**Project-Oriented Manufacturing: "How to Resolve the Critical Business Issues That Impact Organizational Competitiveness"**

**Preston Blevins CFPIM, CIRM**
**Acuity Consulting**

OBJECTIVES OF THIS PAPER:

Identify and discuss the unique and critical business issues with which an Engineer-To-Order (ETO) or project-oriented manufacturer must contend. Also, outline the newly formed body of good business practice that resolves these issues. This new body of knowledge is a logical fusion of formerly disparate approaches to: business acquisition, configuration management, project scheduling, detailed scheduling and control, project accounting and revenue recognition into a cohesive business system. This paper follows the lifecycle of a project.

INFORMATION COVERED:

The operating style of Project-Oriented Manufacturing is very different than that used by traditional discrete and repetitive manufacturers. Project-Oriented Manufacturing and Engineer-To-Order (ETO) are expressions often used interchangeably. For the majority of companies operating in an ETO environment, every machine sold is similar to, yet different from, anything else previously engineered and built. We often refer to these machines as "custom", "unique", "complex machinery", "capital equipment", and "bespoke".

In addition to the engineering and fabrication of the device, the manufacturer must often perform services. Examples of these services are site preparation, on-site installation, and training. The typical worker in an ETO environment is a skilled crafts-person.

Complex engineered-to-order equipment is expensive to build and expensive to buy. A custom-designed, complex machine is often a sub-system in a larger project. Examples of large projects for which an ETO machine would be ordered are: constructing an automated assembly line, building a power station, assembling a large private data network, building a ship.

Consider this combination: the uncertainty of a custom design with the high costs of engineering and producing it and the impact of a late delivery on the customer's project. The result is significant economic risk. These factors create critical business issues for every department, function, and discipline involved in the contract and project lifecycle.

This workshop will cover:

- The life-cycle of an ETO project, including the pre-sales bidding and estimating phase
- The organizations or departments that participate in the project lifecycle and the point or phase in which they are involved
- The critical business issues that each department must address
- The ideal business system framework to manage the project lifecycle
- How to contain, resolve, or eliminate the critical business issues

BENEFITS THE READER WILL GAIN:

- Understand the ideal business system framework to manage the project life-cycle
- How to contain, resolve, or eliminate the critical business issues that adversely influences organizational competitiveness.

THE LIFECYCLE OF AN ETO PROJECT INCLUDING THE PRE-SALES BIDDING AND ESTIMATING PHASE

The life cycle of an ETO Project is a continuous process of discovery. The process is centered on understanding the customer's requirements. Often, not understanding the customer's requirements is directly related to the customer not fully understanding what they want. They typically want a machine "just like the one you built for us in 1962 but with some improvements". There is an expression "The devil is in the details." The devil for the company providing products and delivering services on an ETO basis is an accurate customer requirements definition. The statement, "but with some improvements" is the "force" behind the continuous process of discovery that creates a constant state of uncertainty.

Frequently, the complex device being ordered is part of a capital improvement project or new facilities project. Projects of this nature typically have large budgets. Large budgets generally equate to large customer expectations, such as:

- Seizing a marketplace opportunity
- Increasing revenues
- Decreasing costs or improving efficiencies

The time value of money is an important consideration. Delivering on time is critical. Combine this with changing requirements, even if they seem relatively minor in nature, and you have an extraordinarily challenging environment.

FRONT-END PROCESSES

To have a chance of reconciling the conflicting objectives of having an accurate picture of the customer's requirements and meeting delivery dates, one must gain enough understanding to start designing, building, and procuring items. The phase in which this occurs is often called the "front-end processes". For most companies operating on an ETO basis, this phase is the most demanding part of the project. The expression "front-end processes" is generally understood to include:

- Securing a workable requirements definition
- Bidding and estimating
- Contracts
- Preliminary design
- Partial engineering release

## ENGINEER

In an ETO environment, the engineer is very involved throughout the project. The engineer working generally has a good suite of technical tools and systems. The engineer is most “hands on” with the customer, bidding & estimating, project management, contracts, and manufacturing and procurement phases.

Engineering activities contribute significantly to overall costs and consume a considerable percentage of the overall delivery lead-time. Since an ETO project is very engineering centric, resource planning, and scheduling of engineering are extremely important. In segments of the ETO community, particularly complex mechanical machinery, skilled engineers are in short supply. This situation amplifies the need for constraint management, resource planning, scheduling and accurate status visibility across the engineering organization.

Since meeting the delivery date is critical, engineering often releases component and sub-assembly data to manufacturing and purchasing before the final assembly unit is fully engineered. Engineering, manufacturing, and procurement work in parallel. Because some of the design requirements can and do change, there is typically a steady stream of rework. This situation makes the planning and control of the project more difficult. The root of the problem goes back to the conflicting objectives of incomplete requirements definition and the need to meet delivery dates. The difficulties caused by “islands of automation and information” can be corrected and will be discussed later in this paper.

## MANUFACTURING AND PROCUREMENT

The manufacturing and procurement phase is an execution phase. Often the engineering data that is received and the lead-time to deliver are less then adequate, particularly near the end of a project. Most suppliers and the manufacturing staff are flexible and skilled. Often the manufacturing staff is in short supply and workers are better described as “craftsmen”, not factory workers. The systems used for detailed planning and scheduling are separate from the project planning system.

