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Deltek Special Edition

Project Manufacturing

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Learn to:

- Plan and execute the manufacturing process of built-to-order products
- Effectively share project information across the organization
- Track costs, eliminate waste, and stay in compliance

Debra White
Kim Koster

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Table of Contents

Introduction

Project manufacturing and project management — the two disciplines can have the perfect marriage. As with any happy marriage, there's some work involved, but the bliss from this harmonious union can be a quality product delivered on time and on budget to your customer.

Project manufacturing is all about producing unique but similar products. One missile might be similar to another that your company made two months ago, but it requires different software because it's for a different branch of the military. No need to start from scratch, because the two missiles can use common manufacturing requirements to gain efficiency, while still allowing for customization of the unique project.

Both project manufacturing and project management are steeped in process and rigor, with each step building on the one before it until a product is made and the project is completed. The overall project management life cycle correlates perfectly to the product life cycle, making for a long and happy marriage!

About This Book

This book introduces the basic concepts of manufacturing, procurement, and material systems, showing how it all ties into other functions, such as finance, that are intended to serve project-based businesses. Companies that are project based typically include government contractors, architectural and engineering firms, oil and gas operations, and logistics operations.

If you manufacture items and your work is driven by project requirements, you can benefit from this book. It doesn't matter what your company builds or makes as long as a project is involved. As you flip through the pages of this book, you can explore project manufacturing basics, understand the value of going paperless, and discover how a total

manufacturing system will help your overall business. This book will give you practical information on project manufacturing and how to make the most of your processes and systems.

This book was written by subject matter experts who have worked in the industry for many years, and who have defined underlying processes of multiple types of businesses. The writers are currently employed by Deltek, and this book includes some information about Deltek-specific products. The Deltek writers worked with *For Dummies* editors to create this book.

Foolish Assumptions

While writing this book, we made a few assumptions about you, the reader:

- You're likely an executive, operations manager, production specialist, program manager, or someone whose job it is to deliver and build a great product on time and on budget.
- You might or might not have a lot of experience with and knowledge about automated manufacturing systems.
- You've decided your business would benefit from the competitive edge a good project manufacturing system can provide — maybe you don't have one at all, or it's very cumbersome and you need an upgrade.

Icons Used in This Book

Like all *For Dummies* books, this one uses icons to help draw your attention to certain types of information.

Look beside this icon for a nugget of helpful advice about making project manufacturing work for your business.

We hope you'll remember every single word you read, but just in case that's not possible, please pay special attention to this important point.

You might be able to get by without the technical details next to this icon, but you still might find them quite interesting.

Don't miss this point, because it's a particularly critical bit of info for your project manufacturing success.

Beyond the Book

For more information on project manufacturing, take a look at the following websites:

- Deltek at `www.deltek.com/projectmanufacturing`.
- APICS, which is the leading professional association for supply chain and operations management, at `www.apics.org`.
- Manufacturing Enterprise Solutions Association (MESA) International at `www.mesa.org/en/index.asp`.
- Federal Acquisition Regulation - 252.242-7004 Material Management and Accounting System. You can find more info on it at `http://www.acq.osd.mil/dpap/dars/dfars/html/current/252242.htm`.

Chapter 1

What Is Project Manufacturing?

In This Chapter

- Defining the basic terminology
- Driving demand with materials requirements planning
- Tracking orders and inventory
- Getting to know your manufacturing system
- Tracking time on the shop floor
- Sharing information across the enterprise
- Executing more effectively by automating

Pretty much everyone knows how the concept of mass production brings high-quality, off-the-shelf commercial products into the hands of the many. That's great for manufacturing lots of commodity-type things, but challenging when it comes to complex, highly engineered products that require engineer-to-order or make-to-order principles.

Those principles are the basis of project manufacturing. This chapter focuses on the differences between project manufacturing and commercial manufacturing and defines many of the key concepts and terms central to project manufacturing.

Begin with the Basics

Project manufacturing is a manufacturing discipline ideally suited for *engineer-to-order* (ETO) or *make-to-order* (MTO) manufacturing, through which a company designs and manufactures a product based on very specific customer

requirements. The end product tends to be complex, which means the project manufacturer must engage with the customer through all the design and manufacturing phases to ensure that specifications are met.

Project manufacturers and commercial manufacturers face some very similar challenges. Both kinds of manufacturers track supply and demand, keep tabs on ongoing inventory balances, deal with procurement and supplier challenges, and encounter quality issues. Both are always on the lookout for efficiencies in production, because both share the goal of delivering quality product on time.

So what are the differences? First of all, if your business is project manufacturing, your daily challenges include reacting quickly and efficiently to constant engineering changes. Those changes make it all the trickier to ensure you have the right parts and the right resources to meet customer demands, while also remaining compliant with industry rules and regulations.

Reacting quickly requires a combination of highly specialized tools and processes to track shop floor activities, statuses, and completions. You also need a strong project-based enterprise resource planning environment for invoicing, materials management, and financial accounting.

Of course, the project has to be managed, and that discipline also has systems and processes that must be managed. An ecosystem of people, processes, and tools will provide significant advantages for running an agile and streamlined manufacturing operation.

The Benefits of Integration

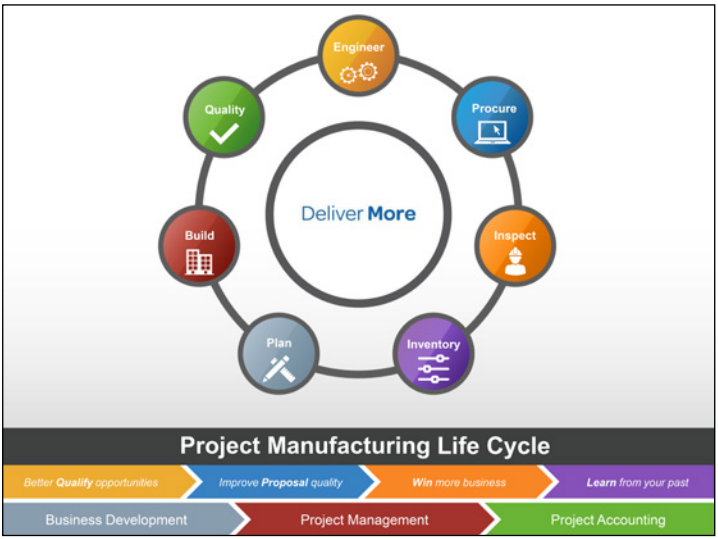
Who or what doesn't benefit from better communication? That's exactly what you get when you employ an integrated project-based ERP, project management, and manufacturing system. Here are some of the advantages your manufacturing operation will experience:

- Greater realized efficiency
- Decreased costs, more financial predictability, and improved profitability
- Increased quality and more consistent processes
- The convenience of meeting government contracting compliance needs (if required), right out of the box
- The capability to deliver on Lean and paperless manufacturing objectives
- The capability to trace product genealogy of every component produced
- An ongoing flow of information to all stakeholders
- Knowledge of the actual time each operation takes and how much it costs
- The creation of an actual basis for future work and cost estimation
- Increased overall competitiveness
- Real-time decision making and the capability to react quickly to risk

Integrate your project-based ERP, project management, and manufacturing systems and you're well on your way to *Lean manufacturing,* a practice focused on creating value for the customer. At its core, Lean manufacturing focuses on ferreting out and eliminating extraneous activities and wasteful expenses.

In the world of Lean, *value* is defined as any action or process the customer is willing to pay for, and the concept strives to preserve value while reducing work. It's an idea derived from the highly regarded Toyota Production System (there's more on Lean in Chapter 6).

Figure 1-1 exhibits the life cycle of manufacturing.



Source: Deltek

Figure 1-1: The manufacturing life cycle.

What Materials Do You Need and When?

When you're responsible for manufacturing, your daily challenges include ensuring that you have enough of the right parts in inventory. That's one of the keys to manufacturing a product just in time to meet the customer's delivery dates, while also living up to your revenue goals and objectives.

If critical parts or materials aren't planned and inserted into the manufacturing process at just the right time, it can royally mess up any project, product, or task. Your procurement system helps order and track the purchase of materials and services, and although that tracking is critical, it's not enough. That's why companies use *materials requirements planning* capabilities (MRP for short) to ensure that the right materials are on hand, in the right quantities, at the right time, and at the lowest possible cost.

MRP automatically generates messages letting planners know what actions need to be taken to meet any new demands and what developments might impact existing demands. These

action messages help planners make the right decisions to expedite, reschedule, order, or cancel supply. MRP helps you answer the following questions:

- What is our demand?
- Do we have enough supply? What parts need to be procured or manufactured? What engineering changes are being proposed?
- How much supply is required?
- When is the supply required?
- What action needs to be taken?

Track Orders and Inventory

The *sales order entry* system (SOE) lets you track and monitor your customers' orders for products and services while managing the shipment and invoicing process. The customer order includes vital information required for processing the order. This information includes payment and ship-to addresses, expected due dates, quantities, prices, product item numbers, and descriptions. Items on sales orders may be recurring, drop-shipped, procured, or manufactured. Sales order entry creates demand in the MRP, and that, in turn, ensures there is enough supply to meet customer deliverables.

Your *inventory* system tracks and manages asset inventories, project-owned inventories (which are expensed or work-in-process), and customer- or government-furnished inventories. Whether inventory is owned by you or your customer, you're responsible for tracking all inventories in your possession. Managing project inventory requires detailed warehouse and location tracking and ensuring each part is identified to the project that owns it.

Each project has rules that determine how that inventory can be planned or used.

You can track lot numbers and serial numbers throughout each inventory transaction, which gives full visibility. The inventory posting process generates the necessary general ledger journal entries covering the inventory transactions.

