Crossing the grand canyon

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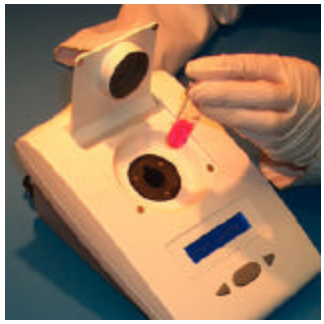

Debbie Giggle investigates how ease of manufacture can be designed into a new product

Common sense tells us that it is better to tackle design and manufacturing issues concurrently when developing a new product. In reality, however, it can often feel to a management team that the gap between the design and the manufacturing departments is as wide as the Grand Canyon. Some potential new products plunge into the chasm between the two – never to be seen again!

The design for manufacture approach was created to bridge this gap. The concept is blissfully simple. The development team incorporates personnel from disciplines such as production or purchasing, in addition to designers. Manufacturing and procurement issues are addressed throughout the design phase of the new product, to reduce time to market, and to keep the final cost of the product as competitive as possible. This avoids the delays and budget overruns that frequently arise from unforeseen problems encountered at late stages in the process. While the concept is simple, making design for manufacture a reality is quite a different matter. However, for UK manufacturers forced to tackle aggressive competition from low cost economies, this approach to design can mean the difference between success and failure.

Mike Cowan, managing director of Copley Motion Systems said: “Our company has a history of innovation, but you can’t have design for design’s sake. There is a threshold for what customers will pay for the features you can make available. That has to be the driver.”

In December 2004, Copley Motion Systems reached the end of a nine-month project to develop a new actuator for industrial applications. The resulting product has enabled the company to target a new customer base – not with a ‘me-too’ unit – but with a solution that is completely new to the market and outperforms alternative actuators for a comparable price. The company believes this could not have been achieved using traditional design approaches.

“We identified a need in the market for a high-speed, flexible actuator,” explained Cowan. “Customers currently had the choice of either a high speed pneumatic actuator, which has comparatively long set-up times, or a more flexible actuator using ball screw technology, which is eight times slower than the pneumatic one. Neither technology is ideal, especially as

many industries want fast processing times, but have to work with smaller batch sizes and more frequent changeovers.

“We already owned the patent for a tubular design of linear actuator. This alternative technology had the potential to replicate the speed of a pneumatic system, at the same time as offering the reliability and flexibility of the ball screw option. Our major problem was cost. If we had designed a unit using current manufacturing methods and product technology it would have come in at around £5000. We knew that the finished product would have to compete at the £600 mark in order to succeed.”

The initial feasibility study quickly identified the huge gap between the features the customer wanted and the price the customer was likely to pay. Instead of walking away from what seemed an impossible task, Copley Motion Systems decided to proceed, using a design for manufacture approach where methods of manufacturing the new product would be developed at the same time as designing the product itself. Personnel from all levels of production were brought into the development meetings.

In the view of experts, selecting the right team is crucial to successful design for manufacture and it isn’t just about making the team multi-disciplinary.

Surrey-based Chelsea Technologies provides a one-stop-shop for design and manufacture of scientific instrumentation. It designs for manufacture from the outset, as time to market is a key requirement of its clients.

“Often our clients bring us into their projects at a very late stage,” explained life science director Dr John Attridge. “Their projects may depend on receiving grants or other financial backing so, when the client gets a green light to go ahead, there is a real sense of urgency at the point where we are approached to provide instrumentation.

“We’ve found that a design for manufacture team needs a balance of personalities as well as skills. Many people in our field are by nature ‘blue sky thinkers’. These sorts of personalities are often more excited by the challenge of proving that something is possible. After that point they may lose interest. So we also include people in the team who are excited by the practical challenges of manufacture.”

For its linear actuator project Copley Motion Systems extended its development team still further to include key component suppliers.

“To lower the cost of the new actuator we needed to simplify its features and reduce the number of components,” said Cowan. “One option was to make components multi-functional. We wanted to see if the insulation between the coils and magnets could also double as the

bearing system. This involved a fair bit of value engineering which isn't always welcomed by suppliers. Eventually though we found a polymer bearing company in Germany who said 'we've made our name out of doing what can't be done, we'll give it a try'. They were successful and the bearing system now features in the finished product."

Both Copley Motion Systems and Chelsea Technologies agree that rigorous attention to detail during the early design stage is crucial to the success of a design for manufacture project.

Dr Attridge said: "It's about really understanding what the customer wants and de-risking the project. Every aspect of the new product is explored at this point – not just what it will look like and the specification, but the optimum method of manufacture accompanied by detailed costings. If you complete this phase of de-risking properly, putting the product into manufacture is just a matter of 'turning the handle'. You also generate much more detailed documentation at an earlier stage, which ultimately benefits the client."

There are differences of opinion regarding how open to leave one's options. Chelsea Technologies settles quite quickly on one design route, using past experience to weed out less successful approaches. Copley, however, preferred to proceed with several design possibilities so as not to limit the opportunities later on.

Cowan explained: "Often you get further along the line and find that there's a 'gotcha' – a problem you couldn't have anticipated earlier. If you set off with two or three possible routes and one is shown to have a major obstacle, you can just switch track rather than going back to the drawing board."

But what about the common pitfalls experienced in all design projects?

The most common problem is that a designer will be seduced by the elegance of the technology and forget the commercial aspects. It's also possible to misunderstand your market. Individuals can also get emotionally committed to an aspect of the project and continue along that path, even when it's the wrong one.

Cowan advised: "The design for manufacture approach avoids a lot of the problems faced by a designer working in isolation. Right from the beginning our team was focused on functionality versus cost. Each time a feature was suggested for the design we examined the cost of that feature versus its desirability to the customer. If it didn't justify the cost – out it went.

"We also documented the pros and cons of each design possibility at the outset, so the team was making objective rather than subjective decisions from the start. Individual reputations weren't at stake."

Copley also warned against the danger of making false economies by specifying cheaper components that might later add to manufacturing cost. For example, his team decided to specify trim pots that require electronic rather than manual adjustment. While this added to the component cost, the shopfloor programming time was reduced from five to 10 minutes per unit to just 45 seconds, facilitating faster manufacturing times with improved quality of finished product.

A larger development team, involving personnel from outside the design function might be expected to add time and complication to a project, but Copley's timescale appears to disprove this theory.

Cowan said: "Throughout the project we joked the product had to be on the shelves for Christmas. I'm pleased to say we brought the new product to the market, within the timescale we set ourselves and at the target price. In total the project took nine months: three months to alpha testing stage, three months for beta testing, and three months to move to beta production. Most importantly the newly-launched actuator offers customers performance that simply wasn't available before. It has enabled us to enter a new market and put us ahead of our competitors."

A final word came from Copley's European sales manager, Steve Hickman. "I joined the company three months ago," he said. "The way Copley approaches design is very different to companies I have worked with before. Design teams can be over-protective when it comes to sales and marketing people. I think they worry that, if they involve the sales team, they will start promising delivery of the product too soon. The process at Copley has been far better. We have been able to provide customer feedback on things like mechanical compatibility, importance of various features, resolution and accuracy. You'd be surprised at how many companies shut the door on important input like that from their own personnel."

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