

# Let's roast engineering's SACRED COWS

Companies intent on improving their manufacturing and design processes should take a hard look at changing some of their most closely held beliefs.

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If a company changes its rules, it can change its culture and benefit tremendously. And when it comes to design and manufacturing, the only ones who can change those rules are the people most involved and responsible for it — the engineers.

Unfortunately, getting ordinary people — let alone engineers — to change is extremely difficult. Old rules die hard, and most people will want to continue using those timeworn rules, the ones they were taught when times were much different. Even after the old rules have been proven wrong, there will still be people crawling back to them, like pagans rubbing a clay idol or a sacred cow in a cave, hoping the bad things will go away.

In manufacturing, the sacred cows are the untouchable designs, specifications, processes, and facilities that companies cherish most. Whether self-inflicted or imposed by someone else, they have been part of the company for so long that often no one knows their true origins. And because they are sometimes perceived as the heart and soul of a product or system, they are

never challenged.

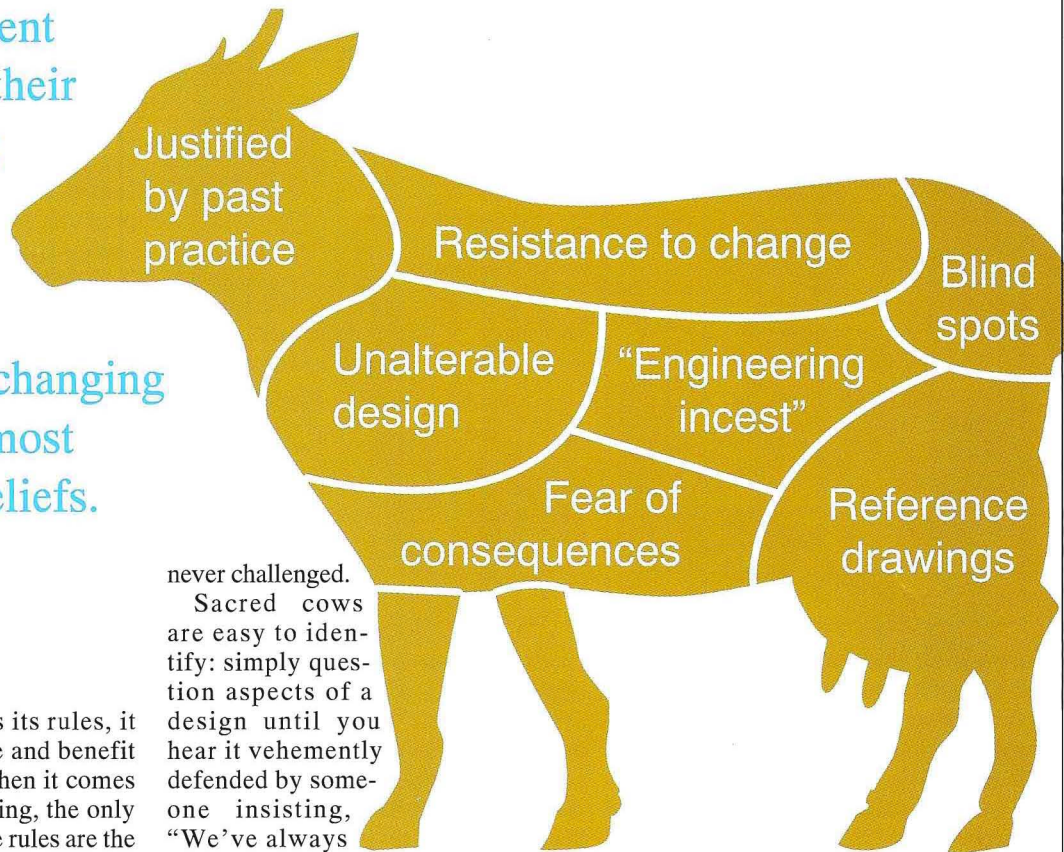
Sacred cows are easy to identify: simply question aspects of a design until you hear it vehemently defended by someone insisting, "We've always done it this way!" "This is the essence of our product!" or "We can't change this, the boss came up with it." And my personal favorite: "We already have too many problems with this. We can't change!"

