

Computer Integrated Manufacturing Case Studies

1. NX supports the full operation of various machine tools

(http://www.plm.automation.siemens.com/en_us/about_us/success/case_study.cfm?Component=240421&ComponentTemplate=1481)

Heiwa Sangyo

Integrated CAD/CAM streamlines creation of production data

Manufacturing high-precision, high-quality parts with simultaneous, multi-axis machining

Heiwa Sangyo Co., Ltd. (Heiwa Sangyo) manufactures products that require high quality and precision, including aircraft frames and engines, high-speed rail transportation components and rocket parts. The company specializes in simultaneous, multi-axis machining and mold manufacturing. Heiwa Sangyo has a diverse set of machine tools, and **NX™ software** from product lifecycle management (**PLM**) specialist Siemens PLM Software has become indispensable as its main computer-aided manufacturing (**CAMCAM**) system.

Operating from Funabashi and Ichikawa in Chiba Prefecture as well as Komagane in Nagano Prefecture, Heiwa Sangyo uses two other systems besides NX - one solely for computer-aided design (**CAD**), and the other for CAM only. The use of NX as an integrated CAD/CAM system is increasing.

NX (formerly Unigraphics® software) was first implemented at Heiwa Sangyo in the late 1990s. At that time, the company was using a very expensive numerical control (NC) programming system that did not yield a favorable cost/performance ratio. Heiwa Sangyo had many heavy industry customers and considered expanding its business by moving into manufacturing tooling for low-power molding. The company chose NX for its lower cost and because it was widely used in the low-power molding industry.

At the time of its introduction, NX was used for mold manufacturing, but it also helped Heiwa Sangyo acquire new business. “NX is the primary CAD/CAM solution in the aircraft engine field,” explains Yasuhiro Yao, president of Heiwa Sangyo. “Previously, the design work was done in 2D but, starting in 2000, engine companies changed to 3D, and NX was the tool they used. For that reason, using NX led to new orders for our company.”

Integrated CAD/CAM accelerates creation of production data

Heiwa Sangyo manufactures parts based on design data supplied by its customers. Customers typically supply only the model of the finished part with some machining instructions and other documents. Heiwa Sangyo engineers must create additional data for the manufacturing process, including designing workholding jigs and fixtures. “The modeling process to create the data for manufacturing is quite complex,” explains Shinichi Ohara, Manufacturing Engineering Department, Heiwa Sangyo. “With its linked CAD and CAM, NX is extremely effective at solving this challenge.”

Heiwa Sangyo uses NX throughout all processes, from the time the data is received from the customer until the machine tools are set in motion. For many projects, Heiwa Sangyo must create blueprints from the designs, using the drafting capabilities of NX. When machining involves many steps and multiple types of machine tools, engineers use NX to create work instructions and process plans. “NX is a complete CAD/CAM solution that we use when we need to go from blueprint creation and design to production on the shop floor,” says Ohara.

Working with customer data

In many cases, the design data supplied by customers is not in native NX format. In such cases, the company imports the data into NX using common intermediate formats such as the Standard for the Exchange of Product Model Data (STEP) or the **Parasolid®** software format.

The synchronous technology modeling capabilities of NX are especially useful in working with imported data. “We lose the original parameters when importing the supplied data and end up with a model that we can’t revise with conventional modeling,” says Ohara. “In that case, using synchronous technology allows us to change the size of holes or move surfaces on models that have no history, so we use it a lot.”

Heiwa Sangyo also uses the modeling functions of NX for troubleshooting when there are problems in converting data from other systems. Translation problems require extra time to clean up and repair data, and can impact the production schedule. Data conversion problems become even more serious when the 3D data is provided without blueprints, because the company must work only with the shape data. “Depending on the system used to create the part model, problems such as missing surfaces may occur when we import data,” Ohara explains. “NX is able to

read such data with no trouble and can easily edit the data, even if there is a problem. NX is very useful for repairing data when conversion problems occur.”

