SURVEY ROUNDTABLE: THE POWER OF DFMA TO REDUCE OPERATIONAL COSTS

LEADING MANUFACTURERS DISCUSS RESULTS—AND THEIR OWN EXPERIENCES—IN THIS ROUNDTABLE REPORT. RARELY HAVE COMPANIES BEEN ASKED TO DOCUMENT THE EXTENDED EFFECTS OF EARLY DESIGN DECISIONS ON DISCIPLINES AND DEPARTMENTS AT THE OTHER END OF THEIR ORGANIZATIONS. IN THE SURVEY TABLE, AND IN THE COMMENTS FROM PARTICIPANTS BELOW, YOU WILL LEARN WHAT THEY STRIVE TO ACCOMPLISH AND WHAT THEY HAVE MEASURED IN SAVINGS FROM FACTORY FLOOR SPACE TO END-OF-LIFE COSTS.

INTRODUCTION

Recent manufacturing advancements are mind-boggling—lasers for industrial fabrication, vision systems for dimensional metrology, micromanufacturing processes for complex devices in electronic and medical applications, to name just a few. Manufacturers everywhere are embracing technology to provide value and improve productivity. But the more things change, the more they also remain the same as the core issue of cost-to-manufacture drives globalization and new approaches, from Lean to virtual manufacturing simulation.

Twenty-five years ago, in response to an onslaught of competition from Japanese manufacturers, a major movement to reduce product development costs took hold with leading U.S. companies. IBM, Ford, Westinghouse, Digital Equipment and others embraced the DFMA® (Design for Manufacturing and Assembly) cost reduction tools introduced in 1983 by Drs. Geoffrey Boothroyd and Peter Dewhurst, founders of Boothroyd Dewhurst Inc., Wakefield, RI.

Today, Boothroyd Dewhurst's client list is a "Who's Who" of leading manufacturers that includes Boeing, GE, Motorola, TRW Automotive, Harley-Davidson, Trane, Flextronics, Hypertherm, and MDS Analytical Technologies. To gain a better understanding of how DFMA is being applied, measured and integrated within today's global manufacturing environment, Boothroyd Dewhurst recently asked these organizations, plus many others, to participate in a qualitative study sponsored by the company and conducted by Parker Group, Providence, RI.

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ABOUT THE SURVEY

The purpose of the questionnaire was to compare what DFMA users felt and observed from their application of the software and methods (Question 1) against what their organizations had actually measured (Question 2). In the past, users had offered insights into DFMA "downstream" savings beyond part-count reduction and assembly labor and operations, even total product costs. But this is the first time these issues are addressed in a systematic manner with defined categories from which DFMA users could search for data and reply.

Notes Boothroyd Dewhurst, Inc. President, John Gilligan, "The survey results show that companies who stayed focused on reducing part count and assembly time are still reaping huge savings. If we had ranked those survey costs ourselves, we would have matched the conclusions of the questionnaire. Not surprisingly, product throughput and quality inspection were ranked the most important factors by users in initially applying DFMA."

SURVEY RESULTS CHART

A customer survey sponsored by Boothroyd Dewhurst, Inc.
Total Participants: 19

1. Which of these categories do you believe contribute to product development costs that could be avoided by analyzing product designs with DFMA? (Select as many as appropriate)

	# of Responses	%
Testing and prototyping	10	52.6%
Engineering change notices	13	68.4%
Production throughput	17	89.5%
Factory floor space	13	68.4%
Quality inspection	15	78.9%
Inventory	13	68.4%
Shipping	8	42.1%
Supply chain management	13	68.4%
Warranty and service	10	52.6%
Order entry and part tracking	9	47.4%
Assembly documentation	13	68.4%
ERP, BOM, and MRP data maintenance and general administration	10	52.6%
CAD and PDM	7	36.8%
End-of-life considerations	4	21.1%
Other dependent events associated with the assembly function	2	10.5%

2. For which of these categories has your company measured savings in overhead costs related to DFA part-count reduction? (Select as many as appropriate)