If they say it can't be done, you've found a sacred cow. And sacred cows, although they are the hardest to change, yield the most profit when they are toppled.

## Sacred cows run rampant

Sacred cows are hardly unique to any single industry. They're in the automotive field, defense applications, aviation work and the appliance industry, to name just a few.

**Automotive:** For years, engine designers harbored a prime example of a sacred cow. They believed that aluminum was for pots and pans, plastic was for kids' toys, and only *iron* was for engines. That certainly isn't the case now,



but in 1984 while working for a major automaker, I was part of a team making an intake manifold out of lost-core plastic. The idea was a little ahead of its time, but the design saved weight, reduced assembly and cut complexity. Quite proud of our concept, we showed it to several manufacturing people. They agreed it was great, in part, because it eliminated an entire machining line costing millions, and reduced assembly costs by 50 percent.

When we showed it to the product design engineers, however, it was rejected. They absolutely hated it and refused to even discuss it. To top it off, my boss said that if I didn't stop pursuing this ridiculous idea, my performance evaluation would suffer.

After leaving that company and starting my own, I made the same suggestion to other engine divisions. Although skeptical at first, they put it to



use and improved engine performance and the manufacturing process.

**Military:** Defense contractors have a penchant for threaded inserts, one of the most common self-inflicted sacred cows. They are used only because they have always been used; there's no real reason for using them. (Try to find one

monolithic structure instead of the riveted plate construction currently used. It is a paradigm shift the aircraft industry doesn't want to make. As a result, they're missing golden opportunities for elegant new cost-efficient designs.

**Appliance industry:** In this industry, too, the old ways run rampant —

“The best design is the simplest one that works.”

The sacred cows are everywhere. Just look in the engineers' cave.

### Crutches for cows

There are several types of crutches that engineers rely on to help prop up their sacred cows. One of the most common is called *engineering incest*. Here, people only deal with their own kind. Auto engineers, for example, only deal with, talk to, work with, and hire other auto engineers. The result can be a stagnant industry characterized by a pool of lackluster, look-alike products.

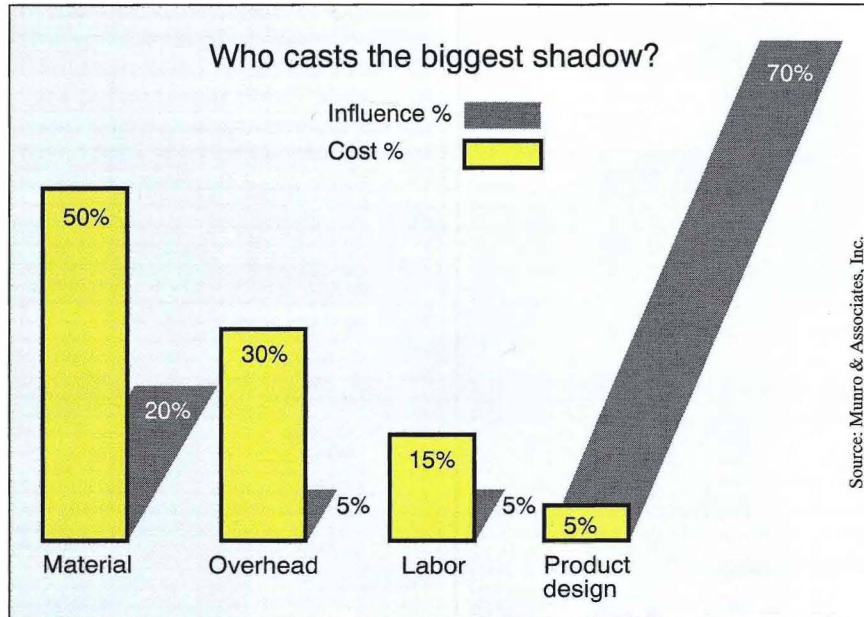
If you're one of those engineers who looks to other fields for new ideas, however, you're usually met with a lot of resistance. If you're an appliance engineer trying to bring a technology to the aircraft industry, you hear, “Hey, this isn't a washing machine. If a washer stops, it's no big deal. You just go to the laundromat. But if an airplane stops, you're dead.”

