HERL Newsletter

Volume 11, No. 2 · July 2012 · News from the Human Engineering Research Laboratories

Still fighting, still learning

Recovering Marines get the basics of machining

Picture a table filled with perfectly polished silver belt buckles, with four bullet casings punctuating the brass cutouts attached to each buckle. These are the buckles created by Marines of the Wounded Warrior Regiment.
All the buckles have black etchings on them: one has the US Marine eagle, globe, and anchor on it. Another simply reads "Sapper." A third has "3 Generations" printed on it, to commemorate the Marine's father and grandfather, who had also been Marines.

In April, five Marines from the Regiment – followed by another five Marines in May – visited the Human Engineering Research Laboratories to take part in the new Fabrication and Assistive Technology (FaTE) Program.

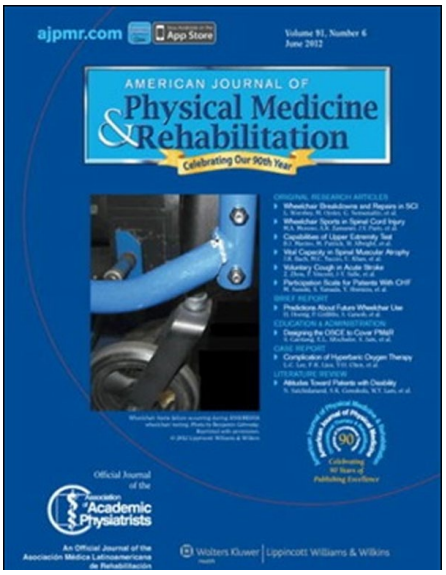
NVWG ... see page 6

> *"We were all having fun, and [they] followed directions to the letter."*
> *- Garrett Grindle*

Their mission: learn the basics of machining to create belt buckles awarded to the participants of two rodeos to benefit the Semper Fi Fund. Along the way, they would also create belt buckles for themselves.

HERL researcher Garrett Grindle was the project leader. "It was a real eye-opener for the Marines to follow a logical process and get a really high-level result from basically low-level objects, like bars of steel and brass," Grindle said. He also praised the Marines' professionalism. "They took it seriously, even though we were all having fun, and followed directions to the letter. We actually didn't have to throw away any material, which is usually just par for the course *(Cont. on page 7)*

Article Warns of Increased Wheelchair Breakdowns



HERL researcher Lynn Worobey and HERL Medical Director Dr. Michael Boninger – in association with HERL Bioengineer Michelle Oyster, Dr. Gregory Nemunaitis, and HERL Director Dr. Rory Cooper – published an important paper in the June issue of the research journal American Journal of Physical Medicine and Rehabilitation in which they found that wheelchair users with spinal cord injuries have very high rates of wheelchair breakdowns, which can result in being stranded, injury, or missing appointments. And the problem, unfortunately, is only getting worse.

More than half (53%) of all the wheelchair users who participated in the study reported having a wheelchair breakdown that required a repair in the previous six months. A similar study took place in 2006, which found a breakdown rate of only 45%. Power wheelchair users reported having significantly more problems than manual wheelchair users.

According to the study, this is a severe problem since many wheelchair users don't have a backup chair they can use. What's more, injury rates from mobility devices are rising. The authors suggest that a simple decline in wheelchair quality could be causing increasing failure rates. While there are standards for wheelchair quality, no one enforces them. This article, then, should serve as a wakeup call to policymakers.

Full citation: Worobey L, Oyster M, Nemunaitis G, Cooper RA, Boninger ML, Increases in Wheelchair Repairs, Breakdown, and Adverse Consequences for People with Traumatic Spinal Cord Injury, American Journal of Physical Medicine and Rehabilitation, pp. 463-469, Vol. 91, No. 6, June 2012.

