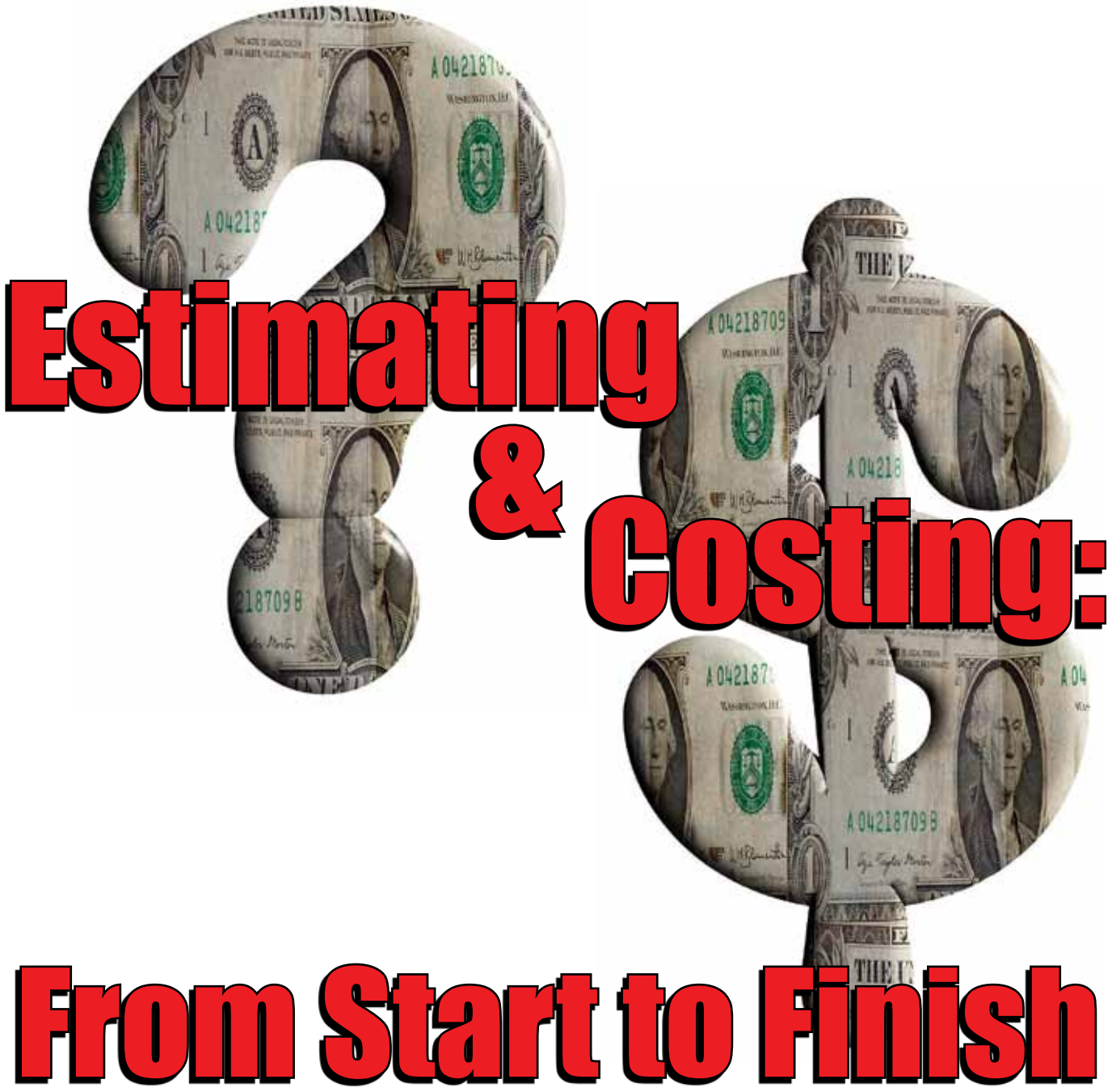

Estimating & Costing: From Start to Finish

To develop accurate financial models, dirty your hands for more valid and reliable data.

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It is said that ancient philosophers often argued about how many teeth a horse had. The simple solution to this debate is to stop arguing, go out to the barn and physically count a horse's teeth.

One of the keys to profitability and the subsequent ability to survive economic downturns is a solid estimating and costing model. In order to make your model more accurately reflect reality, you must be intimately familiar with the operations of the metalcasting facility and visit the "bowels" of the plant. Go out and "count the horse's teeth."