To combat engineering incest and ultimately grow, it is crucial to venture beyond the walls of the company culture and explore new territories, new companies, new industries — in short, to benchmark.

It's amazing where new profitable approaches will come from, if you're open to them. For example, decades ago, automotive giant Henry Ford revolutionized the world with the assembly-line concept. But he didn't get that idea within the auto industry. He got it by touring a Chicago slaughter house. Even when he was one of the world's richest and most powerful men, he was always looking outside his industry for new ideas.

Going outside the company for information and benchmarking against other companies can be extremely unpopular, especially with engineers and middle managers. It disrupts the status quo and threatens change. Although most people are afraid of change, it can work wonders.

An instance of cross-industry benchmarking that met resistance — but paid off — occurred when we were involved with an aircraft manufacturer that wanted to apply Design for Manufacturability (DFM) rules to a complex bulkhead. The assembly required over 10,000 parts and operations. Following the DFA philosophy of minimizing the



in your car.) On one project, when we challenged people close to the project on why they used threaded inserts, their response was, “Well, we have to have them. They lock things in position.” When we proved that wasn't true, we heard, “Well, then it's because they will strip.” When we disproved that as well, they became silent. These people really didn't have any reason for using threaded inserts other than just because they always used them in the past.

Relying solely on the past to justify a practice rather than an understanding why that practice was first used, will always yield a dangerous sacred cow. Its dangerous for two reasons. First, no one understands the technology and therefore the design may not be as bullet-proof as everyone assumes. And second, profits suffer due to cost without value.

**Aviation:** For some unknown reason, rivets are still widely used on aircraft. But what industry uses rivets to that extent anymore? Look at old bridges versus new ones; or look at buildings. Even shipbuilding doesn't rely on rivets like that anymore, but they're still on airplanes. It's a struggle to get this industry to even consider a

especially when it comes to the number of parts used in a product and how they are assembled. When one appliance manufacturer we were working with insisted we couldn't change the design of its stove burner saying, “Can't touch that . . . the regulations, the U.L. testing . . . No, this stays as is,” we knew we had uncovered a sacred cow. By challenging this design and applying Design for Assembly (DFA) principles, we developed a new sealed burner that provided easier assembly, greater integrity, better ignition, and more profit.

**Medical industry:** The medical field is crowded with sacred cows, and fear is used to defend them. When anyone suggests a change, the product engineers say, “People could die if we change anything.” However, most medical equipment isn't designed for profitable manufacture. Instead, medical companies operate under the rules: if it functions, it's tested. And if it passes, it's produced. Profitability never seems to be an issue until the company is up for sale. This means there's great potential for improvement in the medical industry. There's also room for eliminating unnecessary parts, lots of them. As Einstein said,



number of parts, the team proposed a monolithic structure cut from a single block of aluminum. "Impossible," said the aircraft designer, claiming high residual stress would cause cracking.

Experience and exposure to other industries has shown us otherwise. We knew machining the structure with a high-speed spindle would remove metal fast enough to prevent residual stress. With some reservation, the proposed concept was applied by the designers. The result was a stronger and lighter bulkhead with no residual stresses. Plus, by eliminating 9,999 parts and operations, the company saved a bundle in manufacturing costs.

*Reference drawings* are another type of crutch used to support sacred cows. By opting for reference drawings over new ideas, mistakes repeatedly end up on the factory floor and in products. This reliance on drawings helps maintain a company's sacred cows or ultimately becomes one itself.

I once worked as chief engineer at a Detroit-area tool and die shop which had a real problem — the engineering department had absolutely no credibility. The build shop was great and employed 500 of the best toolmakers you'd ever want to meet. They could build anything and a host of major companies sent them work, including NASA, aircraft manufacturers, the automotive industry, plastic injection-molding firms, and even competitors. But the design shop received no work in spite of the fact that it had a lot of old-timers who really knew their stuff.

