DE Digital Engineering

MAKING THE CASE

FOR AN OPEN PLM PLATFORM

You can't build tomorrow's connected products with yesterday's PDM infrastructure.

aras corp®

COMPLEXITY & COMPETITION

Legacy IT and CAD lack readiness to drive digital transformation.

Mounting product complexity necessitates sophisticated product development platforms to foster innovation and streamline collaboration. Yet, the reality is, most traditional product lifecycle management (PLM) and product data management (PDM) systems lack the capabilities to help engineering organizations meet their objectives and accelerate time to market.

The proliferation of sensors and software, driven by demand for smart, connected products and the Internet of Things (IoT), has raised the stakes for manufacturers. Purely mechanical designs are becoming rare, as manufacturers now need to incorporate electronics and software, as well as integrate products into system designs, or into systems of systems. In addition to product complexity, manufacturers face heightened global competition, both from their traditional ranks and from new tech-savvy disruptors, which have the potential to undermine their businesses. At the same time, increased activity on the regulatory front across most industry sectors has put pressure on manufacturers to maintain visibility on product configuration throughout the entire lifecycle to ensure all safety, quality, and disposal rules and standards are consistently being met.

Legacy PLM and PDM applications and related processes were designed for a simpler era and are being stretched by current-day product development processes and requirements. These systems are not adequately equipped to coordinate global collaboration among engineers in different disciplines spanning mechanical, software and electrical/electronics. They also lack capabilities for managing configurations and facilitating processes that span the entire

product lifecycle, especially field maintenance and support, which is an increasingly important element of smart, connected products. The ability to collect data from products—for example, monitoring of aero engines to facilitate predictive maintenance services—or deliver key capabilities through in-service software updates, not hardware, as Tesla does with its electric cars, is becoming requisites for next-generation products. Legacy PDM and PLM systems don't have the muscle to get the job done.

The growing reliance on partners and suppliers for the design of critical product components, not just their manufacturing, also tests the capacity of existing PDM and PLM systems. While these designs might be proprietary to suppliers, it's still incumbent on the original equipment manufacturer (OEM) to orchestrate and track all design work in progress so the elements come together successfully to achieve the stated design goals. Here again, existing PDM and PLM systems are often hamstrung due to their closed proprietary architectures and limited capacity for integration with other enterprise systems, not to mention, high costs due to their traditional licensing paradigms.

Fragmented IT Architectures Require an Open PLM Platform

The reality is that existing PDM systems have largely remained focused on 3D computer-aided design (CAD) data management, aiding in some of the more technical documentation and workflow aspects of engineering, but not making the leap to address broader business-related concerns. This has resulted in numerous disconnected processes. The full vision of PLM has also struggled to get

PRODUCT COMPLEXITY IS ACCELERATING

→ Companies had decades to adjust to the disruption brought about by the move from 2D to 3D CAD, but the disruption caused by the demand for systems of integrated, connected systems is happening at break-neck speeds.
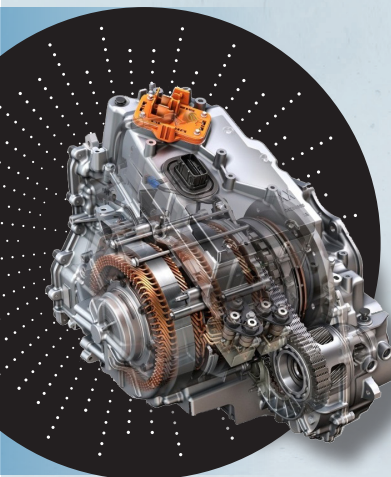
Mechanical – 2D
Mechanical – 3D
Electrical
Electronic
Mechatronics
Software
Systems
Connected
Product as a Service
System Engineering/ Model-Based System Engineering

off the ground. Traditional PLM typically requires complex customizations that prevent systems from being easily upgraded, and the heavily customized data models and workflows make it extremely difficult to implement user-driven changes. For the same reasons, it becomes hard to keep the PLM system current with continually shifting market and user requirements, or to implement on-going vendor upgrades and enhancements.