Post builder yields top performance for machine tools

Because Heiwa Sangyo is in the business of manufacturing actual products, the company must be able to create NC code for a broad variety of machine tool and controller configurations. More than 15 types of postprocessors are needed for the operation of the company’s machine tools. The creation of these posts can be very difficult work, and Heiwa Sangyo engineers use the integrated [NX CAM](#) Post Builder capability to improve this process.

Before NX CAM, Heiwa Sangyo relied on other companies to create postprocessors. “With the CAM system we used previously, we outsourced development of the postprocessor required for each machine tool,” says Ohara. “We had to buy the posts for each machine tool, but we were unable to add or change anything in those posts. We were delighted that NX CAM had the capability to quickly customize postprocessors. It provides users with dedicated functions in an easy-to-operate user interface that responds to the requests of CAM users.”

Yao summarizes the merits of postprocessing with NX: “The postprocessor used to be a black box, but with the NX Post Builder we can now create and adjust it by ourselves.”

Cutting training time in half

In an industry where the use of CAD/CAM is increasing, NX helps reduce the cost and time required for personnel training. “Other systems are CAM-only or CAD-only, so you have to learn two tools to use them as a CAD/CAM system. NX is an integrated CAD/CAM solution, so it only requires half the training time,” says Ohara. Functions that enable the intuitive creation and editing of models, such as synchronous technology, are effective even when used by engineers with few CAD skills.

Confidence in system development and support

Before NX, Heiwa Sangyo used another CAM system as their primary solution. The other system was considered to be easier to use for simultaneous multi-axis machining, which is the company’s core expertise. However, changes in the ongoing development of that system focused more on design functions rather than CAM, and the system lost its prior advantages.

Heiwa Sangyo also values support as a key reason for the use of NX as its primary system. “NX provides tool and holder libraries that are valuable even for tasks that we perform on other systems,” says Shinichi Ohara, who manages the actual NX operation at Heiwa Sangyo. “In addition to the main CAM functions, NX also supports peripheral technologies, such as the templates and design libraries used in CAD. I think that full-fledged support is the main reason that we have been able to use NX in our own way. We are able to talk more directly with the developer, and for a company of our size, the direct communication is personal and reassuring.”

Looking to the future of manufacturing

Heiwa Sangyo sees many advantages provided by NX, such as the software’s support for advanced capabilities of the latest machine tools. The company is also attuned to the potential of NX under Siemens, which also manufactures industry-leading machine tool controllers and has a reputation for facilitating high-performance complex machining.

Heiwa Sangyo is independently expanding the use of NX by linking it with quality control systems. Quality is important for companies engaged in manufacturing and delivering real products that satisfy high customer standards. Currently, the company uses NX to create the production NC data from customers and send it to machine tools. Heiwa Sangyo is building a system to support high-quality manufacturing throughout the process, which will be a significant competitive advantage.

2. **Messerli Informatik AG Messerli Informatik AG**

http://www.spatial.com/sites/default/files/Messerli_CS_2015_FINAL.pdf

COMPANY

Whether designing a ski lift and the terrain around it, or architecting a large manufacturing plant, mechanical designers and plant engineers rely on Messerli Informatik's EliteCAD 3D mechanical design software to get the job done quickly. The Swiss / Austrian software firm has been developing specific industry solutions for the construction planning process for 30 years. With a large installed base in Switzerland, the company also directly serves the Austrian and German markets, and partners cover Germany, Netherlands, England, Czech Republic, France and Spain. Messerli Informatik's EliteCAD software undergoes extensive and rigorous testing, with continuous feature development ensuring that its customers have access to highly configurable software that enables them to develop their products more quickly than with competitive offerings. EliteCAD provides a great deal of flexibility in structuring large models, some of which have more than 100,000 separate parts. Messerli Informatik customers use EliteCAD for a range of modeling operations: they make models from scratch, use 2D drawings to make 3D models and some need several variants of the same machine. If a change is made to a 2D drawing, the 3D model is automatically modified. EliteCAD is used in two primary applications: construction (plant and process engineering) and mechanical (i.e., design of machines for mineral processing or waste paper/plastic/glass recycling). EliteCAD provides the plant engineering market with a streamlined solution with which to do everything from high precision design and drawings to scheduling and cost planning. The software efficiently generates 3D models from which plans, images and measurements can be taken. The 3D model delivers a range of corresponding plans and high quality presentation material for project presentations. A two-dimensional function is also available for the extensions of plans or the reworking of detail drawings. An integrated freeform module enables an interactive method of defining complex three dimensional elements and objects such as facades, roofs, sanitary utilities, furniture, design objects and ramps.