HERL-Authored Instrument Spreads Around the World

Studies indicate that wheelchair users transfer 15 to 18 times a day on average, and some people transfer as many as 40 times a day. Although transfers are a necessary part of everyday life, they can cause major problems such as shoulder/wrist pain, rotator cuff tears, and tendonitis. Using proper transfer techniques can help wheelchair users avoid these problems. But what exactly does good transfer technique look like?

Researchers from the Human Engineering Research Laboratories (HERL) in Pittsburgh are currently working on this question. Over the past several years, HERL researchers and clinicians have analyzed the data collected from thousands of transfers and, in combination with a previous study funded by National Institute on Disability and Rehabilitation Research (NIDRR), have put together a "scoresheet" of transfer quality called the Transfer Assessment Instrument (TAI). Although the TAI is still being refined, the goal is for it to become the clinical standard for grading transfer technique.

Currently, a few clinics outside of Pittsburgh are using the TAI. Most recently a research team from the Department of Motor and Cognition Rehabilitation from the Korea National Rehabilitation Research Institute had the TAI translated into Korean and have been using it in their work. Preliminary results are encouraging.

HERL researchers Maria Toro and Elaine Houston perform a transfer experiment.

HERL cleans up at RESNA

Genevieve Jerome

Yen-Sheng Lin

Lynn Worobey

Students from the Human Engineering Research Laboratories strutted their stuff in front of the Assistive Technology community at the recent Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) Conference. Eleven HERL students attended the annual conference, held this year in Baltimore's Inner Harbor neighborhood from June 28 to July 3, and HERL researchers stole the show, receiving numerous awards. HERL research was also displayed in nine different poster presentations during the conference.

Every year, RESNA holds a Student Scientific Paper Competition, sponsored by the Paralyzed Veterans of America. As described by RESNA, the purpose of the competition is to "promote high quality scientific and engineering research in the field of rehabilitation engineering and assistive technology." This year, three of the four competition winners were from HERL. The winning papers were:

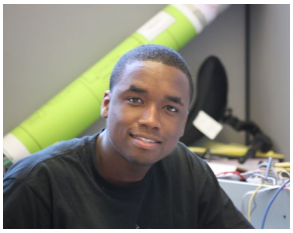
- Genevieve Jerome, **The Impact of Transfer Setup on Hand Positioning During Independent Transfers**, which studied the proper placement and height of handholds or grab bars during transfers;
- Yen-Sheng Lin, **Effect of Muscle Fatiguing Tasks on Subacromial Space in Manual Wheelchair Users**, which used ultrasound to measure changes and fatigue in the joints of manual wheelchair users;
- Lynn Worobey, **Increases in Wheelchair Repairs, Breakdowns, and Adverse Consequences for People with Traumatic Spinal Cord Injury**, which reported growing rates of wheelchair failures.

Additionally, two out of the four Honorable Mentions were by HERL students:

- Hervens Jeannis, **Preliminary Investigation of an Instrumented Glove for In-Home Hand Therapy**, which looked at a commercial data-glove as a tool for stroke rehabilitation;
- Chung-Yung Tsai, **The Feet Free Moment and Ground Reaction Force in Wheelchair Transfer: A Pilot Study**, which studied bone fractures caused by specific friction between the foot and the ground.

Other HERL attendees were Jorge Candiotti, Shiv Hiremath, Claire Hoelmer, Hsin-yi Liu, Manola Ojeda, Maria Toro, and Yu-Kuang Wu.

At the Awards Luncheon on Monday, July 2, HERL Founder and Director Dr. Rory Cooper was awarded the RESNA Distinguished Service Award. The award recognizes Dr. Cooper, who is a former RESNA President, an elected RESNA Fellow, and a member of the RESNA/ANSI Wheelcair Standards Committee, for his sustained contributions and service to RESNA and the fields of assistive technology and rehabilitation engineering.



