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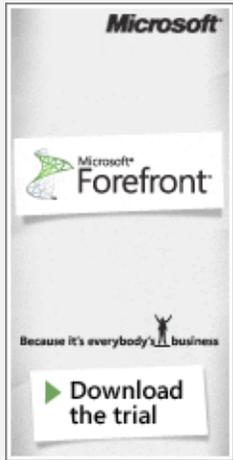
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## 4-page Case Study

### Killdeer Mountain Manufacturing

Small Manufacturer Improves Supply Chain Visibility, Cuts Cycle Time and Costs

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***As a small contract manufacturer with customers ranging from large aerospace contractors to the U.S. Department of Defense, the efficiency, productivity, and responsiveness of Killdeer Mountain Manufacturing, Inc. (KMM) are vital to its success. By moving from a largely manual manufacturing and supply chain process to an automated RFID-based infrastructure, KMM improved inventory visibility, cut costs, reduced production cycle times, enhanced customer service, and increased efficiency and productivity. KMM achieved this by combining Lean manufacturing principles and RFID technology with Microsoft® software for its financial, manufacturing, and RFID infrastructure. KMM now has capabilities that were once limited to the more costly systems used by larger firms. The Boeing Company will offer KMM's solution as a supply chain automation model to its small and midsize manufacturing suppliers.***

## **Situation**

Killdeer Mountain Manufacturing, Inc. (KMM), a family-owned high-tech contract manufacturer based in Killdeer, North Dakota, stakes its reputation on providing reliable electronic assemblies on time and within budget. The 300-employee company has done well over the years by forging relationships with leading original equipment manufacturers (OEMs) and government agencies, including The Boeing Company and the U. S. Department of Defense (DoD). With a desire to help small businesses compete on a level playing field, KMM leaders approached Boeing with a proposal to develop a state-of-the-art system that would automatically track work in progress, mimicking the sophisticated automated processes used by its OEM customers.

KMM's original manufacturing systems had several limitations. The manufacturing process, for example, did not track inventory levels in real time. This made sales and purchase order processing difficult. Also missing was warehouse

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## **Solution Overview**

### **Organization Profile**

Killdeer Mountain Manufacturing, Inc. (KMM) is a contract manufacturer based in Killdeer, North Dakota, with 300 employees that produces electronic circuit board assemblies, cables, and support equipment. Its focus is on-time delivery and quality.

### **Business Situation**

To remain competitive, KMM needed to modernize and automate its supply chain communications to increase efficiency, provide information in real time, and reduce human error.

### **Solution**

An RFID-enabled supply chain network based on Microsoft Dynamics® GP and Microsoft® BizTalk® Server provides real-time information, improves visibility, and cuts costs across the enterprise.

### **Benefits**

- 50 percent reduction in production cycle time
- 35 percent reduction in the time required to fabricate an assembly
- 71 percent reduction in the production to shipment cycle time
- U.S.\$122,880 savings in salary costs

### **Hardware**

- HP Proliant 380 servers
- R16 Symbol MC9090 mobile computers with standard

system validation for item numbers, lot numbers, serial numbers, and quantities. Because it lacked this functionality, KMM experienced too many receiving, picking, and shipping errors, and the company had no real-time visibility into production.

Even more challenging than these internal inefficiencies were the new demands by KMM's leading customers. These customers require just-in-time (JIT) information, but KMM had a two-day lag time. Customers also wanted more detailed and consistent documentation about work in progress and finished goods inventory—something KMM had trouble delivering with its outdated systems.

"Our primary goal was to expand control and visibility to meet supply chain mandates from our customers," says Don Hedger, President of KMM. This would enable the company to deliver the JIT information its customers need, but it would also lay the groundwork for future improvements in process efficiency. Improving internal control and visibility, and communicating status across its value chain, would mean creating checkpoints throughout the lifecycle of an order. Among these checkpoints are the following:

- Order creation
- Work process initiation
- Final assembly

Ideally, KMM and its partners wanted visibility into every step in the manufacturing process. If the companies could achieve this visibility, an instant update would be sent to all suppliers when one member of the supply chain changed its production schedule. As a result, every company in the supply chain can see how that change will affect their own processes and plans.