For any estimating and costing model, generalizations must be confirmed through observations. If you are focusing on the model for a particular part, check your system schedule for when the part is going to be produced and follow it through the process route. This is typically the job responsibility of the industrial engineering (IE) department, in conjunction with sales. Unfortunately, many metalcasters do not have access to an IE department, and management must count the horse's teeth themselves.

As with any daunting project, a top-notch estimating and costing model does not develop overnight. It comes to fruition by breaking the project down into the smallest of steps and making continual progress.

Creating the Models

There are as many methods of cost-

ing and estimating as there are companies operating them. However, an understanding of the basics can assist you in starting the process.

The costs involved in producing a manufactured product are split into two main areas—material costs and conversion costs. Material costs encompass everything that you purchase specifically for the use of manufacturing (not just what it's made of but also consumables). Conversion costs consist of every resource you use to convert materials into the finished product. Setup, design and development costs sometimes are included in this category, specifically by short-run job shops. Some costs are truly "one off," and you should make an allowance for amortizing this type of expense over the life of the job. These costs may be one-off tooling setup or machine modifications.

Material Costs. First, consider the material you buy to make your product. Do you actually know how much it costs? You may know the price per ton, but does that equate to a price per ton in the actual finished product? If you do not buy virgin alloys, you will have to deal with waste that essentially increases the overall cost before the material has even hit the shop floor. Even when waste has been dealt with, does the manufacturing process itself use part of the material inventory? Has the effect of potential scrap, rework and returns been factored in? If part of the material can be recycled, do you value the returned material accurately? It's a common mistake to use the same value for material going into a process as for the value coming out of a process. Ask yourself if you would buy the same specification of material post-melt for the same price as the material going in.

Once you have built all this into your model, there is another fly in the ointment: changing market conditions. Materials are expensive and for some manufactures can form the majority of the overall costs. If you are costing (as opposed to estimating), you are going to be dealing with actual purchase costs, which is straightforward. But, if you're estimating, you have to take into account where the market price is going to be when the purchase actually takes place. If you're planning a scheduled production release over a period of a year or more, material prices are going to change. And to complicate the matter, you may be purchasing the materials outside of your country and have to factor in possible exchange rate fluctuations. Whether varying material costs are your concern or future exchange rates, your company can hedge against these fluctuations or apply customer surcharges. Both of these options are preferable to gambling. Either way, when building a cost model, you need to build in these items as certainties or assumptions.

After you have dealt with the materials that your product is actually made

Defining the Processes

Costing is an action performed to calculate costs after a process has taken place (in hindsight), and estimating is an action performed to approximate costs before a process takes place. It is important to understand that both the action of costing and estimating use the same fundamental methods to attain their goals and should be almost identical if comparison is to be useful. Some would say that the point of costing is to validate the estimate model.

So, given that costing and estimating use similar models to attain a final result and that both should use the same components in their calculation, what is the difference? The difference is that costing data is based upon actual recorded data (after the event) and estimates are based upon what essentially is a best guess. Some would argue that knowledge of similar jobs and a use of industry standard cost knowledge equates to more than a best guess, but you are still trying to predict costs for processes and events that have not yet occurred. ***MC***

The two classes of costs that should be taken into account are material and conversion costs. Material costs include all the things you buy in order to make your product, such as scrap.

Developing any estimating or costing model requires data that is both valid and reliable. Validity refers to the numbers/data being "correct." Reliability means the collection of the data can be repeated.

of, you will need to extend each of these concepts to cover all the purchased items that are directly related to its manufacture, including purchased services, such as sub-contractors. When dealing with subcontract costs, ensure that your suppliers are tied into a product-specific price for the same duration that you are guaranteeing the sale price to your customer.

Conversion Costs. When calculating conversion costs, you must look at all the resources that go into turning your purchased materials into your finished product. This covers a lot of ground. First, it's useful to split conversion costs into two distinct areas—direct costs and indirect costs. Direct costs are those relating to the product's manufacture (all the processes and resources directly used in production), and indirect costs cover all the additional resources that are essential for the production.

In order to obtain accurate direct costs, you must understand how much your processes cost to put in place. This not only covers employee wages, but also plant and equipment. To ensure that you do not include indirect costs in your direct costs, ask yourself if you would own or operate the cost center if you were not manufacturing the specific product in question. If the answer is yes, then at least part of the

Characteristics of a Great Model

The old computer adage "garbage in-garbage out" applies well when developing an estimating and costing model. No matter how good the calculations and parameters are within the models, if you start with incorrect data, you are going to get incorrect costs out of the models. The best costing and estimating model in the world is only as valid and reliable as the data that goes into it.