The problem finally dawned on me when I noticed the designers always depended on "old reference drawings." They kept them in a back room and stuffed them in the bottom drawers of their desks. However, every time they copied something, they copied it wrong. And every time a job went out to the factory floor, it got machined wrong. But the designers never went back and corrected the drawings, so each new job perpetuated a mistake.

One night, the blueprint boy and I gathered up all the reference drawings, all of them, including the ones tucked in the bottom drawers. We took them out and destroyed them.

When the designers came in the next

morning, we had coffee and doughnuts for everyone. It was like a little party. As they were drinking and eating, everyone was asking "What's this all about?"

When I was sure everyone was in attendance, I picked up a shoe box full of ashes and told them: "These are all the company's reference drawings. It's also the root of what's wrong with our shop."

One guy dropped to his knees. Another spilled coffee all over his shoes. Others ran back to their drawing boards to see if we had really gotten everything. We did. There was nothing left. All of them were scared because these were the crutches they had been relying on for years. We didn't have many management changes, and we didn't have any changes as far as the designers were concerned. We just tossed out the crutches.

The difference was almost miraculous. Getting rid of those drawings made them stand up on their own two feet. In six months, we went from the worst design shop in the city to one of the best.

Re-evaluate your reference drawings. How reliable are they? How much of a crutch are they? Do they contribute to problem parts and components that make you less profitable than you could be? Ask these questions everywhere. Reference drawings are creativity's worst enemy.

*Blind spots* are another common phenomenon that help perpetuate sacred cows. In physiology, they are places in the field of vision where the brain overrules the eyes. But there must be plenty of them within the engineering community since the inability to see things clearly is certainly evident among designers.

Futurist Joel Barker calls this the "paradigm effect" and, like him, I have seen engineers with beliefs so strong that their brains actually fail to register what their eyes are seeing. Then, when those engineers' preconceived notions are challenged by new evidence, they just can't see it. The results are parts and products that never change. It becomes a sacred cow and an obstacle to

profits.

Other sacred cows exist, and the best way to identify them is to bring in outsiders. Such corporate fixtures are usually invisible to insiders, but outsiders, such as those in an unrelated field, recent graduates, and consultants, can offer new insights. They can examine the situation from a totally different perspective and with a new set of eyes.

The good news is that once these sacred cows are identified, they offer the greatest opportunities for improvement. Forget everything else, this is where the real profits are: turning sacred cows into cash cows.

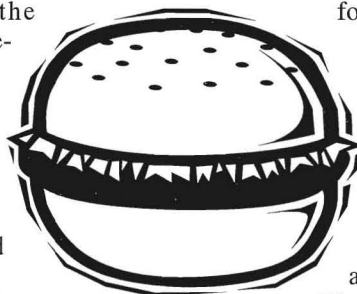
### **Barbecuing sacred cows**

Once a sacred cow has been found, the real work begins. Strategies to rid the company of that problem have to be developed, usually using teamwork. These strategies and new ideas don't have to involve fast and furious change.

They should be broken down into three categories: low-level risk, medium risk, and stretch. Then implemented accordingly.

- ◆ **Low-level risk** ideas can be put into effect almost immediately. The technologies are not new to the product market, and all team members are comfortable that the ideas can be incorporated with minimal testing and validation.
- ◆ **Medium risk** takes a little bit more research before adoption. Ideas may be technologies utilized by other industries or a combination of materials and processes unfamiliar to the team. This level can produce patentable concepts and is the most likely level to be implemented.
- ◆ **Stretch** represents a level where ideas require experimentation, research, testing, and validation. They are the ideas on the edge of new paradigms and, in some cases, propel their company to the forefront of their industry. Almost always patentable, these ideas can truly leap-frog a company ahead of the competition.

At our consulting company, we have three rules for business that also apply:





# TURNING SACRED COWS INTO CASH COWS

Innovate. Innovate. Innovate. Product engineers should dare to deviate, move away from the norm. "We always did it that way before," is the last whisper in an empty factory.

