



# HERL Newsletter

News from the Human Engineering Research Laboratories VOL 17, No 1 • JANUARY 2018

## HERL Director awarded Service to America medal

On September 27, 2017, the Partnership for Public Service honored Dr. Rory Cooper with a Samuel J. Heyman Service to America Medal (Sammie) for his work as director of the Human Engineering Research Laboratories (HERL).



To learn more about the Sammies, visit <https://service-toamericamedals.org>.

Cooper received the Sammie in the Science and Environment category for developing adaptive wheelchairs at HERL. Cooper and six other winners were chosen from 26 finalists and more than 440 nominees by a selection committee that included leaders from government, business, the foundation and nonprofit community, academia, entertainment and the media. The entire awards ceremony was streamed live from Washington, D.C. on the Partnership for Public Service's Facebook page.

"The federal government is a unique instrument for our country. The 2017 Service to America Medal recipients represent the best in government, the unsung heroes who quietly work behind the scenes to serve their country and the public good," said Max Stier, Partnership for Public Service president and CEO. "It is important, especially in these uncertain times, to celebrate and recognize the Sammies honorees and their colleagues throughout the government who are making a positive difference in people's lives."

## 2017 in Review

### MEBot's Blackwood Award

On January 23, 2017, the Blackwood Group announced that HERL's MEBot wheelchair had won the prestigious Blackwood Design Award for Best New Concept. MEBot, short for Mobility Enhancement Robotic Wheelchair, tackles steps, curbs, and rough terrain. According to the Blackwood Group, "[MEBot] caught the attention of the judges in part because it was very clear that it was designed by wheelchair users, for wheelchair users and with very full inclusion from the outset."

### PneuChair Unveiled at Water Park

On April 7, 2017, a new waterproof motorized wheelchair that runs entirely on compressed air called PneuChair was unveiled at Morgan's Wonderland, a 25-acre theme park in San Antonio, Texas. The park was built specifically for individuals with disabilities, and 10 of these chairs were available to patrons at the venue's new splash park, Morgan's Inspiration Island, when it opened later in the spring.

Thanks to some great footwork from the University of Pittsburgh's Office of Communications, PneuChair quickly went viral and was featured in more than 40 online and traditional news sources, most notably CNN, Time, ABC, Gizmodo, Mashable, Mental Floss, Bored Panda, Scary Mommy, Women's Day, Good Housekeeping, The Independent, Epoch Times, New Mobility, Mobility Management, and most recently the New York Times (see story p. 7).

### Disability Mentors Hall of Fame

On August 2, 2017, Partners for Youth with Disabilities and the National Disability Mentoring Coalition announced that the Human Engineering Research Laboratories had been inducted into the 2017 class of the Susan M. Daniels Disability Mentoring Hall of Fame.

The Susan M. Daniels Disability Mentoring Hall of Fame was established to honor those who are making a significant difference in the lives of youth and adults with disabilities through mentoring and to raise awareness about the importance of mentoring for individuals with disabilities. The Hall of Fame's namesake, Susan M. Daniels, devoted her life to improving the lives of others with disabilities. As a person with a disability who achieved enormous professional and personal success, she had significant impact as a senior policy maker, as an inspirational speaker and teacher, and as a mentor to hundreds of individuals.

### Cooper Becomes AAAS Fellow

On November 11, 2017, the American Association for the Advancement of Science (AAAS) announced that Dr. Rory Cooper was awarded the title of Fellow in the category of Engineering in recognition of his contributions to science and technology, scientific leadership, and extraordinary achievements across disciplines. The tradition of AAAS Fellows dates to 1874 and comprises an illustrious group of scientists. Among them are astronomer Maria Mitchell; inventor Thomas Edison; anthropologist Margaret Mead; and biologist James Watson.

## Current Research Abstracts

Worobey LA, Rogot S, Hogaboom NS, Venus C, Boninger ML, Investigating The Efficacy of Web-based Transfer Training on Independent Wheelchair Transfers through Randomized Control Trials, *Archives of Physical Medicine and Rehabilitation*, pp. 9-16.e10, Vol. 99, No. 1, 2018.

**Objectives:** To determine the efficacy of a web-based transfer training module at improving transfer technique across 3 groups: web-based training, in-person training (current standard of practice), and a waitlist control group (WLCG); and secondarily, to determine subject factors that can be used to predict improvements in transfer ability after training.