The Manufacturing System

Manufacturing systems enable you to generate and process manufacturing orders or work orders to build parts. These systems use bills of materials and routings to create manufacturing orders, complete with requirements and routing operations to perform the production process. To ensure accurate valuation of each part manufactured, the process captures the costs of materials, labor, subcontractors, and overhead.

A manufacturing system's advanced features make it easy to propose, design, forecast, plan, purchase, track, and manufacture products. This type of system supplies everything from as-built and as-maintained records to systems compliance to cost reporting to the tracing of serial or lot numbers.

Watching Over Production

A *manufacturing execution system* (or MES for short) provides online, real-time visibility onto the production floor. Using *work plans,* it streamlines the production process and eliminates waste. These work plans include documentation, visualizations, work instructions, data collections, and routing information. This type of system captures work order status throughout the manufacturing process and supports quality control and nonconformance findings and results.

An MES will help you answer the following questions:

- What are the production schedule priorities?
- Who is working on what?
- How close is the work to being completed?
- What corrective actions need to be made? When are they required?
- What is the manufactured product's history or genealogy?

A *work order,* also known as a *manufacturing order* or MO, tells the factory what it must make, how many, and when the product is needed. The MO can be generated manually or automatically based on demand. *Work plans* tell the shop floor the name and description of the operation, what data

needs to be collected through the process, how to perform the process, and the budget for the work.

Keeping Time on the Floor

You'll use a *shop floor time system* to capture the start and stop times for shop floor activities linked to each manufacturing order, as well as each routing operation step. The system must support complex pay, overtime, and union rules, and it must be able to handle multiple shifts and schedules.

Employee self-service in this system allows workers to make scheduling requests and get manager approval. For government contracts, the system handles the compliance requirement of tracking labor time. And by capturing labor and labor costs at the manufacturing order and operation level, a shop floor time system helps with future bids and opportunities, because it can cost each part accurately.

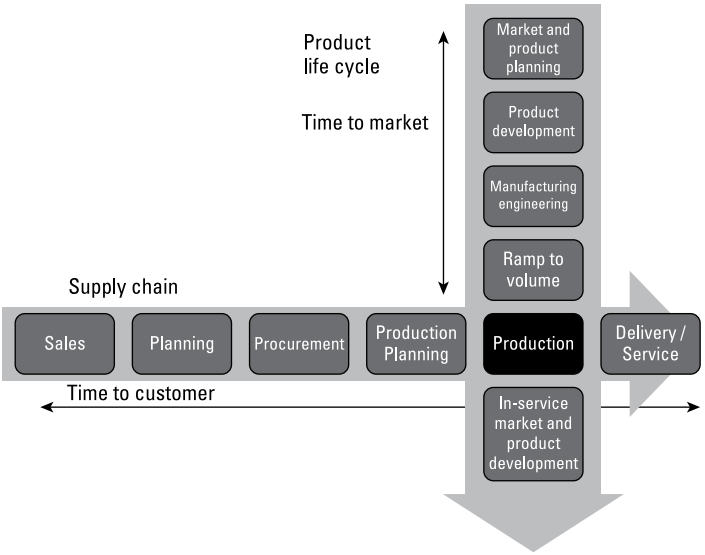
Keeping such detailed tables on the time spent by workers on the factory floor can be time consuming and costly. One way to reduce direct labor costs is to link your manufacturing execution system and shop floor time solution, automatically clocking operations into the time collection system. The result is a low-touch or no-touch solution for tracking labor hours and costs, and it eliminates one of the systems with which factory floor workers must interact.

Sharing Information with Everybody

In manufacturing, all systems should work together to ensure on-time and quality delivery. From procurement through manufacturing execution, these systems must interact seamlessly and provide real-time information about manufacturing activities. If they don't, parts may be late or production slowed, and that means customers won't get what they need when they want it.

It's critical, then, that all the systems mentioned previously interact and share information, so that all teams within your

manufacturing operations can be updated. For example, production scheduling needs timely information from the factory floor regarding current task status in order to build accurate schedules for future production. Procurement needs that same information to ensure that materials and components are available when needed. Figure 1-2 illustrates that production is the pivotal point where the product life cycle and the supply chain (procurement) meet to ensure delivery.



Source: Information Flow for Agility, Compliance and Performance in Project Manufacturing © 2012 Iyno Advisors Inc.

Figure 1-2: Production is the crossroads of the product life cycle and the supply chain.

Keeping Things Running

The acronym *MRO* stands for *maintenance, repair,* and *overhaul.* It refers to any actions intended to keep an item functioning or restore it to a state in which it can perform its required function. MRO includes all technical work (repair, maintain, teardown, rebuild, refurbish) as well as corresponding administrative, managerial, and supervision actions and of course the as-maintained bill of materials.

Because the systems in the field today are so complex, you'll need to manage these operations with software. You can get an MES system that will support the management of MRO.

Executing by Automating

Production managers require real-time visibility of the day-to-day operations on their production floors. You can't prevent problems or delays, nor can you quickly solve them, by simply maintaining spreadsheets and reporting operational details after the fact.

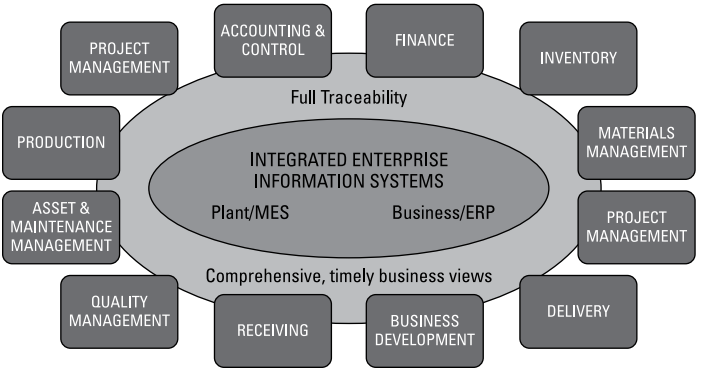
Similarly, it's difficult to monitor labor costs and create time utilization reports if all you have at your fingertips are shop floor employees' manual transactions. If managers must manually ensure their production workers are performing tasks as planned, that can have a negative impact on product cost, quality, and timely delivery.

A manual process can also cost valuable production time by causing a wait for materials, machines, or personnel. Production comes to a standstill if parts, people, or equipment aren't readily available when and where they're needed. Production also stalls when there are quality issues or machinery downtime, or when shop floor personnel must search for work plans or documentation.

And if your manufacturing is aerospace or defense related, you may also face industry traceability requirements. Shop floor employees may find themselves manually entering transactions into multiple systems or spreadsheets which, of course, reduces your labor utilization and slows production. Sounds like a great place for some automation.

A more automated solution not only increases efficiency, but it also helps manufacturers deal with change. To successfully manage production in demand-driven manufacturing environments, you must be able to monitor and react quickly to constant change. Changes that can create shop-floor bottlenecks include customer requests, engineering changes, machinery downtime, absent employees, and many other uncontrollable situations. It's imperative that production managers be able to view these events and reschedule and reprioritize in a timely manner.

A fully integrated and automated project-based ERP and manufacturing system allows information to flow to all stakeholders, as Figure 1-3 demonstrates. This gives each level in the organization the information needed to operate and manage its piece of the pie.



Source: Information Flow for Agility, Compliance and Performance in Project Manufacturing © 2012 Iyno Advisors Inc.

Figure 1-3: Fully integrated ERP and manufacturing system.

Chapter 2

Configuration Management and Estimating

In This Chapter

- Understanding the intricacies
- Making the most of configuration management
- Learning from historical data

Chapter 1 points out that project manufacturers typically build *engineer-to-order* or *make-to-order* products — items that are highly complex and require lots of design effort. But there's more to the product types sometimes abbreviated ETO or MTO (or sometimes BTO, short for *build-to-order*). This chapter details some of the challenges inherent in this kind of manufacturing, and the importance of learning from past experience when bidding on new business.

Making Sense of ETO, MTO, and BTO

Engineer-to-order or make-to-order products are designed and manufactured based on specific customer requirements. As such, they may require a series of engineering changes throughout the manufacturing process. Adding to the challenge is the fact that an ETO product may have never been built before. The design and manufacturing teams may be charting new territory.

These kinds of products require detailed engineering designs and drawings. They require bills of materials

representing product structures of raw materials and subassembly parts, and they can't be made without work instructions and detailed routing operations outlining the steps required to manufacture the part. This information tracks the configuration management and life cycle of the products being manufactured, and also provides historical information that will be useful for winning future projects.

In these situations, engineering change notices become extremely important to track changes to the bills of materials, documents, and work plans throughout the process. It's critical that you have the capability to evaluate and approve any proposed changes before they're adopted.

How can you evaluate proposed changes? Impact reports give visibility to show how engineering changes will impact customer delivery, quality, existing procurement and manufacturing, and most important, the dollar impact to the customer order or project.

The Importance of Configuration Management

Project manufacturers find that configuration management and accurate estimation are critical to every project's success. Configuration management is the unique identification and tracking of products being manufactured over their life cycles. This includes tracking design control and changes, product components, as-designed versus as-manufactured versus as-maintained serial or lot numbers, as well as product performance throughout the life of the product.

This information is especially critical for project manufacturers because they're typically making highly designed and complex products. Project manufacturers that have a handle on configuration management can improve the efficiency of their product development process, which allows for reductions in time-to-market, lower project costs, and higher product quality.

Configuration management is indispensable for project manufacturing companies, because in their world, change is the name of the game. These manufacturers take pride in

understanding customer requirements, and they know full well just how dynamic the product development process is for these kinds of products.

Change is inevitable and frequent, and it must be managed well if the project manufacturer expects to be profitable and ensure repeat customers. Assessing the full impact of proposed changes is critical to avoid additional project costs related to such issues as inventory waste, scrap, and rework — not to mention the cost of disappointed customers.