	# of Responses	%
Testing and prototyping	6	31.6%
Engineering change notices	7	36.8%
Production throughput	13	68.4%
Factory floor space	9	47.4%
Quality inspection	6	31.6%
Inventory	7	36.8%
Shipping	6	31.6%
Supply chain management	8	42.1%
Warranty and service	3	15.8%
Order entry and part tracking	6	31.6%
Assembly documentation	7	36.8%
ERP, BOM, and MRP data maintenance and general administration	5	26.3%
CAD and PDM	4	21.1%
End of life considerations	1	5.3%
Other dependent events associated with the assembly function	1	5.3%
Don't know, our suppliers track these costs	0	0.0%

3. What method does your company use to track overhead costs related to product development?

	# of Responses	%
We don't track these costs	6	31.6%
Activity-based costing	6	31.6%
Other	6	31.6%
Total	18	94.7%

SURVEY PARTICIPANTS

Participating companies include TRW Automotive, Trane, Motorola, Dell Corp., GE, Harley-Davidson, Solectron (Flextronics), DaTuM 3D, Neoteric Product Development, KPMG, Hypertherm, Raytheon, MDS Analytical Technologies, Magna Intier Automotive Seating, and Boeing, among others.

While quantifiable survey highlights appear in the survey, qualitative responses are found in the roundtable that follows. Participants are:

Chris Foley
Process engineer
final assembly
Motorola

Jay Mortensen
Cost optimization professional
KPMG

Bradley Keup
Senior strategist – technology
Dell

Mike Shipulski
Director of engineering
Hypertherm, Inc.

Gordon Lewis
Project manager
DaTuM 3D Inc.

George Valaitis
Manager of mechanical
engineering
MDS Analytical Technologies

David Meeker
Design consultant
Neoteric Product
Development

Paul Zimmermann
Lead systems producibility
engineer
Raytheon

ROUNDTABLE COMMENTS

When did your company first begin identifying a need to reduce unnecessary product development costs, and what steps did it take?

Foley (Motorola): About five years ago, Motorola started an effort to reduce product cycle time and costs that included the use of concurrent engineering techniques and DFMA software as a process tool.

Zimmermann (Raytheon): Ever since I joined Raytheon in 1978, the company has been working R6 Sigma™ efforts to reduce unnecessary product development costs.

Keup (Dell): All along, Dell has recognized product-development costs as an issue, and it put the burden on the design engineers to use best practices. But there wasn't a uniform program or process until DFMA, so savings and improvements varied from engineer to engineer.

Lewis (DaTum 3D): My first experience with using DFMA to reduce unit manufacturing costs was while I was with Xerox and later Digital. In 1987, Digital developed a team to drive DFMA and total cost reductions. This led to the establishment of a hardware and materials standardization process and to an effort to minimize the level of assemblies allowed on the production floor in order to reduce the WIP (work-in-process).

Meeker (Neoteric Product Development): In today's competitive environment, I think everyone is aware that they need to be doing this. Even so, some companies become aware of this the hard way—because of declining company position or because a competitor brings out better or lower cost product.

Mortensen (KPMG*): When it comes to reducing unnecessary product development cost, the trick is figuring out what is an unnecessary cost. Identifying a cause-and-effect relationship between financial performance and product-development (PD) spending can be difficult because the benefit is not realized until a product goes to market. This can lead to the temptation to cut PD costs for a short-term benefit.

But focusing on DFMA goals such as product performance, speed-to-market, and financial return provides the framework within which to identify unnecessary costs. The task, then, becomes one of building a standardized process without the wasted effort and confusion that drains resources and slows the process. Rather than cutting PD costs, the effort should be on eliminating costs that impede the process.

DFMA can reduce costs and time-to-market by identifying opportunities early in the process when actions are easier to take. The standardized DFMA process provides a conduit for communication within the organization and the supply chain. It also provides a means for identifying the financial impact of an efficient design.

* Mortensen is also former director of target costing for Maytag, and was a Kaizen engineer for Toyota.