Therefore, the hallmark of any costing and estimating model must be the data that drives it. It is difficult, labor intensive and time consuming to gather the data for an estimating and costing model, but the future of your facility and hence your paycheck depends upon it. This is where you have to pull out your metatarsals, don your hardhat and go and get dirty within the bowels of the metalcasting facility. You must determine the inputs to your models and verify the numbers. If you have specified that a certain operation takes one actual clock hour and two man hours, you must verify that only two employees are working at the operation and it can be completed in one hour.

A great costing/estimating model:

Is Valid and Reliable. The more you make generalizations or arrive at averages, the further away from the absolute truth you are going to be.

Accounts for Everything. When you are on the facility floor, observe every action that is taken during the metalcasting process. Any time a casting is touched, it costs you money. During this process, you must also account for your scrap rates.

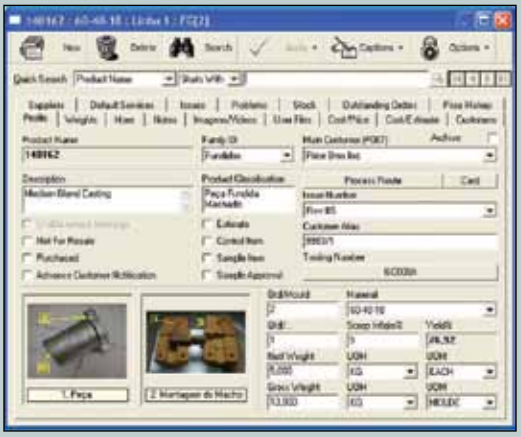
Looks at the Labor. Your model must consider both direct and indirect labor costs. The costs associated with the front office and support staff often are missed. The labor rate also needs to account for benefits, as they can be a large percentage of the total direct and indirect labor rate.

Is Above and Below. Remember that your above the line costs are the revenue and expense items, and your below the costs are overhead, sales, general and administrative expenses, and finally profit margin. Above the line costs are variable, and below the line costs are typically fixed.

Considers Utilization. Plant capacity utilization refers to how the metalcasting facility is running. If the plant is running only three days a week with one eight-hour shift per day, this has a huge impact on how the fixed costs are spread over the casting cost and price. A casting that is produced in a facility that is only running at 50% of capacity has a higher cost when compared with a casting that is produced in a facility that is running at 100% of capacity.

Monitors P&L. Your model must have a system or report in place to constantly monitor and benchmark with regards to your profit and loss. A costing and estimating model is not a "set it and forget it" type of tool. The costing and estimating model must be revisited on a regular basis to ensure its validity and reliability.

Is Computerized. Computer software systems are outstanding at assembling discrete data, crunching numbers and spitting out results. If you are still performing your estimating and costing manually, consider a modern ERP/MRP system that incorporates a world class estimating and costing model. ***MC***



Computer programs can help track your data.

cost involved is indirect. The reason it's important to separate the two accurately is for value/profit comparison.

To determine the cost of operating your equipment, consult your accounting department. If the information is not available, go and find it yourself. Find out how much it costs to run the equipment, how much capital is being expended, and how long the product actually takes during its cycle. With costing, you will already have timing information, and with estimating, you need to develop accurate process simulations. Talk to the people on the shop floor where the expertise actually lies, or use the industry standard time and cost indicators.

Any costs not directly related to production should be included in your indirect costs. Some classify these costs as overheads, miscellaneous rates or running costs. A little organization goes a long way. If you are to add these types of costs in, you will need to proportion them to the product correctly. Many metalcasters add up all the overheads and proportion them to the product costs based on finished weight. However, with a little more effort you can divide indirect costs into categories. For example, indirect power consumption should be attributed to the proportional amount of time from start to finish of manufacture (and possibly storage). Indirect material handling and transport costs could be proportioned to weight, and indirect departmental costs could be applied proportionally to product complexity. The more effort you put into being creative with your indirect costs, the more accurate your final costing and estimate will be.