Yesterday's Data and Tomorrow's Estimating

The old adage cautions against reinventing the wheel, but changing and reinventing are par for the course in project manufacturing. That doesn't mean you can't build on what you already know. In this business model, success depends on being able to use historical information gleaned from existing product configurations — doing so saves both time and money in developing new engineer-to-order products.

Historical information is vital from the very start, as you bid on new work in today's intensely competitive environment. Engineer-to-order manufacturing companies can't hope to win if they can't quickly and efficiently bid on new work. That means using historical data from existing designs, and understanding previous mistakes, to accurately and efficiently bid the next project.

Such historical information includes existing bills of materials and all the details of design changes, parts, labor, and overhead costs. Your proposal will take into consideration existing drawings, historical procurement history, vendor quotations, historical manufacturing history, and breakpoints, combined with a new request for quotes so that it accurately reflects costs and timing. You'll need all of this not only to win the next project but to execute the project profitably, with high customer satisfaction. You can use data to gain insights on cost accounting structures, which gives you an understanding of how a certain contractor charges things like direct costs and overhead. Cost reports are excellent sources of historical cost data for DOD programs.

The CPR/IPMR is the primary report of cost and schedule progress on contracts containing EVM compliance requirements. It contains the time-phased budget, the actual cost, and earned value, which is the budgeted value of completed work. For instance, IPMR data can provide information about changes to the estimate to complete (or the total expected cost of the program) and the performance measurement baseline, and it explains the reason for any variances.

Types of data

In general, there are three main types of data:

- **Cost data** is information about labor, material, other direct costs, and any associated overhead as well as profit that is associated to certain work or a project. It's important to know the type of resource, if they have any special expertise, and the number of hours it took to complete the work.
- **Schedule or program data** has an impact on overall cost data (cost/schedule integration). You can use an IMS (integrated master schedule), schedule information from your routing steps, or overall manufacturing order dates. Schedule information should be used and considered when developing a cost estimate.
- **Technical data** includes drawings, electronic work instructions for the factory floor, and as-built records.

Sources of data

There are two types of data sources:

- **Primary** data sources should be used every chance you get. Primary data came from an original source and can usually be traced to an audited document. Accounting data is a very reliable form of primary data.
- **Secondary** data sources are *derived* (in other words subjective). Because they were produced from original data, the quality of this information is lower and much less useful. *Sanitized* might be a word that could be utilized to describe it.

Chapter 3

Materials and Production Planning

In This Chapter

- Keeping track of real-time information
- Lining up the materials
- Scheduling your resources

Given that project manufacturing is all about creating complex products that are engineer-to-order or made-to-order, it's not surprising to learn that production and materials planning are anything but simple, compared with standard off-the-shelf manufacturing. This chapter explores the role of materials requirements planning in the project manufacturing environment, as well as the benefits of advanced planning and scheduling.

Changes and Challenges

First of all, its ETO or BTO nature means project manufacturing is likely to encompass many engineering and customer changes. Also, the way the project has been negotiated will determine how production and materials planning are handled.

For example, government contractors will be held to certain project and account requirements, depending on the type of project and how it's funded. The project may be negotiated on a fixed-price basis, or costs-plus, or time and materials.

Based on the project type, specific government requirements will flow down to project costing and work breakdown structures, which spell out a hierarchy of program elements supporting the measurement of a contract's cost and schedule performance. There will be very specific requirements related to material planning and tracking, procurement, production, and customer delivery.

And although the government is a notoriously meticulous customer, the same kinds of considerations may also be in place for commercial projects. Needless to say, whether you're a government contractor or a commercial project manufacturer, you'll have the same goals with regard to profitability and customer satisfaction.

Being able to plan, track, and manage activities in a project-driven materials environment requires a continuous stream of accurate, real-time information. Without that, there's no way you'll benefit from effective planning, procurement, inventory, and manufacturing operations. This stream of information should be equally integrated across projects, reporting, and compliance.

Where there's a lot of information, there's a need for good software. As a project manufacturing organization, you need specialized software that completely integrates all aspects of the project environment. You must be able to plan and cost jobs based on project requirements, while also tracking details of jobs in progress as well as maintaining the integrity on the manufacturing floor. In order to quickly resolve day-to-day capacity and resource planning, procurement, inventory, and production issues, you need a system that integrates accounting and project management functions and incorporates materials functionality.

Matching Supply and Demand

Having the right materials in the right place at the right time is one of your daily challenges. If critical parts or materials aren't planned or inserted into the manufacturing process at the optimum time, your project, product, or task will be in a world of hurt.

That's where *materials requirements planning* (MRP) comes into play. Whether you handle materials requirements planning by project or a "netting group" of like projects, it helps you gain the ultimate control over project planning and allows you to ensure that materials are manufactured or procured for the correct project or project task.

The main function of materials requirement planning is evaluating supply and demand, to ensure there's enough supply delivered or manufactured at the right time to meet internal or customer demand. This matching of supply and demand results in action messages, about which the materials planner must make decisions.

Action messages include suggestions for creating manufacturing orders or purchase requisitions, cancelling existing orders, changing order dates or quantities, or transferring inventory. It's up to the materials planner to "firm" these suggestions and have MRP make the necessary updates or changes.

This process is critical to the success of the project and the goal of creating a happy customer. It should go without saying that keeping the customer happy leads to more business in the future.

Matching supply with demand, of course, sounds simpler than it is in practice, and materials requirements planning has its own set of extra challenges in the project manufacturing environment. Because much of project manufacturing involves engineer-to-order, highly complex products, you'll encounter frequent engineering changes, many of which will mean changes to parts on the bill of materials. You must recognize and react to these changes quickly to ensure materials are received or manufactured in time, all the while preventing cost overruns. You'll save both time and money by avoiding rework and scrap.

What's more, because the products are complex, they may have long lead times. Lead times may consist of manufactured time or supplier delivery time, and while it may seem like a longer lead time would ease a complex situation, it adds wrinkles of its own.

If certain subassemblies are manufactured by other suppliers, the accuracy of lead times is particularly critical. Customer due dates and lead time calculations — including procurement, quality control, and manufacture time — determine when a part must be received in-house. If these calculations are incorrect, parts may arrive too early, which can cause warehousing issues and the need for early payments to suppliers. Or they can arrive too late, causing late delivery to customers and late revenue recognition.

Getting Resources into Place

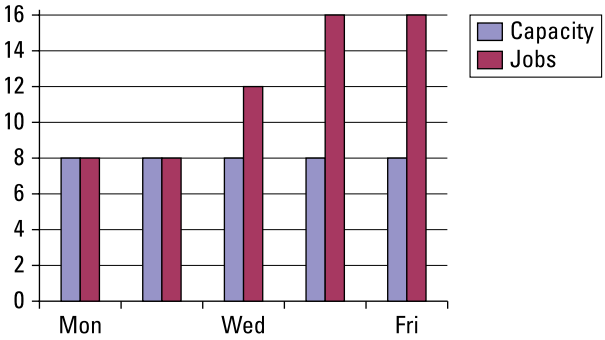
Advanced planning and scheduling (APS) is the manufacturing process of scheduling resources for the production floor. Resources include people, skills, machinery, and tooling, as well as the parts required to meet customer demand.

APS solutions can help determine whether the overall shop capacity, including all resources, is adequate at the times required to meet customer delivery dates. You can approach scheduling from two different perspectives: finite or infinite planning.

Finite scheduling doesn't allow for overbooking of resources, whereas *infinite scheduling* assumes all jobs can take up to the full capacity of each resource. The problem is, this can result in significant and unrealistic overbooking of resources, as you can see in Figure 3-1.

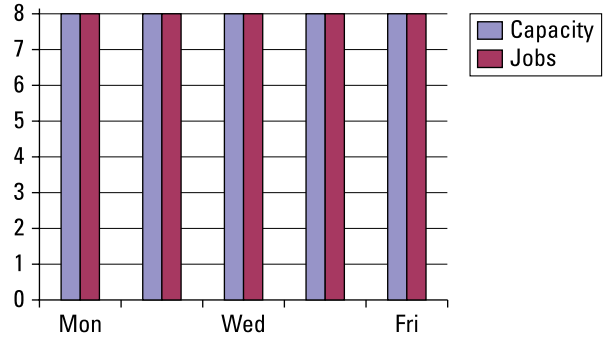
Another advantage of using advanced planning and scheduling is visibility that helps you determine whether you can take on new work while still meeting delivery requirements. You can create "what-if scenarios" to gain visibility into future demands, including near- and long-term resourcing requirements for both labor and equipment. This is critical in deciding to move forward with bids for new work.

Infinite Scheduling Example



Note: With Infinite Scheduling each job assumes it can take up to the full capacity of each resource.

Finite Scheduling Example



Note: With Finite Scheduling each job can only schedule up to the capacity of the resource, taking into consideration other jobs loaded.

Source: Dynafact Advanced Planning and Scheduling

Figure 3-1: Finite versus infinite scheduling.

Also, in day-to-day operations, APS identifies the best recovery plan should you experience a machine breakdown, emergency work interruptions, or shifts in priorities.

Chapter 4

Manufacturing Execution and Quality

In This Chapter

- Tracking manufacturing execution
- Using ISO9001/AS9100 for quality control
- Ensuring the quality of purchased parts
- Maintaining quality throughout manufacturing
- Finding the root cause of problems
- Taking corrective and preventive action
- Following the product genealogy

Project manufacturing organizations require specialized software that completely integrates all aspects of the project execution environment. It's vital to be able to plan and cost jobs based on project requirements, then track details of jobs during manufacturing while maintaining the integrity and quality of the product. This chapter details some of these software functions and the processes that help ensure quality from start to finish.

