The classic manufacturing conundrum is how to make products quicker, cheaper, and better. Product lifecycle management (PLM) software attempts to help manufacturers answer that question with an approach that enables builders to produce higher-quality parts with improved designs that are more easily manufactured at competitive prices, all while drastically compressing the design-to-manufacturing cycle to beat the competition to market.

PLM is a business methodology for leveraging a wide collection of software. That ranges from CAD, CAM, and CAE engineering applications for design, testing prototypes and manufacturing, to product data management (PDM) for managing data, to digital manufacturing...
simulations for visualizing factory-floor processes and plant-floor layout. With PLM, manufacturing operations can manage the entire product lifecycle from concept through retirement. In 2013, CIMdata Inc. (Ann Arbor, MI) forecast that PLM grew 12.6% in 2012 to $21.1 billion, with simulation and analysis applications showing the biggest gains at 19.1% growth.

In spite of its importance to manufacturing, until recent years, PLM has largely been the domain of only the largest companies, predominantly used by aerospace and defense contractors or the automotive industry. While this is slowly changing as PLM developers offer more affordable systems including cloud-based PLM aimed at small- to medium-sized manufacturers, even major manufacturers have struggled to wring maximum payback from their PLM investments.

A recent CIMdata report, “Aerospace and Defense Industry PLM Value Gap Survey,” released in September 2013, noted that with few exceptions, the aerospace and defense industry’s heavy investments in PLM technology have led to uninspiring results: “In most cases, beyond engineering the environment falls far short of the vision—process and information flow is still largely fragmented, and information systems are layered with complexity and redundancy.” The report predicted that this PLM value gap—where a small fraction of aerospace and defense companies achieve significantly
greater value from their PLM investments than others in the industry—will continue to grow in the next 5–10 years.

Digital design and manufacturing tools got a jolt of investment and research with the Feb. 25 announcement by the Obama Administration creating the Digital Manufacturing and Design Innovation (DMDI) Institute in Chicago. Part of the Administration's manufacturing push with the creation of two consortiums, one for digital manufacturing and another on lightweight materials research, the DMDI is a public-private partnership of 73 companies, universities, nonprofits and research labs. Led by UI Labs (Chicago), the institute is funded with $70 million from a US Department of Defense cooperative agreement, and another $250 million in investment from public and private sources. SME is a partner in this new Digital Lab for Manufacturing, which will be headed by SME Vice President Dean L. Bartles, PhD, FSME. Bartles will take early retirement from his position as vice president with General Dynamics Corp. (Falls Church, VA) to become executive director of the Digital Lab.

Pushing PLM to the Masses

On Feb. 20, Automation Alley (Troy, MI) opened the new Automation Alley Product Lifecycle Management Center at Oakland University (Auburn Hills, MI). The center, located in OU Inc., a Michigan SmartZone business accelerator on the Oakland University campus, is a partnership between sponsors Siemens PLM Software (Plano, TX), the Michigan Economic Development Corp., Geometric Solutions (Warren, MI), solidThinking Inc. (Troy, MI), and Oakland University’s School of Engineering and Computer Science. The OU PLM Center will offer affordable training and PLM certification using equipment and software including CAD, CAM, CAE, digital factory simulation, 3D scanning and 3D printing.

Ken Rogers, Automation Alley’s executive director, said more than a year ago about 30 companies led by Rick Darter, president and CEO of Rave Computer (Sterling Heights, MI), met at Automation Alley. “Rick Darter’s the person who really brought this to the attention of Automation Alley. He said, ‘There’s a problem out there. We really don’t have the workforce that’s required to operate the digital equipment in product lifecycle management, modeling and simulation in the visualization areas,’” recalled Rogers. “I think we mistakenly think that innovation only happens in places where modern architecture or multimillion-dollar laboratories exist. In reality, all that’s needed for game-changing innovation is having the right people with the right resources.”
With the right PLM technology, manufacturers get a truer picture of a product design’s complexities and whether new designs are manufactureable, plus the ability to cut manufacturing costs with digital prototypes. Simulating manufacturing throughput is key, said Daniel Raubinger, Automation Alley’s director, Defense and Manufacturing. “You need to validate the throughput,” Raubinger said. With simulations of assembly lines and robots in PLM, manufacturers can see how changes impact the manufacturing process. “You have opportunity to get the design right,” Raubinger said. “It’s 100-to-1 less expensive if you can get that design right through simulation before ever taking the design to the factory floor.”

Beefing Up Collaboration, Digital Validation

Recent enhancements to Siemens’ Tecnomatix plant-floor simulation software portfolio capitalize on more collaborative tools that leverage cloud-based technology to bring a wealth of process-specific information to a much broader range of users via the Web. An example is a pilot project at Siemens customer Ford Motor Co. (Dearborn, MI) that enables virtual navigation within Ford assembly plants.

The Ford IntoSite is a cloud-based plant-mapping system that was developed using the Google Earth infrastructure. Under development for the last 18 months, the IntoSite holds 3D versions of assembly plants that enable users to navigate virtually through the assembly plants right down to individual workstations. The pilot program, announced by Siemens and Ford in December 2013, initially is being studied at the Michigan Assembly Plant in Wayne, MI, and it may be implemented globally by the automaker in the future.

