Contract manufacturer Dynomax Inc. specializes in aerospace components, where cost estimates must adhere to many customer-specific requirements.

Solving the Manufacturing Costing Equation

Contract manufacturers, job shops, and OEMs bolster the bottom line with effective cost estimating methods

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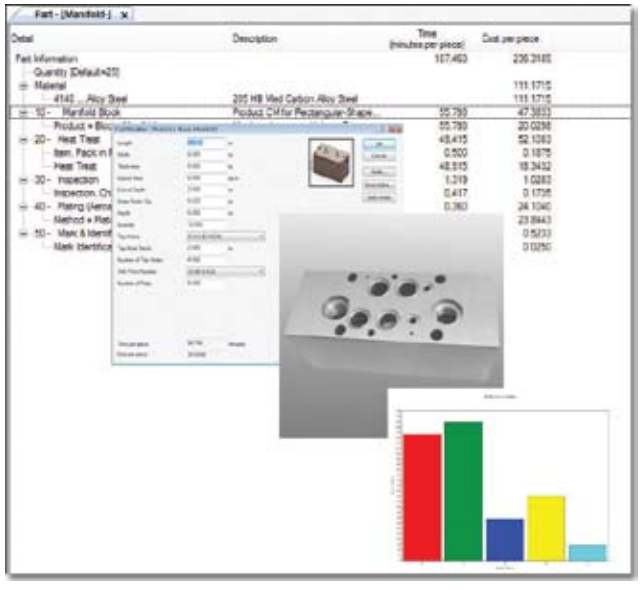
No matter how you cut it, businesses stand or fall based on the bottom line. If a manufacturer can't sell its products for a reasonable profit, the doors won't stay open for long. When contract manufacturers, job shops, or OEMs build components and machines, owners and managers must have solid evidence that they can sell a product for a reasonable price that results in profit.

Today, some manufacturers use fairly basic costing methods, with estimates derived from tools as simple as Excel spreadsheets, because the method fits their manufacturing process and business model. Other companies use custom structured-query language (SQL) relational databases that perform more complex calculations based on business or manufacturing process-spe-

cific data residing in such databases. Other shops may use shop-management production systems, ERP software, or even more specialized cost-estimating software packages.

A contract manufacturer focusing on aerospace/defense, Dynomax Inc. (Wheeling, IL) offers value-added engineering and high-precision machining, injection molding, and tooling services for the aerospace, automotive, and medical industries. When it comes to estimating costs, efficient, accurate calculations are a must to stay competitive. "Costing obviously is huge because without it, you can't tell if you're making money or losing money," states Paul Flanagan, Dynomax project manager, aerospace. "It's easy for people to track what you would think is a big-ticket item, such as cycle time, material in, and component prices, which you can track very easily using MRP [manufacturing resource planning] systems and other tools. But in my mind, the most important thing is tracking what I would call all the hidden costs—things that you might not readily think about but directly affect you. Those things are the hardest to track, not only track, but apply."



The Costimator software from MTI Systems Inc. offers a knowledge base and the ability to do feature, product, and parametric-based costs analysis.

During the design of a new product, material is easy to track, but some nonrecurring items that occur in engineering often are less easy to track, Flanagan says. "You have to put together a plan for manufacturing a certain component, and there are many things that are hard to keep track of," he adds. "When you think of costing, it's very easy to do those first couple things, everybody does that, but what's more important to me is capturing those other things that are less apparent, more indirect costs.

"A lot of times, it'll determine whether or not if you're in the red or in the black," Flanagan adds, "and that's whether or not we actually want to pursue a project in the future, especially on a repetitive basis. Is it something we want to go after again and again, or is it something we're better off letting go?"

In the past, Dynomax has used quoting tools like the Mfg-Quote.com online service for submitting or receiving request-for-quotes (RFQ), but Flanagan says those are used as more of a comparison look for the specialized aero/defense work that makes up the majority of his business. "For certain aspects of what we do, we can definitely use those products as a weather gauge but for the most part, almost exclusively the products that I deal with are on the aerospace and defense side of the business. All the customers we do business with have ASLs, Approved Supplier Listings," Flanagan notes. "If we're going to do work for them, we have to become part of that, which involves a site visit and an audit—it's a very lengthy process. For us to outsource that is a pretty big nonoccurrence. Most of the contracts I deal with, the longer-term contracts, we can't outsource anything in there anyway, even if you wanted to, because there are clauses against doing that."

