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How Project-Based Organizations Can Improve Plan-Build-Operate Processes with Infrastructure Lifecycle Management and Building Information Modeling

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This IDC Vendor Spotlight discusses the emerging market for infrastructure lifecycle management (ILM) applications integrated with building information modeling (BIM) and the impact this new technology is having on project-based organizations. The ILM market is focused on capital asset project planning, execution, and operation for building owners and their architecture, engineering, and construction (AEC) industry service providers. BIM, on the other hand, is an intelligent design methodology that can touch ILM system data at each project phase; BIM is increasingly becoming important to building owners and construction companies throughout the entire project phase.

This paper highlights the ILM application market and explores business dynamics, including an impending increase in public infrastructure spending, that are confronting project-based organizations such as public agencies, program management firms, construction companies, and engineering organizations. In addition, this paper examines how these project-based organizations can improve the plan-build-operate project lifecycle and how they can explore integrations with BIM to achieve integrated project delivery. Furthermore, this paper describes how the implementation of ILM and BIM can result in improvements in project visibility, cost, schedule management, and best practices, and it discusses the role of Meridian Systems in this strategically important market.

ILM and BIM: How They Fit Together

Fundamentally, ILM applications are designed to automate the continuous process of managing complex infrastructure construction/commercial real estate projects and perform an array of tasks, including planning, budgeting, project and cost tracking, and ongoing maintenance plus redevelopment. The goal of ILM is to optimize the plan-build-operate phases of a program or project, bringing together key sets of application functionality into one integrated platform or system of record. ILM applications are a response to the capital building industry's need to achieve true integrated project delivery, a goal to better align project stakeholders through collaboration and a contract structure that allows design team, project owner, and construction team to share in the project risks and rewards. According to the Construction Industry Institute, integrated project delivery can reduce overall project cost by 10%. Major software components in an ILM application can typically include the following:

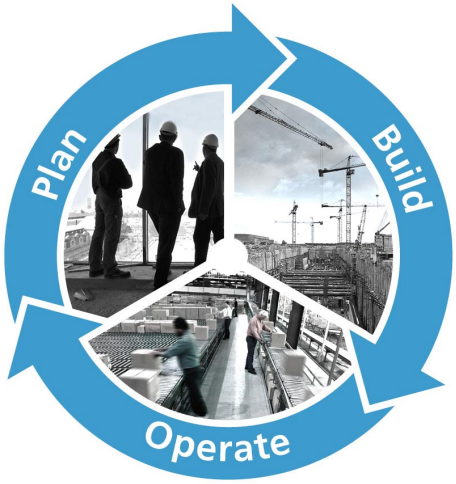
- Budget and cost management
- Contract management

- Field management
- Office management
- Scheduling
- View and redlining management
- Asset management
- Planned and preventive maintenance
- Service requests

Figure 1 illustrates the integrated nature of a typical ILM application and how its components enable companies to track and monitor an infrastructure project from inception to completion as well as ongoing maintenance.

Figure 1

The Goals of ILM Application Technology



Plan: Manage project pipelines, site development and entitlements

Build: Track budgets, contracts, changes, schedules, scopes and quality

Operate: Direct asset management, work orders and maintenance management

Source: Meridian Systems, 2009

BIM is an innovative design methodology for a three-dimensional model that focuses on three areas:

- A facility's geometrical and spatial relationships
- Building systems and components
- Properties of specified equipment and materials

In the plan phase, BIM encompasses a conceptual design; iterative designs; architectural BIM; structural BIM; and mechanical, engineering, and plumbing (MEP) BIM. In the build phase, BIM provides a number of analytic, reporting, view, and modeling capabilities, such as construction sequencing, 4D modeling (i.e., three spatial dimensions plus time), clash detection, fabrication BIM,

spatial BIM installation, and so on. Using BIM for the build phase, companies can detect potential problems and resolve these issues before starting construction on the infrastructure project. The application of BIM then leads into the operate phase with as-built models, as-built equipment, and the complete virtual building.

The ILM Market

Based on key market drivers and emerging ILM application improvements, IDC projects the worldwide ILM applications market will reach $5.9 billion in software and services revenue by 2012, compared with $2.7 billion in 2007. This growth represents a compound annual growth rate (CAGR) of 17%.

Target customers of ILM/BIM applications include program and construction management firms that serve Fortune 1000 enterprises, multinational corporations, and government agencies. Beyond that, organizations in various industries, such as healthcare, oil and gas, real estate development, and consumer products and services, are now adopting ILM and BIM applications.

Demand for ILM applications has traditionally been driven by business factors such as the increasing complexity of commercial building projects, the need to document every step in the life of a new real estate asset, and the pressure to deliver construction projects on time and within budget. Another market driver spurring growth has been the emerging demand for environmental sustainability and efficient energy management, such as Leadership in Energy and Environmental Design (LEED) certification.