Shipulski (Hypertherm): For us, reducing unnecessary product development costs came after our company decided about three years ago that it was important to increase the number of product launches per year. Because the product-development cycles here average one-and-a-half years, instead of increasing the number, we recognized the importance of increasing the breadth of our product launches. That is, we saw that we could

combine product-development projects by switching from a sequential approach to a modular design approach. For example, we might introduce a manual version, with knobs and dials, and then follow it with an automated version that is based on the same basic design of its predecessor. Putting engineering up front doesn't take much longer, but it sets you up well for back-end, flow-on projects.

Valaitis (MDS Analytical Technologies): We moved from a research organization to a matrix product development organization in 1994-95, when we were producing 100-120 units a year. Since then we've increased production by over 10 times and have become a discipline-based organization. As part of that shift, we used DFMA software extensively during the 1990s to fine-tune our designs in order to improve manufacturing efficiency.

Today, we're using DFMA to remain competitive as the market for life-science tools matures. While we're still the market leader, technological advancements are becoming more incremental, and there's a greater emphasis on reducing product-development costs via more efficient designs and outsourced subassemblies. Beginning at the concept phase, our development teams work with vendors that make sheet-metal parts and machine parts as well as plastic thermo-formed and vacuum-formed parts. Application of DFMA is critical when it comes to the outsourced parts and subassemblies because the documentation and designs have to be that much more solid to ensure that the assemblies are exactly what you need.

When did DFMA become a part of these efforts, and why? Is DFMA part of a lean culture at your company? Is it part of a Six Sigma culture? Please explain.

Meeker: Most of my experiences as a consultant have been in implementing DFMA by itself.

Foley: We have always had a DFMA process that had been successful to various degrees. With the implementation of a concurrent engineering lean strategy, DFMA plays a larger role. Our Six Sigma goal of "perfect quality" is part of our way of doing business. And designing a cost-efficient, easy-to-manufacture quality product is what DFMA is about.

Zimmermann: Even though it is included as part of the company's Six Sigma training, I would have to say, no, DFMA is not yet an integrated part of the culture of Six Sigma much less the culture of the company. Raytheon's R6 Sigma™ encompasses both lean manufacturing and Six Sigma, and many of the projects seem to focus on the lean processes. Being both an R6 Sigma Expert, and a Six Sigma Blackbelt, one of the reasons I like Raytheon's R6 Sigma program is because of the focus on the lean process. However, if I compare my Six Sigma experiences between Texas Instruments and Raytheon, I feel that the use of Design for Six Sigma, Design to Cost, and Design for Manufacture & Assembly has definitely taken a step backwards, specifically here in North Texas, and in my opinion it is something Raytheon and all other companies need to focus on.

Keup: In the mid 1990s timeframe, Dell recognized that DFMA was critical. As Dell began to scale up, we needed better products that could be built faster with fewer touch points. Also at that time, DFMA efforts began at Dell, with the first DFMA team addressing desktop product designs. And while Six Sigma was key in the process, it wasn't the main driver. The need to reduce touch points, labor and logistics costs was the driving force.

Lewis: Based on the experiences we had at Xerox and DEC, the DFMA philosophy became one of the founding principles of the formation of DaTuM 3D in 1996. We understood there were further benefits to designing a product for economical production.

Mortensen: When it comes to reducing unnecessary product development and overhead costs, DFMA is always most effective when it is used early in the design process. However, even on an existing product, DFMA in conjunction with a robust evaluation process can identify opportunities for improvement. With better information and communication we can make decisions that have the support of the organization, including senior leadership. Developing a strong communication and coordination process that uses DFMA has the potential to accelerate speed-to-market while using fewer resources as information is identified, analyzed and acted upon early in the design process.

When it comes to lean, DFMA's principal role is to enable the development of products that are lean by design. Too often, lean is viewed as something that can be layered on to a product at the manufacturing stage. While lean processes are of value whenever they are used, their impact is greatest when the product has a lean design. DFMA supports lean designs by reducing product complexity and part count. As for Six Sigma, DFMA's role is to reduce the opportunity for quality problems to occur by reducing design complexity and by developing products that can be efficiently manufactured.