For mechanical designers, EliteCAD is a 2D and 3D CAD software solution for planning and engineering steel structures and the terrain around them. The software is extremely flexible when it comes to multiple building structures with various floor levels. It has an efficient floorlevel and structure management that allows for the planning of larger estates with multiple buildings of staggered heights. CHALLENGE Messerli Informatik had its own 3D CAD kernel for solid modeling but it had weak functionality for blending and precise inline operations. Speed is paramount to EliteCAD customers and these operations performed slowly. The company also sought file translation capabilities to address its customers' need to import 3D models from other CAD programs.

SOLUTION

The company selected Spatial's ACIS geometry kernel and 3D InterOp file translation suite. No other company could offer a geometry kernel with the breadth of ACIS' functionality and the InterOp translators had a reputation for excellent quality. When the ACIS integration into EliteCAD started, technical staff from Spatial worked on site at Messerli Informatik. "The excellent documentation soon allowed us to continue the development process more or less independently," says DI Dr. Wolfgang Stöger, head of development and CEO of Messerli Informatik Austria. Within a few months, Messerli Informatik developers completed the integration of ACIS into EliteCAD. A new release of EliteCAD featuring the latest version of ACIS is released every two years. Many Messerli Informatik customers import 3D models. Spatial's InterOp translators, specifically IGES, CATIA V4 and V5, PRO/E and STEP are heavily relied on to provide accurate file translation. STEP is particularly important because it is widely used in Austria. Messerli Informatik found that InterOp imports 3D objects with very high quality, enabling them to work with the model as if it was created within EliteCAD. "Because of EliteCAD's interoperability capabilities, our customers can work independently from the CAD systems of their suppliers," says Stöger. ACIS was initially selected on the strength of its precise inline and blending functions. "Generating 2D views of 3D models is one of the most important capabilities to our customers," says Stöger. "ACIS' inline function is stable, fast and precise." The

excellent relationship Messerli Informatik has with Spatial's sales and support teams contributes to the strength of the partnership between the two companies.

RESULTS

Messerli Informatik hadn't meant to replace all of EliteCAD's 3D modeling functionality with ACIS, rather it intended to perform blending and precise inline operations in ACIS and then convert the model back to its own 3D data format. "We realized the ACIS toolkit had better overall functionality than our own, so we decided to forgo our own geometry kernel and use ACIS for all modeling functions," says Stöger. Ongoing development efforts to incorporate new releases from Spatial run seamlessly. "When implementing new features it is essential to gather all relevant information quickly in order to achieve fast development cycles," says Stöger. "The Spatial documentation satisfies these requirements and provides a comprehensive overview as well as detailed technical information."

3. **Raytheon Streamlines and Automates its Material Requirement Planning Processes with Exostar's Supply Chain Platform (<http://www.exostar.com/Exostar-Raytheon-Case-Study.pdf>)**

Background – Controlling and Optimizing a Manually Intensive Task As one of the world's largest aerospace and defense (A&D) firms, Raytheon is responsible for the implementation and delivery of a substantial volume of highly-complex products and services to its customers. To achieve its objectives within stringent cost, schedule, and quality constraints, Raytheon relies on a global, multi-tier network of suppliers. In this multi-enterprise operating environment, Raytheon must ensure that each of its suppliers provides the required quantities of goods at precisely the right time to keep customer orders on track while minimizing inventory-related expenditures and handling. The development and communication of these timelines is accomplished via the material requirement planning (MRP) process. Like most large A&D companies, Raytheon's 6 business units each function with a significant degree of autonomy. As a result, each business unit over time created its own MRP processes best suited to its specific requirements. These MRP processes were encapsulated and executed by one or more home-grown or commercial off-the-shelf MRP systems, leading to the deployment of a total of 9 MRP systems across the company – each of which generated new schedules weekly. Regardless of the MRP solutions in place, each business unit faced a common challenge. In order to protect the integrity of the MRP systems and the information they contained, corporate policy mandated that none of these MRP systems could be integrated directly with any of their suppliers' systems. This operating environment meant all coordination between Raytheon buyers and their suppliers had to be conducted manually, including:

PO Acknowledgement: Preceding a commitment, all parties had to reach consensus on a Purchase Order comprised of line items that detailed what was to be delivered and when. POs, PO Responses, PO Changes, and PO Change Responses were faxed back and forth until mutually-acceptable delivery terms were defined, with updates rekeyed into the MRP and supplier systems along the way.

