

Product repair at a fraction of the cost

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When faced with servicing electronic products, some manufacturer's first reaction is to either replace the product or repair it in-house by establishing a dedicated internal repair centre. Steven Olson puts the case for a third way.

While the above solutions may be convenient, and in some cases even appear ideal, both are usually more costly than simply outsourcing to an authorised repair depot. For example, repair depots can significantly reduce an OEM's investment in test systems, laboratory equipment and enable engineers to focus on their core competencies, such as developing new product designs.

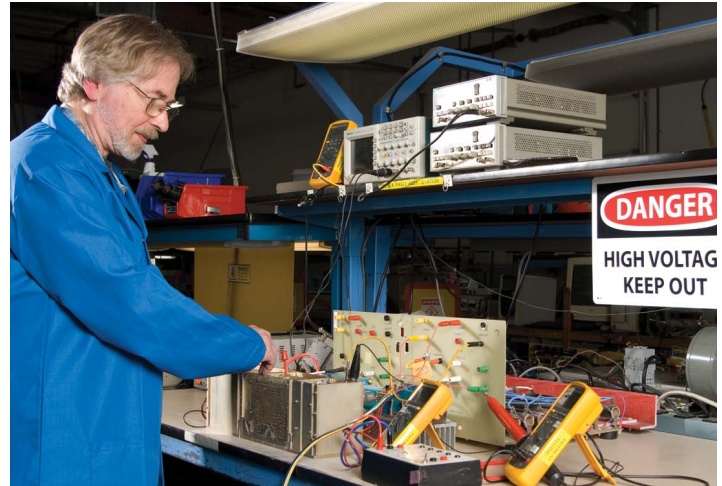
Authorised repair depots are particularly useful for servicing discontinued or end-of-life products and products with stringent quality requirements. The repair depot's experienced test technicians can quickly identify the causes of product failures and produce accurate test results faster and more efficiently than production staff who must "make time" for test and repair. Repair specialists are also adept at producing detailed failure reports that can be used for quality analyses and suggesting design changes to improve manufacturability.

Replace or repair?

Virtually any industrial electronic product can be repaired for a fraction of the replacement cost by a competent repair depot. The Outsourcing Institute indicates that, compared to in-sourcing, outsourcing noncore competencies like repair to third parties can reduce overall manufacturing costs by as much as 20 percent. These savings were confirmed by RAND Research's Project Air Force (PAF), which helped clarify the repair-or-replace decision with a mathematical model that determined when the cost of repairing an aging system exceeds the cost of replacing it.

Warner Robins Air Logistics Center (WR-ALC) is an example of an organization that has been faced with the question of whether to replace or repair. WR-ALC has chosen to outsource repair services for decades. One particular program that WR-ALC is responsible for maintaining is the U.S. Air Force's AN-ALQ-172 Pave Mint Countermeasures Systems.

The AN/ALQ-172 Jammer provides the USAF's B-52H, AC-130U and MC-130H aircraft with electronic countermeasures (ECM) against airborne and ground-based radar systems and missiles. In the 1990's, WR-ALC found that their system's very-high-power Traveling Wave Tube Amplifiers (TWTAs) could no longer be repaired and the exact models of two TWTA versions were no longer being manufactured. WR-ALC put out a request for proposal and Teledyne-MEC, the division of Teledyne Technologies, Inc. that designs, develops and manufactures traveling wave tubes (TWTs)



for radar, ECM and communications applications, won the job. Teledyne partnered with dB Control, a designer and manufacturer of high-power TWTAs, to work as the authorised repair depot for this program. dB Control had more than a decade of experience producing systems for military airborne and shipboard environments and also employed several technicians who had worked for Teledyne's Power Supply Group.

WR-ALC now sends its TWTA assemblies to dB Control's repair depot in Fremont, Calif. After being repaired, refurbished and integrated with new TWTs, the units are forwarded to Teledyne's Rancho Cordova, Calif. facility for final assembly. With every power supply it repairs, dB Control includes a detailed failure report that WR-ALC's source inspectors can use for quality analyses. Over the last decade, dB Control has repaired more than 900 TWTA assemblies for Teledyne, with a return rate of less than one percent. As the result of being equipped with a reliable radar system, the USAF can keep its B-52H in service for several more decades.