## INSTALLATION

Installation is a demanding and often complex phase. The work takes place in front of the customer. There is no place to hide! After the initial installation, there may be acceptance testing and changes in the installation. Customer training frequently follows and possibly more changes. Depending on the complexity of the equipment, the design engineer may be on-site and involved. Configuration management is crucial during this phase and influences the ability to supply spare parts and maintenance services in the future. Inaccurate configuration records translate into poor customer service and lead to high costs in servicing the equipment.

SPARES MANAGEMENT AND ON-SITE SUPPORT

Although this is not strictly speaking part of the project, spares management and on-site support affect the ability to support current projects. The life span for specialized equipment may be 10-40 years or more, an incredibly long time to maintain spares and configuration records. If a customer's machine goes down and the required part is not in stock, manufacturing and or purchasing must respond immediately. This places another demand on limited resources. Feel the tension?

Figure #1 graphically depicts the project lifecycle.

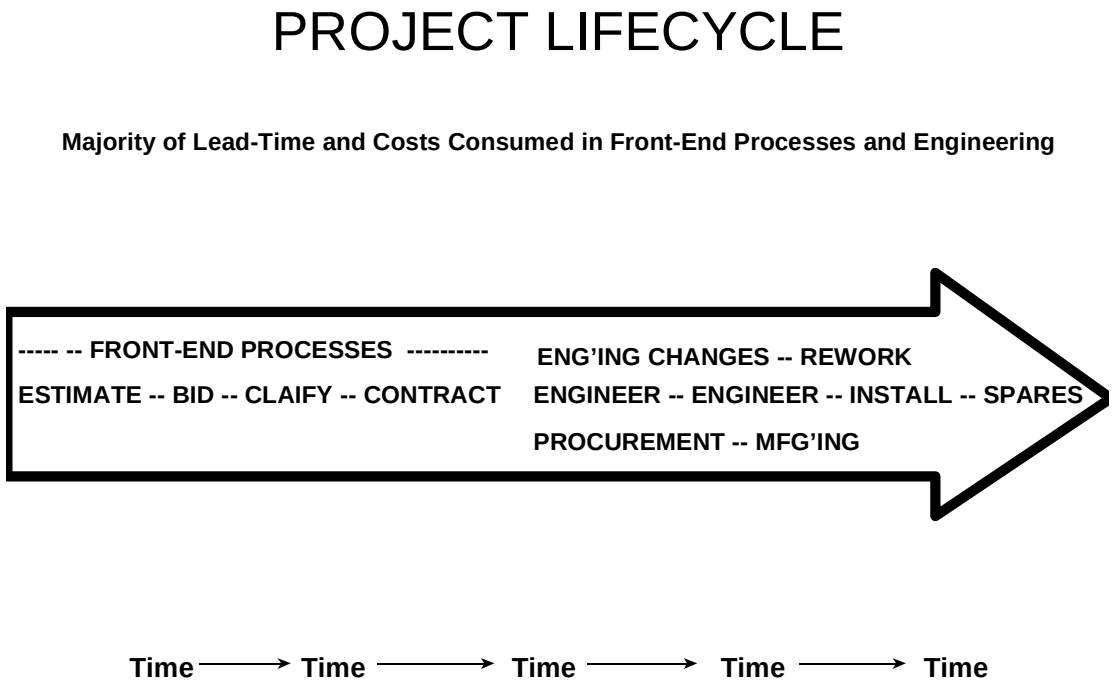



Figure #1

In summary -- The combination of uncertainty and the intensified need to deliver on time mandate a rational, cohesive, and integrated requirement definition, engineering design, planning, control and cost management framework.

THE ORGANIZATIONS OR DEPARTMENTS THAT PARTICIPATE IN THE PROJECT LIFECYCLE

The ETO environment has four roles or disciples not normally associated with traditional discrete manufacturing:

- Bidding and estimating
- Project management (except for capital projects and new product development)
- Contracts
- Installation management

In addition, two roles have a superficial similarity but are different in ether level of authority or technique:

- Engineering – Very active throughout the project lifecycle. The design engineer is king!
- Project accounting – It's a costing function but the technique is radically different then standard costing

Figure #2, an enhancement of figure # 1, highlights the involvement of each organization in the project lifecycle.