Track Your Manufacturing Execution

The *manufacturing execution system* (MES) improves manufacturing productivity, quality, and compliance by giving technicians, supervisors, and plant managers complete visibility and process control at the shop floor. Real-time visibility helps

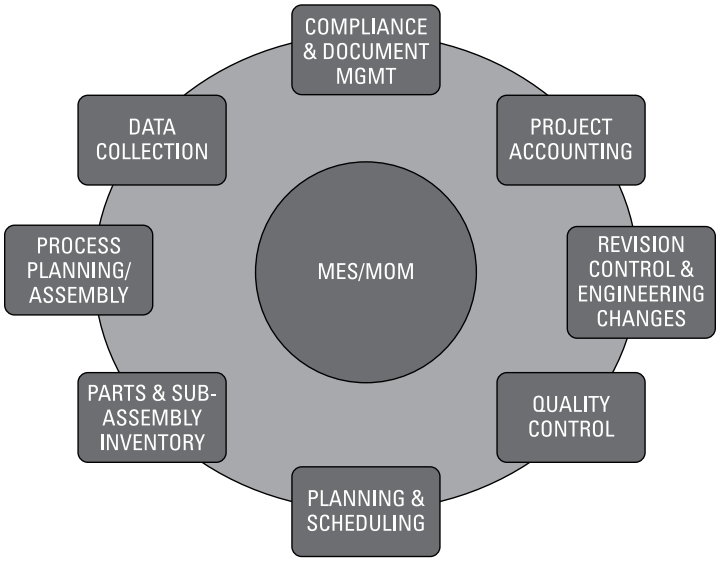
manage risk and gives management the capability to assess schedule conditions and constraints and expedite solutions as quickly as possible. Managers can communicate in real time with support functions including engineering, quality, tooling, and production control through functions in MES. Manufacturing execution is a key piece to providing visibility and management tools throughout the entire product life cycle.

Through automation of manufacturing procedures and integration to support functions, the manufacturing execution system streamlines the production process and eliminates waste. Central to standardizing and enforcing manufacturing practices is the authoring of clear illustrated work instructions for production. The MES does so via work plans that include the breakdown of jobs, routing among work centers, documentation attachments, 3D CAD based visualizations, resource and data collection requirements such as serial/lot number usage, inspection measurements, and verification buyoff signatures.

Technicians become more efficient because they're spending less time looking for paperwork. The MES puts at their fingertips everything they need to complete each routing operation and record all the information needed to create an as-built documentation package for each product manufactured or serviced. No more searching through files to find the pertinent information for the job.

The MES is tightly integrated with the project and materials management system, which tracks bills of materials, supply and demand, inventory, and manufacturing order costs. As orders are planned and firmed up through materials requirement planning and then released to the shop floor, the MES begins tracking the progress and providing real-time updates to the project and materials management functions.

This integration is a two-way exchange of information on routers, manufacturing orders and material issues. That tight integration allows the flow of information and processes from the MES, as depicted in Figure 4-1.



Source: Information Flow for Agility, Compliance and Performance in Project Manufacturing © 2012 Iyno Advisors Inc.

Figure 4-1: Business processes informed by the MES.

Controlling Quality through ISO9001/AS9100

Every customer expects quality — that almost goes without saying. No matter what the product or deliverable is, if it doesn't meet or exceed the customer's expectations, there is a problem. A quality problem directly impacts the bottom line through delays and rework costs — today's quality problems can jeopardize tomorrow's business and damage your company's reputation. The stakes are even higher if you're delivering complex products for highly regulated industries like the aerospace or defense sectors.

ISO9001 and its aerospace counterpart, *AS9100,* establish a standard for a *quality management system,* or QMS. These standards define the basic practices and procedures organizations must follow to ensure that quality goals are systematically and consistently improved and sustained.

The MES forces adherence to procedures including (a) authoring and revision control of work instructions, (b) the execution sequence of manufacturing orders and data collection, (c) the use of proper resources, and (d) the handling and approval of any deviations during production via the configured business process workflows and change management functions.

Companies must be able to demonstrate adherence to process control and risk management. It's not just a matter of satisfying compliance — these procedures and processes will also reduce cost, improve product quality, and ultimately improve customer satisfaction and the bottom line.

Quality is a top priority covering all aspects of material management for the entire product life cycle, starting with suppliers, progressing through manufacturing, and continuing on through maintenance and repair services.

Be Sure Purchased Parts Are Up to Par

The quality of your end product is only as good as the components that go into it. That's why supplier sourcing, incoming inspection, and vendor performance are so critical. Every project manufacturer should establish whatever inspection and oversight activities are necessary to ensure that purchased product meets specified purchase requirements.

Verifying the quality of purchased product may include an inspection and audit at the supplier's location, along with a review of such supplier records as certificates of conformity, test reports, statistical records, and process control documents. It's vital to establish inspection plans so that when a purchased part comes in, the quality assurance organization knows exactly how to inspect it to ensure it meets the quality requirements. Creating inspection plans for each purchased part would be a daunting task, but the supplier quality management system allows efficient management of inspection and verification requirements in reusable groups of requirements organized by part families, types of processes, and regulations.

The system automatically keeps track of historical records regarding quality issues or nonconformance so you can evaluate vendor performance, and fold purchased component and subassembly history into the as-built history for the end product.

Keep Your Eye on Quality

The focus on quality must continue throughout the entire manufacturing process, with quality initiatives ranging from discovering and tracking defects to identifying and issuing the appropriate correction and corrective actions. The primary objective is to deliver quality product while reducing scrap and rework efforts — remember, happy clients translate into new business.

Each manufacturing operation is linked automatically to the detailed data collection, findings, and resolutions for all quality aspects of manufacturing. These can include quality buyoffs, recording of inspection measurements, and documentation of discrepancies to correct any problems found during the manufacturing process.

Find the Cause of the Problem

Root cause analysis is a technique for answering the question: Why did discrepancies occur in the first place? The point is to find out what happened, why it happened, and how likely it is that it will happen again. Asking the right questions helps determine the root cause of the discrepancy and pinpoints how to stop it from recurring.

Root cause analysis starts with the definition of a problem in a discrepancy report and continues through material review board (MRB) functions and corrective actions if the problem is deemed to merit the escalation through these processes in the system. The corrective and preventive action (CAPA) function allows an assigned team to efficiently record all the information further gathered during a CAPA root cause investigation.

Take Corrective and Preventive Action

A CAPA process is initiated to assign a person or team to further investigate a problem and recommend actions to avoid repetition of a problem. In other words, the corrective action is a process improvement process — improvements that lead to happier customers.

CAPA actions can be identified in multiple ways, during receiving and incoming inspection, manufacturing, or audit findings found after the fact.

You can devise preventive actions via the same CAPA processes by extrapolating from one experience and applying lessons learned to similar areas.

Maintain Product Genealogy

Product genealogies — sometimes called *as-built* or *as-maintained* bills of materials — provide support for tracking materials, components, and subassemblies used for each unit, subassembly, and completed product. This tracking includes any lot numbers or serial numbers of components used to manufacture or maintain the end product.

Product genealogies manage complete trees of nested components and subassemblies. If a component or material is determined to be out of compliance, you can query product genealogies to quickly determine which products contain or used that component or material.

The MES provides more than a product genealogy — it provides a complete as-built documentation package that includes the production history, quality inspection history, and change management history of each manufactured and serviced product. See Figure 4-2.

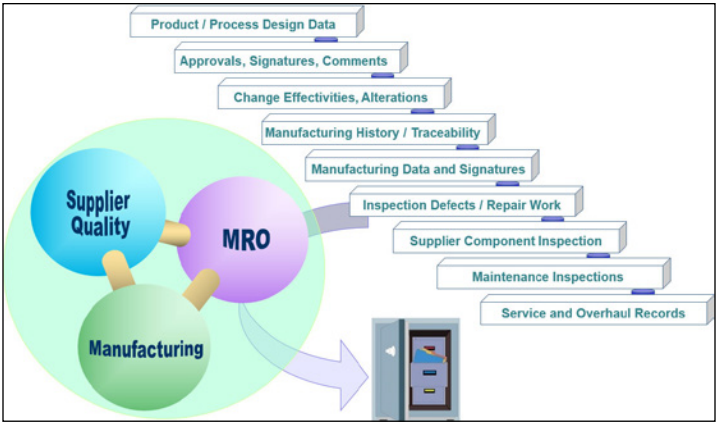


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Figure 4-2: As-built information recorded in MES for each product manufactured and serviced.

Chapter 5

Tracking Costs

In This Chapter

- Understanding the categories of cost
- Differentiating direct and indirect costs
- Separating inventory by project
- Exploring how project costs show up on financial statements

A project-based business is simply a company that generates the majority of — or at least a large portion of — its revenue from managing and delivering projects for its clients. It's critical to analyze all direct and indirect costs related to these projects.

In this regard, project manufacturing is no different than any other project-based endeavor — to ensure profitability, it's necessary to track manufacturing costs. Such costs include direct costs for materials and labor, subcontract costs, and indirect costs or burden. This chapter spells out those various kinds of costs and ways that they're tracked.

Count Your Direct Costs

Direct costs include any costs that are attributed to the production or manufacturing of a product. For example, the cost of an antenna for a satellite can be attributed directly to the cost of manufacturing that product. Direct costs include raw materials used to make subassemblies and finished parts. These costs also include subassemblies from previous manufacturing orders, direct labor costs for the shop floor technicians manufacturing the parts, and subcontract costs for any outside services such as machining or plating.

Tally Up Indirect or Overhead Costs

Indirect or *overhead costs* are those costs that arise in supporting specific day-to-day operations. Examples include such things as utilities (water, electricity, rent), material handling costs such as receiving department or stock room labor, and employee fringe benefits such as health insurance or worker's compensation.