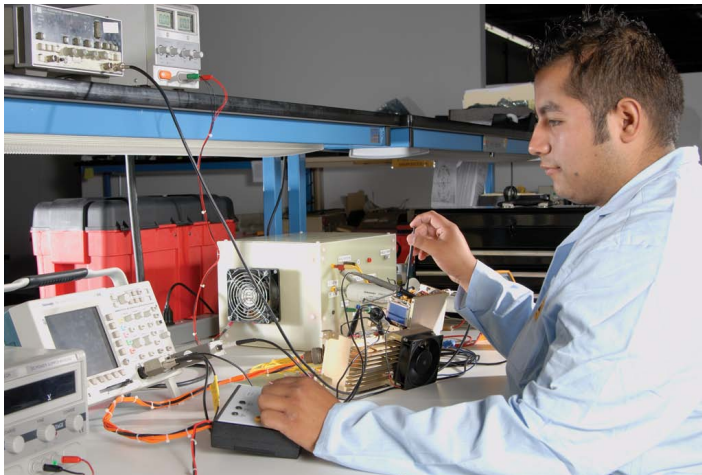
Other major manufacturers, including Rockwell Automation, Siemens, Mitsubishi, GE Intelligent Platforms, Honeywell, Schneider Electric and Eaton successfully outsource to repair depots. Southwest Airlines also uses a third-party provider to perform aircraft maintenance, train repair technicians or handle spare parts inventory. This saves money for the airline and enables it to focus on its core competency – providing convenient air transportation and customer service.

Custom services

According to the National Association of Manufacturers, the manufacture of electronic products is one of the four largest industries in the United States – a number they say is likely to be

consistent with the U.K. and other countries. NAM also reports that small to mid-size companies tend to be responsible for the bulk of manufacturing.

Interestingly enough, the Blumberg Advisory Group's analysis of the after-market service industry discovered that smaller, regional third-party repair depot service providers operating out of a single location in one or two countries are also thriving, even in the current economy. Blumberg interviewed more than 100 consumer electronics, telecommunications, wireless and computer OEMs of various sizes. More than two-thirds indicated that they outsource some portion or all of their depot repair requirements to the smaller third-party providers. One reason given for this preference is that smaller repair depots have had to develop superior problem-solving capabilities to remain competitive.



dB Control experienced this firsthand. The company's high-power assemblies are installed onboard the Predator, Global Hawk and other high-altitude aircraft. It is essential that these onboard systems be compact, lightweight and extremely reliable. Electronic product designers and engineers know that encapsulation decreases the size and weight of assemblies by enabling isolated power components to be located in close proximity to each other. Likewise, conformal coating enhances the assemblies' reliability by protecting the components, and sometimes even the entire assembly, from exposure to dust, moisture and extreme temperatures. However, setting up a laboratory to perform encapsulation and conformal coating requires a significant investment in capital equipment and months of trial and error to develop the formulas and perfect the process.

dB Control had to triple the size of its laboratory and install chemical mixing stations and vapour degreasers to clean products prior to encapsulation. Cold traps were installed to liquefy gas contaminants produced during the potting process. Closet-sized vacuum chambers were purchased to evacuate air from the potting material and multiple large curing ovens were installed to harden the epoxy or silicone RTV. A custom air curtain exhaust

system similar to those used in pressurised clean rooms was designed and installed to remove the chemical fumes and excess heat generated by the curing ovens. Plus, lab technicians were required to undergo extensive training before working with high voltages and hazardous chemicals.

For dB Control, the investment was worth it. Over the last two decades, the company has perfected its potting processes to the point where it now produce quantities of high-voltage assemblies containing dozens of encapsulated components with a zero failure rate.

Choosing the right partner

Considering that the authorised repair depot will be a direct reflection of the OEM's reputation – both in terms of cost and quality – if the decision is made to outsource, it is important to choose the right partner. OEMs should conduct an extensive qualification process in three key areas:

- **Facilities:** evaluate technological strengths, experience of personnel and manufacturing/repairing capabilities.
- **Capacity:** Consider provider's experience repairing reliable products on time and within budget. Inquire about current production backlog to uncover any scheduling constraints.
- **Certifications:** Ensure that all required certifications (e.g., IPC-A-610, IPC/EIA J-STD-001) are up to date.

Reduced cost, improved quality

The complexity of today's electronic products will increase the need for competent repair. But as many manufacturers have found, performing repair internally does not come cheap. In fact, the Society of Manufacturing Engineers notes that poor quality calibration requires manufacturers to spend more than \$1.7 million per year, while large companies (revenue of \$1 billion+), spend an average of \$4 million per year.

Before outsourcing to a repair depot partner, manufacturers should investigate the cost and time savings and the acceptable return rate of the repaired product. Most will find that repair depots will not only significantly reduce costs, but also improve quality. Detailed and accurate failure reports can be provided faster, as there is more focus and precision in small repair teams that are unhindered by the red tape common at larger companies. Repair depot engineers can also reproduce field failures to test the accuracy of the reports and predict the future lifespan of the product. By feeding these results back into the design process, OEMs can react quickly to address potential design issues early on. With the right authorised repair depot partner, manufacturers will enjoy quality craftsmanship and consistently lower costs.

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