Transforming Asset Information Management

How integrated information management throughout the asset lifecycle cuts costs and improves reliability and safety
Summary

Catalyst

For decades, the fragmentation of stakeholders and business processes throughout the asset lifecycle has created information siloes and applications in all asset-intensive industries. One of the problems is that the life expectancy of many assets is counted in decades, much longer than the IT systems that manage them. As a result, legacy information management systems run alongside new systems, which are often incompatible. The result is inefficiency, sub-optimal employee safety, and a huge incremental increase in operating costs throughout an asset’s life. A number of factors are challenging this status quo. Increased pressure to reduce operating costs, aging infrastructure and workforce turnover, increasing public scrutiny, complexity of operations, and health and safety concerns are forcing these industries to invest in new business processes. This paper highlights the problems caused by siloed information, applications, and people in asset-intensive industries, such as petrochemical, process facilities, power generation plants and utilities. It recommends that the integration of planning, design, construction and operations data with enterprise asset management can help address many of the issues facing the industry.

This paper was written in conjunction with Dassault Systèmes and ABB, which have developed an integrated strategy for Dassault Systèmes’ business platform and industry solutions, most importantly asset lifecycle management (ALM), and ABB’s enterprise asset management (EAM) software. In addition, two senior executives responsible for plant operations were interviewed about potential benefits.

Ovum view

A number of issues are created for asset-intensive industries when asset management is functionally separated from planning, design, construction, and operations. An integrated approach to asset information brings substantial flexibility to business information, and allows asset owners to use existing data in ways that were previously impossible. There are many use cases that demonstrate that the new “whole” is vastly greater than the sum of its parts; however, these are not the only opportunities. Integration transforms previously inaccessible data into a fully updated and accessible commodity, allowing operators to reinvent the way they want to work.

The integrated ALM-EAM approach is in keeping with the ISO55000 guidance for asset-related information management, and forms part of a wider initiative to more closely integrate people, systems, and data across organizations and between different companies. Dassault Systèmes and ABB’s pioneering approach to integrated applications and data promises to revolutionize asset management. We reviewed several business cases with industry experts, who confirmed the considerable value to be gained from this integrated approach, throughout the life of an asset.

Key messages

- Asset-based industries are beginning to address the inefficiencies caused by data silos.
- ALM-EAM integration pays dividends throughout the asset lifecycle, from asset handover, through operations and maintenance, to decommissioning.
- Operators must embrace the challenge of ALM-EAM integration by improving data quality and selectively implementing the approach where the highest returns will be made.
Asset-based industries are beginning to address the inefficiencies caused by data silos

Disparate systems along the asset lifecycle creates data silos

The asset lifecycle consists of the following phases:

- project planning and design
- construction
- operations and maintenance (O&M)
- decommissioning.

Each phase is populated by numerous stakeholders using diverse business processes. Historically many different IT systems have been used to support these processes, which create different types of information and data.

The O&M phase of the asset lifecycle is characterized by repetitive business processes that focus on maximizing the return on investment from assets and crews. EAM solutions have been specifically designed to support O&M’s unique requirements and create highly structured data sets. The planning and design, construction, and decommissioning phases are more project-focused, as are major asset upgrades and refurbishments. Data is created in many formats, both structured and unstructured, by diverse applications including project management, planning and construction scheduling, compliance with requirements, simulation and testing, multi-disciplinary design, and more.

Because each IT system independently generates data, and business processes are rarely independent from one another, this data has to be reformatted from one system before it can be used by another. The incompatibility of different systems and a lack of incentives mean that different stakeholders across the asset lifecycle – even those within the same organization – typically do not share data.

Fig 1: Historically, asset lifecycle management has been linear

- Simplistic, rigid vision of the asset lifecycle
- Creates siloed organizations, applications, and data
- Linear processes lack a feedback loop
- Existing processes are unable to adapt to changing reality
- New processes must be created to fulfil new requirements over an asset's lifecycle
Siloed information management creates operational inefficiencies

Significant inefficiencies can result when stakeholders do not share data. The handover of an asset from constructor to operator provides a useful example. In a perfect world, an operator should be given all design- and construction-related documentation, and business process information in compatible, searchable formats.

In practice, operators lack complete as-built information: they often are given manuals and as-built drawings in hardcopy, CAD files that are incompatible with asset management systems, and digitized versions of hardcopy manuals that lack basic search functionality (such as the associated metadata to enable search). Large volumes of design and construction data may not be transferred at all, or, if it is, operators struggle to extract value from the data due to its diverse nature. As a result, information regarding equipment history is locked away in silos, often underexploited, leading to significant inefficiencies in O&M.

