospatial platform include AutoCAD Raster Design, Autodesk Design Review, and Autodesk Buzzsaw. AutoCAD Raster Design works with AutoCAD and AutoCAD-based software such as AutoCAD Map 3D, AutoCAD Civil 3D, and Autodesk Topobase. AutoCAD Raster Design extends these platforms with a complete set of tools for working with raster-based imagery. With tools for raster drawing cleanup, raster to vector conversions, image editing and image processing, AutoCAD Raster Design enables organizations to unlock the value of scanned engineering drawings and maps and efficiently turn hardcopy maps into powerful geospatial data.

Autodesk Design Review integrates with all Autodesk design applications and allows teams to print designs and maps to DWF for taking into the field or sharing with colleagues. When team members need to annotate maps in the field, they can use Autodesk Design Review to track and record markups and redlines. With Autodesk Design Review, organizations keep their map and infrastructure data current while reducing rework and paper-based manual processes.

With Buzzsaw, a web-based collaboration environment, organizations gain a project management toolset for disseminating and receiving all project documents, including design drawings, bid documents, construction requests for information (RFIs), submittals, and meeting minutes. Organizations can easily share documents with multiple consultants and team members throughout all phases of a project—from design through bidding, procurement, and construction.

Autodesk Geospatial in Action

Many organizations use a combination of products in the Autodesk Geospatial product line to drive real, bottom-line benefits: bringing together CAD and GIS data, enabling engineers to update GIS data, distributing previously system-locked data to wide audiences, and streamlining workflows from end-to-end.

Environmental, Parks, and Natural Resources: Stage 3

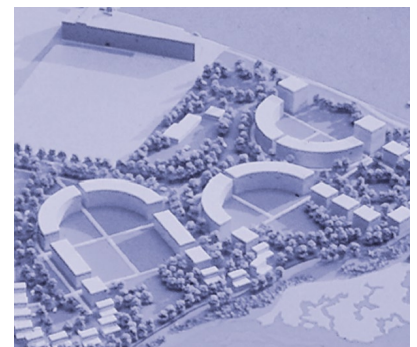
RPS Group

Using AutoCAD Map, RPS Group has taken hundreds of out-of-date paper drawings of the roadside landscape adjacent to England's trunk road and motorway network and created a fully detailed up-to-date set of computerized Landscape Management Plans. To fulfill its contract to maintain Area 16 of the roadside landscape, RPS needed to produce a fully populated strip plan of the whole of the Yorkshire and Humberside section of the motorway and trunk road network. The company had to identify, measure, and map all the elements because the strip plan was to be used to cost and manage the Landscape Management Plan. "AutoCAD Map made it simple," says Kevin Stubbs, senior associate and chartered landscape manager at the Huddersfield office of RPS.

The process involved getting the Ordnance Survey plans off the Highways Agency in National Transfer Format (NTF) and converting the tiles into the right layers, re-surveying the network, picking up all the vegetation and other features, and drawing up the strip plan. Then, RPS created a database that identified each landscape element as well as noted when and how that element should be managed. AutoCAD

"AutoCAD Map 3D enables us to use the applications we prefer for CAD design and GIS analysis and to replicate our CAD data in a single Oracle database. This allows us to maintain our facility and sewer atlases more efficiently and to update our sewer atlas twice as fast."

—Doug Rulison
Engineering Data
Management Specialist
Orange County Sanitation
District



Map's data creation and management abilities were key to the project. AutoCAD Map allowed RPS to orient the map tiles to obtain the linear continuity required for the strip plan. It also kept drawing sizes to a minimum and enhanced performance. In summing up the benefits of AutoCAD Map, Stubbs says, "Without AutoCAD Map, we would have struggled. We would have had to implement a GIS. With AutoCAD Map, we have been able to provide a more cost-effective product, and the deliverable is accurate."

Government/Public Works: Stage 4

City of Tacoma

The Public Works Department of the City of Tacoma (Tacoma), Washington also uses Autodesk Geospatial, integrating its data creation, collection, and storage processes. The city's designers work within Autodesk's civil engineering software, which is built on AutoCAD Map 3D. After projects are complete, the city uses AutoCAD Raster Design to capture and digitize as-built information. Then, it collects and manages data using AutoCAD Map 3D in Oracle Spatial and publishes that information to web-based applications using Autodesk MapGuide. Notes J.R. Smith, the city's senior GIS analyst for the public works, "For us, AutoCAD Map 3D is the heart of our complete end-to-end solution. It just seems natural to have GIS and engineering functions connected. Our engineers and designers have instant access to all the information they need, and our Oracle database contains up-to-date information."



Utilities: Stage 4

Orange County Sanitation District

The Orange County Sanitation District (OCSD) is using Autodesk Geospatial to bring together its CAD and GIS data so that it can reduce the redundant processes involved in maintaining separate geospatial and CAD data, as well as enhance data fidelity and integrity.