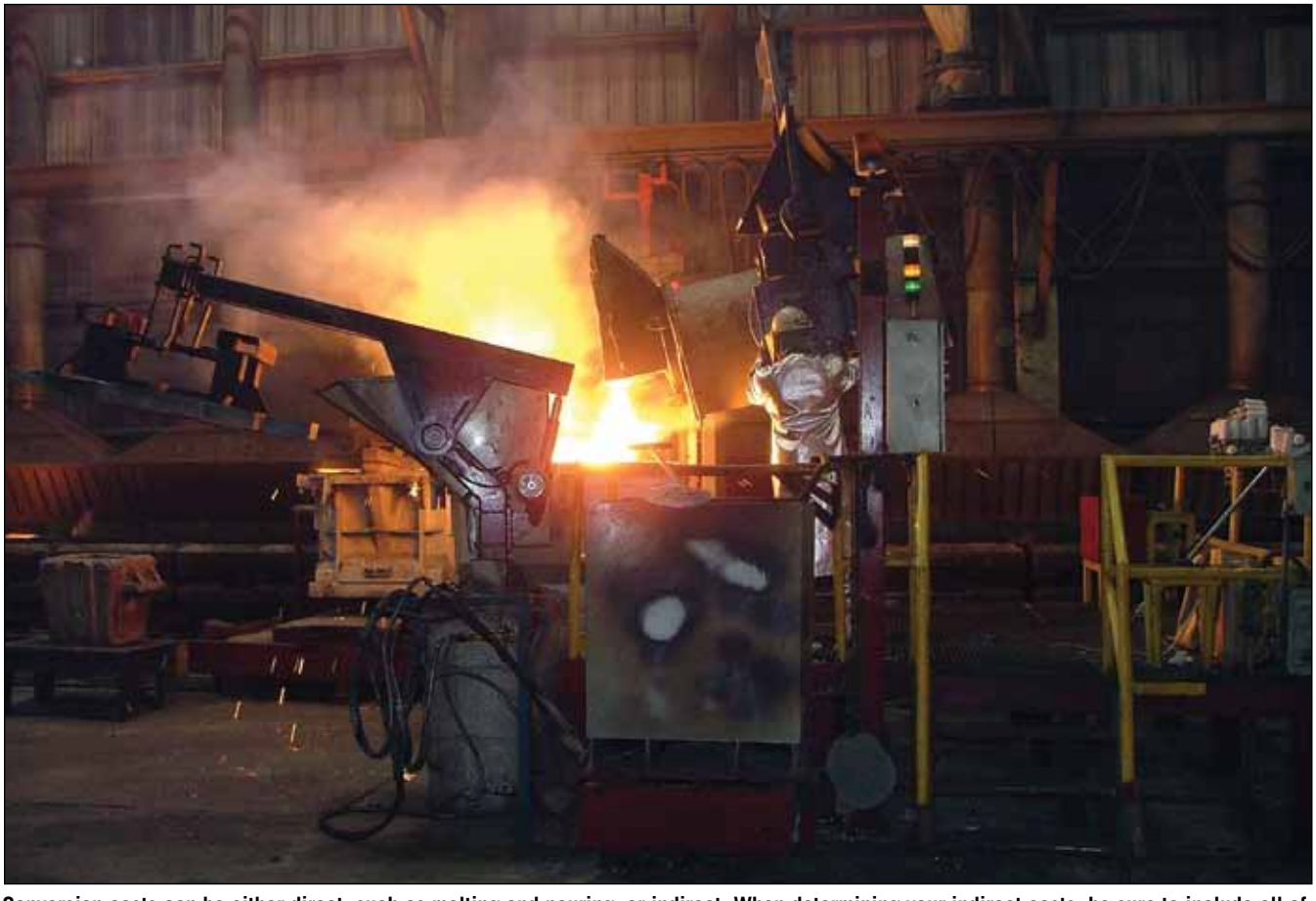
Optimizing the Models

To optimize your existing estimating/costing models, define what your goals are and what you expect to achieve from the process. You should "begin with the end in mind," and then work towards your goal. Hopefully, one of your top goals is to ensure that your facility makes a nor-

One Plant at a Time

At the end of the day, no single metalcasting facility in the world performs costing and estimating using the same methodology. The level of attention to detail required, the ultimate motive, the driving factors and the calculations are entirely different from one facility to the next. Therefore, a one-size-fits-all approach to costing and estimating modeling will not work.

If you are considering a computerized enterprise resource planning/material requirement planning system for your facility, make sure that the estimating and costing portion of the system is flexible, intuitive, user friendly and specific to the metalcasting industry. Estimating and costing do not happen overnight. It is best to keep it simple and grow into it. Paramount amongst considerations, regardless of the model or the software system, is that the data is valid and reliable. ***MC***



Conversion costs can be either direct, such as melting and pouring, or indirect. When determining your indirect costs, be sure to include all of your overheads, such as material handling and transport costs and administrative and departmental costs.

Costing and estimating should be hands-on processes. To obtain valid and reliable data about your metalcasting facility, head to the shop floor.

mal profit (where marginal revenue equals marginal cost) and maintains its long term viability.