**Design:** Randomized controlled trials.

**Setting:** Summer and winter sporting events for disabled veterans.

**Participants:** A convenience sample (N=71) of manual and power wheelchair users who could transfer independently.

**Interventions:** An individualized, in-person transfer training session or a web-based transfer training module. The WLCG received the web training at their follow-up visit.

**Main Outcome Measure:** Transfer Assessment Instrument (TAI) part 1 score was used to assess transfers at baseline, skill acquisition immediately posttraining, and skill retention after a 1- to 2-day follow-up period.

**Results:** The in-person and web-based training groups improved their median (interquartile range) TAI scores from 7.98 (7.18–8.46) to 9.13 (8.57–9.58;  $P<.01$ ), and from 7.14 (6.15–7.86) to 9.23 (8.46–9.82;  $P<.01$ ), respectively, compared with the WLCG that had a median score of 7.69 for both assessments (baseline, 6.15–8.46; follow-up control, 5.83–8.46). Participants retained improvements at follow-up ( $P>.05$ ). A lower initial TAI score was found to be the only significant predictor of a larger percent change in TAI score after receiving training.

**Conclusions:** Transfer training can improve technique with changes retained within a short follow-up window, even among experienced wheelchair users. Web-based transfer training demonstrated comparable improvements to in-person training. With almost half of the United States population consulting online resources before a health care professional, web-based training may be an effective method to increase knowledge translation.

**SUMMARY:** Web-based transfer training demonstrated comparable improvements to in-person training.

Peterson SL, Laferrier JZ, Koontz AM, Wang H, Hannan M, Cooper RA, Psychological Strategies of Veterans Who Participate in Organized Sports, *Journal of Military, Veteran and Family Health*, pp. 42-52, Vol. 3, No. 2, 2017.

**Introduction:** The study sought to examine the performance strategies of wounded, ill, and injured service members and Veterans who participate in the Warrior Games. **Methods:** The Test of Performance Strategies (TOPS) was completed by 23 men and 5 women participants on the first and last days of the Warrior Games. The participants were separated into 2 groups: those who had participated in organized sporting events for more than 1 year (experienced;  $n=14$ ) and those who had less than 1 year of experience (novice;  $n=14$ ). A mixed-model ANOVA was used to assess pre-post changes and the effect of experience on total TOPS scores. **Results:** Overall participation in the Warrior Games did not change the performance strategies used by the participants. However, experienced participants had higher post-competition sub-scale scores than novice participants in the categories of self-talk, goal setting, and activation ( $p<.05$ ). **Discussion:** While participation in a single Warrior Games event did not appear to change participants' short-term psychological thought processes around competition and practice, more than 1 year of participation in organized sporting events was associated with improved skills.

**SUMMARY:** Long-term participation in sports is associated with an improvement in psychological strategizing.

Jeannis H, Joseph J, Goldberg M, Seelman K, Schmeler M, Cooper RA, Full-participation of students with physical disabilities in science and engineering laboratories, *Disability and Rehabilitation: Assistive Technology*, pp. 186-193, Vol. 13, No. 2, 2018.

**Purpose:** To conduct a literature review identifying barriers and facilitators students with physical disabilities (SwD-P) may encounter in science and engineering (S&E) laboratories.

**Method:** Publications were identified from 1991 to 2015 in ERIC, web of science via web of knowledge, CINAHL, SCOPUS, IEEEExplore, engineering village, business source complete and PubMed databases using search terms and synonyms for accommodations, advanced manufacturing, additive manufacturing, assistive technology (AT), barriers, engineering, facilitators, instructor, laboratory, STEM education, science, students with disabilities and technology.

**Results:** Twenty-two of the 233 publications that met the review's inclusion criteria were examined. Barriers and facilitators were grouped based on the international classification of functioning, disability and health framework (ICF). None of the studies directly found barriers or facilitators to SwD-P in science or engineering laboratories within postsecondary environments. The literature is not clear on the issues specifically related to SwD-P. **Conclusion:** Given these findings, further research (e.g., surveys or interviews) should be conducted to identify more details to obtain more substantial information on the barriers that may prevent SwD-P from fully participating in S&E instructional laboratories.

