IS YOUR DESIGN A LIFE SENTENCE?

A. SANDY MUNRO
President
Munro & Associates Inc.

Creating functional designs is not enough.

A Sandy Munro, a pioneer in Design for Assembly with nearly 30 years experience in designing, building, and processing parts, is president of Troy, Mich.-based Munro & Associates Inc., which offers consulting on the implementation of DFA/DFM and concurrent engineering best practices.

Product engineers, one can argue, are the most important employees at any manufacturing company. That's because they are the only people within the company who actually create value. In a strict sense, everyone else — finance, marketing, manufacturing, purchasing, and management — can be viewed as overhead.

Product engineers contribute more than any other function to a company's bottom line. After all, 70% of a product's total cost is determined by its design, and that cost includes material, facilities, tooling, labor, and other support costs. Their work can catapult a company to the heights of profitability, or drop it in the abyss of failure. In more personal terms, they can make everyone else's job a satisfying experience or a living hell.

Consider the case of Juan, an assembly worker I once met. He worked for a company which made harvesting equipment. His job was fairly straight forward: align a couple of components in a counterweight assembly and install a bolt. On the CAD screen and from the designer's point of view, Juan's job appeared simple. In reality, the design made his job an ergonomic nightmare.

To perform his duties, Juan needed to use two crowbars — one wedged against his neck and the other in his right hand — to move a bearing over to a stop point. Then, while maintaining pressure on both bars, he had to locate a hole he couldn't see underneath the assembly, reach up through the hole and, with one hand, install a bolt way up inside the bearing.

This fellow faced this problem all day long. He had been given a life sentence of nearly impossible work all because the product engineer never ventured onto the shop floor to see how his design would actually come together.

If the designer had been required to actually assemble his design, it would have quickly become obvious the task was virtually impossible for anyone who didn't exactly fit Juan's physical profile: 5 feet tall, powerful, with a strong neck, stubby fingers, and left handed. If Juan was sick or on vacation, production ceased. Imagine the classified ad the personnel department would have to run to find a replacement for Juan.

The real shame of the situation, though, was not that the assembly process was so difficult. It was that no one, other than Juan, thought there was a problem. Only Juan had what is called profound knowledge. The chief engineer, who designed the problem component, didn't; he was actually proud of his design and felt it was the heart of the machine. Only after being forced to spend time on the factory floor watching his design going together did the engineer start to realize the impact and responsibility he had as a designer.

The lessons are clear: The days of over-the-wall engineering are dead and product engineers need to obtain profound knowledge. Because design dictates so much of what happens to the company, designers need to know more about how the product is manufactured, shipped, sold, used, serviced, and recycled. Early on, they need to seek out input from these downstream activities to create profitable, world-class designs. The functional design is not enough.

To avoid dooming assembly line workers to a life sentence of misery, the company to financial failure, or yourself to moral bankruptcy, I urge you to spend one *whole* day on the shop floor assembling your designs. Once you've lived with your design for an entire day, ask yourself the following questions. Then you will truly understand the implications of Design for Assembly.

- How would I like to do this all day?
- How can I improve the ergonomics for the assembler?
- How can this be designed so assembly occurs in a layered fashion from above to take advantage of gravity?
- How can I make assembly error-proof by using parts that are easy to align and insert?
- How can I avoid expensive and unreliable fastening operations, as well as parts that tangle and nest?
- How can I minimize the number of parts and reduce complexity?

But don't let your insight-gathering expedition end on the factory floor. Take time to venture out to see other downstream activities your design impacts. See how customers use your product, how field technicians service it, and if possible, how it is disposed of or recycled. ∎