These limitations have sorely affected the perceived benefits of PLM, which has been criticized for taking too long to implement, being almost impossible to upgrade and, ultimately, too narrowly focused. In addition, legacy PDM/PLM systems have taken a hit for their inability to accommodate the mix of tools and processes that come into play as companies embark on partnerships and acquisitions. According to a CIMdata survey of the Aerospace & Defense sector, which has been a pioneer in PLM, over a third of current PDM/PLM implementations have more than three years of development remaining, and another

third have not been upgraded in more than five years.

Without the enterprise tools to deal effectively with product complexity, engineers are forced to circumvent PDM/PLM systems and use whatever tools and manual processes are on hand. Instead of diligently working from the same shared systems, engineers come to rely on email, phone calls, meetings and thousands of Excel spreadsheets to collaborate on designs and manage product-related data. This leads to poor visibility of critical information and undocumented workflows, requiring engineers to spend more time putting out fires, issuing workarounds and fixing problems, undermining their ability to innovate and maintain a competitive edge.

There are other, serious ramifications resulting from the shortcomings of traditional PDM/PLM systems. Companies end up exposed to risk as a result of poor cross-discipline communications between hardware engineers and software developers, which compromises underlying design integrity. Lack of an integrated product

WHAT'S THE DIFFERENCE?

	Monolithic/Legacy PDM	Open PLM Platform
Lifecycle scope	Product development stage	Full product lifecycle
Discipline scope	Mechanical	Mechanical, electrical, electronic, software, system
Information scope	MCAD, documents, some parts and BoMs	All product items across all disciplines
Supply chain scope	Limited supplier involvement	Full supply chain

configuration record creates confusion at critical hand-offs between engineering, manufacturing, suppliers and field support while fragmented data and processes make it next to impossible to support new opportunities in areas like connected products or product as a service. But, more seriously, unanticipated costs and disruptions create avoidable quality problems that result in rising product recalls, warranty claims and liability issues.

Open PLM Platform Enables Digital Thread

As digital transformation promises to disrupt more and more industries, companies are looking for a way to manage what is becoming an entirely digital thread, from the first conception of an idea for a product, through the enterprise, to the customer and back again. The potential business benefits of this transformation are massive: more efficient product design and development, new revenue streams based on services and predictive maintenance, and rock solid compliance and regulatory tracking, just to name a few. The combination of customer demand for smart, connected products; the data those products can collect; and access to nearly unlimited computer processing power to analyze that data is accelerating digital transformation faster than many businesses can handle with their current data management process.

Rather than go through the costly and painful disruption of replacing existing PDM/PLM systems, a platform PLM approach promises the best of both worlds. PLM platforms take a page from what's happening across the enterprise and in consumer circles. Consider that most volume cars are built on platforms that span multiple models and brands while the ubiquitous smartphone comprises an ecosystem of applications and services. Similarly, a PLM platform encompasses a mix of integrated technologies that deliver end-to-end lifecycle management at the enterprise level along with cross-functional collaboration capabilities and through-life configuration management. Integrating existing PDM/PLM systems into a PLM platform approach is a way to protect legacy investments, maximizing the utility of those components without draining productivity or curtailing innovation.

Unlike legacy PDM/PLM systems, a PLM platform supports extended data and process integration across the extended enterprise, beyond the engineering department to other areas of the business. PLM platforms reduce or eliminate integration challenges, help reduce the costs and resources required to support technology upgrades and new capabilities, and deliver greater flexibility managing intellectual assets and processes throughout the entire product lifecycle.

THE ARAS INNOVATOR APPROACH

Aras Innovator embraces the PLM platform approach with an open, resilient technology approach that is flexible, scalable and upgradable to meet the evolving needs of an extended enterprise. Aras offers four critical functions: flexible service-based architecture, predictable total cost of ownership (TCO), open connection to business applications, and upgradeable customizations.