MRP Modifications: Each week, after the MRP systems produced updated schedules, any modifications requested by Raytheon had to be communicated to the affected suppliers by phone, fax, or email, which subsequently initiated the manual exchange of PO Changes and PO Change Responses, as well as corresponding system updates, until the buyer and supplier were in agreement.

Place & Chase: As a PO line item commitment date approached (typically, within a 30-day window), buyers and other Raytheon staff contacted suppliers personally on a weekly basis to reconfirm that the anticipated quantity of goods would be delivered on time. Due to the volume of activity, engaging all relevant suppliers was impractical, forcing Raytheon personnel to focus on outreach to suppliers on hook for only the most critical materials – jeopardizing schedule accuracy. Any supplier-driven deviations necessitated manual entry of changes into the affected MRP systems and subsequent schedule recalculation.

With an annual company-wide load of more than 1 million POs and an average of 2-3 changes per PO, each business unit dedicated 12-15 full-time equivalents to communication with its suppliers and execution of MRP system updates. Raytheon recognized that the substantial amount of human intervention in the MRP process did more than just consume valuable resources – it harbored unnecessary risks, such as:

- Miscommunications between buyers and suppliers.

- Lost or misplaced documentation when printing, faxing, or emailing.
- Unintentional introduction of errors as buyers updated documents by hand in the MRP systems and suppliers did likewise on their systems.

These risks opened the door to longer lead times than were warranted or required by Raytheon. The company's risk mitigation strategy was straightforward: identify a solution that minimized the human factor in the MRP process. Increased automation would not only improve the process, but also set the stage for process consistency across business units, redeployment of resources to the most critical tasks, and a more collaborative experience with suppliers. To achieve these objectives, Raytheon conducted an extensive evaluation of solution alternatives, including analysis of commercial off-the-shelf licensed products from a variety of vendors. Based on the results of their competitive comparison, Raytheon turned to Exostar.

The Solution – Extending MRP Systems with Exostar's Collaborative Supply Chain Platform

Raytheon understood the importance of facilitating the collaboration throughout the MRP process between buyers in their business units and their supplier counterparts, but they were determined not to overhaul their existing infrastructure in order to do so. Business units were unlikely to embrace major changes to their operating environments that would take an extended period of time to complete and necessitate significant investments for implementation, as well as retraining of personnel.

Exostar's Supply Chain Platform (SCP), powered by E2open software, circumvented those concerns. The leading multi-enterprise supply chain collaboration solution for the global A&D marketplace, SCP is offered via a hosted, Software-as-a-Service model. As a consequence, Raytheon received a proven, ready-to-execute capability that limited their upfront financial commitment and encouraged adoption in a phased approach – perfect for an organization whose business units had decision-making autonomy.

Raytheon embraced a tight integration with SCP, thanks to Exostar's ironclad security. SCP's flexible, service-oriented architecture and extensive library of supported standards and protocols meant the solution could be integrated seamlessly and expeditiously into the operating environments of Raytheon and its supplier partners. Raytheon's prior deployment across the organization of a communications bus and integration gateway called cHub paid additional dividends for the company: SCP could connect directly with cHub and the MRP systems at any of Raytheon's business units could be left predominantly intact. Buyers could continue using the MRP system interfaces, documents, and procedures with which they were accustomed, yet transactions including POs and PO Changes could flow electronically to SCP through cHub.