However, with the new Obama administration, industry watchers are hopeful that there will be infrastructure spending stimulus programs that could fund public works projects at the federal, state, and local government levels. Passage of such programs would have significant impact on the infrastructure building industry. The American Association of State Highway and Transportation Officials released a list of more than 5,000 highway and bridge projects totaling $64.3 billion that could be impacted, creating the need for project-based organizations to provide elevated levels of project visibility and transparency on these federally funded projects. Demand for ILM and BIM applications could surge as a result.

Using Technology to Connect the Plan-Build-Operate Lifecycle

In the past, the construction project lifecycle was managed as three segments, each with different stakeholders:

- Planning/designing by architecture/engineering firms
- Construction execution by general contractors and subcontractors
- Operating/managing by owners/operators or real estate managers

Occasionally, these stakeholders would pass their project information from one team to the next, but more likely, they did not. Reasons ranged from data incompatibility to the desire to keep information such as pricing, scheduling, and materials costs within the company's own four walls. Frequently, the result was distrust, misunderstanding, and litigation among owners and construction execution partners. However, the increasing complexity of global projects now forces the construction and real estate industries to look for better ways to handle the management and documentation of projects, from inception to retirement.

The ILM market addresses three particular groups of challenges:

- **Project data:** Where is project and design data? How do I access it? How do I maintain it?

- **Project management:** Which tools do I need for the plan, build, and operate phases of capital programs and redevelopment projects?
- **Risk reduction:** How do I develop repeatable processes, standardize project processes, and mine project data to transfer key business intelligence to future projects?

For many organizations, the application of choice is Excel or, one step up, Microsoft Project. Large enterprises are frequently relying on their internal IT departments to design and maintain in-house solutions. However, this market is now waking up to the benefits of project and portfolio management (PPM) solutions and more specifically to the combination of ILM and BIM that is designed specifically for the construction and building management services industry.

Business Challenges for Project-Based Organizations

Life for project owners in any infrastructure-intensive industry is fraught with risks. Depending on their business focus and management structure, building owners are facing a range of challenges that can make or break their success:

- Operators have to manage the maintenance of their assets over many years to protect them against deterioration or unexpected catastrophic failures. Examples include collapsing bridges, caving roofs in shopping malls, and neglected roads and highways with potholes and water damage.
- The construction industry is notoriously subject not only to economic fluctuation but also to increasingly global competition. To survive and thrive, market players have to plan, build, and operate as efficiently as possible.
- Cost management, particularly for complex programs with large numbers of stakeholders (including architects/designers, general contractors and subcontractors, owners and operators, and, of course, government agencies and financial institutions), can be very challenging and easily spin out of control. Integrating multiple, cost-loaded BIM models — such as architectural, structural, and MEP — and exporting them into ILM can support the budget development process and ensure greater precision for funding and spending approval.
- Public sector demands for environmental sustainability and efficient energy management are increasingly pushing building owners and operators to adopt BIM methodologies and LEED certification. It seems likely that compliance with project accountability, transparency, and environmental standards will become an increasingly hot topic as the Obama administration drives forward its stimulus spending plans and takes hold of the energy and environmental departments.

Of course, these examples do not cover all the operational issues confronting building owners and operators on a daily basis, but they certainly give an indication of the complexity of their business environment.

Synergies Between ILM and BIM

Diving deeper into the plan-build-operate project lifecycle, one can see many synergistic opportunities for ILM technology and BIM models to come together (see Figure 2). The plan phase usually consists of the building owner determining the financial feasibility of a project and hiring architects and engineers to design the project. The build phase is typically where a general contractor is selected to construct the facility, while the owner and design teams provide oversight. The operate phase allows the owner to take over the newly completed facility and maintain the assets through preventive, predictive, and corrective maintenance.

Figure 2

How ILM and BIM Fit Together

	Plan	Build	Operate
Infrastructure Lifecycle Management (ILM) *Operational Business Processes and Data*	• Project Pipelines • Budget Development • Scope Development • Budget Approvals • Funding Approvals	• Contracts & Changes • Scheduling • Bidding and Buyout • Design Distribution • RFIs & Submittals	• Asset Management • Equipment Assets • Location Assets • Maintenance Mgmt. • Work Orders
Building Information Modeling (BIM) *Digital Design Model*	• Conceptual Design • Iterative Designs • Architectural BIM • Structural BIM • MEP BIM	• Construction Sequencing • 4D Modeling • Clash Detection • Fabrication BIM • Spatial BIM Installation	• As-Built Model • As-Built Equipment • Complete Virtual Bldg.

Note: There are several opportunities to synchronize ILM with BIM methodology across the plan-build-operate lifecycle, including conceptual design to budget development integration, fabrication BIM integration with submittals, spatial and equipment models and asset management integration, and more.