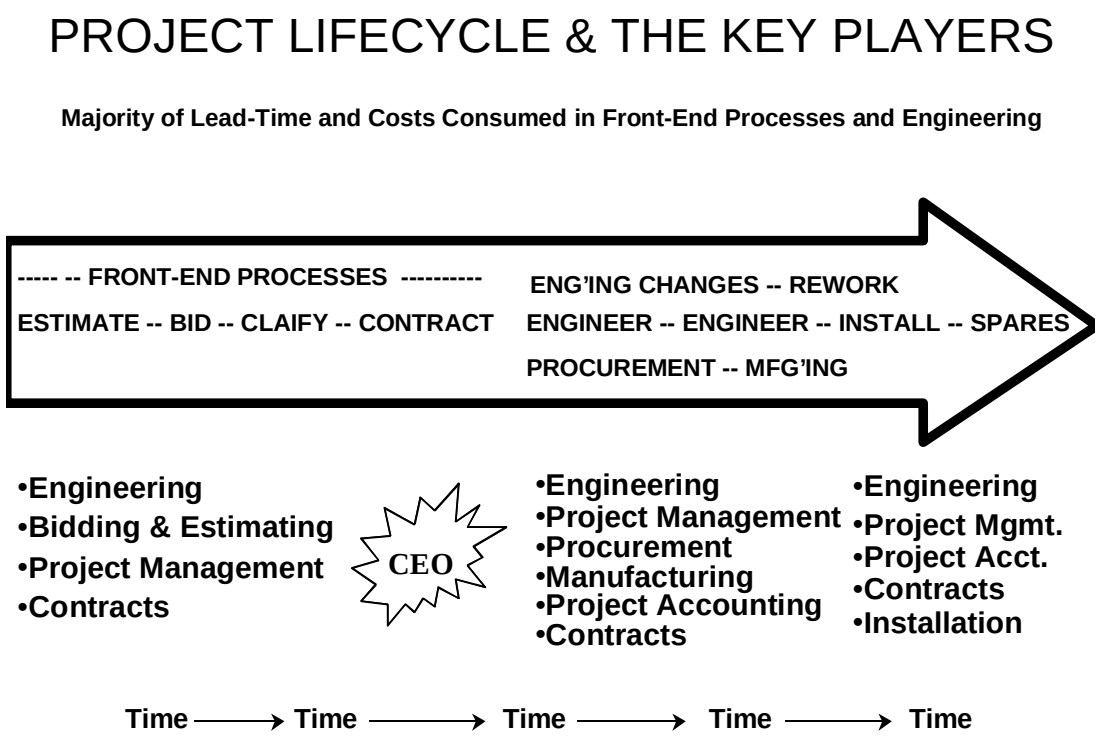



Figure #2

## THE CRITICAL BUSINESS ISSUES THAT EACH DEPARTMENT MUST ADDRESS

Now that we've described the overall business environment of a company operating on an ETO basis, let's examine some of the critical business issues with which each department or function must deal. Since there are many functions involved and many challenges, I'll limit the discussion. For seven different departments or functions, I'll cover just a few issues. Since the audience here is resource management and project management professionals, I will expand on issues that directly affect them.

A disclaimer, every role, or function I describe is a generalization. The ETO community is very creative and pragmatic on job responsibilities and reporting relationships!

BIDDING AND ESTIMATING (PROPOSAL MANAGEMENT)

This role is a difficult one to play. The bid process is an integral part of the front-end processes. During this phase (see figures 1 & 2), the first critical objective is extracting a workable and reasonably accurate requirements definition or specification from the customer. The second objective is to select the strategy to satisfy delivery and cost requirements. This selection is complicated since both machinery and value-added services must be delivered. Decisions include: Should we sub-contract or perform this activity in house? How much project reserve should we incorporate and not damage our ability to get the contract? Can I use a blended labor rate for my estimates? How reliable are the estimates I've gotten from engineering, procurement, etc.? Do I have enough historical data on similar projects, and how accurate is it?

The people responsible for bidding and estimating work collaboratively with engineering, project management, and contracts. They work with data from past projects and templates that are similar to the bid under development.

Most, if not all, of the computerized systems they use are "stand alone", that is not integrated with the company's other major systems. This lack of integration between systems is common in companies operating on an ETO basis and serving the commercial marketplace. Figure #3 depicts the nature of systems in a typical ETO environment.

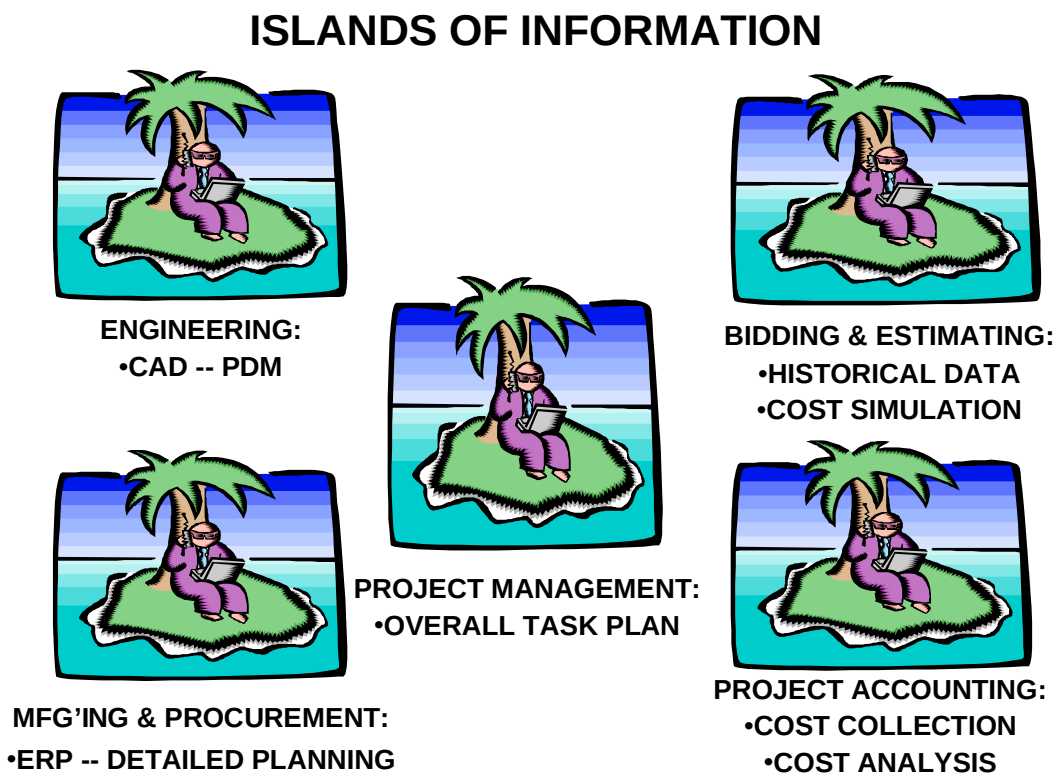



Figure #3

The bidding and estimating team is very much aware of the day-to-day, week-to-week, and month-to-month activities and problems in their company. "Head knowledge" is vital for success, and intuition is frequently applied.