Hervens Jeannis

Chung-Ying Tsai

Dr. Rory A. Cooper

PITT VETS: the University of Pittsburgh Student Veterans Group

What is Pitt Vets? In 2007, the Student Veterans Association was formed to represent all Veterans attending the University of Pittsburgh. The group was reformed as Pitt Vets in Fall 2011 and has been getting stronger ever since - the group now has 50 members and is still growing. Pitt Vets is affiliated with the Student Veterans of America, which has over 500 chapters across the United States.

What is the mission of Pitt Vets? Pitt Vets' purpose is to sustain its members with on-campus and community resources to ensure that the University of Pittsburgh's Veterans have continued support during their academic education, and to ensure that they graduate ready to enter the workforce or pursue graduate education. Pitt Vets helps veterans access benefits and introduces them to peer support networks and resources necessary for transition into academic and civilian life.

Why is Pitt Vets necessary? It's an unfortunate fact that Warriors often return home from battle with a host of mental and physical disabilities. Another unfortunate fact is that such disabilities can make transitioning to civilian life and receiving an education much more difficult for Veterans. Veterans who take advantage of the Post 9-11 GI Bill are far less likely to be unemployed and far more likely to contribute to society and federal and state revenues through meaningful work. Moreover, Veterans, by virtue of their wealth of experience, hold a unique place in the marketplace of ideas that we, as Americans, hold dear in both a university setting and in public discourse. It's clear, however, that Veterans are able to express themselves better when they have physical, mental, and emotional support. Therefore, this is the rationale for Pitt Vets: to provide physical, mental, and emotional support for Veterans attending the University of Pittsburgh.

Who is eligible to join Pitt Vets? Pitt Vets is at the University of Pittsburgh to help student Veterans, ROTC cadets, Veterans' spouses/dependents, and Veteran alumni. Membership is free.

Pitt Vets can be contacted via email at pittvets@gmail.com, or through Facebook (http://is.gd/pittvets) or Twitter (@PITTVETS). The Student Veterans of America is on the web at http://www.studentveterans.org/.

CURRENT RESEARCH ABSTRACTS • CURRENT RESEARCH ABSTRACTS • CURRENT RESEARCH ABSTRACTS

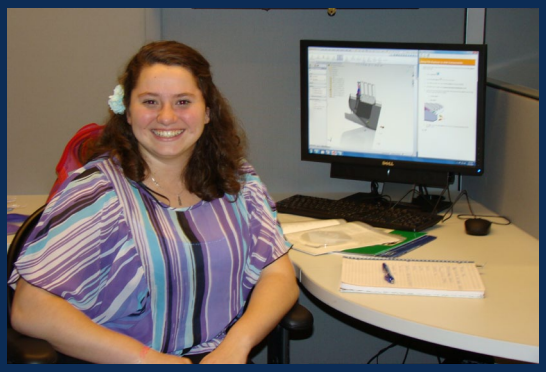
Cooper RA, Molinero AM, Souza A, Collins DM, Karmarkar A, Teodorski E, Sporner M, **Effects of Cross Slopes and Varying Surface Characteristics on the Mobility of Wheelchair Users**, *Assistive Technology*, Vol. 24, No. 2, Summer 2012, pp. 102-109.

Surface characteristics of a cross slope can impact the ease with which a manual wheelchair (MWC) user propels across a surface. The purpose of this research was two-fold. Phase I of this research surveyed MWC users to identify cross slope scenarios that they reported to be more difficult to traverse compared to other common driving obstacles. Our survey results showed that, overall, cross slopes were harder to propel across than narrow and doors, and cross-slopes in inclement weather conditions were equal or more difficult than gravel and rough-surfaces. Cross slopes with severe angles and those with compound angles (slope with cross-slope) were the most difficult to traverse. Phase II focused on identifying the responses (e.g., avoid, explore alternative, experience a sense of insecurity, no effect) people had when viewing pictures of various cross-slopes scenarios (e.g. narrow space, compound angles, extreme weather) that wheelchair users would encounter. These results showed that people reported that they would avoid or feel insecure on some cross-sloped surfaces, like the weather, that are not in our control, others, like compound angle and curb-cuts on slopes, that can be addressed in the construction of pathways or sidewalks.