### Implications for Rehabilitation:

- Students with disabilities remain underrepresented going into STEM careers.
- A need exists to help uncover barriers students with disabilities encounter in STEM laboratory.
- Environments.
- Accommodations and strategies that facilitate participation in STEM laboratory environments are promising for students with disabilities.

**SUMMARY:** More research is needed to identify barriers to SwD-P participation in instructional laboratories.

## Current Research Abstracts

Hwang S, Lin YS, Hogaboom NS, Wang LH, Koontz AM, Relationship between linear velocity and tangential push force while turning to change the direction of the manual wheelchair, *Biomedical Engineering (Berlin)*, pp. 439-446, Vol. 62, No. 4, August 2017.

Wheelchair propulsion is a major cause of upper limb pain and injuries for manual wheelchair users with spinal cord injuries (SCIs). Few studies have investigated wheelchair turning biomechanics on natural ground surfaces. The purpose of this study was to investigate the relationship between tangential push force and linear velocity of the wheelchair during the turning portions of propulsion. Using an instrumented handrim, velocity and push force data were recorded for 25 subjects while they propel their own wheelchairs on a concrete floor along a figure-eight-shaped course at a maximum velocity. The braking force (1.03 N) of the inside wheel while turning was the largest of all other push forces ( $p < 0.05$ ). Larger changes in squared velocity while turning were significantly correlated with higher propulsive and braking forces used at the pre-turning, turning, and post-turning phases ( $p < 0.05$ ). Subjects with less change of velocity while turning needed less braking force to maneuver themselves successfully and safely around the turns. Considering the magnitude and direction of tangential force applied to the wheel, it seems that there are higher risks of injury and instability for upper limb joints when braking the inside wheel to turn. The results provide insight into wheelchair setup and mobility skills training for wheelchair users.

**SUMMARY:** Investigated wheelchair turning biomechanics with regard to velocity and push force.

Chung C, Wang H, Hannan MJ, Kelleher AR, Cooper RA, Daily Task-Oriented Performance Evaluation for Commercially Available Assistive Robot Manipulators, *International Journal of Robotics and Automation Technology*, pp. 16-27, Vol. 3, No. 1, July 2017.

This preliminary study investigates the performance and cognitive loading of the two commercial wheelchair-mounted assistive robotic manipulators (ARMs) with their original user interfaces (UIs). This study of 20 able-bodied individuals evaluated the performance of two user interfaces, keypad and joystick, using six tasks on an activities of daily living (ADL) task board with environment-independent measures, self-reported cognitive loading and questionnaires. Participants performed tasks with two commercial arms with their original UIs in a randomized order of arm and the six tasks on the ADL task board. Performance was evaluated using completion time, throughput, and trajectory parameters. Self-reported measures of workload and questionnaires were also administered. Statistical performance differences were found in the translational tasks ( $p < 0.05$ ) in task completion time, throughput, and difficulty. The keypad showed faster performance on the knob turning task. Similar responses were reported in the perceived workload with both UI. Participants rated the UI's low on frustration and physical workload, but higher on mental effort. The findings of this study provide a preliminary comparison between two commercial ARMs with their original UIs. Barriers and recommendations for training and evaluation for first time users were discovered. The results provide information to help develop ARM UI and recommendations for clinicians and health service providers to develop better training and evaluation for arm users.

**SUMMARY:** Evaluated the user interfaces included with commercial assistive robotic manipulators.

Toro ML, Bird E, Oyster ML, Worobey LA, Lain M, Bucior S, Cooper RA, Pearlman JL, Development of a wheelchair maintenance training programme and questionnaire for clinicians and wheelchair users, *Disability and Rehabilitation: Assistive Technology*, pp. 843-851, Vol. 12, No. 8, 2017.