“With PLM, we have lots of very strong analytical tools for developing manufacturing-based simulations—3D visualization of the factory, product data and the math data to design cars and trucks and airplanes,” said Al Hufstetler, vice president of Digital Manufacturing at Siemens PLM Software.
president, Product Management, Manufacturing Engineering Solutions, Siemens PLM Software. “Everybody uses Google, or some semblance of it. This lets us leverage the Google Earth technology as sort of a menu for customers to dig in and query on various components of data.”

The IntoSite development effort employs technology licensed by Siemens from Google, with users employing lightweight visualization technology to stream the imagery to their desktop. A translator within Google processes the visualization information. With this technology, users don’t even need to open an authoring application, Hufstetler noted. “I can just have them click on a URL and see Zone 3, Line 2, for assembly. I can see it for Brazil’s plant, Germany’s plant, or for Kentucky’s plant, and I don’t have to be a power user. It makes it a very attractive proposition for, say, the non-authoring folks out there to have access to whatever anybody’s uploaded about that particular line. That’s a key enabler there.”

Customers want to collaborate more and more with common processes. “There are less people [at companies] and with all the pressures that everyone has, having a lightweight tool to see what the plant in Sao Paulo is doing for a similar type product can be a huge value without having to fly there.”

Digital validation of plant processes is another key requirement. Siemens’ Tecnomatix virtual commissioning enables its PLM customers to virtually validate factory-floor processes at the PLC level long before cementing any final assembly line layout. “Siemens is a big company that has world-class con-

**Cloud-Based PLM Changing the Cost Equation**

Lowering the cost of PLM and speeding the deployment of new systems has made some of the newer cloud-based PLM offerings increasingly attractive. The PLM 360 platform from Autodesk Inc. (San Rafael, CA) is a cloud-based system that is said to offer significant pricing advantages over more established PLM players, and is very quick to deploy. Autodesk, which finalized its acquisition of CAM developer Delcam in February, also plans to link its CAM offerings, which include the cloud-based CAM 360, with PLM 360.

Developer of AutoCAD and many multiphysics simulation offerings including SIM 360, Autodesk now offers users a full suite of software for design, manufacturing, and simulation. “There’s the challenge of carefully evolving where we go with cloud-based products and making them complementary with our other products,” said Ron Locklin, Autodesk’s director,
PLM 360, Industry Strategy Marketing. “PLM 360 works very well with our desktop design products, like Inventor, in that it adds the ability to do highly flexible workflows to the CAD design process.”

Autodesk has offered Vault, the company’s on-premise PLM solution, for many years. The company announced a new workflow engine in one of last year’s PLM 360 releases, and typically releases updates to PLM 360 every five to six weeks. “We’ve been releasing updates monthly, but we’re starting to throttle back,” said Locklin. While the releases show investment and offer rapid advances in PLM 360 to customers, they can also present challenges in training, sales and deployment. “Obviously the popularity and frequent releases are a double-edged sword.”

Another SaaS PLM developer, Arena Solutions (Foster City, CA), in October updated its cloud-based PLM software with Arena Demand, Arena Projects, Arena Exchange and Arena API. Its customers focus on high-technology, medical and industrial manufacturing, said Steve Chalgren, Arena vice president, Product Management and Strategy.

Arena’s PLM offering helps customers shepherd product development from birth through the end of the lifecycle, as opposed to focusing more on the design end, noted Chalgren. “The fact of the matter is most OEMs today outsource at least some, often all, of their manufacturing,” he said. “The reason is because there is a lot of expensive, specialized manufacturing technology out there. These days you rarely can manufacture a product end-to-end inhouse.”

With Arena’s SaaS-based PLM solutions, users get simplicity and collaboration with anyone in their supply chain, at an attractive price point. “When you think about time-to-market and quality, the key thing you have to deliver is to get that design out to your manufacturing team,” Chalgren, “and then keep them all in sync.”

Cloud-based systems will only get more popular in the future, he added, noting that Adobe is transferring its
entire business model in that direction. “You’re not buying a house, you’re renting it, and you get a really nice place,” Chalgren said. “That’s a really gigantic value proposition.”

Stronger Links to the Shop Floor

With several recent acquisitions including manufacturing execution systems (MES) developers Intercim and Apriso, PLM developer Dassault Systèmes (Vélizy-Villacoublay, France) has sought to augment its 3DEXperience platform’s connection with the shop floor. “We’re all about having the virtual world and the real world seamlessly go back and forth so you can take issues you have in the real world off-line, optimize them, and improve the real world,” said Patrick Michel, vice president, Delmia Digital Manufacturing Offers, Dassault Systèmes. “In order to have a good virtual simulation, you need to have the live update from what’s really happening in your global production system.”

Digital manufacturing systems accomplished some up-front optimization over the years, Michel said, but it never carried over into the execution, the full production. With Apriso’s MES expertise, he added, Dassault Systèmes is seeking to better leverage its assets from the virtual world.