 \_\_\_\_\_ The first steps toward greater

 We have seen some of our cycle times cut almost in half. 

**Don Hedger**  
President, Killdeer  
Mountain Manufacturin



automation and efficiency were implementing Lean manufacturing and Six Sigma methodology. Lean manufacturing is a system of management in which sources of waste, such as over-production or waiting time, are eliminated from the manufacturing process. Six Sigma is a system of practices that improves quality by reducing variability.

To make the plan work, KMM executives knew they also needed to apply new technology. Dan Hedger, KMM's Vice President, looked to one of the company's main partners—Boeing—for direction. He learned that Boeing had improved its supply chain communications using a combination of sophisticated software and radio-frequency identification (RFID) technology. Boeing's system, however, was geared toward large OEMs and was not appropriate for small to midsize contract manufacturers such as KMM.

"We knew that combining RFID technology with Lean and Six Sigma was a relatively new idea," Dan Hedger says. "But we also knew that if we could do it, we could exploit those sensors throughout our value chain to increase visibility and improve processes."

In concert with Boeing, KMM was looking to satisfy one of its largest mutual customers: the U.S. Air Force Manufacturing Technology Division at Wright-Patterson Air Force Base. The Air Force was relying on Boeing and KMM to improve production predictability for the parts and subassemblies for a military aircraft program. The Air Force would also document the approach and solution implemented by KMM in a white paper that would provide guidance to help its smaller suppliers compete more effectively. In addition, a more efficient supply chain network would satisfy the Air Force's demand for shorter lead times and lower cost.

"We needed a methodology for the small and midsize enterprises that make up the supply chain of prime contractors to help reduce cost and enhance product visibility along the whole supply chain," says John

Crabill, Senior Product Engineer and Program Manager at the Air Force's Manufacturing Technology Division. "To impact cost at the bottom line, we have got to get back down the supply chain to the small companies."

For funding, KMM turned to both the Air Force and the State of North Dakota. Senator Byron Dorgan (D-N.D.) spearheaded the search for federal funding.

"Senator Dorgan has been very supportive in securing federal research dollars for the project in an effort to accelerate technology transfer to the small business community around the country," says Don Hedger.

## **Solution**

Combining RFID with the principles of Six Sigma and Lean manufacturing soon became the foundation of the RFID Supply Chain Optimization Universal Toolkit (SCOUT) program. This program was developed collaboratively among KMM, the Air Force Manufacturing Technology Division, and Boeing, along with systems integrator Activ Technologies, Inc. and RFID hardware vendors Alien Technology Corp. and Avery Dennison Corp.

RFID SCOUT combines RFID hardware, software from Microsoft and other vendors, integration services, and design recommendations to produce a reusable blueprint for an RFID-enabled supply chain solution tailored for small to midsize manufacturers.

The RFID SCOUT program is divided into three phases. Phase 1, completed at KMM in 2007, encompassed the Lean manufacturing, Six Sigma, RFID-readiness assessment, and the RFID hardware infrastructure design and deployment. It also included RFID software integration and electronic tracking among supply chain partners. Once Phase I was complete, KMM could generate an RFID tag, affix it to a single package, and ship the tagged package from its facility to Boeing.

Phase 2, recently completed, focused on capturing and processing RFID data to provide both KMM and Boeing with real-time visibility into production and inventory. By

the end of Phase 2, KMM had implemented an end-to-end process that includes product being picked up and received with Microsoft® BizTalk® Server RFID, brought into Microsoft Dynamics® GP business software, and presented in a way that Boeing can view. KMM is also creating advance ship notices, which provide Boeing with accurate, real-time information about product availability, explains Mike Roberts, president of Activ Technologies, an enterprise resource planning (ERP) process optimization and supply chain consulting firm brought in to support Phase 2 of the project.