**Purpose of state:** The aims of this study were to develop a Wheelchair Maintenance Training Programme (WMTP) as a tool for clinicians to teach wheelchair users (and caregivers when applicable) in a group setting to perform basic maintenance at home in the USA and to develop a Wheelchair Maintenance Training Questionnaire (WMT-Q) to evaluate wheelchair maintenance knowledge in clinicians, manual and power wheelchair users. **Methods:** The WMTP and WMT-Q were developed through an iterative process. **Results:** A convenience sample of clinicians ( $n=17$ ), manual wheelchair ( $n=5$ ), power wheelchair users ( $n=4$ ) and caregivers ( $n=4$ ) provided feedback on the training programme. A convenience sample of clinicians ( $n=38$ ), manual wheelchair ( $n=25$ ), and power wheelchair users ( $n=30$ ) answered the WMT-Q throughout different phases of development. The subscores of the WMT-Q achieved a reliability that ranged between ICC(3,1)=0.48 to ICC(3,1)=0.89. The WMTP and WMT-Q were implemented with 15 clinicians who received in-person training in the USA using the materials developed and showed a significant increase in all except one of the WMT-Q subscores after the WMTP ( $p < 0.007$ ). **Conclusion:** The WMTP will continue to be revised as it is further implemented. The WMT-Q is an acceptable instrument to measure pre- and post-training maintenance knowledge. **Implications for Rehabilitation:** The Wheelchair Maintenance Training Program can be used to educate rehabilitation clinicians and technicians to improve wheelchair service and delivery to end users; This training complements the World Health Organization basic wheelchair service curriculum, which only includes training of the clinicians, but does not include detailed information to train wheelchair users and caregivers; This training program offers a time efficient method for providing education to end users in a group setting that may mitigate adverse consequences resulting from wheelchair breakdown; This training program has significant potential for impact among wheelchair users in areas where access to repair services is limited.

**SUMMARY:** Creation and evaluation of a wheelchair maintenance program for clinicians to teach wheelchair users.



# 2017 HERL Journal Articles

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- Crytzer TM, Cooper RA, Jerome GM, Koontz AM, Identifying Research Needs for Wheelchair Transfers in the Built Environment, *Disability and Rehabilitation: Assistive Technology*, pp. 121-127, Vol. 12, No. 2, 2017.
- Cooper RA, Commentary on WHO GATE Initiative, *Journal of Spinal Cord Medicine*, pp. 2-4, Vol. 40, No. 1, 2017.
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## Other 2017 HERL Achievements

Senator Robert Casey requested a briefing/tour of HERL on Monday Nov. 6.

HERL hosted Dr. Ramoni, Chief Research and Development Officer (CRADO) for the VA, on Monday, May 15.

PneuMobility was the winner for the Kuzneski Innovation Cup. The Kuzneski Innovation Cup is sponsored by Andrew and Laurie Kuzneski, and is for University of Pittsburgh students who are developing innovations that can positively impact people's lives in areas other than healthcare.

Sr. Associate Medical Director, Michael Boninger, MD, is volunteering with the National Academies. The National Academies wanted a team of scientists they can call on when asked to weigh in on confidential matters by the government.

HERL hosted its annual Open House on July 28, 2017. Opening remarks were provided on video by Carolyn Clancy, MD, Deputy Under Secretary for Health for Organizational Excellence, Veterans Health Administration, and in person by Ali Sonel, MD, VA Pittsburgh Healthcare System Chief of Staff. The afternoon culminated with the announcement of the winners of the Research Experience for Undergraduates/ Experiential Learning for Veterans in Assistive Technology and Engineering (ELeVATE) poster session.

Recently graduated HERL PhD alumni, Mahender Mandala, won first place in the Goldman Prize competition. Inaugural Goldman Prize Competition Seeks to Improve Education Through Innovation. <https://www.pittwire.pitt.edu/news/inaugural-goldman-prize>

Stacy Eckstein, HERL Lead Clinical Coordinator was the recipient of the "Herma Galsgow Award" from the national African-Caribbean Cancer Consortium.

Jon Duvall, HERL graduate student was awarded \$1000 to assist in funding for his research proposal entitled "Movement Monitoring for Pressure Injury Prevention" from the University of Pittsburgh.

## 2017 Employee of the Year



Michael Lain, Information Dissemination Coordinator for the Human Engineering Research Laboratories, has been named the 2017 Staff Employee of the Year.

Also in 2017, Michael won the Commander's Award for Public Service from the Surgeon General of the United States Army for his contributions to the preparation of the book *Promoting Successful Rehabilitation*. He was also promoted to a Communications III level employee of the University of Pittsburgh, Department of Physical Medicine and Rehabilitation.