In February, Dassault Systèmes announced availability of Release 2014x of the 3DEXperience platform’s on-premise and on-the-cloud portfolio that includes CATIA, SolidWorks, Enovia PDM, Simulia finite element analysis (FEA) and multi-physics simulation software, and the Delmia digital manufacturing applications.

Complex Turn-Key Applications

Start and Finish with Sugino

Looking for one supplier to provide full turn-key solutions for your most complex part applications? Sugino has the answer.

Our diverse lineup of machining equipment, water jets, precision finishing tools and high-pressure washing & deburring systems are available to meet your individual needs. Learn more at SuginoCorp.com, or call for further details.
Many Dassault Systèmes customers, including Cummins, Saint-Gobain, and Alstom Transport, are finding value in digitizing manufacturing processes in order to guide, control and synchronize manufacturing operations, said Tom Comstock, Delmia vice president, Strategy and Digital Production. “In that environment, you need to be much closer to the engineering world and the manufacturing world,” Comstock said. “The traditional digital manufacturing of Delmia is right in the middle of that mix, doing the simulation and process planning for manufacturing, then we take that and make it digitally executable, to improve manufacturing efficiency and quality—and do all that while you’re rolling out all these new products.”

The race to compress design cycles can cause major problems in the supply chain, as evidenced by hiccups with high-profile commercial aircraft programs at Airbus and Boeing. “In aerospace, you’ve got huge supply-chain challenges,” Comstock said. “What I think a lot of companies are finding, with the news about the Airbus A380 and the Dreamliner, is that some of the designs were not manufacturable and were not able to be consistently manufactured. In high-tech, it’s often how you get to yield to get to a profitable product, as opposed to a losing product. How do you get to those high yields quickly? The digital environment really allows you to do that.”

Adding Apriso’s MES, Dassault dramatically cut time on new developments, reducing two years to just six months. “That’s the key reason Dassault Systèmes acquired Apriso, because of our capability to move manufacturing processes across locations, and synchronize those updates across multiple locations,” Comstock said. The digital manufacturing systems reduce time, the cost of all the manufacturing engineering, and the cost of engineering changes. “I can’t afford to wait, because I need to get to volume production as quickly as possible.”

PTC made two key acquisitions last year to bolster its Windchill 17 PLM for manufacturing. In September 2013, PTC acquired partner NetIdeas Inc., a software hosting provider, and then bought ThingWorx, developer of a platform for building and running applications for the Internet of Things (IoT). PTC will use ThingWorx to create IoT applications for its service strategies, including predictive maintenance and system monitoring, complementing PTC’s existing service lifestyle management (SLM) and PLM portfolio.

“Is cloud the be-all and end-all? I would say no,” Shoemaker noted. “We’ve had a hosted option for a long time, and we purchased NetIdeas. Where things are going is this notion that the product is always on. This Industrial Internet, or the ‘Internet of Things’ is a huge issue that is going to be even bigger.”

The market for IoT is taking off, he added, with applications like remote healthcare monitoring, as with the Fitbit Force that tracks daily activities to help promote healthier lifestyles, agricultural equipment with embedded sensors, or ski-slope grooming machines that can be automated to groom hills most efficiently.

“It can be made smart, and connected, taking information from satellites and using sensors, like an intelligent tractor or with automobiles that will be able to drive themselves,” Shoemaker observed. “These things are not far off, they’re a reality.” ME

Want More Information?

<table>
<thead>
<tr>
<th>Company</th>
<th>Phone</th>
<th>Web Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arena Solutions</td>
<td>650-513-3500</td>
<td><a href="http://www.arenasolutions.com">www.arenasolutions.com</a></td>
</tr>
<tr>
<td>Autodesk Inc.</td>
<td>415-507-5000</td>
<td><a href="http://www.autodesk.com">www.autodesk.com</a></td>
</tr>
<tr>
<td>Automation Alley</td>
<td>248-457-3200</td>
<td><a href="http://www.automationalley.com">www.automationalley.com</a></td>
</tr>
<tr>
<td>Dassault Systèmes</td>
<td>248-267-9696</td>
<td><a href="http://www.3ds.com">www.3ds.com</a></td>
</tr>
<tr>
<td>PTC</td>
<td>781-370-5000</td>
<td><a href="http://www.ptc.com">www.ptc.com</a></td>
</tr>
<tr>
<td>Siemens PLM Software</td>
<td>800-498-5351</td>
<td><a href="http://www.plm.automation.siemens.com">www.plm.automation.siemens.com</a></td>
</tr>
</tbody>
</table>

Design for Manufacturing, and IoT (Internet of Things)

Resolving problems caused by poorly designed products remains a huge stumbling block in manufacturing. “A big issue confronting manufacturers has been the disconnect between design and manufacturing,” said Tom Shoemaker, vice president, Solutions Marketing, PTC Inc. (Needham, MA), developer of Windchill PLM. “Doing the NC programs and the toolpaths are one thing. We have that as part of our PTC Creo. Another big thing that is perhaps more impactful is process planning. We have a capability that allows a manufacturing engineer to do concurrent planning. It gives manufacturing a seat at the table.”