Shipulski: DFMA started here before we decided to increase the number of products launched per year. We had a significant cost reduction goal that we needed to meet, and DFMA was the only way we could meet the cost goal. Currently, DFMA is not done or taught as part of our lean Six Sigma programs; it is simply what we use to design products with low costs, great functionality, robustness, and that manufacturing likes to build.

Valaitis: We implemented DFMA when we developed one of our flagship products—the API 2000 mass spectrometer. It didn't become part of our lean manufacturing culture until four or five years later. When it did, it became an important part of the lean Six Sigma approach here. DFMA is an effective vehicle for connecting our product design engineers with manufacturing process engineering. Right now, I have an initiative to institutionalize our DFMA approach within product development. The DFMA software and philosophy enables our product design engineers to accelerate their capabilities.

Please discuss DFMA successes specific to your organization.

Foley: Motorola has successfully avoided the following overhead costs: designing and maintaining a part in the MRP and engineering databases, supply chain tracking, cost of production floor space not used, cost of quality, warranty and service, all of which are related to part-count reduction. All of these costs are related to each part in any product. By using the DFMA software, we can easily identify and quantify part-count reduction and drive down overall costs.

Keup: Dell uses DFMA to increase the level of integration, ultimately reducing supply-chain costs. For example, instead of sending 10- to 12-piece parts to our factories worldwide for final assembly, we added them in China at the chassis supplier and shortened the supply chain, saved on individual logistics costs, and reduced the final assembly time in the factories, all of which calculated into savings due to the less expensive Chinese labor.

Dell also has been successful in eliminating post-release tooling and design changes. These savings aren't classified as savings, but are considered "cost opportunity dollars." We instituted many design checkpoints and DFMA reviews prior to release in order to capture potential failure point areas. By changing the order of assembly steps, or by highlighting potential areas that could cause quality failures, we eliminated rejects.

But on a new project, it is very hard to quantify what those changes saved in terms of dollars; therefore they are "cost opportunity dollars." They're not truly attributed on a bottom-line basis because they never occurred in the factory; nor were they filed to see what they really cost because they were caught upfront.

Lewis: Our DFA analysis has allowed us to accurately forecast the need and cost for assembly tooling and test fixtures, which we're sometimes able to eliminate completely. We also have reduced our number of suppliers because we've reduced parts. By reducing the supplier base for the right reasons, we are able to develop strong partnerships that drive trust and allow suppliers to be open and constructive during the early design stages. The supplier selection criteria should be high quality, on-time deliveries, and low cost. Also, the supplier should be able to accept and work from CAD files, which is always difficult because of tooling requirements and other external parts requirements such as finishing.

Meeker: Because DFMA is a journey, I have been able to transfer what I've learned from a previous DFMA implementation while with another company and build upon that. We've been able to reduce overhead associated with CAD documentation because fewer parts mean fewer drawings that need to be created.

Mortensen: We have found the DFMA approach to be helpful for benchmarking studies, design analysis, operational analysis, performance measure development, and organizational risk assessment. It also can be used to evaluate process design as well as product design. In this case we are focusing on improving the efficiency of the "Bill of Process" or the process steps necessary to complete a strategy. This type of evaluation can support process-based cost optimization as well as product and overhead cost optimization.

While we expect to reduce parts using DFMA, we should also challenge process steps. One example of a process reduction occurred when the supply chain was involved. It was brought to the company's attention that a particular part used a unique process that required the supplier to shut down the system, purge it, set it up, run the product, shut it down, purge it, and then set it back up for everyone else's products. The supplier was able to change the product after the appropriate engineering evaluation in order to reduce process costs.

I haven't given an example of part-count reduction because I want to emphasize that cost optimization is much more than reducing the invoice cost of a part. However, I have seen part-count reductions that often require old paradigms to be challenged, leading to a factual analysis that DFMA can support.