Michael's position has expanded greatly since joining the HERL team in 2010. Everyone is familiar with his responsibility as Editor of the HERL newsletter but his duties encompass management of all operations of the media department. This past year Michael has been a key to coordination and production of many videos that highlight HERL research including the MeBOT and highly publicized PneuChair. He is a design artist for our many promotional materials, public relations manager, publications manager, media events coordinator, webmaster for several websites related to HERL research, and an excellent writer. Michael graduated from Miami University in Ohio in 1993 with a bachelor's degree in Linguistics. He has worked previously as a webmaster, computer service technician, project manager, writer, and editor. Michael is very diligent with regards to offering assistance whether related to his job duties or providing guidance when it is not in the realm of his position. He happily resides in Pittsburgh with his wife, son, and cat.

Congratulations Michael!

## HERL Welcomes New Staff Members

HERL would like to welcome its newest staff members, **Christina Kelsey Zigler** and **Jorge Candiotti**. Christina will serve as staff statistician. She has a PhD in Research Methodology and a background in statistics, measurement, and medical research. She has over ten years of experience working on clinical and translational research projects. Jorge recently received his doctorate from the Department of Rehabilitation Science and Technology and will be a Postdoctoral Researcher. He assisted in the development of the MEBot wheelchair.





# State of the Science Symposium, 20 October 2017

## *Promoting Successful Community Reintegration After Trauma: The impact of community support, educational, vocational and driving rehabilitation*

The State of the Science Symposium on Promoting Successful Community Reintegration After Trauma was held in Sanford Auditorium at the Uniformed University of the Health Sciences in Bethesda, Maryland on Friday, October 20, 2017. The symposium was presented by the Center for Rehabilitation Science Research; the Department of Physical Medicine and Rehabilitation at the Uniformed Services University of the Health Sciences; the Department of Rehabilitation,



**Reintegrating Veterans and their Families: It Takes a Team** - Kenneth O. Preston, Sergeant Major of the Army, Retired, Association of the U.S. Army: Explains Soldier for Life, Homes For Our Troops, and other programs.

**Driver Rehabilitation: Clinical Perspectives and Practice** - Amy Lane, Clinical Instructor, Department of Rehabilitation Science & Technology, University of Pittsburgh: A thorough discussion of driver rehabilitation.



Reed National Military Medical Center; the University of Pittsburgh, School of Health and Rehabilitation Sciences, Department of Rehabilitation Science and Technology; the Human Engineering

Research Laboratories, VA Pittsburgh Healthcare System; the University of Pittsburgh School of Medicine Center for Continuing Education in the Health Sciences; with generous support from the Paralyzed Veterans of America.

Presentations at the Symposium:

**Finding True Independence through the Choice to Work** - Josie Badger, PhD, President, J Badger Consulting Inc.: Vocational rehabilitation and the #IWantToWork campaign, presented by an expert.

**Normalizing Help-Seeking Behavior with Student Veterans** - Dan Standage, MA, COMS, Director of Disability in Education, Student Veterans of America: Methods SVA uses to assist Veterans on campus.

**Community Reintegration and Employment** - Nancy



B. Adams, MS, CRC and Lonnie C. Moore, CPT, U.S. Army Warrior Care and Transition Directorate: A discussion of the Army's transition plan for successful reintegration back into the Armed Forces or into the community.

**The Color of Tears: How Communities Can Care for Service Members with Moral Injuries** - Douglas A. Etter, CH (COL), Division Chaplain/Manager, Public and Community Relations, Lebanon VA Medical Center: How the power of an understanding community can mitigate a Service Members' violations of their own moral expectations.

**Employment for Wounded, Ill and Injured Veterans** - SgtMaj Michael T. Mack, USMC Retired, Program Manager for Veterans Employment Initiatives, U.S. Ability-One Commission.

**Interagency Care Coordination (Panel Discussion)**

- Karen Malebranche, Executive Director for VA/DoD Health Affairs, IC3: A panel discussion with Ms. Malebranche; Ms. Lisa Perla, National Polytrauma Coordinator; Ms. Jennifer Perez, Transition and Care Services; and Mr. Jack Kammerer, Vocational Rehab and Education.