At the core of the Aras PLM platform is model-based technology and a service-oriented architecture (SOA) that allows companies to easily develop and modify applications, processes, and workflows compared to traditional PLM systems that take a hard coded approach and can't be easily adapted. Applications are built and modified using a visual approach with the Aras Modeling Engine, and models "subscribe" to the services they need, which ensures easier upgrades and the preservation of customizations. In fact, subscribers have their upgrades completed for them by Aras in a matter of weeks.

Another upside to the Aras PLM platform is its open source model and its predictable annual subscription fee, which covers full access to applications and platform features, maintenance, support, training, software updates, and upgrade services. In comparison, traditional PLM typically has a hefty upfront cost covering modules and per-user fees on top of additional annual maintenance charges. Aras PLM also brings flexibility to the deployment model, supporting on-site public or private cloud installations along with hybrid installations.

In addition, Aras Innovator supports

The Aras PLM platform offers an open source model and annual subscription fee with full access to applications, maintenance, support, training and software updates.

an open architecture, including open standards and Connectors, ensuring the platform can be easily integrated with other enterprise applications and legacy PDM/PLM systems. Finally, the open community approach means companies can participate in collaborative open-source development and innovation, casting a wider net for capabilities that will accelerate and increase the value of their PLM implementations.

The Aras PLM platform enables organizations to maintain their legacy PDM and PLM systems that have been heavily customized, yet still keep their environments current with new features. By overlaying legacy PDM/PLM environments, organizations can avoid the short-term costs and risks of migrating older systems while positioning themselves to deliver on product innovation.

THE 4 KEY FUNCTIONS OF PLM PLATFORMS

1 **Connect teams to contextual information**. Sounds simple, but legacy PDM systems have struggled to do so for more than two decades. In comparison, PLM platforms allow users to work across system and functional boundaries, providing access to mechanical and electronic designs, software, requirements, technical documentation, process plans and quality documents—a scenario not possible with legacy PLM systems due to their fragmented architectures. In addition, PLM platforms also present information in a usable way, provide consistent access controls, and respect configuration rules.

2 **Share configuration data across disciplines**. Complex, connected products require a systems approach to design, and a PLM platform can ensure all disciplines and functions are working from the same requirements and systems model. Moreover, PLM platforms allow hardware and software deliverables to be structured in the same composite Bill of Materials (BOM) and enable multiple engineering disciplines to take part in the same design reviews and adhere to the same change management processes. A PLM platform also supports the concept of a digital thread, which establishes linkages between information items—for example, selecting a part and seeing the related CAD model, simulation tests,

requirements, change history and manufacturing parameters. Most importantly, a PLM platform ensures those linkages persist for years despite subsequent system changes.

3 **Enable collaboration across teams, functions, and disciplines**. A PLM platform goes beyond team collaboration to support interactions across functions (e.g. design, analysis, quality, and planning), across disciplines (systems, mechanical, software, and electrical), and across the extended enterprise with suppliers and partners. Both formal and informal collaboration is supported. Informal collaboration supports review, markup (of all information types) and discussions threads. Formal collaboration ensures processes and rules are adhered to by means of flexible workflows, while creating an audit trail that records critical decisions.

4 **Support all phases of the complete product lifecycle**. Unlike legacy PDM/PLM systems that have struggled with functionality beyond design engineering, PLM platforms manage the evolving BOM structure and associated changes process, provide context for industrial Internet of Things (IIoT) data, and support quality, manufacturing planning and service documentation processes.

ARAS PLM PLATFORM

Aras Innovator embraces the PLM platform approach with an open, resilient technology that is flexible, scalable and upgradable to meet the evolving needs of an extended enterprise. The Aras PLM Platform layers applications; data access and search management; configuration and change management; as well as process and knowledge management on top of existing processes.

