How are you influencing medical devices related to military?

Andy Strange
Chief Engineer, Omnetics

Medical devices for military applications offer a unique set of challenges. When soldiers are injured on the battlefield, they must be quickly stabilized and removed from the hazardous environment. Medical equipment used in these situations must be lightweight, as it may need to be carried into remote hostile locations. These harsh environments also call for ruggedized medical equipment. Due to the dangerous situation, extreme ease of use is also critical for the safety of both the patient and the combat medic. Omnetics Connector Corp. is a manufacturer of connectors and cable harnesses for a wide range of high end applications. We began as a supplier of interconnect systems solely for military/aerospace applications. However, in the past 15 years, our involvement with medical devices has increased dramatically as technology has driven the need for small, high reliability connectors in medical devises as well. Since, Omnetics has such a rich history with both medical and military applications, it is always exciting when we find new challenges and opportunities that require both a combination of military and medical specifications.

Thomas B. Pickens, III
Chairman, 1st Detect Corp.

Our company is developing a miniaturized, portable chemical detector that can help the armed forces diagnose exposure to chemical and biological warfare agents and toxic chemicals quickly and pre-symptomatically. The 1st Detect device was originally developed for the International Space Station as an air quality monitor; however, we identified alternative applications on Earth for the military, as well as the security, healthcare, and industrial sectors.

In addition to its ability to diagnose soldiers that have been exposed to CWAs and BWAs, it will supply soldiers in the field a handheld instrument to more accurately detect potentially lethal chemical agents and explosives before they are exposed. Chemicals are identified on site, eliminating the need for time-consuming laboratory analysis. It uses advanced mass spectrometer technology that can adapt as new threats emerge without needing to change the hardware.

The lightweight, battery-powered, cost-effective device is about the size of a shoebox, weighing approximately 12 pounds. We're completing the prototype stage and we've earned recognition from DHS's SAFETY Act program and from the U.S. Army's Chemical and Biological Defense SBIR Program.

Jeffrey VanZwol
VP of Marketing, Micro Power

Micro Power's two largest market segments are medical and military OEMs, and we see crossover of the specialized medical products designed for military environments. Most of the medical products that we see getting "ruggedized" are portable emergency medical devices, like defibrillators, patient monitors, and pulse oximeters. Micro Power designs and manufactures batteries and chargers for these medical devices. Our influence on these portable power accessories is applying design principles for MIL-STD-810 environmental qualification and MIL-STD-461 electromagnetic emissions conformity. We apply the design principles and qualification tests typically utilized for ruggedized portable devices, like radios, notebooks, GPS, and PDAs. Differences between a typical medical battery and a MIL-STD-810 qualified medical battery include the use of absorbent plastics that tolerate ballistic shock and gunfire vibration, sealing techniques that enable submersion up to 10 meters, elevated high temperature performance (70°C), extreme low temperature performance (-40°C), high altitude performance, and resistance to salt water corrosion. Many of these MIL-STD-810 requirements get applied to medical battery packs we design for military environments.

Nelson Gernert
VP, Engineering and Technology, Thermacore Inc.

The challenge of thermal management for military-related medical devices, the need for extraordinary reliability (to deal with field conditions like sand or salt

water), and portability, coupled with increasing demands for devices with “field-replaceable” components make up a set of needs rarely encountered in commercial medical applications.

Our thermal engineers generally rely on passive heat transfer devices, such as heat pipes, to meet these challenges. Heat pipes, without moving parts to fail (a key consideration for ensuring reliability), can be used as stand-alone heat exchangers or form the basis for heat pipe heat sink and other combinations. The straightforward design of heat pipes makes them relatively easy to fabricate and miniaturize, and continual advances in wicking structure technology allow reliable operation in any orientation.

We also make use of advanced materials, such as annealed pyrolytic graphite (APG), to develop thermal components that are smaller, lighter, and more efficient than traditional heat sinks using aluminum or copper. APG can also be encapsulated for applications such as surgical instruments, where it is critical to avoid contact between APG and human tissue.

The area where heat pipe technology most impacts military medical devices is diagnostic imaging, including electronics-rich technologies, such as magnetic resonance imaging (MRI), computerized tomography (CAT scan), ultrasound, and radiography (X-ray). A heat pipe’s time-to-failure performance in the millions of hours makes it ideal for these applications.

The advantages of heat pipes for military medical technology are being reflected in some newly issued specifications. A recent specification for a CAT scan cooling system, issued by a DARPA contractor, involved design for a condenser fin, duct, and forced air supply along with a set of heat pipes. The project may also require the use of a variable-conductance heat pipe using fluid whose vapor pressure responds to tiny variations in temperature. We expect to see more military specifications involving passive heat transfer devices for medical devices, because they provide excellent reliability with relatively low size and weight.

Clayton Tucker
Global Business Director, Embedded Healthcare Technologies, Emerson Network Power

Healthcare OEMs have been spearheading the evolution of standard off-the-shelf technologies for quite some time. Healthcare technologists are under extreme pressure to drive down costs and improve performance while increasing technology usefulness in enhancing the world's healthcare. This is a daunting, multi-faceted task that is generating an environment that supports creativity and advancement.

Stakeholders ranging from governmental agencies to healthcare practitioners to scientists and patients demand rapid innovation to tackle the vast requirements of the users. Along with the need for speed-to-market, factors, such as regulatory standards, equipment capabilities, mechanical guidelines, and aesthetics, continue to drive advancement and adoption of products based on commercial open-standards platforms. These forces, paired with the cost requirements, have provided a fertile ground for mass adoption of commercial open standards-based platforms.

The military and aerospace prime contractors have also always been at the forefront of technology advancement, but have been somewhat reluctant to adopt "commercial" platforms, such as motherboards, COM Express modules, and server and enterprise platforms. Emerson Network Power's leadership and healthcare advancements with these technologies has provided a strong foundation and a promising future for military and aerospace applications.

Joel Delman
L.A. Design Director, Product Development Technologies Inc.

PDT has taken a step towards combining our expertise in the medical and military industries via an alliance with Biomimetic Microelectronics Systems—Engineering Research Center (BMES-ERC). Through this partnership, we are able to sync our experience in product development with technology innovation. For example, the increased prevalence of eye and head trauma caused on the battlefield is driving the need for new technologies. In developing technology for injury diagnosis, injury treatment, surgical instrumentation, and imaging technology, the BMES-ERC and PDT have partnered to accelerate development by implementing our experience in market research and product development for military applications. The pairing of the two teams' specialties in medical device technology and innovation paired with our product development expertise will allow for market development of the retinal and cortical prosthesis concepts. Merging expertise from these industries allows us to develop rewarding products that could have a significant impact on our veterans' quality of life.

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