These are necessary indirect expenses of manufacturing, and they're important cost elements shared across projects and manufacturing orders. Overhead cost pools are used to track these expenses when the indirect costs benefit more than one project and can be split up among the projects in a reasonable proportion to benefits received.

Options for the overhead bases include:

- **Direct labor dollars:** This is the norm when labor rates are relatively uniform and when labor costs are a significant portion of total costs.
- **Direct labor hours:** This is accepted when the employees are interchangeable, as in manufacturing operations.
- **Machine hours:** This is appropriate when machinery is used heavily in manufacturing.
- **Material cost:** Material handling costs may be allocated on the dollar value of the material.
- **Units of production:** This is one of the simplest methods to track costs, but it may not be your best option if products vary in size or require different amounts of material or time to produce.

Check Figure 5-1 for an example of how manufacturing costs are calculated, with indirect costs figured on a base of total direct costs.

INDIRECT COSTS		DIRECT COSTS	
Electric	$10,000	Shop Floor Direct MO Labor	$40,000
Freight In	$5,000	Raw Materials	$35,000
Rent	$15,000		
Total Expense	$30,000	Total Manufacturing Costs	$75,000

Overhead Rates = Total Expense/Total Manufacturing Costs = 40%

Joe works 8 hours on MO 1 at a cost of:	$800
Raw material costs for MO 1 are:	$1,000
Total MO Direct Costs	$1,800
Overhead applied to MO 1 ($1,800 x 40%)	$720
Total costs for MO 1	$2,520

Figure 5-1: Calculating indirect costs as a percentage of direct costs.

Track Your Inventory by Project

In commercial manufacturing, the definition of inventory is typically the asset inventory that is held on your balance sheet. Raw materials, work in process, and finished goods are held by your company as assets until delivered to your customers.

For the project manufacturer, this becomes a bit more complicated. Of course, an asset inventory that includes raw materials, work in process, and finished goods is still a viable option, and many times the project manufacturer will have spare inventory or commercial work as well. But check out the following list for more about other considerations, which vary depending on the project type.

- **Commercial:** Inventory is typically carried on the balance sheet for raw materials, work in process, and finished goods as assets. The price of the product is set and fixed by unit of product. Commercial products are sold on the open market, and they impose the maximum risk on the manufacturer and minimum administrative burden on the customer.
- **Cost-plus:** Inventories are expensed when procured and costs for raw materials, work in process, and finished goods are held on the income statement. This method

reimburses the contractor for allowable costs, typically when costs are incurred. There are three types of cost-plus contracts:

- **Cost-plus-award-fee (CPAF):** Reimburses the contractor for allowable costs and adds a fee consisting of a base fee (which may be zero) and an award fee, determined at periodic milestones set forth in the contract.
- **Cost-plus-fixed-fee (CPFF):** Reimburses the contractor for costs and adds a negotiated fee.
- **Cost-plus-incentive-fee (CPIF):** Reimburses the contractor for costs and adds a negotiated fee, which is adjusted by a formula based on target.

- **Firm fixed price (FFP):** Inventory is typically carried on the balance sheet for raw materials, work in process, and finished goods as assets. Firm fixed-price contracts have a set price fixed by unit of product. Firm fixed price contracts impose the maximum risk on the contractor and minimum administrative burden on the customer.
- **Work in process (WIP):** A contract in which the costs of raw materials, work in process, and finished goods are held on the balance sheet as assets until the product is delivered. The price of the delivered item may be based on build cost amount with estimate to complete, percent cost amount, or a rate predetermined in the contract.
- **Government- or customer-furnished material or equipment (GFM/GFE):** An inventory type that represents any materials or equipment provided by the customer. These materials aren't carried on either the balance sheet or income statement.

The financial statements mentioned previously are:

- **Balance sheet:** This shows the financial condition of the firm at a particular point in time, listing the assets, liabilities, and equity.
- **Income statement:** This shows the results of operations for a specific time period by listing revenue (sales), expenses, and the difference between the two (that's the profit or loss).

For government contractor project manufacturers, holding inventory under each project is critical for the success and compliance of the project per the *DFARS Subpart 242.72 – Contractor Materials Management and Accounting Systems (MMAS).* These manufacturers are also required to segregate inventory in the warehouse based on the project that owns the raw materials, work in process, and finished goods. At any point in time each inventory part must be identified as belonging to a particular project.

This makes inventory planning and tracking much more complex for the project manufacturer than it is in commercial manufacturing. Not only do project manufacturers stock parts in the warehouse, but they also have to inventory them by the owning project. Parts may be commingled in a single location as long as you can identify ownership. These rules may also apply to any project manufacturer, especially if real-time project reporting is critical to your success.

Chapter 6

Get Lean

In This Chapter

- Understanding Lean manufacturing
- Profiting by reducing the seven biggest wastes
- Counting on the Five S's
- Putting paper in the wastebasket
- Embracing automation
- Reducing indirect costs

Lean manufacturing sounds simple enough. Its basic tenets are to help companies achieve higher margins, delight their customers, and win more recurring and new contracts. Making that happen, of course, takes a lot of dedication and hard work. This chapter explores the basics of putting Lean into practice.

Rolling Off the Line

The *Lean* concept is said to have been emerged from the automotive industry, originated by Henry Ford and the Ford Motor Company, and then honed by Toyota. The two companies created a paradigm shift in the manufacturing of motor vehicles, which rolled off the auto assembly line to change how everything else is manufactured, too.

The idea is to make improvements in all functions affecting manufacturing. Lean works by identifying processes or actions that can be categorized as nonproductive functions — better known as waste — then eliminating them. Get rid of that waste, and you create more value for the customer, which is the ultimate objective.

Waste Not, Profit More

In every workflow, there are processes or tasks that are resource hogs, that take way too long, and that waste energy and time. So why do such wasteful things? Often the answer is, "It's how we have always done it." But, pressed further, no one can explain exactly why! Changing course isn't easy, though — fear of change can be a formidable obstacle.

Lean puts all tasks under the microscope and, if they don't add value, seeks to reduce or eliminate them. So what if it's always been done that way? That's no longer a good reason to continue down a wasteful path.

Following are details of the seven most commonly noted wastes.

Overproduction

So you finished your instant project, and you keep on making more product. The more, the merrier, right? Not necessarily. Not if you don't have a project on which to place the costs of the additional units. If there's no customer, this overproduction could cost your company big bucks. So, produce what you need to comply with your contract, and then call it a day!

Unnecessary transportation

It's inevitable that you'll have to move your product and the parts that go into it through the course of manufacturing — from a supplier, through the plant, and eventually to a customer. But moving stuff takes time and can be risky. If you can reduce the transportation time, you'll lower your risk and lessen costs. Don't move your product more than you have to, and always look for ways to eliminate or shorten transportation time.

Inventory

Be sure you have the right amount of inventory at the right time — not too much too soon, nor too little too late. Easier said than done, but storing inventory costs money and adds

no value to your customer. Keep the level of inventory that you need and don't stockpile.

Motion

The word *motion* means many things. In this case, we're talking primarily about the motion of your people. There's a good chance they're moving around doing something unnecessary, "Because they've always done it this way." Get rid of those unnecessary activities and you'll reap huge cost savings. Keep things moving, but make sure the movement is adding value to the process.

Defects

The D word, *defects,* represents a huge problem for manufacturers. For customers, too. Missiles that don't work or rocket motors that explode unexpectedly could cost lives! So make sure to put rigor into your manufacturing process and have the discipline to adhere to the processes. Put quality first in everything you do, and everyone will be happy.

Overprocessing

Yes, there can be too much of a good thing. *Overprocessing* refers to adding more value to a product than the customer requires or has asked for. Why not go the extra mile that no one asked you to go? For one thing, there may be reasons the customer wants a missile case made of plastic versus leather. Stick to the requirements your customer has laid out in the contract, and you'll save money and potential rework. Say "No" to scope creep and stick to the plan, Stan!

Waiting

You already know how frustrating it is to do nothing or work slowly while waiting for a previous step in the process to wrap up late. Waiting is a huge waste of employees' time and can cost the company valuable profit dollars. Pull the process through the factory, so no one has to push it, or wait around with nothing to do.

The Five S's

Remember these five concepts that all begin with S, and you'll memorize a systematic way to reduce waste and optimize productivity. The Five S's are *sort, systematize, shine, standardize,* and *self-discipline,* and following them helps you maintain an orderly workplace and use visual cues to achieve better and more predictable results.

This method helps you organize and clean up your place of work, and get a good start on your Lean journey. Once you get a handle on this in the manufacturing environment, you'll be ready to spread the concept to an even more challenging place: your kid's room!

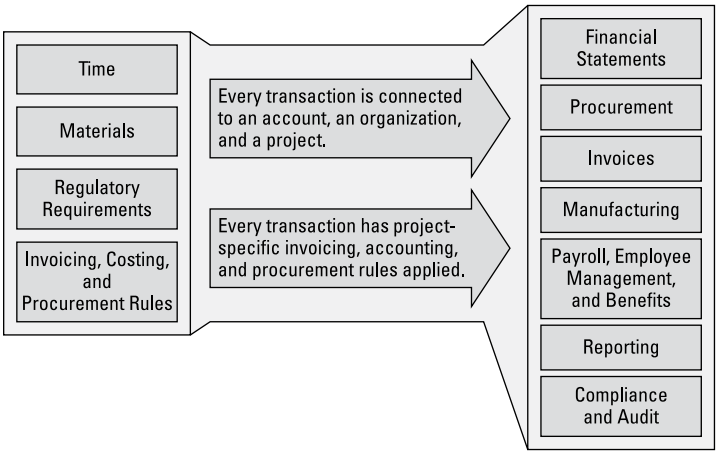
- **Sort:** Get stuff in its rightful place and eliminate clutter.
- **Systematize or set in order:** Make it easy for employees to put things where they belong. For example, recycled items belong in the green bins and trash in the black.
- **Shine:** Clean up every day, making sure the workplace is spic and span. This cleanup also serves as a visual inspection of the equipment, giving you early opportunities to notice a leak or a crack.
- **Standardize:** Utilize and standardize best practices in your work area and prevent these processes from breaking down.
- **Sustain:** Continuous improvement is key, because it's easy for employees to retreat to the old way of doing things. Make the new processes the new — and only — way of doing things.