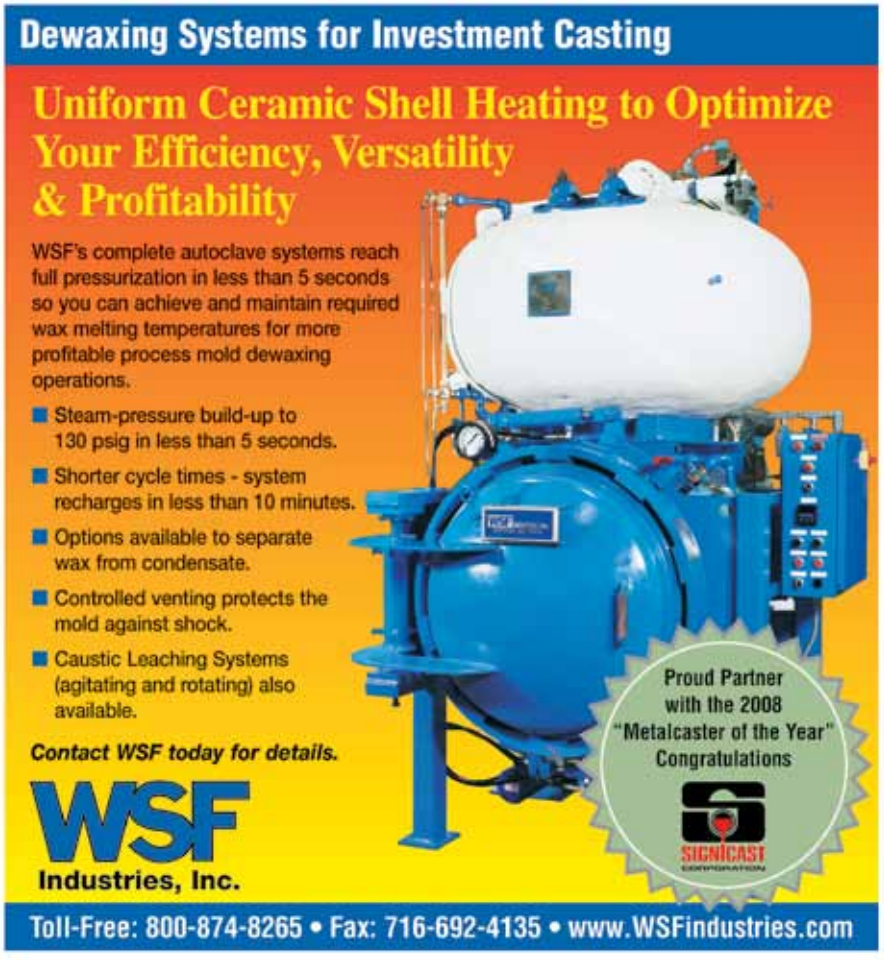
You also should start with a good understanding of the difference between estimating and costing models. An estimating model is a "best fit" analysis of what a new part will cost and what it can be sold for. This is more than an educated guess. It should be a statistically significant approximation based on sound data. A costing model is a reflection of what it actually costs to produce an existing part. Thus, costing can be easily used to project the profit and loss of a facility based on volumes. A good estimating model should be approximately equal to the results obtained from a costing model.

Many metalcasters are still using the rule of thumb that cost-per-pound is a reliable measure for estimating and costing. According to this model, if a casting weighs X pounds and is known to cost Y dollars to produce, then the cost per pound equals Y/X. For a casting that weighs 5 lbs. and costs $15 to produce, the cost per pound would be $3.

The fallacy of this method of costing and estimating is that it assumes that "a casting is a casting is a casting." Unless a metalcasting facility is producing only one type of casting, the cost per pound model is flawed. The approach neglects the specific routing, sibling parts, assemblies, materials and everything else that goes into making a casting.

Developing any estimating or costing model requires data that is both valid and reliable. Validity refers to the numbers/data being "correct," and reliability implies that the measurement used at arriving at the numbers/data can be consistently repeated over and over again. According to these definitions, a cost per unit of measure of weight is neither reliable nor valid.

Another common metric that is often used in the metalcasting industry is man hours per unit of measure, or MHPum, where the unit of measure would be the weight of castings produced. However, any generic metric used within an estimating or costing model can result in deficiencies, as its reliability will be questionable. ***MC***



About the Authors

Chris Collins *is CEO of R&D Concepts Ltd., creators of the ERP/MRP system Synchro32. With more than 20 years of experience in the design and creation of production control systems for the cast metal industry, Collins has personally written three complete ERP/MRP suites including Synchro32.* ***Shane Allen*** *is employed at Synchro32's North American Operations. He has 14 years of experience in the metalcasting industry.*

For More Information

"A Fresh Approach to Foundry Costing," *T. Law and S. Adlington, 2006 AFS Transactions.*