For the data capture process, KMM installed the following hardware components:

- Portal readers from Alien Technology
- Mobile computers with scanners from Symbol Technologies, Inc.
- Universal access points from Cisco Systems, Inc.
- RFID/barcode printers from Avery Dennison

Once the data capture process was solidified, the team chose to make Microsoft Dynamics GP the foundation of the supply chain system—an easy choice, because KMM was already using some basic capabilities of the software internally. “It was a natural choice,” says Dan Hedger, “because Microsoft Dynamics GP easily incorporates RFID data into its internal processes for streamlined automation.

“Microsoft Dynamics GP is the back-end system for everything we do, and it is a great choice to pair with our front-end collection of sensors,” he adds.

The heart of the solution is Microsoft Dynamics GP 10.0 for financial, inventory, and production management and the Microsoft Dynamics GP Business Portal, which creates an integrated Web-based system that delivers applications and business information across KMM’s entire supply chain. For example, KMM is using the portal to make information available to external vendors, such as Boeing, via the Internet. Once inside the secure portal, Boeing views pertinent information, such as order status and production volumes, from within Microsoft Dynamics GP. In addition,

and by design, Microsoft Dynamics GP and the portal integrate easily with BizTalk Server. The Microsoft Dynamics GP Adapter for BizTalk, a supported adapter that provides a highly maintainable and supportable gateway to the core ERP business logic, makes it easy for customers to integrate key systems and optimize end-to-end processes both within the four walls and across organizational boundaries.

An important component of RFID SCOUT is the Avery Dennison Monarch Model 9855RFMP RFID Printer/Encoder, which allows on-the-fly printing and encoding. It also is capable of sending variable data from a source, such as an SQL database, to the printer through the BizTalk Server RFID interface in every form necessary—human-readable, barcode, and embedded into an RFID chip by the printer, explains Jeanne Duckett, Director of Advanced Development at Avery Dennison.

The glue binding all of these systems together is BizTalk Server 2006 R2. Using BizTalk and its RFID Server, KMM has created a service-oriented architecture (SOA) capable of the following:

- Connecting all of the systems and data sources in its supply chain processes
- Enabling real-time integration of and visibility into data from multiple sources
- Orchestrating, managing, and monitoring production and supply chain processes
- Producing and managing all of the standard electronic data interchange (EDI) documents—Advanced Ship Notice (ASN) 850, 856, and so on—needed to trade successfully with large supply chain partners like Boeing

KMM and RFID SCOUT rely on BizTalk Server RFID to gather, filter, and clean RFID data from edge devices, such as handheld readers. In addition, BizTalk Server's business activity monitoring (BAM) helps KMM keep its finger on the pulse of its systems, alerting personnel in real time when any process needs attention. BizTalk Server connects all of the solution components to provide visibility, more accurate and timely predictive analytics, triggers, and business alerts.

The alerts are especially important in a just-in-time environment. BizTalk Server notifies KMM if the company reaches an out-of-limit or out-of-sync condition on the shop floor, which allows KMM personnel to take appropriate actions immediately. BizTalk Server also generates an RFID shipping compliance alert to Boeing, through an EDI 856 ASN notification, thereby providing full tracking and accountability on both ends.

“BizTalk Server is remarkable in that it has so many subapplications within it and capabilities for generating and modeling so many different types of manufacturing scenarios,” says Dan Hedger. “What we produce and what our manufacturing floor looks like can be different from one week to the next, so our layout and flexibility needs require an RFID solution that is very flexible and allows us to deal with any type of configuration that might come our way.”

When combined with BizTalk’s native RFID infrastructure, EDI, process optimization/management tools, and application services for device/tag interaction, Microsoft Dynamics GP users effectively have a large-enterprise RFID solution in a box.

