INNOVATION

Wounded Warriors + Design

BIOMIMICRY • SHOWCASE • OBsolescence
Support from a High-Tech Lab—or the House Next Door

FROM A MYOELECTRIC MOUSE TO A HAMMER AND NAIL

A quick Google search for “wounded warrior project” returns more than 2.3 million hits. While it’s unlikely that there are that many wounded warrior programs in the US, odds are good that hundreds, if not thousands, of initiatives are being undertaken by associations, organizations, foundations, partnerships, societies and interested citizens across the country. That there are so many wounded warrior initiatives is a good thing. These programs return some measure of stability to those who have sacrificed so much for their country. One such initiative, Quality of Life+ (QL+), is a shining example of the next generation creating innovations to aid the current generation.

QL+ is a 501(c)(3) nonprofit organization whose mission is to foster and generate innovations that aid and improve the quality of life of those injured in the line of duty. QL+ accepts challenges from wounded active-duty and veteran military members, intelligence and law enforcement personnel, first responders and others injured in service. These challenges become projects at the QL+ Laboratory at the California Polytechnic State University (Cal Poly) in San Luis Obispo, CA. Located within the College of Engineering, the QL+ Lab is the pilot research and development facility for all innovations sponsored by QL+. Students and faculty apply engineering and creative skills to real-life problems and develop assistive technologies to address the physical challenges faced daily by our wounded heroes.

Achievements rarely occur in a vacuum, however. For QL+, and other similarly remarkable initiatives, success is as much a lesson in collaboration as invention. Fundraising is critical to providing the infrastructure from which, in QL+’s case, the engineering students can push past the limits and create viable solutions for amputee, injured or disabled veterans.

A Symbiotic Goal

For the members of the Society of American Military Engineers (SAME), the work being done by QL+ resonates in myriad ways: foremost, that the students from Cal Poly are engineering solutions that will give quality of life back to wounded warriors.

Founded nearly 100 years ago by World War I veterans to ensure that the nation’s security and infrastructure would be respondent in future conflicts, SAME continues its pledge so that military engineering innovations and lessons learned are not lost to history. Aligning with an inspirational wounded warrior initiative, such as QL+, which aims to support our servicemen and women as well as motivate and inspire future engineers, was a seamless match. Last year,
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under the direction of its 2011–2012 president, Navy Rear Adm. Christopher Mossey, commander of Naval Facilities Engineering Command and chief of civil engineers, SAME established a Wounded Warrior Task Force. Three keys efforts were developed to aid in the holistic recovery of veterans and their reentry to civilian life: mentoring, job transition and education assistance, rehabilitation and support, and support to QL+.

In October 2011, the SAME Wounded Warrior Task Force introduced QL+ to the society’s members with a fundraising opportunity for two challenges: the Myoelectric Mouse Control Project and the Prosthetic Knee-Leg Lift Project. Each was given a fundraising goal of $25,000 to aid in funding research and development. In just a few short months, the generosity of SAME’s membership resulted in total contributions of $57,495.95—enough to meet the targets and then some. SAME has since added QL+’s Universal Lift Program to its list of fundraising initiatives—charging to meet a new $25,000 goal for the project by the summer of 2012.

Prosthetic Knee-Leg Lift  Above-the-knee amputees in particular have difficulty ascending and descending inclined slopes and stairs. It is the objective of the team assigned to the Prosthetic Knee-Leg Lift Project to develop a device that helps individuals ascend and descend stairs. The device will be designed to achieve near-universal compatibility with existing prosthetics. It is the team’s intent that the device will be quiet, convenient and helpful to amputees who want the same mobility that others can achieve. The Prosthetic Knee-Leg Lift team is made up of four senior engineering students: a materials engineering student, a mechanical engineering student, a general engineering student and an electrical/biomedical engineering student. A faculty advisor supervises these students.