Configuration management in the nuclear industry provides us with a useful example. The IAEA states that the successful long-term operation of a nuclear power plant is predicated on good configuration management, which in turn relies on the retention of as-designed, as-built, and as-maintained data throughout the life of the asset.

**Fig 2: Configuration Management**

An accurate configuration gives the operator insight into the modifications made over the life of equipment and systems. It allows for more detailed planning prior to maintenance, shortens the time the plant is shut down, reduces staff costs associated with maintenance, minimizes staff exposure to radiation, reduces uncertainties in the planning process, and as a consequence reduces planning and health and safety risks.
However, most nuclear assets were built before configuration management tools were available, and approaches to configuration management, including the retention of design information, were deficient. As a result, many modifications are not reflected in asset documentation and, to determine an asset’s configuration, operators waste significant time manually correlating information from multiple sources.

Plant operators can only paint a partial picture of their assets’ configuration due to incomplete, and disparate data. There is an increased risk of missing modifications made to an asset, which can lead to unnecessary and extensive delays during the maintenance project. With hundreds or thousands of staff on site for major maintenance, exceptions can cause huge cost increases.

Some industry experts estimate that engineers spend up to 60% of their time during a planning analysis project just finding the relevant documentation. Most of this time can be saved if configuration is digitally managed.

Fragmented information management also leads to problems when an operator is subject to a regulatory audit or inspection: the process of gathering information to demonstrate the traceability of information. Furthermore, overall regulatory compliance becomes harder when information management is not centralized.

The industry must recognize the risks associated with a lack of integration and data governance

For decades, asset-intensive industries have operated under the most rigorous regulatory environment, but have failed to recognize the inherent risks of disparate information management. However, the industry is changing. In 2004 the Institute of Asset Management and the British Standards Institution codified these best practices in the PAS55 standard. PAS55 evolved over the next decade until 2014, when the International Standards Organization took over responsibility and published its ISO55000 Standard for Asset Management.

The ISO blames the parlous state of information management squarely on the lack of forethought by asset managers, which in turn is symptomatic of the lack of good asset management practices. It believes that unexpected outages or protracted repair times are clear indicators that asset management is suboptimal. The ISO also recognizes that the disconnect between the ALM and owner/operator worlds has led to inaccessible, disparate, and out-of-date information. Managing this data will be a challenge to most asset-intensive organizations, but is imperative for good asset management. ISO55000 requires organizations to bring enterprise information up to date and made available to those who need it, when it is needed. Organizations must “determine (their) information requirements to support Asset Management Systems and the achievement of … organizational objectives.” Its recommendations are to:

- use a formal document management system to include all relevant documentation from design drawing through to maintenance reports
- specify, implement, and maintain processes for managing information
- determine the requirements for alignment of financial and non-financial terminology relevant to asset management throughout the organization
- ensure consistency and traceability between the financial and technical data and other relevant non-financial data.
- align technical property data with other corporate data systems.
ALM-EAM integration pays dividends throughout the asset lifecycle

ALM-EAM integration makes the whole greater than the sum of its parts

Although data and applications have historically remained in silos, today the most advanced ALM platforms integrate data without the need for major data preparation. It is now possible to create a single view of an asset, throughout the entire lifecycle.

ALM-EAM integration bridges the disconnect between the worlds of engineering and construction and O&M, improving visibility across the value chain. However, this is not just an exercise in data storage efficiency: there are many benefits to this integration that were simply not possible before. A single data repository improves the consistency, quality, and traceability of information in a rapidly changing and demanding environment. People can access all the information they require for the activities they need to carry out.

Figure 3: ALM-EAM integration creates a feedback loop in the asset lifecycle

- Flexible approach to changing requirements
- Facilitates collaboration across multiple organizations
- Continuous feedback loop between ALM and EAM
- Changes, lessons learnt, and modifications become part of the asset lifecycle
- Processes change flexibly, as required
Asset handover becomes more efficient

Previously, we discussed how siloed information management affects the efficiency of asset handovers. Integrated asset information enables a fully digital handover process, by requiring all stakeholders to make all relevant information available in a digital format, which is fully searchable and stored in a single repository. This approach is demonstrably more efficient: a mutual customer of Dassault Systèmes and ABB experimented with the automatic load of an EAM configuration from an engineering data repository saving in the region of €5–6m, when compared with manual data entry. Although this customer has not fully implemented ALM-EAM integration, this test gives a good indication of the expected savings from a digital handover.

