Military & Aerospace Electronics
MILITARY & AEROSPACE ELECTRONICS EUROPE
Military TECHNOLOGIES CONFERENCE

FROM MILITARY & AEROSPACE ELECTRONICS APRIL 2006 ISSUE

Form-fit-function replacement power supplies breathe new life into old systems

By Ron Storm

U.S. military managers often must consider replacing a system's aging power supply as they upgrade communication and support systems that in some cases date back half a century. Managers, after all, are charged with making the most of the mission-effective lives of legacy weapon systems.

Power supplies can be a difficult problem. Electronic parts used in the original power supply may have become obsolete, printed wiring boards and castings may no longer be available, or the original schematic diagrams may no longer exist.

In these cases, a "form-fit-function" replacement power supply becomes the most economical solution if the only alternatives are to allow the system to become obsolete or to make a costly and temporary repair.

A form-fit-function replacement power supply is a newly manufactured power supply designed to match the "form" (shape, materials, and interfaces), "fit" (size and all connectors), and "function" (delivering the same output power from the appropriate input power) of an original power supply.

Form-fit-function replacement power supplies provide at the very least a "new" power supply that meets the specifications of the original. However, their redesign and manufacture present unique and significant opportunities to address defects or shortcomings in the original design, as well as a chance to improve system performance and reliability with modern technologies and manufacturing techniques.

All power supplies are a complex combination of several design considerations dedicated to the unique requirements of the system they support. As complex as they may be, using commercial off-the-

shelf (COTS) components can reduce the design and manufacturing costs as well as time-to-production of a form-fit-function replacement power supply. Military managers and systems contractors are wise to partner with a power-supply vendor that offers proven technical design expertise combined with the ability to implement a wide array of COTS technologies.

U.S. Army officials, for example, recently benefited from an improvement of the original design of a power supply when they contracted with Behlman Electronics Inc. in Hauppauge, N.Y., to provide form-fit-function replacements for power processors in some of the Army's TTC/TYC-38 and -39 communications switch systems. Behlman has more than four decades of experience in the design, manufacture, and repair of custom, COTS, modified COTS, build-to-print, and reverse-engineered power sources used on military programs.

The original power processors in the Army's 1,500 fielded communication switch systems had a high failure rate and it was increasingly difficult to keep up with repairs. In many cases repairs were not possible or economical.

The Army contracted with Behlman to provide 100 build-to-print power supplies based on the original power processors. Modern materials, technology, modern test procedures, and manufacturing techniques not only helped engineers manufacture the power supplies, but also pinpointed why the original power supplies experienced such a high failure rate in the first place. A Value Engineering Change Proposal (VECP) improved the original design and resulted in a form-fit-function replacement power processor with state-of-the-art integrated modular technology. A VECP can reduce the overall cost of the product without degrading performance, reliability, and maintenance.

The VECP eliminated the defects while improving overall system performance. Total ownership cost dropped significantly; Army managers achieved a lower cost per unit for manufacture and realized additional savings in logistical support costs. The 400 new power processors installed have been virtually failure-free, and the original power processors still in use can be swapped around for repairs to the Army's 1500 systems.

In another example, an aerospace equipment manufacturer needed a form-fit-function replacement for a 30-year-old power supply in one of its Air Force E-3 Airborne Warning and Control System (AWACS)

systems. More than 300 units were installed in AWACS aircraft and the failure rate of the power supplies had become unacceptable.

Behlman designers used existing modules and circuits to supplant those in the original AWACS power supply, which kept development time of the form-fit-function replacement to a minimum. They also integrated several upgrades that improved performance, ease-of-maintenance, and manufacturability. They added a thermal pad, for example, in place of a compound that originally coated the base of the power supply. Designers also included a new extraction/carry handle for easier access. Finally, they implemented a modular design to simplify maintenance and repair.

Armed forces managers, prime contractors, system integrators and power supply vendors must work together to arrive at the ideal solution of a form-fit-function replacement power supply. The power-supply vendor must be able to identify all alternatives and options, and explain the pros and cons of each; look beyond the provided specifications and make recommendations to improve performance, manufacturability, and cost; draw from and implement a wide array of proven COTS technologies; and ensure that the replacement power supply meets all current standards.

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Military & Aerospace Electronics April, 2006
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