Silo-busting in the Supply Chain
Digital manufacturing, bridging the gap between silos and cost efficiencies across the board
By Patrick Michel

Over the last decade, technological advances have driven an avalanche of change, both inside original equipment manufacturers (OEMs) and across their target markets, heating the competition to the boiling point. In this environment there is no acceptable margin for error, especially downstream, where budget overruns and downtime can delay product launches and reduce profit margins. With 80 percent of development costs determined in the early phases of the product lifecycle, to achieve dramatic time and cost reductions designs must be conceived with manufacturing in mind and released to production "error free."

Given this hyper-competitive environment, manufacturing planners are continually searching for solutions that will reduce development costs, increase productivity and heighten visibility into product definition early on, thus helping to indicate what resources and relationships will be impacted by changes.

Even after tremendous growth in the past 20-30 years in industries such as automotive, aerospace, industrial equipment and consumer packaged goods, companies are still bringing designs to production the hard way. Before the advent of concurrent engineering, engineers would "throw designs over the wall" to different departments, with a final toss to production planners who often determined the products couldn't be manufactured. The designs were either sent back for rework or the issues reconciled through trial-and-error testing on physical prototypes, wasting time and money. This cycle was repeated endlessly, but most manufacturers shared the problem so the playing field was somewhat level.

There is a more cost- and time-effective way of bringing designs through to production, and it is well within reach of every company in the supply chain. Design and manufacturing engineering have both been digitized for years, but the only thing unifying them is educated guesswork that costs companies time, money and competitive advantage. With design and production data available, there's no reason that companies can't unify the two processes in a digital environment that enables them to prototype their products virtually, saving material, time and introducing an unimaginable degree of agility into the design process.

The Solution: Digital Manufacturing in Product Lifecycle Management

Digital manufacturing is a departure from traditional methods of manufacturing planning, control and implementation. As such, it requires different people skills, different business processes and practices, and the right technology. Both the promise of substantial improvements in cost reduction with ROIs higher than current traditional initiatives and

increases in productivity to justify the effort in pursuing digital manufacturing systems are reasons compelling enough for consideration for organizations in competitive industry sectors, executives must embrace digital manufacturing as not just a competitive tactic but something that is needed for survival.

Digital manufacturing solutions work within the enterprise-wide product lifecycle management (PLM) frameworks to further support the development of improved production processes. The use of PLM to support digital manufacturing provides the potential for even more substantial benefits. Until recently, executives were faced with using point solutions directed primarily toward manufacturing engineering organizations and not fully integrated into broader PLM environments. The missing ingredients are common data models that link design activities with production engineering.

Holistic Approach

Digital manufacturing within PLM can provide executives with a holistic view of product and process design as integral components of the overall product lifecycle and enable product design to be sensitive to process constraints and capabilities. More and more manufacturers are turning to digital manufacturing as a natural extension to computer-aided design (CAD), product data manufacturing (PDM) and other PLM-related applications. Companies like Lockheed Martin and Volkswagen have made well-publicized commitments to PLM and digital manufacturing.

The following will outline how executives increase revenue and reduce cycle times by taking a holistic approach toward design and manufacturing excellence:

Give manufacturing planners early access
With planners having visibility to in-work designs, it allows for concurrent design/manufacturing planning and ongoing manufacturing input into design decisions. This not only saves costs, as potential problems will be discovered earlier on in the process, but it also reduces non-value-added activities that waste time and energy.

Introduce production rules into design processes from the conceptual phase
PLM assists in introducing production rules into the design process from the very beginning. For example, a PLM data model will advise a designer that a company cannot manufacture an assembly as they have conceived it because of compliance or supplier conflicts. At the same time, production engineers can continue to consult the data models during the design process to ensure repeatability.

Provide a change management system with bi-directional communication and real-time impact analysis
The amount of collaboration necessary between the players that encompass these

processes is staggering: The information required to describe the production of a product vastly exceeds the information represented within the product design itself. Consider the ramifications, then, of a very simple design change on a car — the information representing something as benign as, say, a change in the shape of a turn-signal stalk can have a significant multiplier effect by the time it comes to manufacturing.

Establish an integrated virtual product and factory definition that evolves together
Digital manufacturing tools connect the product that exists in a designer's imagination and the processes necessary to make that product a reality. It's important to validate and optimize plant and product layouts and processes before production begins through simulation of equipment, lines, people and material delivery. By using simulations integrated with plant layout to both better plan out the production line and ensure it remains up-to-date, it has been proven that material flow costs have been reduced by as much as 35 percent.

Virtual products and factories allow the integration of manufacturing processes, tooling designs, line designs and material handling to produce an overall factory layout that is more efficient and cost-effective.

Collaborate in a unified 3D environment to ensure designs are produced "right the first time"
Many leading manufacturers are using a digital environment to produce virtual products and perfect manufacturing processes before making physical plant investments. These digital factories can solve obvious problems-is my plant large enough to host an assembly line to manufacture an airplane-to less obvious ones-how does a redesigned part affect my existing assembly process? By simulating production in a "digital factory," companies can evaluate multiple plant and process designs even before any capital is committed. The result is a faster, more efficient, error-free manufacturing process, and a higher level of information-sharing throughout the supply chain.

Conclusion

While digital manufacturing solutions have been available for some time, most implementations have been comprised of siloed point solutions that provide only a portion of the capabilities available in a complete manufacturing solution. Point solutions clearly provide benefits, but they are not as extensive as the benefits received from integrated solutions. Digital manufacturing can be beneficial as a standalone, but when incorporated into a broad enterprise PLM process it is particularly compelling and results in substantially improved operations, more innovation and much higher benefits — leading companies to an ultimate competitive advantage.

About the Author: *Patrick Michel is vice president, DELMIA Solutions & Marketing, at Dassault Systèmes (www.3ds.com). He was appointed to this position in 2005. Patrick joined Dassault Systèmes in 1996 after graduating in Electrical Engineering at the University of Grenoble in France and having completed a Master's of Engineering at the Thayer School of Engineering, Dartmouth College. In his current position he leads the*

Solutions & Marketing organization for DELMIA, Dassault Systemes' brand for Digital Manufacturing, defining solutions for the different industries including automotive, aerospace & shipbuilding industries.