Put Your Paper in the Wastebasket

The trusty notebook: a time-honored part of the work environment, and also the one of the biggest barriers to getting Lean on the factory floor. You've learned about eliminating the seven wastes and adopting the Five S's. The next step is to discover how to transform the factory floor from being

paper-driven to being totally automated. The Deltek Difference offers a great example of an integrated solution.

In generic ERP and MRP systems, the components are all disconnected. Imagine a project-based system in which every transaction is connected to a general ledger account, an organization, and a project. Yes, a project! That ensures that the multiple ledgers needed to run a manufacturing company are all in sync all the time. Having all manufacturing aspects completely integrated adds even more to the value, and can help every project manufacturer strive toward Lean goals. Check Figure 6-1 for a visual depiction of this concept.



Source: Deltek

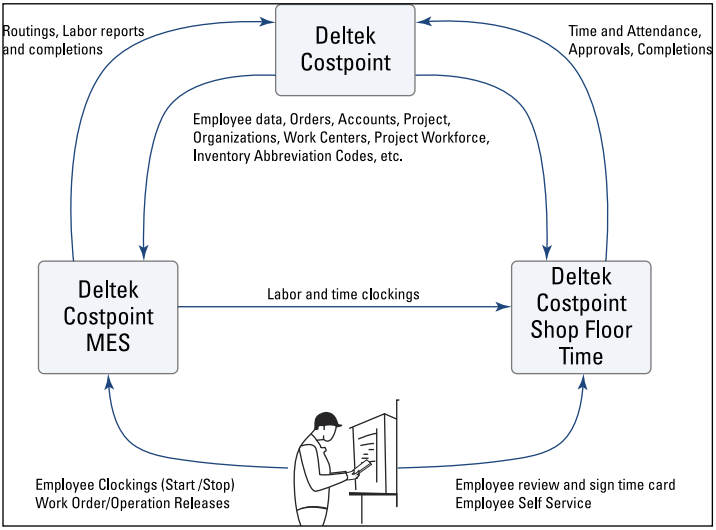
Figure 6-1: Tying a project and its details together.

Then take a look at Figure 6-2 for a picture of how to get a handle on the manufacturing environment itself.

What you just looked at is an illustration of how to drive efficiencies with Costpoint project manufacturing. Here are the key benefits of this solution:

- Complete visibility of all project aspects (financial and manufacturing)
- Compliance
- Materials planning by project or project netting group

- Detailed work plans allowing all team members a work environment in which every necessary piece of information is available at their fingertips
- Data needs only to be entered once
- All data collected is validated in real-time at the source



Source: Deltek

Figure 6-2: Project manufacturing life cycle automated.

Get to Love Automation

An automated manufacturing system coupled with best-in-class processes will help drive efficiencies in the following areas, which in turn will help reduce direct labor costs:

- You're efficiently communicating work instructions through one screen, with one logon, using visual information such as 3D drawings, tooling requirements, and detailed routing operations to help the operator understand the task at hand.
- You've got a collection of manufacturing data, such as parts consumed/removed, serial/lot numbers used, test measurements, tools used, and buyoffs of work completed. All this information will help ensure the instant project is successful, and will also help with all new bids.

The collection of the part and cost information in a project-based system will truly be a competitive differentiator.

- You'll master the art of time capture, which is absolutely critical on the floor. Operators' hours are captured automatically as they sign on and off of work order operations in the MES. Labor is captured against the manufacturing order in a near-real-time basis to accurately cost the work effort before the unit moves downstream. Also, labor can be distributed across multiple manufacturing orders.
- Your operators will have access to quality training and resource onboarding.
- Your system will handle discrepancy tracking, identify corrective actions, and perform root cause analysis at each operation step to help spot scrap and rework issues and prevent future problems.

Get a Handle on Indirect Labor

With the best systems and processes in place, you'll be able to reduce indirect labor costs. Here are some of the ways you'll benefit:

- You create efficient engineering change management cycles by automating bills of materials, documents, and work plan revisions; by cloning plans/operations/steps; and by controlling workflows that enable teams to pull through the processes. All the while, you're ensuring that proper analyses of impacts have been verified and approved before accepting any changes.
- With efficient data capture, you're eliminating duplicate entry points and ensuring the overall quality of the information being disseminated. Doing so also eliminates manual efforts for audit trails and product genealogy, which reduce both indirect labor and paper storage. Ultimately, you're producing an awesome product.
- Real-time shop floor visibility gives you insight into manufacturing operations and can help you make good decisions based on data instead of just instinct.

Capturing key manufacturing data to baseline and measuring performance will help you minimize cycle times, collect labor operations actuals, and generate the quality metrics you need to help you continuously improve.

And speaking of costs that a best-in-class system will help you reduce or eliminate, don't forget those pesky scrap, rework, and warranty costs:

- You enhance efficient nonconformance and resolution with a fully integrated MES and quality system, which will provide such information as nonconformances, incoming inspection, WIP inspection, corrective actions, and root cause analysis.
- You eliminate scrap and rework by understanding previous mistakes and correcting them in a timely fashion.
- The logical end result is a reduction in warranty costs.

Chapter 7

An Eye on Compliance

In This Chapter

- Understanding the need for compliance policies
- Introducing the ten MMAS standards
- Preparing for other audits

No matter what industry you're in, you're going to be required to comply with something. If you're a government contractor, compliance should always be top of mind for you and your entire organization, because the federal government is allowed to come in and audit your organization at any time.

If you're both a project manufacturer and a government contractor, the rules you will come to *love* are called the Contractor Material and Management Accounting System regulations, or MMAS for short. This chapter explores the ten standards of MMAS and touches on other audits you might encounter.

Understanding MMAS

Sure, rules and regulations can be a hassle. Does anyone really look forward to April 15? But like death and taxes, compliance is certain, so there's no point in griping. Better to embrace compliance by developing and following sound compliance policies, for a number of good reasons.

First of all, compliance policies demonstrate your corporate commitment to following the federal government's rules. Such policies demonstrate consistency in the way you and your staff behave. Compliance policies also lower your risk

of exposure. And if you have solid policies that your organization really follows, they reduce noncompliance in your government procurement program. That, of course, is the whole point.

The MMAS audit is to help ensure the following:

- You're properly accounting for materials and costs.
- You're ordering materials based on accurate requirements in a time-phased approach.
- You're implementing valid processes and procedures.
- You're using complete audit trails from part to project to customer delivery.

The goal of the project manufacturer is to maintain compliant systems and use good business practices, ensuring proper cost accounting for projects, inventory, and overall operations.

The Big 10

There are ten MMAS standards outlined in the Defense Federal Acquisition Regulation Supplement (DFARS).

The actual reference for the MMAS requirements is DFARS subpart 252.242-7004.

Standard 1

System Description: Policy, Procedures, and Operating Instructions

MMAS Standard 1 requires you to provide an adequate system description — including policies, procedures, and operating instructions — compliant with FAR and CAS criteria for all elements of affected cost.

It's important for the contractor to maintain a self-assessment of its systems, including written policies, procedures, and operating instructions. During the MMAS audit, the auditor must obtain an understanding of the contractor's control activities and assess contractor risk accordingly.

Standard 2

Material Requirements: Time-Phased Materials, Bill of Material Accuracy, and Master Production Schedule Accuracy

MMAS Standard 2 requires that the costs of purchased and fabricated material charged or allocated to a contract be based on valid time-phased requirements, as affected by minimum/economic order quantity restrictions.

The primary objective of this standard is to ensure that sufficient controls are established and used to ascertain that material costs are valid and time-phased.

Accurate bills of material and master production schedules should ensure that the contractor's material costs are both valid — meaning that there was a valid requirement for the material — and reasonably time-phased, which means they were billed within a reasonable time of the actual need date.

Materials requirements cover three main areas for the government contractor:

- First, the auditor must review your procedures for planning and ordering material, and determine when those material costs are billed to the contract. This will ensure materials aren't received and charged to contracts earlier than is reasonably justified.
- Second, the auditor will evaluate the engineering design process, looking for a goal of 98 percent accuracy in the bill of materials. Because many contractors manufacture and deliver highly complex products, engineering changes are frequent and require immediate attention. The review will look at how these changes are processed and what affect they have on the accuracy of bills of material and overall project costing.
- Third, production scheduling will be reviewed to ensure that manufacturing process times and lead times are accurate, and there will be a look at the availability of resources and capacity.

Standard 3

System Monitoring

MMAS Standard 3 requires that your system provide a mechanism to identify weaknesses and manual overrides in report and resolve system control. As with standards 1 and 4, the requirements of this standard are an integral part of the evaluation of all standards.

If you're audited, the auditor will use the following criteria to determine whether you comply with MMAS Standard 3:

- The auditor will determine the sufficiency of the contractor's analysis of MMAS-related exception reports as well as reports that track manufacturing process performance pertaining to the contractor's material.
- The auditor will evaluate how the contractor selected significant reports and determined that exceptions are adequately identified, reported, and resolved consistent with procedures (testing of the system).
- The auditor will evaluate the analysis regarding the adequacy of the system to identify in a timely manner exceptions such as excess and residual materials, no cost transfers, lost/found parts, and so on.