While historically a lot of paper and spreadsheet files have been passed from construction companies to the operator, a handover based on integrated ALM-EAM is managed within a single, shared solution. The single repository removes the requirement for the manual exchange of as-built drawings, manuals, and other hardcopy documents. An added benefit is that if the document repository is used from the beginning of a project, operators have much earlier access to review documents, reducing the need for bulk data loads during the final handover.

Asset configurations are determined accurately during O&M

Engineers can waste significant time trawling through disparate data to determine the current configuration of an asset while the plant is in operation. While EAM is the current system of record for all modifications to a plant, many operators do very little with this data. An integrated ALM-EAM approach automatically updates asset configuration in ALM using EAM data, and vice-versa. By doing so, a facility’s entire workforce – engineers, maintenance managers, and operators – have access to consistent information. Again, this is not just about efficient information storage in a single repository: the real benefit comes from the creation of a collaborative environment where staff can share information more efficiently, manage requirements and dependencies, identify risks, create multi-view classifications, and more.

During the handover of a new build or on a refurbished plant, Dassault Systèmes and ABB’s clients’ assets can now be configured digitally. We mentioned previously the significant savings during a digital handover; however, many long-term benefits can be derived from improved information management. An EAM-based configuration is updated continuously with ALM-based design information from regular asset modifications. Conversely, ALM can monitor significant operating activities from EAM-based data. Thanks to this approach, Dassault Systèmes and ABB estimate a significant reduction in operator hours of 20–25% by decreasing the time spent looking for data, redoing work because of the wrong information, and more.

4D planning optimizes maintenance projects

Historically, maintenance projects were planned using EAM and, for more advanced asset operators, a separate 3D simulation of the project. The two systems were never integrated, so the output from one system lacked the insight of the other, except through manual integration. Planning is very time consuming, and relies heavily on the knowledge stored in maintenance teams’ heads.

ALM-EAM integration provides O&M staff access to technologies previously only available in engineering offices. The 4D maintenance planning process relies heavily on this integrated and open approach. We spoke with an industry expert who investigated the use of a 4D planning approach during major planned outages. He believes that the use of interactive planning for maintenance
projects directly integrated with EAM is far more detailed, accurate, and efficient, reducing downtime by up to two days for a four-week outage. 4D maintenance planning is a radical change to current planning, depicting in advance how an asset is modified over time during the maintenance event. All available data is integrated – including maintenance operatives’ knowledge – connecting 3D simulations directly with business data such as planned work orders, tasks, and resources. These simulations improve the efficiency of planned maintenance in the following ways:

- **Identify potential bottlenecks and exceptions in advance:** significant delays can occur if a maintenance crew is dispatched to carry out a task, only to find an obstruction prevents them from completing it. The work order will likely be delayed, or even cancelled, for schedules to be rerun to account for exceptions. Identifying exceptions in advance speeds the return to operation.

- **Improve efficiency through more effective resource planning:** a 4D simulation allows an operator to identify how many operatives will be required on site to perform particular tasks, and provide an accurate estimation of how long they will be needed on site. This stops overcrowding in the asset, reduces unnecessary exposure in hazardous environments, and allows operators to more accurately calculate the cost of individual contractors.

- **Minimize exposure to hazardous conditions:** operators can model in advance the duration of maintenance tasks in hazardous environments. Exposure can be reduced by optimizing the routes different operatives take through a complex facility, for example by directing them away from a dangerous area.

- **React faster to unplanned event:** faster and more efficient rescheduling is possible if an unplanned event occurs during a maintenance event. Operators can quickly identify workarounds and assign new tasks to crews to achieve the initial maintenance goals.

**ALM-EAM integration enhances the value of 3D training**

Employee training can be enhanced by the ALM-EAM integration, particularly for pre-maintenance briefings and emergency preparedness. Virtual training provides operators with a cheaper and safer environment in which employees can familiarize themselves with assets and particular maintenance tasks. Most asset-intensive industries have an aging workforce that is being replaced by new recruits and temporary workers, who need significant training. Experienced employees who visit scores of sites during the course of a year will also benefit from training on asset-specific maintenance tasks.

By integrating ABB EAM with Dassault Systèmes’ business platform, an operator can access work orders created in EAM to create a real-time 3D simulation to step through activities in a virtual environment. In this way, employees can perform tasks in the right order in a risk-controlled environment. Each task can be reviewed by the relevant crews before an asset is shut down. Although historically this planning was done with little more than a whiteboard, a virtual environment shows employees what the task actually looks like.

