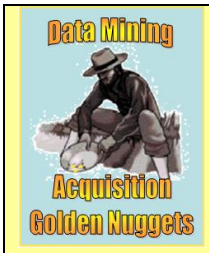


Note: The information provided is for reference purposes only. Although the information provided was accurate and current when first created, it may now be dated. The "Born-on-Date" is when the document was first created. Please contact the originator for updates. Please review the DAU Legal Notice at the bottom of the AKSS homepage for additional guidance. **Keywords** are highlighted in bold.

Problem: How do you take a complex design and make it simpler, more producible?

Solution: Texas Instruments faced this problem on several programs to include their portion of the M1 tank. Texas Instruments redesigned the M1 tank electronic box using "Design for Manufacturing and Assembly" techniques and realized total cost savings of 50 percent, a reduction in assembly operations of 49 percent, and reductions in parts costs of 58 percent. The reduction in parts had a significant impact on reducing maintenance time and the logistics tail thus reducing Total Ownership Cost.

Title: Using **Design for Manufacturing and Assembly (DFMA)™** to Improve **Quality**, Cost and Productivity.

Value Statement: DFMA™ is a systematic analysis of the design of an assembly or subassembly to reduce product cost by simplifying its design, assembly, and manufacturing without impacting performance. The analysis allows you to determine the theoretical minimum number of parts that must be in the design for the product to function as required. As you identify and eliminate unnecessary parts, you eliminate unnecessary manufacturing and assembly costs.

Born-on-Date: 8 June 2004

Background: DFMA™ was developed in 1980 by Geoffrey Boothroyd and Peter Dewhurst, professors of industrial and manufacturing engineering at the University of Rhode Island. The following year, they formed Boothroyd Dewhurst Inc. to market proprietary DFMA packages that are nationally recognized standards.

Discussion: The DFMA™ software analyzes product designs for:

- Design for Assembly (mainly lowers complexity by reducing the number of parts)
- Design for Manufacture (provides cost estimates for individual parts thus allowing for tradeoff decisions)
- Design for Service (provides insights into maintenance and repair)
- Design for the Environment (considers impact of design through disposal against environmental laws)

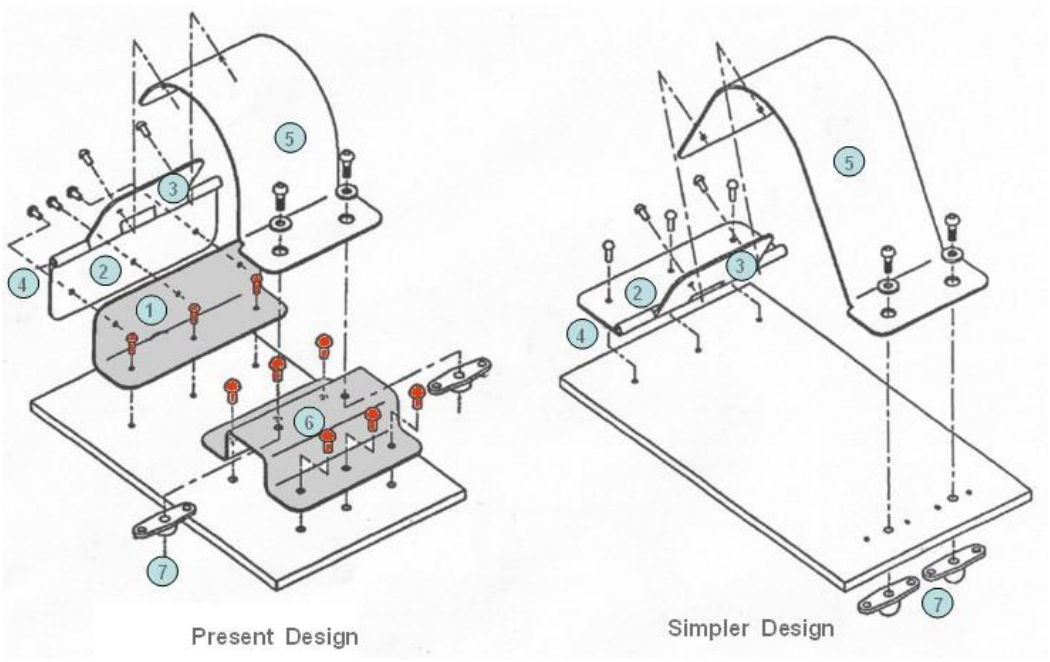
DFMA Process Steps: The basic process asks three questions:

1. During operation, does this part move relative to the part to which it is attached?

2. Does this part need to be made of a different material than the part to which it is attached?
3. Does this part need to be removable?

If the answer to all three questions is "no", then the part is a candidate for elimination or combination with other part(s). See the illustration on the next page. See example next page of a bailout bottle holder for the F/A-18.

Results: 80% improvement in design efficiency



The improved design eliminates nine fasteners (highlighted in red) and two parts (highlighted in grey). This new design is 80% more efficient than the old design.

Measures of Simplicity (include):

- Number of components
- Number of fasteners
- Volume and weight

Other Success Stories:

- The C-17 design team redesigned the Main Landing Gear Pod and greatly reduced the cost to manufacture by reducing the number of fasteners by 47%, reducing the total number of parts by 53%, cutting 10-days from the production schedule, and an 85% reduction in rework/repair cost.
- The Navy on its Reconfigurable Transportable Consolidated Automated Support System (RTCASS) cut the number of discrete cables from 381 to 177, thereby having large payoffs in terms of life cycle costs.

Benefits: The application of DFMA™ to a weapon system program can result in significant reductions in cost and cycle times, and major improvements in quality, responsiveness and performance. DFMA is best accomplished prior to

production, but can be used at any time in the life of a program.

Application to other programs:

This practice is applicable on any program in which a new high-technology product is being designed, developed, produced and/or maintained. Has successfully been applied on the F-18 E/F program.

Key words: Design for Manufacturing and Assembly, DFMA, Design for X or DFX

(keywords are used to support improved search capabilities in the information repository):

Additional Resources:

http://www.dfma.com/ homepage for Bothroyd and Dewhurst
http://acc.dau.mil/simplify/ev_en.php click on the Production, Quality and Manufacturing Special Interest Area for additional information
http://www.betterproductdesign.net/guide/design4X.htm links to the IBM ProPrinter Case Study
http://www.npd-solutions.com/dfm.html DRM Associates homepage with links to DFMA checklist and guidelines
http://www.engineering.uiowa.edu/~cam/Documents/DesignForAssemblySpring2004.ppt a tutorial on DFA

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