Koontz A, Toro M, Kankipati P, Naber M, Cooper RA, **An Expert Review of the Scientific Literature on Independent Wheelchair Transfers**, *Disability and Rehabilitation: Assistive Technology*, Vol. 7, No. 1, 2012, pp. 20-29.

Purpose. The purpose of this study was to perform a literature review and seek expert opinion on the relevance and strength of the evidence concerning setup and transfer performance.
Methods. Scientific literature databases were searched until June 2009 using 43 keywords resulting in 339 articles. These were internally reviewed and narrowed to 41 articles which were formally assessed by 13 external experts. Articles that 80% or more of the reviewers scored as moderately or highly relevant were included in the final results.
Results. Nineteen articles met the relevancy criteria. The aspects of setup that experts felt were addressed to some degree included vertical transfer distance, transferring across a gap and position of the mobility device relative to target destination. None of the 19 articles were scored as having strong to very strong resulting evidence.
Conclusions. There is a consensus among studies that transferring to a higher surface implies greater exertion of the upper limb. However, there is no evidence concerning how high or low, how close, and how much space is needed next to the target surface so it can be accessible by a majority of wheelchair users.

2012 Summer Interns!









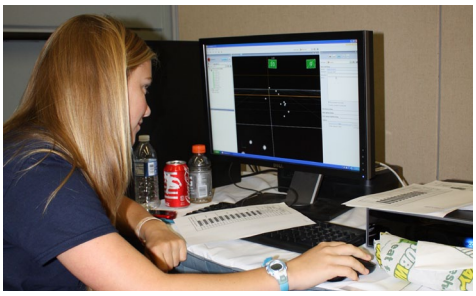






View more photos like these on Facebook at http://facebook.com/herlpitt !!

32nd National Veterans Wheelchair Games



The 32nd National Veterans Wheelchair Games were held from June 25-30 in Richmond, Virginia. Richmond was also the site of the very first National Veterans Wheelchair Games, held back in 1981, when 74 Veterans from 14 states participated. This year, over 500 Veterans from all 50 states, Puerto Rico, and Great Britain competed in more than a dozen events. It's now the largest annual wheelchair sports event in the world!

Our local group, the Keystone Chapter of the Paralyzed Veterans of America, had 16 separate athletes medal in 13 different events for a grand total of 50 medals in events from air guns to weightlifting. HERL Director Dr. Rory Cooper personally brought home five gold medals for swimming events.

The Wheelchair Games are extremely important to HERL's research, since many of our research subjects are recruited at the Games and agree to take part in our projects during their downtime. This year, we enrolled 151 people in six separate studies. This is a great result for us and we continue to be in the debt of our research subjects at the Games. **A huge thank you to everyone who volunteered to help us!**

Next year's Games will be held in Tampa, Florida, July 13-18, 2013. We'll be there, and we certainly hope to see YOU there too!

NBC Visits HERL for Olympics

Producers and a camera crew from NBC came to visit HERL on April 10, interviewing Director Dr. Rory Cooper and researcher Justin Laferrier, and shooting a wide range of projects related to the engineering behind the Olympic and Paralympic Games. U.S. Paralympian shot-putter Scott Winkler was also on hand to help.

Now, the NBC Learn channel has used the footage in a series of videos leading up to NBC's coverage of the Games. You can find the videos on the web at http://www.nbclearn.com/portal/site/learn/science-of-the-summer-olympics - be sure to check out, most especially, the "Engineering for Mobility" video!

Cooper Contributes to Landmark Report

"Dismounted Complex Blast Injury" (DCBI) is an explosion-induced battle injury sustained by a warfighter on foot patrol that produces a specific pattern of wounds. In particular, it involves traumatic amputation of at least one leg, a minimum of severe injury to another extremity, and pelvic, abdominal, or urogenital wounding. The incidence of dismounted complex blast injuries has recently increased greatly, thus the Army Surgeon General appointed a task force to study this injury pattern. The task force has now released their report, to which HERL Director Dr. Rory Cooper contributed.