There are a number of important business issues that cause problems for the bidding and estimating professional (1). Since the length of this paper is limited, the discussion will be kept to two issues:

- Unrealistic schedules and.
- Limited availability of knowledge workers and craftsmen

Unrealistic schedules -- If you're responsible for bidding the contract, you are interested in performance to schedules. Since there may be a penalty clause in the contract, your power of concentration on schedule integrity is enhanced. However, the information you receive from co-workers on new tasks and deliverables to be used in the bid is often faulty. Since those people do not have reliable data and simulation tools, the estimates on effort and time are often well off the mark. They do not have a problem of personal integrity; they just do not have the appropriate means to estimate time and effort. Then, there's the problem of the CEO or Managing Director.

Right at a critical point in contract negotiations, the CEO gives away the project contingency reserve, not only for the budget, but also for delivery. The result -- unrealistic schedules. If Diogenes [(2)] had worked in an ETO environment, he would have looked for a realistic schedule, not an honest man. Today we are looking for the means to give a realistic estimate and put together a realistic schedule.

Limited availability of craftsmen and knowledge workers – The reality every company operating on an ETO basis cannot escape is limited knowledge worker resources. In other words, there just aren't enough craftsmen around. This is an EXTREME issue for those producing complex mechanical machinery. A valid and achievable bid and contract both in terms of schedule and cost is very dependent on leveraging these critical resources. The "islands of information" typical of an ETO environment hinder resource or constraint planning. The result, poor schedule reliability, integrity, credibility, and high costs. Everyone involved in the bidding and estimating function wants to leverage these critical resources and get the maximum possible value-added contribution from them. Unfortunately, their systems conspire against them.

ENGINEERING

Heavily involved throughout the project lifecycle, the design engineer is very concerned about the profitability of each project. Many believe the operative word in Engineer-to-Order is engineer. For a design engineer to survive the rigors of the ETO environment, they must be above average in engineering skills, flexibility, and innovation. Because they often interact with the customer, they must also have good people skills. A few critical business (not technical) issues the design engineer has to cope with:

- Better requirement definition and specifications
- Limited availability of knowledge workers and craftsmen

Better requirement definition and specifications – This crucial business issue has two dimensions. The first relates to an accurate requirement statement from the customer. Customers are expert at designing and building their products, not necessarily the special machinery used in the manufacturing process. Identifying and articulating needs is more difficult then one might think. That's why the computer software professionals often prototype a new program for customer review before building the final program. The typical engineer would prefer to design in a systematic, thorough, and efficient manner. The realities of the ETO world do not permit that. Often the issue is not just defining how the device will work, but also designing within a budget and to an inflexible delivery schedule.

The second dimension is the completeness of designs and specifications engineering releases to purchasing and manufacturing. Manufacturing and procurement commonly complain that the designs and specifications are incomplete. Some of this can be attributed to the difficulty in getting the customer to adequately define their requirements. Much of it is time pressure, inadequate systems support, and perhaps habit.
Since engineering is concerned about profitability, they would prefer to improve the quality of the information they release to purchasing and manufacturing.

Limited availability of knowledge workers and craftsmen – This is a critical business issue shared by engineering with many of their co-workers. If you design it and they can not build it, either because they lack the skills and capabilities or because they can not build it to the schedule because of capacity constraints, the result is the same -- a past due shipment.

CONTRACT (S) MANAGEMENT

This department is responsible for defining, in contractual language, what equipment and services will be delivered, the schedule for these deliverables, and the payment milestones. In addition, they track requirement revisions and guard against "scope creep". Scope creep is a proven cause of eroded project profit and schedule integrity.

Critical issues for the Contracts organization include:

Performance tracking – If the project is running off schedule and the contract has a penalty clause for late delivery, the contracts person responsible really would like to know about it. Conversely, if a major milestone has been achieved that is a billable (progress billing), they also want to know about it. Getting such information is often difficult and/or time consuming. The supporting systems are often the culprit.

Timely and flexible response – The dynamic of an ETO project is fluid, because there is frequent interaction with the customer. Requirements often change, and these changes may have cost and schedule implications. These changes in turn may affect payment schedules and contract terms, i.e. penalty clauses. The Contracts function needs information from various organizations within the company. This information flow must be timely and provide easy access to the underlying supporting information. All of this is necessary to promptly communicate the contract changes that must be agreed upon between the customer and your company. Doing business without a valid contractual framework is an invitation for disputes and possible project "write-offs" at the project's conclusion.

CHIEF EXECUTIVE OFFICER (CEO)

One of the key characteristics of a project is uncertainty. Imagine being responsible for the well being of a company filled with uncertainties. That's the life of a CEO in a company operating on an ETO basis. A few of that person's critical business issues:

- Reliability and predictability of business processes
- Customer relations

Reliability and predictability of business processes – Earlier in this discussion, we graphically depicted the lifecycle of a project and the key players (Figure #2). The CEO is shown in a representation of an explosion. This situation occurs at point of contract agreement between the customer and the supplier. The explosion represents the reduction in the cost and schedule project reserve. Combine this with the information infrastructure in the company (see Figure #3) and it's reasonable to assume the anxiety level for the CEO increases. I'm sure that the compromising of the project reserves was absolutely necessary and justified to get the business. When all this is brought into the discussion, it is easy to understand why the CEO wants more reliable and predictable business processes -- there is no margin for error.