Stringent customer requirements mandate much of what is done related to aerospace/defense quotes, he notes. "To be compliant with our AS9100, we have to keep an approved supplier listing of our own. So if we're going to go out and purchase material, we have to keep a list of the people we're going to use, and we have to audit them on a regular basis," explains Flanagan. "We have to keep track of their on-time delivery, performance, quality, all these things, and they get a scorecard, so we're limited in the sources we can choose, even internally, based on vendors that we like to work with."

When the company bids out contracts, the main key criteria include price, lead time, and quality. "Depending on what kind of project you've got going, you have to balance all of those things differently," Flanagan observes. "That's a very dynamic set of requirements. If lead time is critical for a defense application, then lead time becomes the central tenet and the others go away. Obviously quality is never negotiable—no matter what the price is, we can't deviate from that." With high-volume, multiyear runs, price becomes quite a big concern, he adds, as well as factors including variability in available stocking and just-in-time delivery.

Competing with low-cost offshore manufacturers means shaving mere seconds off cycle time can make or break a contract manufacturer's efforts to bid jobs at a competitive, profitable price. Cost factors can affect the manufacturing processes chosen by manufacturers, Flanagan notes. "It's a huge factor, and I would even call it a driving concern, for how we would pick our manufacturing processes," Flanagan says. "With global economies, we often find ourselves competing really hard with low-cost countries, to bring that work back onshore. There are a lot of ways to do that, but here at Dynomax we do that with brand-new equipment and processes. In certain cases, we're talking about saving three seconds of cycle time can mean the difference winning and losing a project.

With many high-volume jobs in automotive and medical, or even in aerospace where shops may run very long cycle times, Flanagan says the payoff can be substantial simply with small cycle-time improvements. "Where that directly relates to costing is if I do all this work and have engineering time, equipment, and capital tied up in saving three seconds, and then I don't account for it properly, I'll quote it too high and I lose it. Let's say you're cutting very complex titanium parts and you're running it for 30–40 hours. If you're able to save 2% of that and you miscalculate and think you're saving a half a percent, you'll quote too high and lose the bid. That's potentially millions of dollars that you lose over multiple years. It's a big part of what we do. At the end of the day, if you're not accounting for it properly, it doesn't really much matter."

For full-service custom molder Columbia Plastics Ltd. (Surrey, BC, Canada), price and material costs rank among the top considerations when estimating job costs, notes Brian Holmes, A. Sc.T., CMfgE, Columbia Plastics vice president and general manager and SME Past President. "We define ourselves as a full-service custom molder, as opposed to a contract manufacturer," Holmes notes. "What we try to do to draw the distinction is we'll do a whole lot of assembly and decorating and all this other work, or we'll even sub some of it out for you. We try to avoid owning all of the components along the way. That's where the costs go crazy. We do work for some contract manufacturers as a molding supplier—and every one of them is working on razor-thin margins, because they have so much inventory compared to the value they're putting in. That's where you run into some of the issues in being a contract manufacturer."

An important aspect of costing is material prices, notes Holmes, which he sees as volatile right now, particularly in larger products that have a greater number of components. "We're a full-service injection-molding house, and we'll start right from the design end of it," Holmes says. "We have done some designs, but our preference is to work with the customer's design and optimize it for manufacture, and then go from there right through to the finished product.

"What we try to do is look at what the value stream is and say, 'How much should we do, that would be most cost-effective? How much should our customer, or another supplier in the chain do?' It needs to be done in most effective place to do it."

The whole cost equation is handled best if it's process-driven, he says. "We just basically follow the product value stream physically. What is the flow? Maybe we can print this thing and do some assembly within our molding cycle, so that's an absolute minimal cost," Holmes says. "I may want to do another step or two, depending on how it works, or I may say that it would be more effective for another supplier or the customer to do. And sometimes they come back and say, 'That makes sense, but he doesn't have the quality systems in place we want, or we have to have.' It's still an open discussion. But it's best to truly follow the value stream map of that job, and then do what makes sense."

When doing RFQs for his products, Holmes gets input from his suppliers and looks at the cost of buying materials, which he says are a major component of overall cost. "The other major element is what we are going to do," he adds. "We come up with a manufacturing plan, if you will, then cost that out, and that's how we come up with our pricing. I don't think anybody's doing it dramatically differently."