Zimmermann: One of the most recent DFMA successes (I can talk about) has been on the Long Range Advanced Scout Surveillance System (LRAS3). I published a white paper on the Global Positioning System (GPS) cover assembly example several years ago. Using both DFMA and Design for Six Sigma it enabled us to develop a design that met all performance requirements, weight goals, and GPS performance goals.

Shipulski: We've had a number of successes in our five product-development teams, all of which are at different points on the DFMA continuum. That is, one team has demonstrated faster product development capabilities; a second team is in midstream; and the other teams are being brought along.

Another huge area of success comes in the form of overcoming an internal learning curve having to do with engineering "wait days" and throughput. We consider it most important to reduce engineering wait days—the number of days our engineers wait for parts, designs, analyses, testing resources. We no longer accept wait time as a part of product development, and instead use it as a metric because we see it as a good way to improve the areas that will increase throughput. This emphasis on reducing wait time enables us to identify unnecessary activities that add to the wait days. For example, if a product development project goes overboard with too many iterations that overload the model shop, then everyone waits. Or a product may be over-engineered with

functions and features that require extensive testing and validation, adding to the wait days. We test and analyze only what is necessary, and we do it well. Emphasis on wait days also allows us to demonstrate a need for certain capital expenditures.

With traditional cost accounting, it's all about utilization; companies want their equipment to be fully utilized. That's OK when it comes to manufacturing, but with product development, there's a lot of volatility in the demand seen by the equipment, and a machine tool may be only 20 percent utilized. But if that $500,000 machine tool is used once every other day, but is able to take engineering wait days from 10 to one, then we've made up nine days on the critical product-development path.

It took us four years to get there, but we've been able to make the link between fewer engineering wait days and faster product development with new machine tools. The lean culture is still isolated in manufacturing, and product development still doesn't fall within the lean culture, but we're starting to use engineering wait days in value-stream mapping.

Also, by taking a lot of cost and labor out of one product family using DFMA tools, we achieved a 300 percent increase in profit per square foot of factory floor space. We know floor space scales with labor time, and we know how much floor space it cost us for one product, so this is a tangible and powerful metric.

Valaitis: Over the years, we've successfully implemented a system engineering approach. Our teams today have to be more system- and subsystem-oriented in terms of their design approach being able to integrate subsystems designed internally with ones that have been strategically outsourced. The days of designing a widget and then passing it over to the electrical person, who then passes it over to a software developer, are long gone. Everything having to do with product development is done in parallel. We have teams that are system integrators, and we co-locate our development teams and often bring in outside contractors to work within the teams. We just went through three development programs, each involving teams of 20 or 30 that included scientists, engineers, software developers, contractors and consultants, project managers, and team leaders.

The thing is, when all manufacturing took place at the same location, you could address issues that came up within each of the subsystems and you could go to the area that was making mistakes and correct it. Now, with subsystems coming from our Singapore facility and supplier facilities across the U.S., if we haven't done all of our tolerance stackups, and if we haven't sorted out all of our form, fit and function issues, the vendor may provide us with a piece that hasn't been thoroughly designed for assembly, and doesn't fit the design, which means additional wait time while the problem is corrected.

Why do you suppose so many firms (about a third of the survey respondents) still don't track overhead costs related to product development, and what advice do you have for them?

Lewis: This is somewhat difficult to quantify. A highly motivated, well-trained and experienced product-development team will naturally gravitate toward cost reduction by looking at overhead cost drivers and making the adjustments.

Foley: It is a very touchy dance when you try to answer questions such as, how much does it cost to track costs? how accurate is the data collected? and compared to other costs, what is the impact of a product's development

on the bottom line? A company must decide if the "presumed" cost savings could be a factor in installing all of the processes to control and track the costs.

Keup: Because it is hard to track and quantify before the fact vs. after the fact, it is also hard to convince Finance and Accounting that you will achieve savings. They believe everything should be designed perfectly, but that is not real world. It's hard to convince someone of future savings in a do-it-right-the-first-time environment.

Meeker: On a case-by-case basis, it is too difficult to allocate costs associated with all of the various functions—quality, testing, documentation, purchasing—on a per-part basis because the amount of time spent with each part varies.