Customer relations – Throughout the project lifecycle, the customer, and supplier closely collaborate, creating many opportunities for misunderstandings and friction. The project represents significant risk to both parties.

From the customer's perspective, they have committed to a supplier and quickly finding a replacement if things are not going well is difficult, if not impossible. The device being engineered and manufactured is either part of a major internal improvement project (capital project) or is a sub-project for a larger more complex and expensive project being managed by the customer. In both cases, the economic impact of a late delivery or failure to deliver at all is significant. Combine this with the nature of ETO projects, the inevitable discovery of new requirements and design limitations, and the probability of resulting reschedules and cost increases, and you have the fuel for disagreements.

Also, the relationship will continue well beyond the device's shipment and installation. When complex machinery is involved, spares and on-site repair or maintenance services are needed. The full life-span of these devices can be decades. That is a long time to have a business relationship, and it needs to be a good one.

The CEO has to be the ultimate relationship manager with the customer, the dynamics of the situation demand it.

PROJECT MANAGEMENT

The captain of the project is the Project Manager (PM). All projects contend with other projects for resources. Most projects have a significant number of value-added services being delivered, such as engineering design, test planning, specification development, customer education etc. Skilled knowledge workers provide many of these services. These individuals often have trouble estimating the level of difficulty, effort, and time required to perform a new service. The nature of complex projects creates a significant planning and control challenge. Because of all these factors, the PM in an ETO environment must be a generalist with enough understanding of each discipline involved in the project to separate fact from fiction. The appreciation for the PM role has progressively increased. Project management is considered one of today's "hot" and growing professions. Because of the complexity of ETO environment, a PM needs a high level of computer systems support. In addition, the PM is concerned about the adequacy of computer systems that other line organizations use in support of everyday activities. A system is only as strong as its weakest link.

Some of the key business issues for the PM are:

- Inadequate project status visibility and communications
- Project "scope creep"
- Inadequate requirements definition and specifications
- Ineffective "early warning" signals
- Unreliable estimates of effort and time required on new tasks

Inadequate project status visibility and communications – A typical ETO device requires many services delivered and thousands of parts procured or fabricated. Significant information flow is necessary to adequately monitor, control and replan as required. The "islands of information" currently found in most ETO environments severely compromise the timeliness and accuracy of this critical information flow.

There is a story often used to explain the impact of even a small error on a complex endeavor. The story:

> You are in a large sailing schooner and will sail from Ireland across the Atlantic Ocean to the "New World". The navigator makes a small error of two-three degrees (2-3) in the sailing plan. This SMALL error lands you SEVERAL HUNDRED MILES FROM YOUR DESTINATION. It's winter, you are out of supplies, the locals are hostile, and your health is marginal. Question: do you give a bonus to the navigator?

That's why the PM (AKA the navigator) needs improved visibility into the real project status and the ability to communicate this status.

Project "scope creep" – The bane of every PM, not only for those in an ETO environment but also those managing any project. We previously stated, "the defining of requirements is really a process of discovery". Nothing will change this. The issue here is the ability to interpret the changes as they influence schedule and cost. The key is the ability to access current and valid information and to simulate possibilities and choose the best strategy and approach.

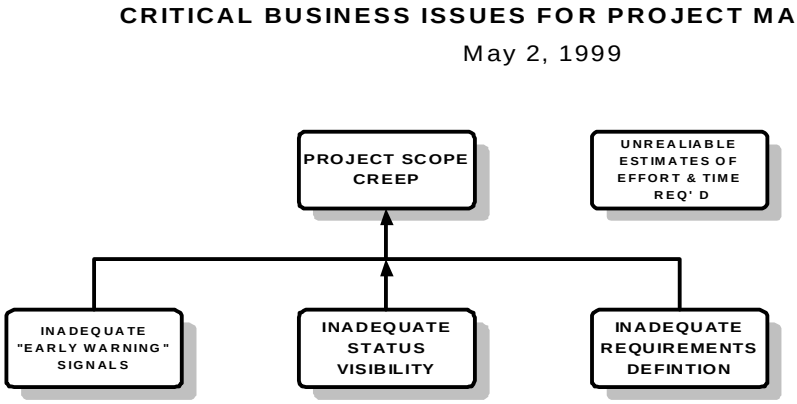
Inadequate requirements definition and specifications – Please refer to our earlier discussion on the critical business issues for the engineering executive. If you were responsible for the planning, monitoring, controlling, and replanning of all tasks, you logically would want an accurate definition of requirements. It is not going to happen. Realistically, what the PM wants is the ability to respond to new requirements and plan and assess the impact they have.

Ineffective "early warning", signals – Knowing when things are not going well is important to everyone, particularly the PM. To know when the patient is not well, one must understand the symptoms and monitor the situation to detect them.

Unreliable estimates of effort and time required on new tasks – In our opening discussions on the PM role, we mentioned this problem. The root cause of this problem is the inability to access accurate data, simulate possibilities, and monitor performance to targets once an estimate is made and applied to the project schedule/budget.

Whenever I discuss critical business issues, I try to understand if they are a "symptom" or a "cause". Figure # 4 is attempts to interpret cause and effect. If we had a meeting with five individuals in it, we probably would have five different conclusions.