Like many large organizations, the OCSD depends on Autodesk software to design infrastructure and ESRI software for traditional GIS functions. With AutoCAD Map 3D, the OCSD can work with both data formats efficiently. AutoCAD Map 3D translates CAD design data into the OCSD's GIS and from its GIS to CAD in minutes. Notes Doug Rulison, engineering data management specialist for the OCSD, "AutoCAD Map 3D enables us to use the applications we prefer for CAD design and GIS analysis and to replicate our CAD data in a single Oracle database. This allows us to maintain our facility and sewer atlases more efficiently and to update our sewer atlas twice as fast."



To update and maintain its scanned record drawings in its document management system, the OCSD also uses AutoCAD Raster Design. Jettisoning its old, time-consuming manual process for updating scanned drawings in favor of AutoCAD Raster Design, OCSD's designers can now check out the scanned image from the document management system, make changes in CAD, and merge edits directly to the image itself, maintaining existing hyperlinks.

Communications: Stage 5

Comcast Corporation

Using a comprehensive Geospatial Solution, including AutoCAD Map, Autodesk MapGuide, and Oracle Spatial, Comcast Corporation is able to create, manage, and share geospatial data throughout its organization. Using AutoCAD Map, Comcast's engineers geospatially-enabled their drawings for upgrading 22,000 miles of cable plant in Seattle. The new state-of-the-art communications plant was designed to serve more than two million homes with video, high-speed Internet, and telephone services. By geospatially-enabling engineering drawings, Comcast ensured that it could later use this data throughout the organization to complete mission-critical tasks.

With Oracle Spatial, Comcast has a central, seamless GIS database that reduces costs and errors associated with file management. Because data in the database is geospatially-enabled, most addresses are already in the system as existing



or potential customers. Using back-office, web-based Autodesk MapGuide applications, Comcast can carry out core customer service and maintenance tasks, such as determining if a new customer is located near the network and quickly identifying issues inside a facility or in the field that may impact service. “We’ve added more than 10,000 basic customers using our Autodesk and Oracle Spatial system,” says Sean Bristol, Comcast’s engineering director for Washington. “We’ve identified \$8.6 million in new revenue using our own database and \$1.5 million with data from an industry group. These are great indicators of the power of Autodesk’s tools.”

Utilities: Stage 5

Stadtwerke Augsburg

Stadtwerke Augsburg, an independent public utility that delivers a wide-range of services to the 350,000 residents of Augsburg, Germany, is also using Autodesk Geospatial to integrate its data. Autodesk Topobase provides the data management backbone of Stadtwerke Augsburg’s integrated solution, while Oracle Spatial provides rich RDBMS functionality. Prior to Topobase, Stadtwerke Augsburg stored its asset data in multiple systems; engineers wasted time querying multiple systems and reconciling the information when they needed asset data. Now, Stadtwerke Augsburg uses its integrated system to manage all the events that take place in the lifecycle of infrastructure assets, from planning to design to construction.



With Topobase, Stadtwerke Augsburg has been able to save time, ensure the integrity of its asset data, and improve service to customers. “Previously, customer service agents needed over 30 minutes to answer asset location-related questions for customers, but now it takes less than a minute,” notes Juergen Biedermann, documentation and data processing manager for Stadtwerke Augsburg. “With Topobase and Oracle Spatial, we no longer have to maintain multiple data sets, and we have reduced the risk of data entry errors. Our system is definitely helping us to deliver higher quality work, faster.”

Conclusion

Autodesk Geospatial helps increase productivity and save time and money by combating high levels of redundancy, inaccuracies, data mismatches, currency issues, and versioning problems that result from siloed information that is not shared throughout the organization or accessed by all applications that can utilize geospatial information. Whether an organization is using Mylar and paper-based systems to work with spatial data in siloed departments and has not yet entered Stage 1 of the Geospatial Value Chain or is at Stage 3, using Autodesk MapGuide Enterprise to customize and share data with wide audiences, Autodesk Geospatial offers solutions to help it leverage its data more fully and increase productivity and take full advantage of its data assets.

With Autodesk Geospatial, organizations can fully harness the power of their data by bridging the gap between engineering and GIS departments and the rest of the organization. Organizations with Autodesk Geospatial build powerful solutions that easily grow as they evolve and leverage their spatial data more fully. Because it utilizes open standards and open architecture whenever possible, Autodesk Geospatial spatially enables business applications, powering cross-product workflows with accurate, up-to-date information. From planning through design, construction, and maintenance, Autodesk Geospatial delivers powerful data interoperability and a fully integrated platform for managing spatial data assets.

Learn more about how your organization can move up the Geospatial Value Chain and take advantage of the Autodesk Geospatial product line by visiting www.autodesk.com/geospatial.