### **Proof of Concept**

Once KMM chose the solution components, it needed an approach that would help the extended team come together and ensure all of the pieces would work smoothly. To achieve that, Activ Technologies led the team in creating a real-world test environment at KMM.



By

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**Dan Hedger**

Vice President, Killdeer  
Mountain  
Manufacturing

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connecting all of the components in just the same way that they would function in a production environment, Activ, KMM, and the other participants were able to validate how many RFID readers were needed, how far apart they should be placed, and what data should be sent to the Microsoft Dynamics GP system. It was then much easier to create the reporting mechanisms that detail which data is transmitted from Microsoft Dynamics GP to other parts of the overall system and, eventually to KMM's supply chain partners.

In addition, the test environment allowed KMM to show Boeing the specific data that would be transmitted, thus enabling Boeing to request changes in advance of the system going live. During the proof-of-concept testing, Boeing used the data to develop its own graphical dashboard, thereby creating a supplier visibility portal internal to Boeing, according to Scott Martin, a Manager on the Production Systems Technology team in Boeing's Phantom Works Division.

Boeing users were also able to see first-hand how the data would be transmitted from the RFID reader to Microsoft Dynamics GP and released into a manufacturing order, so they could see how KMM's day-to-day work would be affected.

"We were now beginning to get really useful data from Killdeer regarding production work," Martin says. "In fact, the system is working so well that Boeing executives are interested in expanding it from just one military aircraft program to all other manufacturing endeavors across the company."

By the end of Phase 2, KMM, Boeing, and the rest of the team had done what they set out to do. "We demonstrated that we could put the parts that make up a component into a kit, commission an RFID label associated with that kit, and watch that kit go through the production line into the shipping area—and build on what we did in

Phase 1," Don Hedger says. Real-time visibility was a reality.

Phase 3, currently in progress, will provide cradle-to-grave inventory tracking. The first task is to extend RFID tracking to point-of-use at Boeing. That means making sure each member of the supply chain has visibility into not only what other members of the supply chain are doing but also their supply levels. With this knowledge, all parts of the supply chain will be able to run more efficiently and profitably.

"Say Boeing is building a fighter jet and uses a specific set of Killdeer parts from its inventory for the job. We will be able to see that at Killdeer, and then match our parts production and replenishment rate to Boeing's rate of use, which will keep everyone on schedule," Dan Hedger explains. "We would also be able to see how many airplanes Boeing is building at any given time, which will further help us with inventory tracking and streamlining."

Another goal of Phase 3 is to add e-commerce portal capabilities so that any member of Exostar—an industry-wide e-commerce portal designed to facilitate aerospace and defense collaboration—will be able to exchange data with other members. Although Exostar is not developed to that point yet, the RFID SCOUT development team is planning ahead, making its system compatible with Exostar's format requirements.

## **Benefits**

Although the project is not complete, KMM is already realizing benefits. Coordination with its supply chain has improved significantly, and expectations are that it is only going to get better. In addition, KMM is enjoying greater inventory visibility, reduced costs, reduced cycle and lead times, better customer service, and more efficient processes.

"By the time we are finished, we will have an integrated IT architecture that aligns internal supplier operations with internal customer operations, providing deeper levels of detail about component production on our end, as well as the reverse—visibility into Boeing's consumption of KMM

components," Don Hedger says. "Efficiency, responsiveness, and reliability have always been our goals, and with this solution, we are well on the way to exceeding those goals."

A chart showing the cycle time in days, before and after implementation.

### **Inventory Visibility and Cost Reduction**

Controlling costs is a major competitive weapon used by all manufacturers, and one of the biggest drains on finances is holding extra inventory for long periods of time. But with a system like RFID SCOUT, "we can watch Boeing's back and it can watch ours, because we will have visibility into Boeing's consumption of our product. We can then match our production line and inventory associated with it to Boeing's consumption," says Dan Hedger.