The challenge is to build upon the advances already achieved, further refining the design to maximize the prosthesis’ security and comfort and reduce its weight. Roughly six percent of US military veterans with limb amputations are classified as bilateral above-the-knee. Restricted movement of the leg at the knee joint while walking on inclined
surfaces or stairs adds unnecessary strain because of the need to use the upper body to move up and down stairs. A redesign of the prosthetic knee would improve the quality of life for many unilateral and bilateral leg amputees.

The current version of the device was developed as a proof-of-concept prototype. A redesign for a bilateral above-the-knee amputee should focus on making it easier for the user to climb stairs. For safety, the attachment must provide comfort and security. The skin in contact with the prosthesis must avoid chafing, blisters, pressure sores, friction burns and cuts. This challenge was initiated during the fall 2011 quarter, and the product will be completed and fully tested by the end of the spring 2012 quarter.

Myoelectric Mouse Control The Myoelectric Mouse Control challenge, which points out that there are no commercially accessible myoelectric devices on the market for amputees, seeks to develop a myoelectric control-based interface for a standard USB computer mouse. According to recent studies, people who have undergone an amputee procedure or have lost a limb benefit from nerve stimulation in the residual limb. One successful example is the Center for the Intrepid in San Antonio, TX, which is a rehabilitation center that uses nerve stimulation control to interface with software games. Myoelectric stimulation used as soon as possible after the amputation helps retain crucial nerve endings, ultimately allowing for greater control of prostheses fitted at a later date. Creating a rehabilitative experience that is both engaging and fun will assist in improving patients’ quality of life. This serves as a precursor to prosthetic options.

Universal Lift Program This challenge being undertaken by QL+ seeks to engineer a universal lift system that will allow individuals with mobility issues to enter and exit heavy machinery. Creating this device will ultimately help make it possible for wounded warriors to work in construction, agriculture, waste management and transportation fields—occupations that otherwise would not be possible. The universal lift system is the cornerstone of the QL+ Universal Lift Program, a comprehensive three-phase training and certification reemployment program that is currently in development by QL+ and partners.

One Project at a Time As SAME embarks on a new donation goal to support QL+’s Universal Lift Program, the society and its 106 posts worldwide also continue to raise awareness and work on other ways to promote the spirit of giving back. Many SAME members are bringing hands-on support in the same cities and towns where soldiers, Marines, sailors and airmen are returning every day. While QL+ initiatives are technological advancements that may some day help thousands, SAME’s members and posts are also working on projects that may help dozens of servicemen and women—or even just one veteran at a time.

In February 2012, SAME’s Carolina Midlands Post removed old shingles and replaced the roof on a home of a wounded warrior from nearby Sumter, SC. Volunteers from Shaw Air Force Base 20th Civil Engineering Squadron, the Sumter County Sheriff’s office and local businesses joined in. The Carolina Midlands Post has done similar work for others in its area, too, like 91-year-old World War II veteran Bob Fogle, a former Army Air Corps flight engineer who still lives with his wife in Columbia, SC.

SAME’s Kittyhawk Post, meanwhile, recently engaged in an advanced project with students from the Air Force Institute of Technology to build a wheelchair ramp for army veteran Bill Elliot of Troy, OH, which has enabled him to receive a motorized cart from the local hospital. The ingenuity did not stop there. In true engineering fashion, the students applied a unique design to allow for further modifications to the home; future additions include a first-floor bathroom and a chair lift that will allow access to the second floor. Additionally, having applied lessons learned from earlier work, the students incorporated changes to the ramp design that allowed small crews to handle multiple phases of the ramp simultaneously—thus, expediting completion. They continued to modify the process in order to better use limited time and resources.

Opportunities to offer wounded warriors support are abundant, and that is a good thing. They range from technological innovations created in laboratories to outreach programs from each of the armed services and local support from the neighbors next door.

Just as houses are still built with hammers and nails—yet modernized to include solar panels, renewable heating and cooling systems and other sustainable innovations—helping a wounded warrior find recovery may best be accomplished with a mix of the world-class ingenuity that QL+ and Cal Poly are fostering and some old-fashioned neighborly support that anyone can provide.