Figure # 4



MANUFACTURING AND PROCUREMENT (PURCHASING)

Life is difficult when you're at the end of a lifecycle that is characterized by change. The discovery process means that a certain number of assumptions that the design engineer made will be wrong. This translates into rework. In addition, the conflict between getting all the details of a design worked out and documented and the need to maintain schedule often result in incomplete engineering specifications. An item not adequately defined is difficult for anyone to manufacture.The fact that most of those who make hardware and deliver services are craftspeople in short supply compounds the problem.. Their skills in dealing with the ill defined and the flexibility that results from their skills may in fact be the un-prescribed antidote for the situation. Unfortunately, this antidote is treating a symptom not the cause.

Most of the detail planning, scheduling, and monitoring in manufacturing and purchasing is done by stand-alone systems. This "islands of information" condition is typical to the c ompany as a whole. Often the system used is a system based on the MRP2 (Manufacturing Resource Planning) business model and has been partially enhanced to support the project environment. For those unfamiliar with MRP2, I suggest reading this authors paper Enterprise Resource Planning (ERP) - An Executive Perspective [(3)].

The key critical business issues are:

- Frequent schedule changes
- Unreliable schedules
- Poor accuracy of BOM/product specifications
- Poor inventory record accuracy
- Too many engineering changes
- Inadequate and inaccurate cost accumulation

Frequent schedule changes – New requirements, rework due to engineering changes, and changes in priority all add up to a "nervous" schedule. Schedules that change frequently are often viewed as unreliable. When you doubt the integrity of the schedule, you make up you are own. The capacity problem and the shortage of skilled craftspeople magnify the situation. A credible and relatively stable schedule is necessary to build a complex device.

Unreliable schedules – See above.

Poor accuracy of BOM/product specifications – If the BOM is inaccurate, there are only two possibilities: build it, and then rework it; or get engineering involved when you discover the problem while you are building it. Both choices consume limited resources and time. Remember that there isn't a pool of readily available capacity. If you don't properly utilize the resources you have, you are in trouble.

Poor inventory record accuracy – There are many potential causes of inaccurate inventory records. You think you have it in stock, and then you discover you don't. Poor inventory record accuracy is the affliction of any firm that assembles a complex device of hundreds, if not thousands, of parts. Perhaps an engineering change may have made a part in stock un-useable, and your inventory system does not record or show component revision levels. In addition, in the free wheeling ETO environment, an item often is not processed through the inventory record system.

Too many engineering changes – If the customer has not adequately communicated requirements, changes are inevitable. Sometimes engineers just make mistakes. The machine being designed and built is complex; there are pressures to perform to schedule on a project that may have very little schedule reserve. Then, there is the possibility of bad habits -- releasing a design without a review. Whatever the cause, the number of engineering changes is unacceptably high.

Inadequate and inaccurate cost accumulation – The schedule is not the only important thing. To make a profit, you must meet or perform better then budget. Understanding how you are performing is important to to staying on budget. Understanding requires accurate information. Accurate information is dependent in part on ease of recording activities and the disciple of those recording it. The problem in part is the "islands of information" within a company. Another contributor may be the organizational reporting relationships. When I researched project accounting, I found that there

was no real consistency in where this function reported. Sometimes it was finance, others engineering, project management or manufacturing.

I mentioned earlier that whenever I discuss critical business issues, I try to understand if they are a "symptom" or a "cause". Figure # 5 attempts to interpret cause and effect.