## Resistance to change

Getting rid of sacred cows involves change, and a variety of obstacles, especially fear, make people apprehensive of those changes. While President Roosevelt said, "The only thing we have to fear is fear itself," the fear of consequences is also very much present when changes are taking place. People fear failure, the unknown, ridicule by peers and the boss, and they fear losing a promotion or their job.

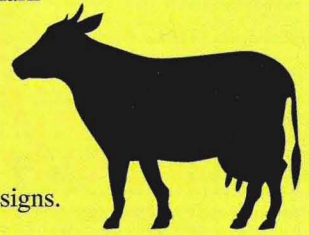
Joel Barker says of industry, "If the rules change, everything goes back to zero." People can go back to zero, as well. Imagine a guy who has been doing the same thing for 15 years, sheet-metal bending, for example. If he is asked to do plastic injection-molding, his whole knowledge base goes back to zero. That's an unbelievable challenge for him. That's why there's a reluctance to move into new areas on the part of individuals and organizations.

As Deming stresses in one of his 14 points of management, it is important to drive out fear from the organization so that everyone may work effectively for the company. Once this is done, obstacles will be removed and progress can be made. An incident at General Motors back in 1988 really brought this message home to me.

Only 30 days before GM was ready to pull the plug on the Camaro/Firebird program, we were invited in to help turn that program around. Though everyone new their jobs were at stake, there were still those who didn't want to change, especially engineers. The changes we suggested were very different from what GM engineers were familiar with.

First, we asked engineers to stop using piece costs and start using total accounted cost. The difference meant engineers were no longer viewing the cost of a single fastener as five cents. Instead, they looked at the total accounted cost through the production cycle, which, for a fastener, amounted to about one dollar. This made non value-added components highly unattractive to the product cost and moti-

- Challenge the most protected, oldest or most basic designs.
- Bring in "outsiders" to offer clever perspectives.
- Avoid "engineering incest" through benchmarking. And look outside your company and industry for new ideas.
- Toss out reference drawings.
- Don't be afraid to stretch. Dare to deviate.
- Keep management involved from early on.
- Make product designers spend a day on the assembly line putting together their own designs.



vated them to switch to self-securing parts.

Second, we showed GM engineers how the parts they designed were really a life sentence for assembly line workers. To get this idea across, the engineers spent a day on the assembly line putting their parts on the car. Only then did they realize what impact they truly had. They could see how their designs could be an ergonomic nightmare and why it was important to design for assembly, as well as manufacturability, serviceability, and recyclability.

Third, we challenged their beliefs about the true causes of poor quality. The engineers didn't realize how much impact fasteners, springs, and belts had on a product design's total quality. The common excuse was, "We've always done it this way." The new way of thinking was that root causes of poor quality are always candidates for elimination.

Despite credible statistics regarding the high failure rate of threaded fasteners, one of the engineers just couldn't accept the negatives behind them. He had a blind spot, until he was affected personally.

After a heated argument at one day's session and no sight of him at the beginning of the next days' session, we were sure he had decided to forget all this nonsense. But this very frustrated man had a legitimate excuse for his absence — his car had caught fire.

Two weeks later, this vocal "doubting Thomas" had a major shift in his attitude. He learned the fire resulted from a screw working loose from the exhaust-manifold heat shield. This caused the heat shield to fall, which exposed

the spark plug wires to the exhaust manifold. The wiring, which shorted out, caught fire, as did the carburetor. All this from a loose screw. From that day forward, he was a convert.

The Camaro and Firebird, developed at a lower cost through DFA and DFM principles, went from financial losers and near cancellation to be vehicles with elegant designs and good looks that function well and can be built with quality and at a profit.

Most companies ignore the dramatic changes they need until they experience the luxury of adversity. As the old Russian proverb says, "The sight of the gallows clarifies the mind." But if you can start the process of change before your company is in trouble, you gain a huge competitive advantage.

An ancient general, Sun Tzu, said, "The battle is won in the strategy room, not the battlefield." I say, "The manufacturing company that engineers elegant products with innovation and bewitching quality is the one that will sweep all others behind them." And the only way to do that is to eliminate the old — the old rules, the crutches, the sacred cows — and make way for the new. Something has to die before something else can live. ■



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