Mortensen: Applying overhead costs correctly can be difficult, even with advanced ERP systems that track product costs. Maintaining the usefulness of ERP cost tracking data can require a lot of time when it comes to keeping the input data in step with an evolving manufacturing operation. Companies that have optimized overhead costs generally have identified the key costs that should be tracked--and they focus on them. They also know that cost reduction is not always the best goal, and that improving utilization or throughput capacity of the existing investment may have a greater potential to improve financial performance.

A first step is to invigorate the process of coordinating cooperation in the value chain. With the appropriate level of communication built into a standardized PD process, it is more likely that cost optimization of the product and the overhead investment can be realized.

Shipulski: Overhead costs are a business metric and a process metric is needed if you want to improve a process. My advice is to let the overhead rate be what your accountants tell you and don't use it for anything. Instead, measure a process metric that, when improved, leads to more products launched per year. The best process metric I know of is to measure the number of days engineers wait for their parts, information, analyses, and decisions that are handed down to them.

Valaitis: Using eTime (an automated time and attendance system by ADP) we're tracking the time spent on projects, department meetings, vacations and nonproject activities. Our development teams also can be supplemented with outside contractors and consultants when needed. This allows us then to have 80 percent of our in-house people's time spent on specific projects for which we can claim R&D tax credits. Furthermore, the savings realized from tracking and keeping overhead costs low allow for more dollars to be allocated to product development, resulting in more products developed. To do this takes a lot of effort to document, but it's worth it.

Zimmermann: I would imagine they struggle with how to estimate the overhead cost. My advice is to take a step back and take a "bigger picture perspective" that doesn't just look at the cost of the assembly or piece parts, but instead answers, what is the impact on the system? is it hindering deliveries? is it impacting yields? and, what is the burn rate of the program (cost per day to run the program)?

What conclusions do you draw from the attached survey findings regarding DFMA and how it is being used as a tool for reducing overhead costs in product development?

Keup: I think many companies, especially smaller ones, struggle to see the investment of having DFMA engineers on their team and of taking the extra design cycle reviews because the savings are soft. Many companies are more excited to push a design out quickly with a sub-par part, and then modify later.

Foley: From the survey you can read that the driving force for both development and overhead cost reductions is that production throughput is the foremost driver. Increasing the throughput reduces the ratio of the development and overhead costs.

Lewis: This survey is the first step in educating concerned people in the new product development community about additional opportunities for cost reduction. It provides some direction and starting points for further exploration.

Mortensen: It is interesting that the number of people who actually believe that savings exist is about twice that of those who are actually tracking savings in these areas.

From my experience, people close to the DFMA work see the results, but financial and operations systems do not always measure or track the performance. If the adage "you get what you measure" can be applied, it would seem that the difficulty optimizing overhead costs can be one result of not effectively tracking these costs. DFMA coupled with a process to communicate measurable results can provide actionable information that can help optimize overhead costs. This benefit can be achieved by identifying, measuring, and communicating the opportunities.

Shipulski: I was surprised that companies are not measuring savings in terms of warranty, testing and prototyping. And I feel badly for those that are measuring overhead for product development. Again, it is very difficult for companies to get away from traditional business and financial metrics and into process metrics, such as wait days. Companies must identify the processes that will make a difference in their product development, and then they have to develop metrics that make a connection between the process and reduced costs.

Valaitis: To run an efficient product development organization, tracking overhead is extremely important because companies may not realize how much money it is taking away from the development side of the business, especially during growth spurts, if such costs aren't being tracked and monitored carefully.

Zimmermann: My conclusion is that organizations are making the mistake of looking at overhead costs more from their "realm-of-responsibility" perspective and not from a business perspective. That is, if I were to do a DFMA on an assembly and I were to eliminate three fabricated parts and a subassembly, then, since those parts would no longer exist, I wouldn't need to prototype and write change notices. Further, they wouldn't take up floor space, the inspection and inventory control would be nonexistent, there would be no shipping cost, no need for supply chain management, no warranty or service, no order entry, no assembly or fabrication documentation and no end-of-life considerations.

