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DESIGN

PSSST! WANT A SECRET FOR MAKING SUPERPRODUCTS?

It's all in 'design for assembly,' the brainchild of two Brits

"It was the biggest secret we had at Ford," confides A. Sandy Munro, a former Ford Motor Co. engineer. "Absolutely nobody talked about it outside the company." Indeed, in one year alone it trimmed manufacturing costs by more than $1.2 billion and helped Ford edge out General Motors Corp. as Detroit's most profitable auto maker.

"It" is a new approach to product development dubbed design for manufacturability and assembly, or DFMA. Now, GM is racing to make up for lost time. And dozens of other manufacturers, small as well as large, are discovering that DFMA can be a potent weapon in developing better products—better in that they not only cost less to produce but also can exhibit higher quality and reliability.

EASY TO BUILD. The movement harks back to the days when automated assembly was transforming the factory. Yet designers kept on fashioning products with disdain for how their handiwork would be produced. Meanwhile, the Japanese were grabbing market share with products that, to American eyes, were simple ripoffs. In reality, their simplicity betrayed elegant reengineering that rendered them easy to manufacture. As a result, Japanese companies could get products to market sooner, make improvements faster, and offer higher quality at lower prices.

That's when the first glimmerings of design for assembly (DFA) dawned on Geoffrey Boothroyd. A PhD manufacturing engineer who was teaching at Britain's University of Salford, Boothroyd set out to develop a set of guidelines that would point designers, from the start, toward designs that would be easy to build. He envisioned a simple checklist that would stress the economic implications of design decisions. This is crucial because, while design is a minor factor in the total cost of a product, the design process fixes between 70% and 95% of all costs.

When British industry turned a deaf ear to Boothroyd's scheme, he moved to the U.S. and soon found a more receptive audience. The National Science Foundation got things rolling in 1977 with a $400,000 research grant, plus more than double that sum during the 1980s. Companies began supporting Boothroyd's research in 1978, led by AMP Inc. Then came Digital Equipment, General Electric, Westinghouse, and Xerox. IBM joined them in 1983. Ford signed on in 1984 and quickly became the biggest supporter, throwing $660,000 into research that has since moved beyond just assembly to include process manufacturing. Ford also embraced the concept with the most fervor and has trained roughly 10,000 people in DFMA.

After Peter Dewhurst joined Boothroyd in 1981 at the University of Massachusetts, the two professors formed Boothroyd Dewhurst Inc. (BDI) to commercialize the concept. Dewhurst, also a PhD immigrant from Britain, is BDI's mathematician and computer whiz. He is chiefly responsible for what is now a small library of DFMA software that runs on IBM-type personal computers.

TURNED THE TABLES. Using DFMA is ridiculously inexpensive. Some programs analyze the design of molded-plastic or machined-metal parts. Others deal with manually assembled products or robot-made assemblies. And prices for the programs start at only $1,500. "Nobody ever accused of us of being businessmen," quips Boothroyd.

Users have earned paybacks that are nothing short of spectacular. Probably the best-known example is the Pro-printer line of computer printers launched by IBM in 1985. Before then, IBM got its personal printers from Japan's Seiko Epson Corp. By applying DFA analysis, IBM turned the tables on Japan, slashing assembly time from Epson's 30 minutes to only 3 minutes. Today, IBM is holding its own against offshore rivals, cranking out nearly 500,000 printers a year at its automated factory in Lexington, Ky.

With BDI's "toolkit," New York Air Brake Co. cut the parts count and cost by 30% and 50%, respectively, on a new valve. Texas Instruments Inc. did even better with an infrared sighting mechanism that it supplies to the Pentagon (table). Most recently, NCR Corp. stole the DFA spotlight with a new electronic

PHOTOGRAPH BY BRIAN SMITH

MAKING MORE WITH LESS

Results of using 'DFA' to analyze a gun-sight component

	BEFORE	AFTER	REDUCTION
ASSEMBLY TIME (MINUTES)	129	20	85%
NUMBER OF PARTS	47	12	75
NUMBER OF ASSEMBLY STEPS	56	13	78
METAL FABRICATION (MINUTES)	757	219	71

DATA: TEXAS INSTRUMENTS INC.

cash register. NCR's model 2760 point-of-sale terminal snaps together even faster than the Proprinter. In fact, assembly is so easy that NCR's William R. Sprague, a senior manufacturing engineer and DFA booster, can do it in less than two minutes—blindfolded (BW—May 8).

With DFA's soaring acceptance, BDI will soon get a full-time professional manager. The startup was relocated to Wakefield, R. I., when Boothroyd and Dewhurst moved to the University of Rhode Island in 1985. Software sales exploded by 50% last year, to $414,000, and will more than double this year, thanks in no small measure to GM.

Until this year, GM relied on a rival DFA technique from General Electric Co. that blends some early work by Boothroyd and Dewhurst with a methodology developed in Japan by Hitachi Ltd. But smarting from the gains made by Ford partly at its expense, GM decided to fight fire with fire. In January, it retained Ford engineer-turned-consultant Munro, who founded MTS for Productivity Inc. in Windsor, Ont., to infuse GM with the Boothroyd Dewhurst approach.

WATCHFUL EYE. The Chevrolet-Pontiac-GM of Canada Group was the test bed, and the first applications included parts for Camaros and Firebirds expected in 1992 and later. Insiders say tersely that GM expects major gains—but won't elaborate. Then, in late August, GM signed a $275,000, two-year license with BDI, expanding the Boothroyd Dewhurst beachhead to other GM units, including the Saturn operation. GM's director of assembly systems, Barbara A. Sanders, says this is just the start of a shift away from the GE-Hitachi system.

Meanwhile, Ford isn't sitting still. While DFA contributed only slightly to the phenomenal success of the Taurus, Donald L. Smith, Ford's corporate DFMA coordinator, boasts that 1993 will bring the first Ford model on which DFMA will have been used "from bumper to bumper." By the time GM gets to where Ford is now, he adds, "we're not going to be at that level anymore."

What's next? One idea is to marry DFMA with artificial intelligence and computer-aided engineering to foster systems that will serve as real-time design advisers. Rather than wait passively to be fed designs for analysis, they'll keep a watchful eye on designs in progress and offer helpful hints on the best materials and processes for a given product.

For now, Boothroyd insists that DFMA can spring to the aid of almost any U. S. company under the gun from offshore rivals. "If you scrutinize the design of most Japanese products with DFMA tools," he says, "you'll see that they leave a lot to be desired."

By Otis Port in Wakefield, R. I., with Wendy Zellner in Detroit