Standard 4

Audit Trails and Testing

MMAS Standard 4 requires you to provide audit trails and maintain records necessary to evaluate system logic, and to verify through transaction testing that the system is operating as desired.

For each of the ten standards, the auditor will determine the adequacy and accuracy of the audit trails provided by the contractor's system. This will require the auditor to not only review the audit trails but also see enough transactional history to ensure that the system is operating properly.

Standard 5

Physical Inventories, Receipts, Returns, Cycle/Physical Count Materials

MMAS Standard 5 aims to find 95 percent inventory record accuracy, hoping to ensure that recorded inventory quantities reconcile to the physical inventory. You must establish and maintain adequate levels of record accuracy, and include reconciliation of recorded inventory quantities to physical inventory by part number on a periodic basis.

Auditors will evaluate your policies and procedures for material receipt and inspection to ensure that:

- All material received and issued is accounted for.
- Only materials meeting agreed-to quantity and quality specifications are accepted.
- Material returns are properly controlled and accounted for.
- Cycle counts and physical inventories are periodically performed to validate inventory balances and reconcile to the book of record.

If your systems have an accuracy level below 95 percent, you must provide adequate evidence that the lower accuracy levels are causing no material harm to the government, and that meeting the accuracy goal would be too expensive, compared with the impact on the government.

Standard 6

Material Transfers

MMAS Standard 6 states that your policies and procedures should include detailed descriptions of circumstances that will result in manual or system-generated transfers of parts. The government wants to determine whether the contractor adequately describes circumstances which will result in manual or system-generated transfers of parts.

Standard 7

Material Costing and Borrow/Payback

Of the ten standards, this one is a biggie, and it's very hard to accomplish if you don't have an automated/integrated ERP and manufacturing system.

MMAS Standard 7 requires you to maintain a consistent, equitable, and unbiased logic for costing material. For cost transfers, loans, and paybacks, these are the rules that apply:

- You must maintain and disclose written policies describing the transfer methodology and the loan/payback technique.
- The costing methodology may be standard or actual cost, or any of the inventory costing methods in 48 CFR 9904.411-50(b).
- You must maintain consistency across all contract and customer types, and from accounting period to accounting period for initial charging and transfer charging.
- Your system should transfer parts and associated costs within the same billing period. In the few instances where this may not be appropriate, you may accomplish the material transaction using a loan/payback technique.

The *loan/payback technique* means that the physical part is moved temporarily from the contract, but the cost of the part remains on the contract. The procedures for the loan/payback technique must be approved by the administrative contracting officer.

Costing of inventories is critical to the project manufacturer. Just as with any standard accounting rules, costing methodology of inventory must be consistent for all inventories and shouldn't change from accounting period to accounting period. Valid costing methods include actual costing, moving-average cost, weighted moving-average cost, standard costing, FIFO, and LIFO. Transactions should be recorded in the accounting period in which they occur.

Project transfers can add another layer of complexity. As with Standard 6, material transfer procedures and circumstances

need to be defined and adhered to. If an owning project "lends" a part to a borrowing project, the owning project must remain whole. Borrow/payback transactions ensure that the owning project's costs are intact.

Standard 8

Inventory Allocations: Common Inventory

MMAS Standard 8 requires that your system handle allocations of common inventory in a manner that keeps improper allocation and costing of allocations from happening.

Where allocations from common inventory accounts are used, you must have controls to ensure that:

- Reallocations and any credit due are processed no less frequently than the routine billing cycle.
- Inventories retained for requirements that aren't under contract aren't allocated to contracts.

Your auditor will review common inventory allocations for materiality. If common inventory allocations are material, a deeper analysis of how and when those allocations happen will be performed. The audit will consider two important aspects. First, are there project requirements to support the allocations? Second, are the allocations time-phased appropriately?

Standard 9

Commingled Inventory

MMAS Standard 9 states that you must have adequate controls to ensure that physically commingled inventories don't compromise requirements of any of the first eight MMAS Standards. These commingled inventories may include material for which costs are charged or allocated to fixed-price, cost-reimbursement, and commercial contracts. Government-furnished material must not be physically commingled with other material or used on commercial work.

Warehouse management can be challenging in general, but when you're procuring and stocking inventory for a project, the challenge broadens. Not only do you need to keep your stockroom in order, but despite your limited warehouse space, you now have to identify which project owns each part! Commingling inventory requires that stockroom personnel know the physical location and ownership of each part in the warehouse at any time.

Auditors will check to see if parts are properly tagged to the project they belong to. Your inventory system needs to be able to provide for all parts, location, and project ownership.

Tracking government-furnished material (GFM) requires the same diligence as with any inventory item. The part should be tagged to the project for which it is to be used and given a stock location. Your inventory system should be able to provide stock and location status of all project inventories, including GFM.

Standard 10

Compliance

MMAS Standard 10 requires that your system be subjected to periodic internal audits to ensure compliance with established policies and procedures.

The auditor will evaluate your internal audit plan and review completed audit schedules. It's critical that your policies, procedures, and operation instructions are compliant and have been implemented effectively.

A Noncompliant MMAS Can Be Tough on You

The contracting officer has 30 days to provide to the contractor (in writing) the initial determination and any significant deficiencies identified by the auditor during the MMAS audit. As the contractor, you have 30 days to respond in writing to any disagreements.

The contracting officer will evaluate your responses and notify you in writing of the final determination. At this point, if significant deficiencies still exist, the contractor must within 45 days correct the deficiencies or submit an acceptable corrective action plan showing milestones and actions to eliminate the deficiency.

If the contracting officer doesn't approve of your Materials Management Accounting System, and the contract requires adherence to 252.242-7005, the contracting officer can decide to withhold payments in accordance with the contract.

Other Audits

Keep in mind that material costs are examined in all DCAA audits that touch cost or invoicing. It's important to make sure your material costs are proper.

Another audit for which you may prep yourself is the contractor procurement system review (CPSR) performed by the Defense Contract Management Agency. The objective of a CPSR is to evaluate the efficiency and effectiveness with which the contractor spends government funds and complies with government policy.

The Defense Contract Management Agency ensures the integrity of the contracting process, and provides a broad range of contract-procurement management services for the military. The agency is the independent eyes and ears of the Department of Defense and its partners, delivering actionable acquisition insight from the factory floor to the front line.

Companies will need the following basics to pass a CPSR:

- The organization must have a clear understanding of roles and responsibilities.
- There must be segregation of duties.
- The company must have policies making sure that all purchases are authorized and have the proper documentation.
- There must be auditable support for why the vendor was chosen, the price paid, and any other documentation.

- The company must have a self-audit program and training for all affected employees.
- Compliance must be a part of the overall culture.

There also could be an audit of your quality management system. These audits are also accomplished by DCMA in accordance with FAR Part 46 Quality Assurance. The audit ensures that deliverables meet quality and technical requirements. It also assesses the quality control system's processes and procedures, ensuring that quality goals are systematically sustained and improved while reducing risk to the project.

Chapter 8

Ten Myths about Project Manufacturing

In This Chapter

- Tracking the costs
- Helping employees succeed
- Automating to optimize

Project manufacturing is a lot of amazing things. And there are a lot of things it isn't. Read on to bulldoze a bunch of myths that stand in the way of understanding how to get ahead in project manufacturing.

Myth: Detailed Cost Tracking Isn't Always Important

Think it's not all that important to track manufacturing costs when you're rolling up costs by the project? Think all that matters is the cost as it relates to the project itself? Think again. Don't forget that you want and need to grow your business by winning new projects. Project manufacturers must understand not only the project costs but also the costs associated with building each subassembly and finished good. This information includes all direct costs, material, labor, and subcontractor, as well as the indirects and fringe benefits. Without this vital information, it's difficult to bid and win the next project. Understanding historical configurations and their costs is imperative to winning new business.

Myth: Change Doesn't Happen

Yeah, right, and unicorns are real, too. Don't think for a minute that an engineer-to-order or make-to-order customer isn't going to change the requirement, or that the engineering department isn't going to mess with the design. Change is the name of the game, especially when you're manufacturing complex products for a specific customer and set of requirements. Engineering, procurement, quality control, and manufacturing must all understand these changes and their impacts on a timely basis to ensure that change can be accommodated while minimizing risk to the cost and delivery date.

Myth: Manufacturing Is All the Same

Yes, there are some similarities between project manufacturing and commercial manufacturing. Both track inventory, both have bills of materials, both follow work plans and operation steps, both have quality concerns, and customer delivery due dates are critical in both environments. The extra complications with project manufacturing come with the design of complex products, the engineering changes that are par for the course, the need to meet customer-specific requirements, and the common requirement of dealing with regulatory compliance, whether aerospace and defense, FAR, CAS, or MMAS.

Myth: You Need a Bigger Warehouse

The nature of project inventory typically involves stocking and identifying raw materials and subassemblies by project in the stockroom or warehouse. It makes sense to imagine that you'll need more warehouse space to make that happen. But do you really need to physically segregate the parts by project? In reality, parts, raw materials, and subassemblies may be commingled in the same warehouse or stockroom location as long as they're tagged to the project to which they belong.

There's even an element of MMAS stating that parts may be commingled if necessary.

Myth: This Is a Great Way to Cut Jobs

The main goal of Lean manufacturing processes isn't to eliminate jobs but to ensure that shop floor technicians and warehouse personnel make the best use of their time. Lean practices cut the "fat" from what it takes to get the job done, while increasing on-time delivery and product quality. Lean practices help the employee become more efficient, less frustrated with redundant tasks, and more empowered to build the best quality product possible. With a good MES, you can meet Lean objectives by giving shop floor technicians the capability to have all work instructions, 3D images, and data collections at their fingertips. Measurements and buyoffs are prompted through each step of the process. It's not about slicing people from the payroll, but making them more productive.