Concept	Development	Manufacturing	Service

	Simulation					IOT
MBSE	ALM	ECAD	MCAD PDM	ERP	MES	Maintenance Management

Integrated Applications

Data, Access and Search Management

Configuration & Change Management

Process and Knowledge Management
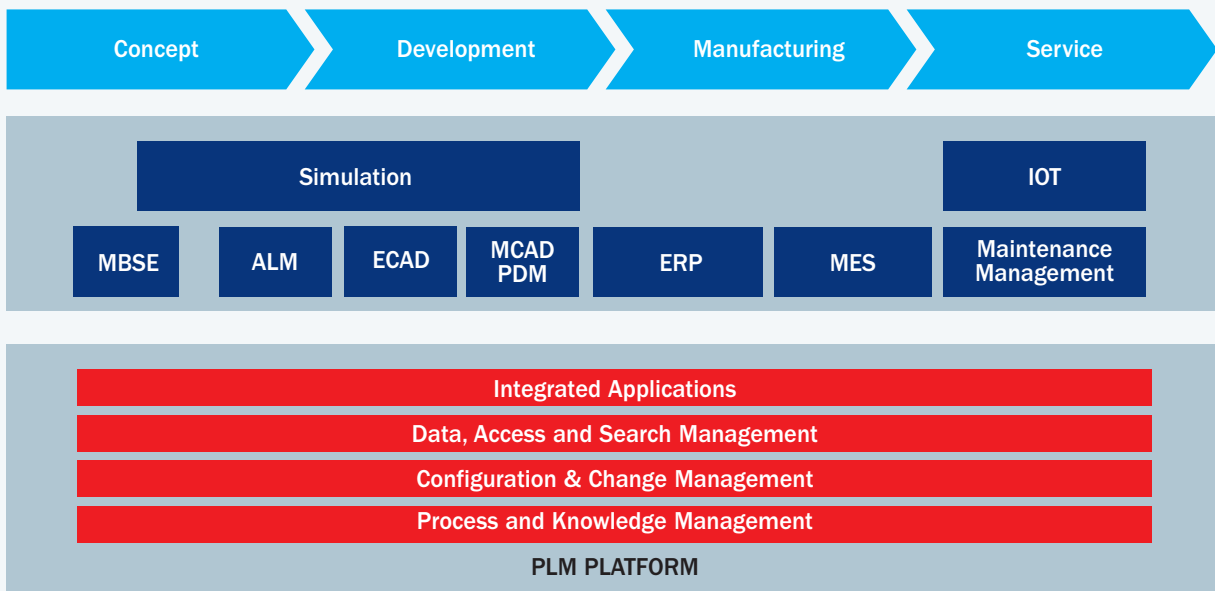
PLM PLATFORM

PLM PLATFORM IN ACTION

Aras Innovator's open PLM platform approach is helping many organizations break free of the constraints and deployment challenges of traditional PDM/PLM systems. Here are some of their stories.

Schaeffler Group Chases IoT, Digital Thread

Schaeffler Group, a global automotive and industrial supplier, is knee deep in digital transformation as part of a mission to optimize processes and gain a competitive edge. One of the key technology pieces in its vision is a web-based application to be used by 20,000 employees and built on the Aras PLM platform.

The Engineering Cockpit, a central tool for connecting cross disciplines and systems across the 85,000-person company, is an on-going initiative designed to provide role-based access to information via a web portal. The system is being designed to work across multiple disciplines, interfaces, systems and authoring tools to help stakeholders throughout the organization make better development decisions throughout the product lifecycle while also supporting companywide configuration and change management.

The Aras PLM platform's flexibility and extensibility aligns with Schaeffler's greater push for digital transformation, officials said. Initially, the Aras Platform will be used to deliver a companywide solution for configuration and change management processes over the next six months; eventually, the system will help with the efficient management of service requests, facilitate cross-discipline communications of product data and engineering processes throughout the company's supply chain, and be used for overarching project coordination. The system will also integrate with existing enterprise systems, including SAP and PTC's WIndchill PLM system.