Over the years, Holmes has evaluated cost-estimating software systems for costing, and he recently saw one at the Canadian Manufacturing Technology Show (CMTS) in Toronto. "I looked at it and said, 'It's an incredibly good platform from a starting point, but because we have so many specialty and add-on processes, we'd really end up customizing the databases for our processes and business model.' So I don't know that it's really that powerful."

Using off-the-shelf software can end up being a difficult maintenance task, he adds. "You've got so many variables. As this guy noted, the people he runs into, almost every shop has its own spreadsheet that they work, and do it that way," Holmes recalls. "I'm looking at it and thinking, 'I can see that, because we all have a little different take and a little different business model.' I actually tried an off-the-shelf system about 15 years ago, when there were two major off-the-shelf production monitoring systems, for order handling, scheduling, and all that. We put in a pilot project with one, then after a year

scrapped it. It wasn't that it wouldn't do what we wanted it to do—it would do it really well—it was the labor requirement to make it work. It wasn't streamlined to our business model, and part of that was they were making assumptions based on the business model they wrote it for, and it wasn't our business model. So we had to put extra labor into it to make it work for us, and to me, that is one of the challenges with any off-the-shelf software is that you then have to sort of tweak it to what you want."

Instead, Columbia has stayed with a customized costing database that the company developed years ago, after initially doing spreadsheet-based costing efforts. The company first started on Apple II computers, then moved to Lotus spreadsheets, and later to Microsoft Excel. In 2000, Holmes says Columbia launched its custom SQL database, which is currently being updated. "It's not that complicated," Holmes says. "We try to keep it as simple, and as visual, as we can."

Specialized cost-estimating software such as the Costimator package from MTI Systems Inc. (West Springfield, MA) can offer the contract manufacturer, job shops, and OEMs versatile methods of calculating job costs and many other parameters. The Costimator software includes a knowledge database with historic cost models, and it allows users to estimate costs with feature-based and parametric-based methods as well as a specific product-based cost model.

"Understanding product costs are more important today than ever given the fact that the competition for work [suppliers] and market share [OEMs] is at an all-time high," notes David LaJoie, MTI Systems vice president. "Value-added labor costs and material costs have to top the list. If you are sourcing or manufacturing parts overseas, other factors such as shipping costs become a large factor as well."

Consistency, accuracy, and speed are critical to helping job shops compete in today's highly competitive manufacturing market, adds Jay Snow, MTI business development manager. "Contract manufacturers, who produce more of consistent product lines, refer to cost-estimating software to help develop lower-cost alternatives to existing product lines either to increase their profits or to remain competitive," Snow adds. "OEMs rely on the ability to use agreed-upon data to ball-park costs for the processes used on the parts they outsource.

The latest Costimator package adds the ability to develop and use cost models through the system's new Cost Modeler design tool, Snow notes. "With this tool, engineers can quickly modify an existing cost model, any one of the 300-plus models that are shipped with the system, or they can create new ones from scratch," he says. The Cost Modeler tool is powerful and also easy to use, he adds, offering estimators embedded formulas encapsulated in individual cost models, resulting in fewer decisions and less manual calculations. These models can be based on features, multiple features, and multiple processes."

Another method of cost estimating is through using functionality embedded within software such as Vistagy Inc.'s (Waltham, MA) Seat Design Environment (SDE) software for automotive OEMs. "SDE creates a master model that contains information about all the seat trim design features, such as material area, seam length, even details such as the type of needle needed to perform a sewing operation," says Ed Bernardon, Vistagy vice president, business development. "This information can then be used to automatically drive cost calculations, making it easy for a designer to get instant feedback on the relative cost of design alternatives.

Vistagy's software is widely used in designing composite components for aerospace, but the SDE package targets automotive. "SDE's costing tools include the ability to collect all items and quantities for the Bill of Materials [BOM], including type and quantity of seat cover materials, attachments, retainers, clips, thread, foam backing, etc.," Bernardon says. "By using information from the SDE master model, the designer is able to automatically calculate material cost, sewing time, and labor costs.

"The BOM lists cost drivers for a seat design and is of utmost importance in controlling costs. Since the seat trim cover is the most costly element of the seat, and the SDE allows for the precise calculation of the area of the 2-D patterns needed to make a seat cover, this enables the manufacturer to more precisely understand the key seat cost drivers." **ME**