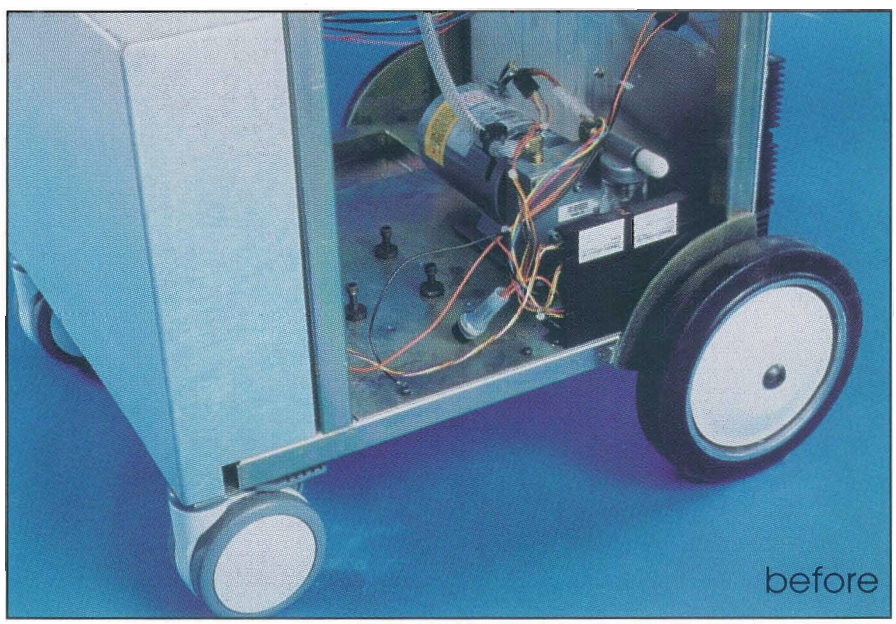
DFA/DFM Approach Shapes Engineering Culture

Design for Assembly (DFA) and Design for Manufacturability (DFM) are not new concepts in the design engineering field. However, now that they are old hat at our drafting and CAD tables, the challenge lies in how far the two practices can be stretched in order to reduce parts, costs and time. Here is the story of how two manufacturers implemented DFA and DFM in the design of a treatment instrument, which resulted in a reduced parts count of 30%, a three-hour cut in assembly time, and a price reduction of about $500 per unit made.



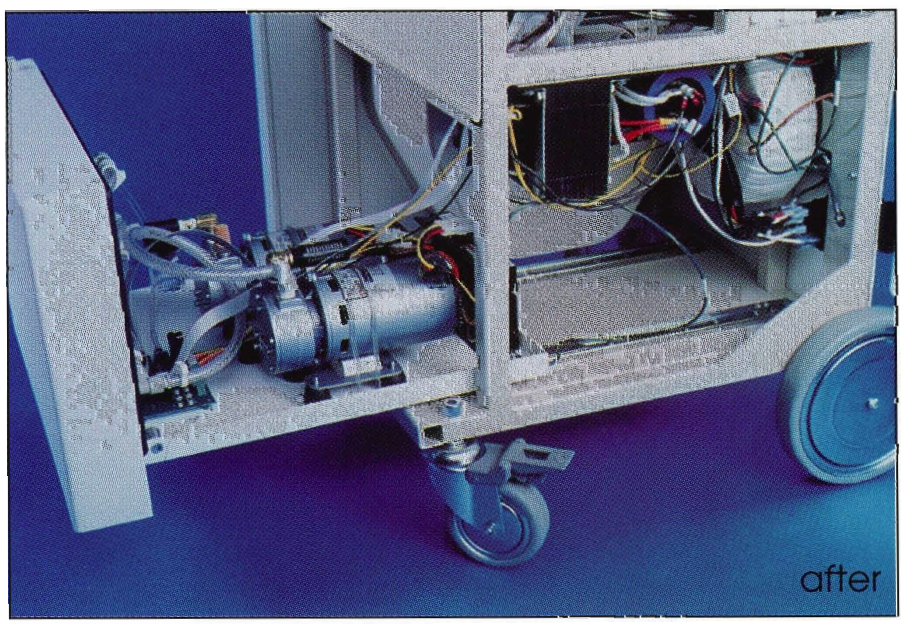
The BioLogic DT instrument, originally developed and marketed through HemoCleanse, West Lafayette, IN, helps treat comatose drug-overdose patients; it is also used in clinical studies for the treatment of AIDS patients. In the latter role, the DT maintains correct blood chemistries while the patient is undergoing high-temperature therapy, called hyperthermia. Doctors and nurses who were involved in these treatment procedures required a unit that could be cleaned and serviced more easily than the original. HemoCleanse turned to United Medical Manufacturing Company (UMM), Indianapolis, IN, for help.