Source: Meridian Systems, 2009

Considering Meridian Systems

Meridian Systems is a Folsom, California-based ILM/PPM applications provider that is rapidly expanding its footprint in the market for project and program management of assets and facilities. Meridian originally earned its stripes in the AEC project and portfolio management arena. It now has more than 5,000 customers with nearly 100,000 users and was cited several times as a leading project portfolio supplier by construction industry trade magazine *Constructech*. In 2006, Meridian Systems was acquired by Trimble, a provider of GPS systems, and is now managed as a Trimble division. According to the company, it had 2007 revenue of $26 million.

Meridian Systems has two product lines, Prolog and Proliance.

- **Prolog.** Meridian's original product offering, Prolog software, targets the midmarket PPM arena. Prolog is focused on construction project management and delivers collaboration, purchasing management, cost control, document management, and field administration. Prolog Manager is targeted at midsize to large AEC organizations, including general contractors, program/construction managers, and engineering firms, as well as public agencies and private building owners. These organizations on average have revenue between $10 million and $500 million and 10 to 99 employees, although larger installations exist among large international contractors. Prolog automates all aspects of the construction lifecycle, from project design to closeout. In mid-2008, Meridian announced the release of Prolog 2008, with a new user interface and many customer-requested enhancements. In December 2008, Meridian introduced Prolog Connect, an extensive Web Services platform that — when combined with Prolog Manager —

provides collaboration across organizations and vendor communities, flexible application integration, and secure interoperability over the Internet. Prolog Connect supports the creation of Microsoft Office Business Applications (OBAs) and allows users to interact with Prolog data using desktop applications such as Microsoft Excel, Word, Outlook, and SharePoint. When used with Prolog Connect, OBAs allow secure, bidirectional data exchange with Prolog Manager over the Internet. Prolog can be deployed in a self-hosted or ASP environment. Prolog Connect combined with Prolog Manager is targeted at higher midmarket companies with revenue between $500 million and $1 billion and from 100 to 500 employees.

- **Proliance.** In 2003, Meridian released Proliance, its next-generation product line. A Web application built on a service-oriented architecture (SOA) utilizing XML technology, Proliance targets the tier 1 enterprise account segment, where larger organizations with more than 500 users require a higher level of enterprise scalability and security. The latest version, Proliance 3.6, which was released in 2007, provides customers with a single system of record that they can use from development through maintenance in the plan-build-operate lifecycle. Proliance is browser based and has a zero-footprint client. The product has three layers that target the needs of three user types:
  - The Web Services platform layer includes system technology important to the IT department.
  - The Plan/Build/Operate applications layer provides access to Proliance features important to project team members and contributors.
  - The Analytics layer delivers visibility and performance tracking to corporate executives.

Meridian provides a number of deployment options, including self-hosted licenses, an ASP subscription model, and a managed-host environment that combines the best of these two options.

The Proliance solution suite consists of the following components (see Figure 3):

- **For planning:** pipeline planning; scope/budget development, program management, and cash flow projections
- **For building:** cost and contract management, change management, design collaboration, scheduling, and job site tracking
- **For operating:** asset management, preventive/predictive maintenance, work orders, and service requests
- **For analytics:** dashboards, reporting, score cards, alerts, KPIs, and trend analysis
- **Web Services platform:** workflow and routing, configurable forms, notices and actions, templates, vendor management, transactional reporting, audit logs, security, and Web Services/XML

Figure 3

Meridian Solution Portfolio

Organization Size	Product	Why Meridian Wins
Tier 1 High-End • $1B+ • 500+ FTEs	PROLIANCE •ILM on a Web services platform	• Office Business Application (OBA) strategy • BIM & ERP Integrations • Web Services Platform • Unique PBO product breadth • Superior BI for PBO
Higher Mid-Market • $500M - $1B • 100-500 FTEs	Prolog CONNECT + Prolog •PPM on a Web services platform	• Web Services Platform • Role-based access • OBA strategy • Flexible integration
Smaller Mid-Market • $10M - $500M • 10 – 99 FTEs	Prolog •PPM via a desktop application	• Micro-vertical expertise • Intuitive interface • Customizable by business users vs. IT

Note: Meridian Systems provides software solutions across the entire spectrum of project-based organizations: tier 1, higher midmarket, and smaller midmarket.