Dassault Systèmes and ABB believe this new approach to training significantly improves site safety and the cost-effectiveness of maintenance. They estimate that improved training can save an operator around 6,000 man hours during a major maintenance event.
ALM-EAM integration adds significant value to asset decommissioning

In nuclear power, for example, the decommissioning process is unique and often one part of an asset continues to operate while another is dismantled. In addition, the majority of assets will have their licenses extended well beyond their original decommission date; many assets may operate for up to 60 years. When the time comes to decommission, regulatory disclosure is as essential as it is unavoidable. However, it is dangerous to second-guess future regulatory requirements, so current strategies are to retain all asset information, albeit in a sub-optimal way. It is essential that operators use an information system that can retain and maintain asset-related data over many decades.

An integrated ALM-EAM approach helps operators better manage decommissioning: the synchronized data helps reconstruct historical data, using integrated and interoperable information. Data retrieval is far more efficient, and more complete data sets reduce risk.

Analytics optimize processes for new and existing assets

Asset owners can exploit the rich insights ALM-EAM integration brings to improve business processes throughout an asset’s lifecycle. Operators building new plants can learn a great deal from the information created in existing installations, but only if this data is collected and stored in formats that allow it to be analyzed. Because the ALM-EAM integration creates a current and detailed configuration of each asset, operators can mash up data from an entire fleet, analyze the historic context of each piece of equipment, and optimize future business processes in new and existing assets over the full lifecycle of a plant. For instance:

- operators can model how an asset’s configuration changes over time
- designers can use this context to include within the original design the requirements for efficient future modifications
- operators can analyze previous handovers to identify what previously caused significant delay, to better manage future handovers.

In the same vein, past decommissioning processes can be analyzed to optimize future asset decommissioning.

Operators must embrace the opportunity of ALM-EAM integration

Data quality improvements are critical

We have spoken to many companies undertaking digital transformations, similar to the ALM-EAM integration discussed in this report. Each company recognized that business-as-usual was no longer tenable, that digitization was a necessity for a 21st century utility, and that the quality of their asset information had to be dramatically improved to maximize benefits.

ALM-EAM integration requires operators to fully digitize and index paper drawings related to a particular asset, fill gaps where no information exists, and invest in meta- and master-data management tools to ensure documents are searchable and data quality remains high. Mobile laser scanning can help accelerate the digitization of, and access to, 3D data. Advanced search
functionality automates many manual processes, and can substantially reduce the man-hours spent searching for information.

While a digital transformation relies on a transformation in data quality, these data cleansing projects can at first appear daunting. It is therefore important for operators to take a staged approach to data cleansing, with clear goals that help deliver the quickest time-to-value.

Operators should also ensure that inappropriate business processes do not subsequently spoil their data quality efforts. A concurrent business process change management program is strongly recommended as part of any data cleansing project, to change the processes that impair information quality.

Although the implementation of ALM-EAM integration requires significant effort, we believe that most operators will see a positive return on their investments in just a few years. The return on investment will be significantly shorter for major upgrade or refurbishment projects, which could deliver a positive return within the same timeframe as the project itself.

Integrate ALM with EAM during your next transformational project

We do not expect all operators to integrate ALM with EAM immediately across all of their assets. Its adoption will happen where it makes most sense to do so. We strongly recommend all new asset builds should include a ALM-EAM integration: the approach should deliver a large return on investment over the asset’s life, if it is adopted at the start of the planning stage. It will also help operators during major refurbishment projects. Finally, there is a strong argument for an operator to adopt this approach as a part of EAM or ALM software replacements or improvement.

We recommend asset owners perform a full risk assessment, identifying existing pain points, and calculate the expected return on investment that ALM-EAM integration will deliver.

Ensure your vendors’ roadmaps embrace a future where ALM and EAM are integrated

Each large-scale asset is unique. It has its own business processes and physical construction; even for similar assets, the companies involved in the design, construction, operations, and maintenance will likely be different each time; the suite of IT systems used across an asset’s lifecycle will also be different, creating information in different formats.

Consequently, each project is unique: there is no out-of-the-box integration. Therefore, IT vendors must develop their products in readiness for an integrated approach. As a consequence it is critical that operators ensure their IT vendors’ product roadmaps include a detailed strategy to integrate with other applications. Operators should work with their vendor partners to develop integration strategies, and press for change where gaps exist.
Appendix

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Ovum Consulting
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