Aras' deep integration between systems engineering and embedded software development tools creates a foundation for the digital thread and integration of an IoT platform. "With Aras, we are entering a new sphere of data integration," says Dirk Spindler, Schaeffler's senior vice president, R&D. "We want to digitally optimize processes and procedures as well as create new service-oriented processes."

The Engineering Cockpit connects Schaeffler Group employees from different disciplines and locations.

Flexibility, Open Architecture Drive Carestream to Aras PLM Platform

Greater connectivity and flexibility—those were the two primary requirements for Carestream Health, a manufacturer of medical and dental testing film, when seeking out a new PLM system.

The company had embarked on a globalization strategy, and its legacy PLM system could not accommodate the demands of a range of users spanning multiple manufacturing sites and an extended supply chain, according to David G. Sherburne, Carestream's director of global R&D effectiveness and engineering IT. Moreover, its aging PLM system lacked the inherent security capabilities and Web-enabled framework necessary to support a global PLM implementation, Sherburne said.

After a rigorous requirements gathering and return on investment process, Carestream selected Aras Innovator, in part because of its open architecture and ability to easily integrate with other enterprise systems. Aras' flexibility also was helpful when it came time to re-engineer the firm's largely manual BOM system. Carestream was able to easily develop custom modules that addressed the unique elements of its manufacturing processes—a process that would have been far more rigorous and

> Carestream Health uses Aras Innovator to integrate and globalize its systems.

time consuming with traditional PLM, Sherburne said.

Today, Carestream is using Aras Innovator to assemble engineering releases and initiate change orders in addition to facilitating the approval and release process to manufacturing. Key to this process was integrating the Aras PLM platform with SAP to create synergies between the engineering BOM and the manufacturing BOM. Beyond that, Carestream has expanded its Aras PLM platform implementation to integrate with a variety of core systems, including commercial parts management, ECAD and MCAD tools, defect management, audit management and environmental health and safety management.

> **TODAY, CARESTREAM IS USING ARAS INNOVATOR TO ASSEMBLE ENGINEERING RELEASES AND INITIATE CHANGE ORDERS IN ADDITION TO FACILITATING THE APPROVAL AND RELEASE PROCESS TO MANUFACTURING.**

Magna Deploys Aras PLM Platform to Integrate Legacy IT

With 22 worldwide locations across Europe, North America and Asia, and 12 individual companies prior to its acquisition by Magna, GETRAG was in search of a way to harmonize applications developed over the years while maintaining some of its core legacy systems.

In order to accommodate the car transmission manufacturer's increasing product complexity, myriad product families and OEM customers, GETRAG opted for an evolutionary approach that leverages a PLM platform to provide general access to specialist systems. In addition, the company wanted a single source for master data and a way to implement workflows across multiple disciplines as well as across global sites.

GETRAG chose the Aras Innovator PLM platform because of its flexibility to easily adapt to existing businesses processes as well as changing business requirements, including any modifications to the company's structure or product portfolio as a result of on-going acquisitions. The company

Magna uses the Aras PLM platform to evolve with increasing complexity

wanted a platform that preserved the benefits of existing expertise and systems in areas like PDM and document management, but that could serve as an integration platform for other critical enterprise platforms like customer relationship management (CRM) and application lifecycle management (ALM), officials said. Moreover, with the Aras PLM platform, GETRAG could hold onto legacy solutions that were still functional, yet replace outdated systems and have everything still work as an integrated environment.