Source: Meridian Systems, 2009

Meridian Customers

Meridian's customers range from tier 1 enterprises to smaller midmarket organizations — including engineering and construction firms, program managers, real estate developers, and public and private sector building owners — across several industries, including energy, healthcare, education, government, and transportation. The following are five examples:

- DMJM H&N AECOM is an EPC firm and one of the largest design, technology, and program and construction management firms in the world. In mid-2008, Meridian Systems and DMJM H&N AECOM announced a new consulting relationship. DMJM H&N AECOM uses Proliance as the basis for its branded electronic program management (ePM) solution and will make it available as part of the program management services the company offers to its AEC clients.
- The Illinois Tollway maintains and operates 286 miles of interstate tollways in northern Illinois. In 2005, construction began on the Tollway's $6.3 billion congestion relief program, and in 2006, the Tollway went live on Proliance to enable program controls for scheduling, cost control, change order management, exception reporting, and project management. With Proliance, the Tollway has achieved its "three A's" of access, accountability, and audit regarding project performance.

- Ryan Companies US Inc. is a leading national commercial real estate firm offering integrated design/build and development as well as asset, property, and facilities management services.
- Brasfield & Gorrie is a 40-year-old full-service general contracting, construction management, and design/build service provider. The company is active in healthcare, industrial, office, institutional, retail, education, and water treatment facilities.
- The U.S. General Services Administration (GSA) Public Buildings Service serves as the centralized procurement and property management agency for the federal government. GSA manages more than one-fourth of the government's total procurement dollars and influences the management of $500 billion in federal assets, including 8,600 government-owned or leased buildings and 208,000 vehicles.

Challenges

The hallmark of the capital building and construction industry is its fragmented, high-risk, and cyclical nature. There is hardly an industry with a more challenging business environment — immensely complex projects, high-risk financing, dependence on global and local business climates, and long delays between initial planning and final completion of the project. The current business environment will most likely cool the global construction boom in 2009 and beyond to a point where construction companies may decide to drastically lower their investments in application software.

Since its entry into the construction and facilities management arena, Meridian has been a pioneer in creating the ILM market and, more recently, the ILM/BIM spaces. At this point, the benefits of ILM are well-understood and Meridian is no longer able to fly below the radar of potential competitors.

Competition by enterprise application providers will be hard to fend off. To do so, Meridian will have to go deep by adding features and functions specifically for ILM/BIM.

Competition for Meridian solutions comes from Autodesk in the smaller midmarket and from Skire and Primavera in the higher midmarket. Meridian's competitive strength lies primarily in its microvertical expertise, its ease of use, and its support for Web Services.

Competition in the enterprise market comes from Oracle/Primavera and Skire. Meridian's strengths against these competitors are the emerging demand for BIM and ERP integrations, its product breadth, its support for business intelligence for the plan/build/operate market, and its utilization of Web Services.

ERP players such as SAP represent more of a partnership opportunity, as most of Meridian's Proliance customers are pursuing integrations between Proliance and SAP Financials.

Road Map for Meridian's Future

IDC believes that Meridian has an early start on providing plan/build/operate solutions; the company's entry into ILM and market dynamics, such as the demand for new infrastructure, potential government stimulus programs, and BIM and green building practices, will help it to maintain its advantage for a number of years. It will certainly be helped by the deep pockets of its parent, Trimble (**www.trimble.com**), a company with 2007 revenue of $1.222 billion, up by 30% from 2006.

IDC believes that the future for ILM and BIM will be bright and that Meridian Systems will be able to benefit from a number of emerging opportunities. In IDC's opinion, the most promising opportunities are the following:

- Meridian can add vertical industry expertise to expand into government, energy, public works/transportation, and education.
- Meridian can deepen its product offering with applications for compliance reporting/auditing across the entire plan-build-operate cycle.
- Meridian can expand into the areas of environmental sustainability and asset management for energy efficiency.
- Meridian may convince its parent Trimble to acquire a number of best-of-breed providers to expand its product offerings beyond its own technology developed in-house.

Conclusion

Few projects are as complex and have as long a lifecycle as infrastructure projects — bridges, high-rises, and airports require hundreds of experts in a vast number of specialties to coordinate their efforts during the plan and build phases and to then make their as-built data available to asset operators for the many decades of the functional life of these assets. These challenges, plus ever-increasing global competition, require infrastructure-related companies to increase their efficiencies throughout the entire plan-build-operate cycle. Meridian has done excellent work as a pioneer to create this market space.

The company's ILM applications provide solid benefits to end users by enabling cost control, visibility into project status for all stakeholders, and precise and detailed schedule management. Beyond that, Meridian's business process management ensures that ILM practitioners can plan and enforce consistent business practices. Furthermore, companies can develop knowledge bases over the long term that can be mined by subsequent managers to optimize the execution of future projects. New opportunities also arise from the increasing demand for environmental sustainability. And lastly, Meridian's integration of ILM with BIM takes its product offering beyond the reach of its competitors.

IDC believes that these benefits will go a long way to help the ILM market achieve solid growth rates once the global construction industry has regained solid economic footing. To the extent that Meridian can address the challenges described in this paper, the company has a significant opportunity for success.