If there is a problem along the way, such as an obsolete part in inventory, other supply chain partners are immediately alerted to help get the process get back on track quickly. Inventory visibility also provides immediate notification about quantities from the point of creation to receipt. The tracking is so complete in RFID SCOUT that customers can know with certainty about any breach anywhere in the chain.

The new system has also allowed KMM to reduce personnel dedicated to the military aircraft work cell by about 38 percent. KMM assigned those employees to another program that needed additional staff, thereby avoiding the cost of hiring and training new personnel. "We are looking at approximately \$122,880 savings in salary costs for the military aircraft area for the year," says Don Hedger.

In addition, better inventory management meant KMM was able to reduce its facility space, saving roughly U.S.\$121,000 in real estate costs.

KMM also realized savings by adopting a new method of kitting its machine tooling. By better utilizing and maximizing its tooling capability, the company was able to avoid more than \$12,000 in tooling costs.

The system should help the Air Force save money, too. Although it is hard to say exactly how much, "with over 80 percent of the cost of the systems coming from the subtier—everything from raw materials through subassemblies ready to be installed on the final product—the potential cost savings to the Air Force is great," Crabill said.

### **Reduced Cycle Time and Time to Delivery**

Reducing production cycle times is a major goal of the RFID SCOUT program. Although the system is still under development, "we have seen some of our cycle times in the early stages cut almost in half," says Don Hedger. "It used to take us 99 days for a typical cycle, and now it takes 53 days."

And there will be additional benefits for KMM's customers, too. Because the system now automatically creates the RFID shipment and updates at Boeing, shipping efficiency is likely to increase during the manufacturing process at Boeing.

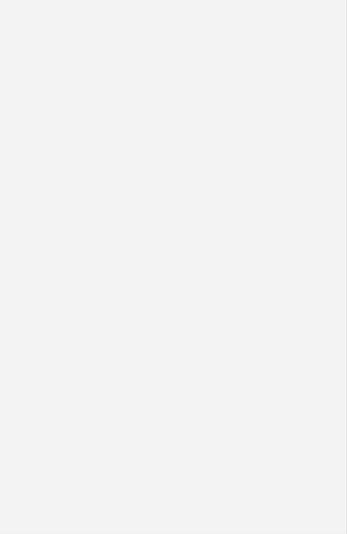
Measurements also show that KMM achieved a 35 percent reduction in job completion time, to 44 days from the time a fabrication job starts to the time it is completed. Furthermore, KMM reduced the time from production to shipment of an assembly by 71 percent, to 9 days.

### **Eliminates the Need for a Third-Party VAN**

Thanks to BizTalk Server and its RFID infrastructure, there is no need to integrate a third-party value-added network (VAN) into RFID SCOUT. An ASN 856 generated by BizTalk Server validates business-to-business (B2B) RFID shipment communications between KMM and Boeing. With this validation, either party can expand EDI usage to any other customer, thereby eliminating the need for a third-party VAN.

### **The Final Frontier**

One of the goals of the project is to share best practices and lessons learned by KMM with other small to midsize suppliers that want to achieve the same types of productivity, cost, and efficiency benefits. In



conjunction with the Air Force Research Lab, which will release a white paper reviewing the project, the RFID SCOUT team is developing a toolkit that explains in full the solution KMM is implementing. The toolkit includes an explanation of the specific software and other components used, best practices, and IT architectural guidance. The toolkit will be available by the end of Phase 3.

“The work we have done in concert with Boeing and our other partners creates a blueprint that can be used by other small and midsize manufacturers if they are looking for full integration to their DoD customers,” says Dan Hedger. “But it is more than just wanting to profit—we really want to help other DoD suppliers facing similar challenges in working with larger organizations. The RFID SCOUT toolkit will help them become RFID-compliant, expand supply chain visibility and functionality upstream and downstream, and build on a proven model.”

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