Other requirements where Aras Innovator made its mark:

Airbus Cultivates IT with Aras

As Airbus' digital transformation strategy takes flight, the Aras Innovator PLM platform is emerging as an engine for IT modernization of more than 1,000 point systems currently used across engineering, test, quality and manufacturing.
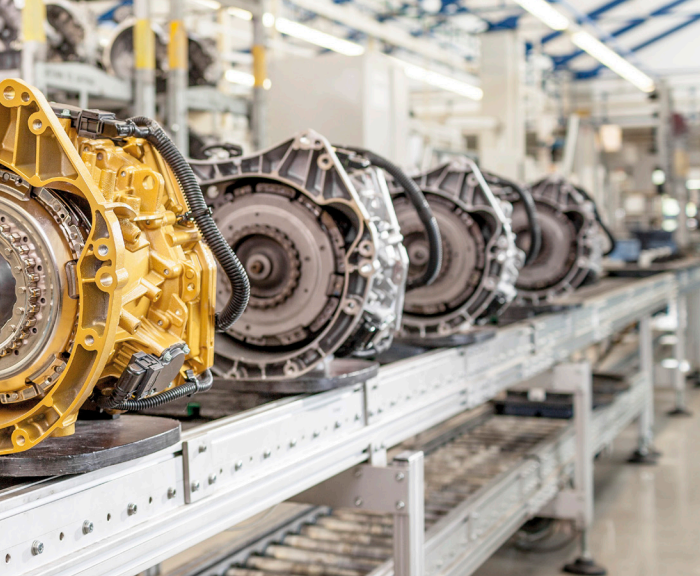
Rather than use a "top down" approach and force the business units to implement new systems, the Airbus IT team created a Greenhouse environment that business stakeholders can leverage to modernize and enhance their applications with help from IT. The Greenhouse emphasizes real-time prototyping and rapid development for application modernization and invites business users to voluntarily modernize their systems. Aras Innovator is a key enabling technology for the Greenhouse because it is flexible, scalable, upgradable, while also delivering much of the functionality traditionally found in PLM, PDM, content management (CMS), and project management systems.

Aras Innovator's support for agile development coupled with its governance capabilities has made the Greenhouse a hit among Airbus business units. After success modernizing an aging Test Information Management application, business units were sold on the viability of the Greenhouse and Aras for complex engineering processes, officials said. Today, the Greenhouse has its own project pipeline.

Airbus is modernizing IT across more than 1,000 point systems via a real-time prototyping and rapid development project.

An open licensing and simple upgrade process that helped reduce cost of ownership of PLM, and flexibility, including ease of customization and a data model that was easy to leverage in various areas. Support for standard technologies was also a requisite.

Using the Aras architecture, GETRAG was able to configure a standard platform that integrates Aras PLM with a range of existing systems, including design tools such as those from PTC, Dassault Systèmes and Autodesk, along with standard systems such as Microsoft Office and SharePoint.

MORE INFORMATION
See more real-world applications of Aras' open PLM platform at aras.com/ resources

AGILE DEVELOPMENT MEETS PLM

One of the hallmarks of modern-day business is agility. Companies are reinventing processes to get products out the door more quickly, respond faster to customer requirements and, internally, define and deploy mission-critical systems.

Yet product lifecycle management (PLM), a backbone for manufacturers, has typically been the antithesis of agile. PLM deployments are notoriously difficult to implement, off-the-charts expensive and take years to complete. By the time most PLM implementations are a wrap, the business processes they were designed to automate have changed, resulting in a costly deployment that frustrates business users.

Therefore, to keep pace with fast-changing business requirements, companies need to tackle PLM as an agile-style implementation. Yet that can only happen if the underlying PLM platform technology was designed to be as adaptable as the agile methodology itself. Most legacy PDM and PLM systems support a more rigid construct, leaning on traditional Waterfall implementation approaches and the need to capture requirements in exhaustive detail and with highly specific documentation. Traditional PLM implementations also task stakeholders with formalizing the exact system specifications prior to any development work, which inhibits the ability to continuously evolve the system to adapt to shifting business requirements and goals.

In contrast, agile methods (and agile PLM platforms) support a more collaborative process, relying on principles like short-duration work sets called "sprints," and smaller "user story" requirement sets to make it easier to develop, test and deploy PLM with less risk. This approach ensures that companies can easily shift course with PLM, adjust to changing business requirements, and incorporate resulting changes into successive sprints.