Looking ahead, Gilligan and Nick Dewhurst, executive vice president at Boothroyd Dewhurst, Inc., believe that DFMA will play a greater role in the cost-reduction efforts of companies who understand the effects of design across the whole of the manufacturing organization. Says Dewhurst, "There's a significant investment by industry, via PLM, in understanding product life cycle costs. For those companies truly concerned with production throughput and other organizational savings, further study needs to be undertaken."

SECONDARY READING

The Parts Standardization and Management Committee at the DoD has prepared a 24-page report titled, "Reduce Program Costs Through Parts Management." The report notes, "the average cost for adding a new part into a system is $20,000." The full report is available online here.

Analyst Roy Wildeman of Forrester Research included Boothroyd Dewhurst and user Dell in a report titled, "Design for Manufacturability Becomes a Reality," March 2007. You can read the executive summary here or view a PowerPoint presentation for a teleconference based on the report here.

Design News has published its annual engineer salary survey for 2007. In answering a question about why current design projects are requiring engineers to be more creative and innovative than a year ago, respondees said that the greatest driver is cost. See the bar chart at the bottom right of this article.

DFMA CASE STUDIES AND FORUM ARTICLES BY ROUNDTABLE PARTICIPANTS

Brad Keup, Dell: "No New Factories" http://www.dfma.com/news/keup.htm

George Valaitis, MDS Analytical Technologies: "Design for Opportunity with DFA"
http://www.dfma.com/news/mdssciex.htm

Mike Shipulski, Hypertherm: "Successful Design for Assembly"
http://www.assemblymag.com/CDA/Articles/Feature_Article/BNP_GUID_9-5-2006_A_10000000000000059386

Chris Foley, Motorola: "Symbol Puts It All Together (Faster) with DFMA" http://www.dfma.com/news/symbol.htm

Gordon Lewis, DaTum3D: "The Anatomy of Product Cost Estimating to Support Product Development"
http://www.dfma.com/news/lewis.htm

Dave Meeker, Neoteric Product Development: "DFMA a Multi-Functional Analysis Tool"
http://www.dfma.com/news/meeker.htm

Paul Zimmermann, Raytheon: "Raytheon Six Sigma/Design for Six Sigma – Our Vision"
http://www.dfma.com/news/zimmermann.htm

WHAT IS DFMA?

The Design for Manufacture and Assembly suite of software provides tools for use anytime during the product development cycle to analyze and understand the cost effects of design decisions. From the earliest conceptual stages of design, DFMA software offers quick and accurate cost information. The software also provides a way to work creatively and objectively with suppliers to find new avenues for improving design efficiency and profitability.

The software is a combination of two complementary tools: Design for Assembly (DFA) and Design for Manufacture (DFM). DFA software is used to reduce the complexity of a product by consolidating parts into elegant and multifunctional designs. DFM software then allows the design engineer to quickly judge the cost of producing the new design and to compare it with the cost of producing the original design. The resulting early and accurate cost understanding provided enables companies to proactively manage product cost while the product is still under development.

ABOUT BOOTHROYD DEWHURST, INC.

Boothroyd Dewhurst, Inc., was the first company to commercialize Design for Manufacture and Assembly (DFMA) methodologies and software tools, which make it possible to evaluate, estimate, and reduce the manufacturing cost of a product in the design phase through product simplification and cost estimation. Hundreds of Fortune 1000 companies, including Dell, John Deere, Harley-Davidson, and Whirlpool, use DFMA to cut the costs of their manufactured products and achieve design innovation in their markets. The company was founded in 1983 and received the National Medal of Technology Award in 1991. For more information about DFMA software, workshops, consulting services, and international conferences, contact Boothroyd Dewhurst, Inc., 138 Main Street, Wakefield, R.I. 02879, USA. Tel. (401) 783-5840. Fax (401) 783-6872. Web site: www.dfma.com. E-mail: info@dfma.com.