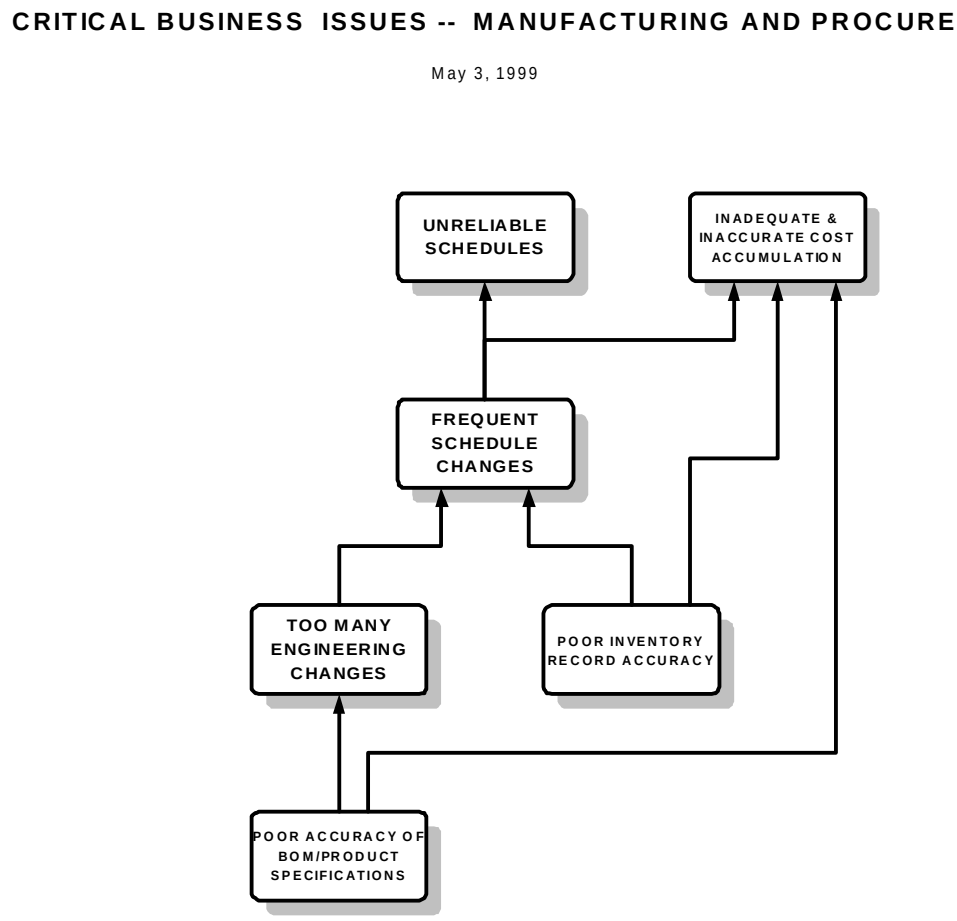



Exhibit #5

## THE IDEAL BUSINESS SYSTEM FRAMEWORK

The expression "the whole is greater then the sum of the individual parts" applies to the ideal business system framework. Earlier we discussed the "islands of information" typical of a company operating on an ETO basis. Individually these systems are excellent supporting departmental activities but are sub-optimal in supporting the overall project lifecycle. The key to solving or at least minimizing critical business issues is integrating all systems into a cohesive whole. We have been progressing or evolving toward this complete system framework for some time.

In the late eighties and early nineties, the Aerospace and Defense community drove, in the pursuit of efficiencies (Don't laugh, it's true) the evolution of Manufacturing Resource Planning (MRP2) and then Enterprise Resource Planning (ERP) the successor to MRP2 to support project-oriented manufacturing.
This significant achievement was not widely known in the commercial ETO community until recently. Since then, advanced and affordable computing technology has made the integration, or at minimum interfacing, of the other important business systems to Project-Oriented ERP feasible. Examples are bidding and estimating, Product Data Management (PDM) project management and project accounting systems. A number of commercial firms operating on an ETO basis have pioneered this new variant of ERP.

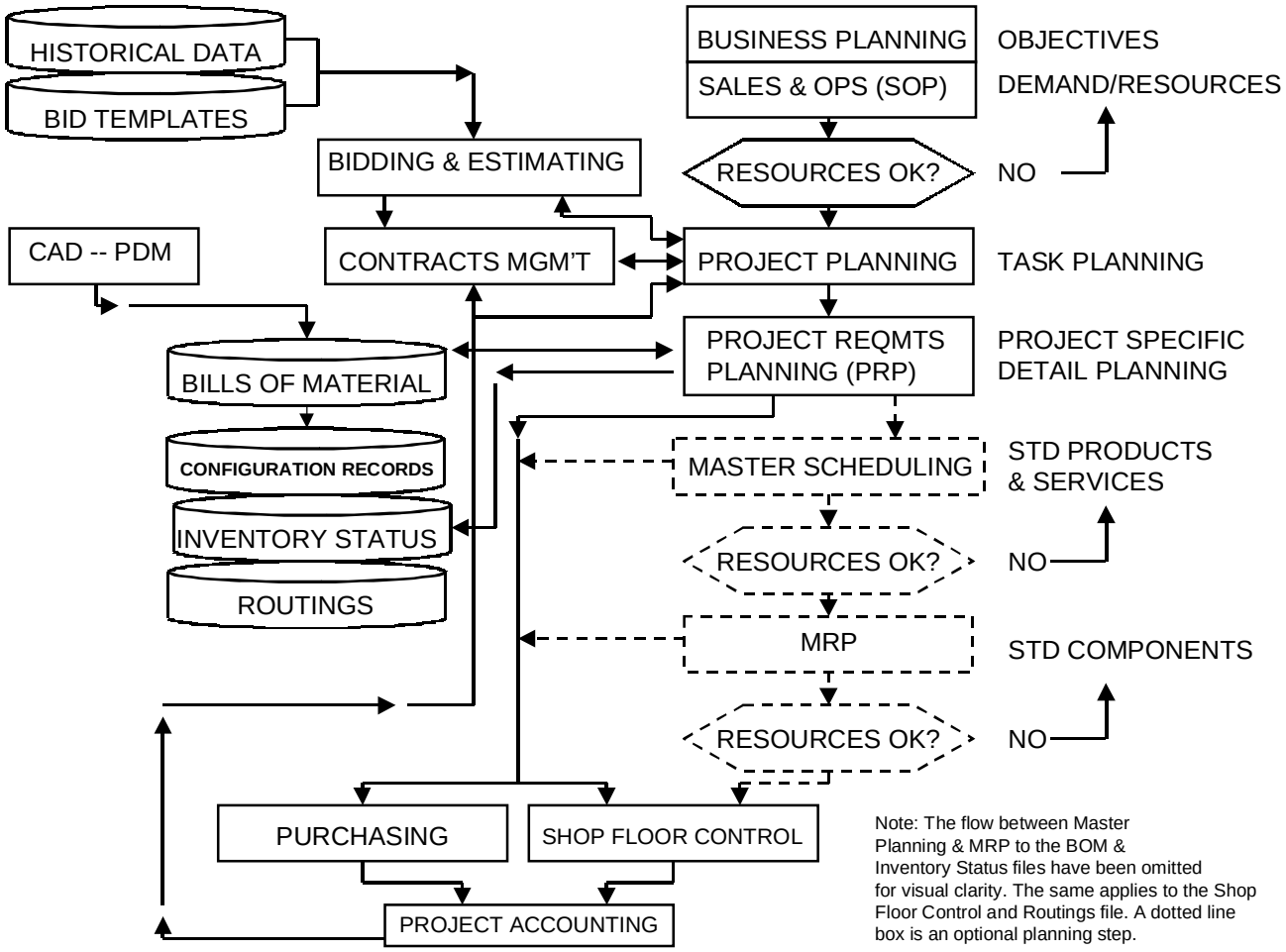
During their pioneering efforts, these firms found that the earlier Project-Oriented MRP2/ERP model needed enhancement to work harmoniously with all of its new "peers".