Aras PLM fully aligns with the agile methodology. Unlike legacy PLM systems, which require extensive knowledge of coding, configuration, and databases, Aras PLM takes a model-based approach that encapsulates many of those elements, allowing implementation teams to model and iterate solutions more quickly. Aras PLM also supports a subscription license that includes upgrades to the platform, which keeps costs in check. Its deployment model encourages the ability to capture feedback quickly and build upon continuous user involvement.

Aras' open and flexible services-based architecture, coupled with a model-based approach, ensures PLM can be implemented as a series of production releases, each providing incremental value to the business. By doing so, manufacturers put small wins on the board and build PLM momentum as opposed to the traditional scenario, which expends multiple years and millions of dollars on implementing a system that's obsolete on arrival.

PLM SUCCESS

Every organization needs a PLM hero.

Who is your organization's PLM hero? Because of PLM's breadth and requirement to engage a broad community of users, PLM platforms need a champion with enterprise-wide project authority to avoid disruption and gain the traction that will ensure effective use across the business.

As complex as PLM projects are, integrating the hardware, software, disciplines and processes is not what ultimately derails deployments—it's bringing the right people into the mix to elicit enterprise-wide buy-in.

Unlike PDM or even legacy PLM systems that have typically been championed and orchestrated by engineering departments and led by engineering management, a PLM platform touches myriad functions across the enterprise, thus requiring a different strategy. Commonly used design tools like CAD and simulation are typically only used by engineers, therefore, they are the only ones providing feedback on what software to buy, best practices for deployment and how to customize their system to adapt to their workflows and business processes.

It's a completely different scenario with a PLM platform, which breaks out of the silo of engineering. PLM platforms support workflows and foster collaboration within the engineering ranks, but also with other areas of the business, including manufacturing, sales, field service and support. Moreover, either as a replacement or another layer to legacy PDM/PLM systems, PLM platforms facilitate workflows and data sharing with participants outside an enterprise's four walls, with key suppliers, partners, even customers.

Some best practices for an effective PLM evaluation and deployment project are outlined below.

Align the proposal to the needs of the business. Many organizations are undergoing significant change as they revamp systems and processes to support a digital business. The C-level suite already understands why digital transformation is critical to maintaining a competitive edge for marketing, sales and customer experience initiatives—it's simply a continuation of the same theme around product-related process-

es. Engineering management across the business needs to communicate their challenges in terms top management can understand so it is part of the overall corporate mission.

Create a bridge to IT. In most organizations, the chief information officer or chief technology officer is spearheading digital initiatives, thus he/she should be a co-collaborator and champion for a PLM platform. Engineering management needs to work alongside the CIO/CTO to build a business case for a PLM platform and develop a deployment and implementation strategy that will engage the broadest community of users.

Put an action plan in place. As with any transformational system, it's not enough to put a PLM platform in place and hope it becomes popular enough to gain traction among users. A cross-functional management team representing all areas of the business needs to work together on defining the requirements, identifying business processes and creating workflows that fully exploit the capabilities of the PLM platform. In addition, the cross-functional team should identify initial pilot projects where they can achieve measurable results and use those metrics to broaden the scope of the PLM platform.

Engage business stakeholders. Beyond management, it's critical to have champions throughout the enterprise to promote use of the PLM platform. Appoint a cross-functional task force representing engineering, manufacturing, sales, field service support and supply chain users. Empower them to engage with peers to highlight the benefits of the system, answer questions and solicit on-going feedback.

PLM platforms have the power to transform critical product development processes and bolster an organization's ability to innovate and maintain a competitive edge. With the right people on board, companies can reduce implementation costs, minimize disruptions and accelerate time to value.

MORE INFORMATION
Share ideas, development and work together with the Aras Open PLM Community: community.aras.com