The report is available online as a PDF at http://is.gd/dcbitf.

Recovering Marines *(Continued from p. 1)*

in a machining project."

The rodeo belt buckles were designed using computer-aided design (CAD) software and sent to Wounded Warrior Regiment Commander Colonel John L. Mayer for approval. Three categories of belt buckles were designed: a buckle for rodeo participants, a larger buckle for the rodeo champions, and a special buckle for the Marines themselves. The proper materials – stainless steel, brass, and spent 9mm shell casings – were acquired and cut for assembly. The Marines' job was to polish the metal, assemble the pieces, etch images and letterings into the assembled buckles, and help weld attachments to the rear of each buckle.

Lettering and graphics were added onto each belt buckle with one of the lab's two laser cutters, supervised by shop staffer Dalton Relich. For their personal buckles, the Marines could find and etch images found on the Internet – for example, their company insignia or the EGA logo – and could etch their name or a nickname at the top of the buckle.

The rodeo buckles were extremely popular when they were awarded at the conclusion of the Cutting Horse Classic on April 14 in Nokesville, Virginia, and the Wouunded Warrior Cowpuncher Roundup on June 1 outside of Casper, Wyoming.

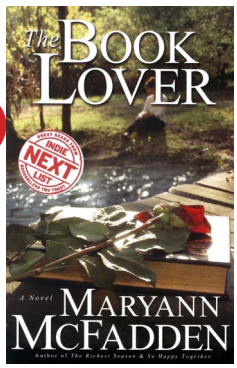
Grindle was impressed at the Marines' industriousness. "They were working hard, learning new skills, putting something together that they could really be proud of," he recalled. "And most of them decided to make their buckles for someone else – to give it away to someone they cared about. It just really shows the attitude of sacrifice and tradition that Warriors live every day."

First Fabrication and Assistive Technology cohort, April 2012.

Second Fabrication and Assistive Technology cohort, May 2012.

ODDS -N- ENDS

- Congratulations to the SHRS Dean's Student Advisory Board and the 30 student volunteers who worked two weekends to rebuild two homes!
- Congratulations also to RST student Abbas Quamar, who was featured on the radio program "Pushing Limits" this spring on KPFA and http://www.kpfa.org.



- Bestselling author Maryann McFadden's new book, **The Book Lover**, features a character that was crafted with help from (and might be a little similar to!) HERL Director Rory Cooper. It's now available from all fine bookstores and also Amazon.com.
- The Pennsylvania Veterans Foundation (PVF) is currently awarding grants to Veterans in need. For more information, or to make a donation, contact the PVF at http://www.paveteransfoundation.org/ or call (717) 861-8902.

Human Engineering Research Laboratories

VA Center of Excellence for Wheelchairs and Associated Rehabilitation Engineering

University of Pittsburgh NIDRR Model Center on Spinal Cord Injury

Part of Quality of Life Technology Center
A National Science Foundation Engineering Research Center

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ARE YOU INTERESTED IN ASSISTIVE TECHNOLOGY RESEARCH?

The Human Engineering Research Laboratories (HERL) is recruiting individuals interested in participating in research studies for the ASSISTIVE TECHNOLOGY REGISTRY.

If you would like to be notified of research studies related to assistive technology for which you may be eligible to participate, contact The Human Engineering Research Laboratories and join the Assistive Technology Registry.

This is an informational resource and notification of a study does not obligate you to participate. You do not need to be located in, nor are you required to travel to, Pittsburgh in order to participate in research studies.

If you are at least 18 years of age, and use assistive technology (e.g. wheelchair, scooter, prosthesis, etc) please contact a Clinical Coordinator at (412) 822-3700 or herlregistry@shrs.pitt.edu.

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HERL Director Dr. Rory Cooper with his five 2012 National Veterans Wheelchair Games gold medals.