Myth: Tracking Time Is a Waste of Time

No, you can't just wait until the end of the day to collect and enter time data. Time collection is critical to evaluating manufacturing order costs for labor and any overhead associated with that labor. Shop floor technicians need easy-to-use systems that allow them to clock on and clock off manufacturing operations in an efficient manner, collecting and recording their time as they go. Waiting until the end of the day to record time against the manufacturing orders worked on each day is time-consuming and inefficient. What's more, this delays getting costs to the manufacturing order, which can create big issues if the orders are closed before all manufacturing costs are accumulated. Work in process can be overstated, while finished goods are missing labor and overhead associated with the labor. For that reason, having a real-time shop floor time collection system is critical to having accurate manufacturing and parts costs.

Myth: Materials Requirements Planning Doesn't Work Here

Some people believe materials requirements planning isn't an option for project manufacturing. On the contrary, materials requirement planning is extremely useful in planning project manufacturing orders and reacting to changes, whether they're engineering change notices, order cancellations, or updates to expected due dates. A true MRP system for project manufacturing allows you to plan by project if desired, or plan across a group of like projects. Specific rules define how each project is to be governed by MRP. For example a cost-plus project, in which costs are reimbursed when they occur, may be planned independent of other projects. Three similar fixed-price projects may be planned together under a netting group assigned to those projects. Whatever the project rules, success depends on materials requirements planning and understanding the impacts of changes to the project, customer order, or drawing.

Myth: Earned Value Management Is Out of the Question

Yes, earned value management is challenging to implement on manufacturing projects, but that doesn't mean it should be avoided. These kinds of manufacturing projects are most likely the largest projects in your portfolio, with the highest margin potential. The riskiest part of these projects is the development phase. It's likely that a lot of money has been spent trying to mitigate risk and make the product more producible. Once you finally reach the promised land of production, that's when most opportunities are created. Improvement in predictability, economic order quantities of material, and other cost reductions can now be realized. Marrying project management and manufacturing on these contracts is in the best interest of the company.

Myth: Success Is Just a Button-Push Away

Oh, if only you could take a pill and alleviate your project headaches. Project management and project manufacturing can seem almost magical, with the potential that some carefully chosen and connected software application will instantly make life smoother and easier. Sure, the upsides are amazing, but there are a few more steps than that. Keep in mind that a project manufacturing system is made up of multiple functions and their respective people, processes, and tools. People are a *key* ingredient. To be successful, you need to build healthy and productive social behavior among the project team, beginning with an atmosphere of openness and communication. That is much more than just a software implementation, and it doesn't just happen with the push of a button.

Myth: Automation Is Costly and Difficult

Of course, there's an upfront cost for effectively implementing a paperless project manufacturing ecosystem and integrating all the needed functions into a closed-loop system. But consider this cost kind of like you think of buying project insurance — it's necessary, and you'll be glad you spent the money. Do this correctly and your manufacturing system will give you visibility and control into your projects like never before. When implemented in a constructive manner, this system will pay back the initial investments in dollars, time, quality, and accuracy in project visibility.

Chapter 9

Ten Ways Deltek Can Help Your Business

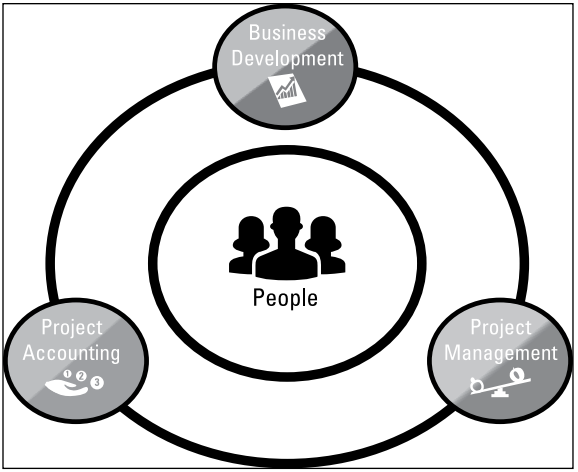
In This Chapter

- Highlighting the Deltek solutions
- Putting the pieces in place

This chapter explores solutions that Deltek has created with projects in mind. Deltek's solutions can help you manage your business in three key areas, as shown in Figure 9-1:

- **Business development:** This involves understanding the market, and identifying, tracking, and capturing opportunities from before RFP through the contract award.
- **Project management:** Helpful tools move you from contract award to execution through schedule, cost, resource, and risk management, to attain fully integrated program management.
- **Project accounting:** Execute and deliver on your projects and corporate objectives through a project-based ERP and manufacturing suite of solutions. Manage your key back office processes by the project, not just the account or organization.

Deltek's solutions are built for project-based businesses, but you may have your own specific needs based on the types of projects you do, the clients you serve, and the areas you want to manage as part of your projects — such as business development, bill of materials, quality, resources, billing, or all of the above. What specific tools might you need for the kinds of projects you do? Figure 9-2 shows some specific uses to look at when deciding what tools you might need based on the types of projects you do.



Source: Deltek

Figure 9-1: Deltek Enterprise Management.

Source: Deltek

Figure 9-2: Deltek project-based solutions.

For more information on how Deltek products can support your business, please visit `www.deltek.com`

Projects for the Government

If you perform work for the government, you know just how complex those projects can be. Chapter 7 discusses many of the rules and regulations that you must comply with from a manufacturing perspective, but countless other rules and regulations must be followed. Deltek has solutions built specifically for businesses conducting projects that fall under federal regulations and an extensive offering for government contracting companies.

For more on the importance of these regulations and the intricacies of doing business with the government, please see *Government Contracting For Dummies,* Deltek Special Edition.

Develop Business through CRM

What's the difference between standard customer relationship management and CRM geared specifically for project-based businesses? The short answer is that project-based CRM helps manage, track, and forecast opportunities in ways especially helpful for project-focused businesses. Deltek offers Project CRM for both professional service organizations and government subcontractors.

Handle the Financials

The financials include everything from accounting and billing to revenue tracking — everything you need to track the revenue and costs on your projects and bill your clients. Depending on the types of projects you do and for whom you do those projects, Deltek has a number of options. For example, if you're a small government contractor your needs are quite different from those of a large accounting business.

Track Time and Expense

For most businesses, time and expense tracking is part of the overall ERP solution, and is important for resource tracking, costing, billing, and so on. The capability to capture time via mobile devices can be quite helpful as well.

Master Project Management

For businesses that need to plan out the project, the phases, or tasks, and budget the project at any of those levels, Deltek offers project planning and budgeting tools that can help give your project managers visibility into the projects and help them stay on-task and on-budget all the way through.

Get a Handle on Resource Planning

Creating the project plan and lining up the necessary resources is critical for all types of projects and especially in the world of project manufacturing. For those businesses that need to schedule and manage their resources and teams, Deltek offers planning tools to help get the right people and materials on the right job at the right time.

Materials Management Made Simple

Manage the purchasing and tracking of materials throughout the procurement process. You can track customer orders completely from planning to approval, purchase, shipment, and receiving. Deltek's solutions include purchasing, receiving, and procurement planning applications.

Social Collaboration

Need to collaborate with a team around your project? Perhaps share status updates with your client? Perhaps you need to bring together the project team to come up with ideas for dealing with a tough situation while making sure the project is delivered on time. Just as other social tools are connecting people, Deltek's Social Collaboration tools link people around the project to share conversations, tasks, events, and files.

Analysis and Portfolio Management

If you manage many projects, you need to be able to view and measure the entire portfolio so you can answer some incredibly important questions. Which clients are most profitable (and how can you get more business from them)? On what industries should you focus, and which should you avoid? Are all your projects on track and profitable for the business?

Project Manufacturing

If your company builds or manufactures deliverables, Deltek offers a full set of project-based manufacturing tools. The software links shop-floor activities with financial management, accounting, and project management at the most detailed levels possible. It provides instructions for complex product assembly or maintenance, repair, and overhaul. It also collects important information, including start and stop times for each operation as well as quality inspection results. All the project status and cost information is automatically fed from the shop floor into the ERP environment.

This combination provides a significant competitive advantage in the build-to-order, engineer-to-order, and MRO fields. Businesses that develop and maintain complex product offerings will benefit from improved compliance, efficiency, quality, and visibility.

About the Authors

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Kim Koster is currently the Senior Director of Product Marketing for GovCon tools and solutions. She has 21 years of industry experience working for Raytheon and ATK where she had the opportunity to work as a finance professional on multiple projects, programs, and product lines. Kim also participated in in multiple successful ERP selections and implementations. She held management positions such as Javelin JV Controller, Director of Financial Business Systems, Product Line Business Manager, and EVMS Focal Point. She has been a trainer in her organizations and has provided guidance to many project and executive teams. Kim holds a BBA in Finance from the University of North Texas.

Manufacturing businesses driven by project requirements can benefit from this book!

It's one thing to manufacture thousands of products that are all identical. It's another challenge entirely to build highly complex things on an engineer-to-order basis. This book offers tips for successfully navigating the world of project manufacturing.

- ***Communicate more effectively* — *integrate your project-based ERP, project management, and manufacturing systems***
- ***Learn from the past* — *track details that will help you win new projects***
- ***Achieve higher quality* — *find, resolve, and prevent problems on the factory floor***
- ***Build new efficiencies* — *document and shrink costs, while eliminating waste***
- ***Match supply and demand* — *ensure that you have the materials you need, when and where you need them***

Open the book and find:

- **The benefits of truly integrating your systems**
- **Secrets for generating accurate cost estimates**
- **Advice for more effective quality control**
- **Ways to get Lean with engineer-to-order work**
- **The ins and outs of compliance in project manufacturing**

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