UMM reduced part counts and simplified cleaning by twin-sheet vacuum forming the unit's two plastic doors, rather than the previous method of using laid-up fiberglass skins mounted on a metal frame. According to David Storvick, an R&D mechanical engineer at UMM, there was no rhyme or reason to the previous DT design. "It was a mess," he says. Threaded fasteners were replaced with pin studs, and nuts and bolts were replaced with elastic tie downs, both reducing expensive hardware costs. The top portion of the enclosed unit (which opens to all of the occluders) is now hinged, rather than bolted, for serviceability. Additional modifications made with serviceability in mind include: doors that open on both sides, a drawer that slides out, and subassemblies that attach to the basic unit, rather than to additional subassemblies.

This focus on serviceability was not part of the original redesign program, says Vincent Fischer, Program Manager, Advanced Systems Development, UMM. The emphasis on serviceability began when UMM solicited the guidance of Munro & Associates, Inc., a Troy,

MI,-based firm with expertise in DFA/DFM and concurrent engineering implementation. In addition to providing assistance with management training, research and development, manufacturing engineering, and quality control, Munro also changed the mindset within UMM's engineering community.

"A big part of [the new mindset] is to get those people who normally wouldn't be involved until the design is completed involved up front," says Storvick. These people include manufacturing and quality engineers as well as assembly people. The latter tells engineering which designs will work and not work at the prototype stage, rather than deal with an inefficient end design. Manufacturing engineers are involved at the concept stage to help facilitate designs that *can* be manufactured.



Munro also got UMM engineers to consider fasteners, heads and other components differently. The plan is to reduce or eliminate these components wherever possible. The company provided UMM with some tools to evaluate assembly time. One example is measuring how long it takes to pick up a spring. Also, these components must also be able to be used in one place on the assembly. Munro says that the assembly should be able to be put together by a blindfolded person with an arm behind his back. "It should be an obvious fit," says Storvick. There is a systematic way of rating assembly for manufacturability; therefore, assembly time must also be analyzed. "If we're doing a proposal, and we're not familiar with the assembly, we'll go through it part by part, subassembly by subassembly, and we'll make an initial estimate on how long it would take us to assemble or manufacture the unit," says Storvick. "We'll then go back and apply DFA/DFM principles to those assemblies for part elimination," he says. The result is a totally new assembly which, in turn, will also be evaluated for assembly time.

Another time- and cost-savings approach involves a video work instruction system. Rather than handing associates a cumbersome, dry training manual, UMM videotapes the manufacture of an assembly from the prototype stage to the finished product. From the videos, frames are pulled out and loaded onto a software program. Associates can access the procedures, including drawings, part numbers, etc., from their own PC. "The big improvement is the learning curve, especially when you're dealing with a complex instrument with lots of wiring or pneumatics," says Storvick.

The implementation of DFA/DFM principles, from the proposal stage on through the quality stage, has afforded end users of the BioLogic DT ease of use as well as reduced costs. This is the result of reduced time-to-market, reduced parts counts, and thus, reduced manufacturing costs which trickle down to the end user.

—M. Pasquale

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