Some of the needed enhancements:

- The ability of ERP, which is due date oriented to work with project management systems that are task and duration oriented
- The ability to effectively manage value-added services
- The ability to not only collect costs at the project level but to plan for and recognize revenues
- The ability to create bid specific structures beyond the traditional project specific Bill-of-Material (BOM).
- The ability to effectively manage material supplied to sub-contractors

Since these new capabilities are a significant addition to the Project-Oriented ERP model, it seems appropriate to refer to this enhanced and improved model as Extended Project-Oriented ERP. Figure #6 below graphically depicts this improved model.

**EXTENDED PROJECT-ORIENTED ERP**




For those interested in Extended Project-Oriented ERP there is some good news. The APICS Complex Industries SIG and the Project Management Institute's (PMI) Manufacturing SIG are exploring the possibility of collaborating on this enhanced model for project-oriented manufacturing. If they are successful in working together, the ETO community will benefit from a model will be documented, refined, and distributed to industry. Both organizations are effective as educating professional societies.

## SUMMARY

- The ETO operating environment is significantly different then that found in traditional discrete manufacturing
- There are a number of departments or functions unique to the ETO operational environment
- The lifecycle of an ETO project is complex, and there are frequent revisions to the end-item specifications
- The front-end processes; the defining of customer requirements, bidding and estimating, contract definition and preliminary design engineering are often the most difficult part of the project
- Most companies operating on an ETO basis have disconnected departmental systems resulting in "islands of information"
- An incomplete requirements definition in combination with the "islands of information" are the root causes for many of the critical business issues impacting organizational competitiveness
- The evolution of ERP and advanced computing technology have made the integration of the various department systems feasible and desirable
- This new integrated business model is often called Extended Project-Oriented ERP
- A few progressive professional societies are in the process of organizing the underlying body of knowledge to support this new model

## SUGGESTIONS TO THE READER

I suggest you check out the following web sites:

The American Production and Inventory Control Society (APICS) – http://www.apics.org/
The APICS Complex Industries (CI) SIG -- http://www.apics.org/sigs/CI/sci3top.htm
The Project Management Institute (PMI) -- http://www.pmi.org/
The Association of Proposal Management Professionals (APMP) -- http://www.apmp.org/
The Product Development and Management Association (PDMA) -- http://www.pdma.org/

## FOOTNOTES

(1) There is at least one professional society serving the bidding and estimating professional: The Association of Proposal Management Professionals (APMP)

(2) Greek philosopher who founded the Cynic school of philosophy, stressing self-control and the pursuit of virtue. He is said to have once wandered through the streets of Athens with a lantern, searching for an honest man – Source: Microsoft Bookshelf Basics.

(3) Enterprise Resource Planning (ERP) - An Executive Perspective, Preston W. Blevins CFPIM, CIRM – Source: APICS 1994 International Conference Proceedings

## BIOGRAPHY

Preston Blevins is a Consultant/Advisor. He specializes in the implementation of enterprise resource management systems. Preston's manufacturing experience spans 12 -years. Positions held during that time include all positions associated with materials, manufacturing, and plant management. He has worked in a variety of environments including commercial, aerospace, job shop and repetitive.

Following his manufacturing industry career, Preston has spent the last 18-years in the consulting and the manufacturing software industry. The last three-four years have been centered on program and project management.

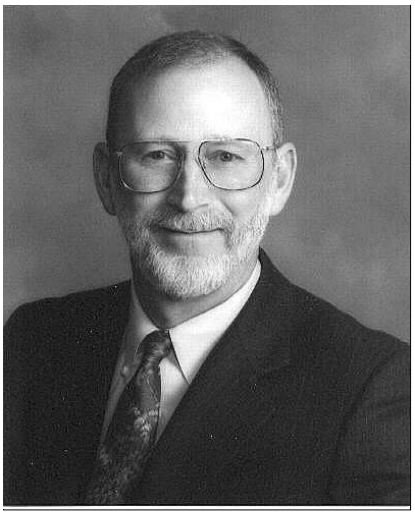
Preston is certified by APICS as a CFPIM and CIRM. The British Production and Inventory Control Society (BPICS) also have certified him at the Fellow (FBPICS) level. Preston is an active member of the Project Management Institute (PMI)

Preston has had extensive involvement with APICS, holding several key management offices, including:

- Chapter President
- Regional Vice-President (Region VII)
- National Conference Chair (1980)
- Member of the Education and Research (E & R) board
- VP of Education, LAADSIG (Los Angeles Aerospace and Defense Special Interest Group)
- Member of the CIRM Delivering Products and Services Course Development Committee

He has been a frequent speaker at:
- APICS
- BPICS
- AMS (Advanced Manufacturing Systems)
- NAPM (National Association of Purchasing Management)
- SME (Society of Manufacturing Engineering), and
- A variety of other public meetings and conferences.

Preston has had extensive international experience living on multi-year extended assignments in the UK, Sweden, and Belgium.



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