Raytheon's Integrated Defense Systems (IDS) group was the first business unit to transition to SCP and migrate its legacy MRP process to a collaborative MRP (cMRP) process connecting its existing MRP systems with SCP. IDS was driven to automate its collaborative planning processes with a more scalable framework to promote the establishment and ultimate fulfillment of aggressive business growth targets. Exostar worked closely with Raytheon to train buyers and selected suppliers and on-board them to SCP. SCP controls the transactions associated with the planning, scheduling, and delivery of goods for IDS buyers and their suppliers. Specifically, SCP enables:

Automated Processes: Constituents no longer need to print and fax POs, PO Responses, PO Changes, and PO Change Responses during the initial negotiation leading to a commitment or in response to the weekly cMRP scheduling updates. All relevant documents are exchanged and archived in SCP throughout the cMRP process.

Alerts & Notifications: Buyers no longer have to call, fax, or email suppliers on a weekly basis to reconfirm delivery dates and quantities for PO line items with a near-term commitment date. SCP identifies the relevant line items and initiates email communication with suppliers requesting a status update. If a supplier fails to respond or indicates that it cannot meet its obligation, SCP notifies the affected buyer, who subsequently can contact the supplier to determine the appropriate course of action.

Supplier Performance Traceability: SCP allows suppliers to electronically issue an Advance Shipping Notice (ASN) when they are prepared to deliver goods to Raytheon, providing buyers with additional insight into status and eliminating excess shipping costs due to miscommunications. In return, buyers acknowledge the ASN and the arrival of materials by using SCP to create and send suppliers a Goods Receipt Notice (GRN).

ASNs and GRNs provide the depth of detail and traceability necessary for compilation of robust real-time and historical supplier performance metrics.

Results – Driving Improvement through Truly Collaborative cMRP

The IDS business unit's decision to leverage SCP is benefiting its buyers and suppliers. Because SCP fosters improved collaborative planning and scheduling processes, IDS has been able to modify its legacy end-to-end MRP process to make it a leaner, more automated, and standardized cMRP process that reduces human intervention, increases productivity, and more closely integrates Raytheon and its suppliers.

By minimizing the need for data re-entry, printing and faxing of documents, and phone- and email-based communication and coordination throughout the cMRP process, SCP has delivered the advantages IDS anticipated: a reduction in administrative and overhead expenditures, the virtual elimination of manually-induced errors, and an opportunity for buyers and suppliers to work together even more efficiently.

SCP's Information Manager component extends the solution's benefits by providing clear, comprehensive visibility into interactions and performance throughout the cMRP process – in real-time and over the course of time. Its executive dashboards and reports promote greater collaboration and accountability across the supply chain, enabling buyers to create supplier scorecards. Because Information Manager allows anomalous conditions to be identified in short-order, IDS can manage by exception, no longer requiring personnel to scrutinize each and every transaction in detail. Consequently, the cMRP process executes more consistently and smoothly, leading to improved supplier performance with regard to fulfilling commitments on-time and on-budget.

To help ensure the success of its new cMRP process and operating environment, IDS is migrating its suppliers to the solution in a series of waves. The initial waves incorporated a group of 71 suppliers producing in excess of 20 thousand transactions per month – 40 percent of all MRBased transactions in the business unit. Additional suppliers will be brought on-board in subsequent waves, with IDS rapidly approaching its initial milestone of SCP handling 80 percent of all transactions and its ultimate objective of transitioning almost all of its nearly 150 suppliers by the end of 2009. By the conclusion of the migration, IDS expects to:

- Re-deploy the 12-15 full-time equivalents once required to administer communication with suppliers and execution of manual MRP system updates – dramatically improving resource utilization.
- Increase on-time delivery of goods from its suppliers by at least 10 percent.

IDS's cMRP achievements have encouraged other business units at Raytheon to embrace change. The company's Space and Airborne Systems business unit has adopted SCP as its cMRP standard and has transitioned its core group of suppliers to the platform, while the Raytheon Missile Systems unit expects to begin its migration to SCP for cMRP process execution in the second half of 2009. As more of Raytheon's business units make the move to SCP to streamline and improve their existing MRP processes, not only will they benefit individually, but the firm will be positioned to realize economies of scale that will lead to even greater advantage – to the tune of up to 3 million dollars a year.