**How I Got Back to Being Me: The Many Facets of Rehabilitation**

- Joshua Marino, Veteran Mentor, Human Engineering Research Laboratories: Marino discusses what worked for him during his post-combat rehabilitation.

Videos, presentations, and photos from these symposia, along with biographies of all speakers, are available on the HERL website at <http://herl.pitt.edu/education-outreach/symposia>. You can find videos and presentations from Promoting Successful Community Reintegration After Trauma at <http://herl.pitt.edu/reintegration>.

## Toyota Launches the Mobility Unlimited Challenge

The Toyota Mobility Foundation, in partnership with Nesta's Challenge Prize Centre, has launched a \$4 million dollar global challenge to change the lives of people with lower-limb paralysis, culminating in the unveiling of the winners in Tokyo in 2020.

The Mobility Unlimited Challenge is seeking teams around the world to create game-changing technology that will help radically improve the mobility and independence of paralyzed people.



The Mobility Unlimited Challenge aims to harness creative thinking from across the world to accelerate innovation and encourage collaboration with users to find winning devices to transform the world for people with lower-limb paralysis. The Challenge will reward the development of personal mobility devices incorporating intelligent systems.

The mobility solutions of the future could include anything from exoskeletons, to artificial intelligence and machine learning, from cloud computing to batteries.

Around the world, millions of people are living with lower-limb paralysis (the most common causes being strokes, spinal cord injury and multiple sclerosis). While there are no statistics on paralysis worldwide, the World Health Organization estimates there are 250,000-500,000 new cases of spinal cord injury globally every year.

HERL Director Dr. Rory Cooper has been named one of Toyota's Global Ambassadors. Other Ambassadors include August de los Reyes, Head of Design at Pinterest; Yinka Shonibare MBE, Turner-Prize nominated British/Nigerian artist; Sophie Morgan, British TV presenter; and US paralympian Tatyana McFadden.

For more information, visit <https://mobilityunlimited.org>.

## HELP US HELP ELeVATE!

The Experiential Learning for Veterans in Assistive Technology and Engineering (ELeVATE) program supports Veterans transitioning to college for STEM careers.

Your contribution will help raise \$25,000 to cover the living stipends for five Veterans during the 10-week on-campus portion of the Summer 2018 ELeVATE program. Funds raised above our goal will be applied to stipends for other ELeVATE participants.

More information is available at <https://engage.pitt.edu/elevate>.



*From left to right: Dr. Brad Dicianno, HERL Medical Director; Dr. Rory Cooper, HERL Director; Patrick D. Gallagher, Chancellor of the University of Pittsburgh; Robert Casey, U.S. Senator for the Commonwealth of Pennsylvania. Senator Casey visited HERL on November 6, 2017.*

## HERL's PneuChair in New York Times Waterpark Video



On December 5, 2017, the New York Times posted a video and accompanying article featuring Morgan's Inspiration Island waterpark in San Antonio, Texas, and the story of how HERL provided the park with air-powered PneuChair wheelchairs.

The video and story can be found at <https://www.nytimes.com/2017/12/05/opinion/morgans-wonderland-waterpark-kids-play.html>. The video was created by Samantha Stark, Jawad Metni, Sarah Kramer, and Vanessa Carr. The accompanying article was written by Tina Rosenberg.





## Human Engineering Research Laboratories



VA Center of Excellence for  
Wheelchairs and Associated  
Rehabilitation Engineering



University of Pittsburgh  
School of Health & Rehabilitation Sciences  
School of Medicine



University of Pittsburgh  
NIDILRR Model Center on  
Spinal Cord Injury



National Science Foundation  
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# Give the gift of your time! **VOLUNTEER!**



**HERL is always on the lookout  
for people to participate in our  
research studies!**

**Check out our current studies at  
<http://herl.pitt.edu/volunteer>  
including:**

- Effectiveness of Online Transfer Training Materials
- Participatory Evaluation of Assistive Technologies
- Field Validation of Wearables for Detecting Activity Patterns in Wheelchair Users
- Effects of Vibration Exercise on Upper Limb Strength, Function and Pain
- Power Mobility Screening Tool / Power Mobility Clinical Driving Assessment
- Feasibility and acceptability of a six week high intensity interval training program for persons with SCI

**INTERESTED? For more details, visit the website.  
Contact us at 412-822-3700.**

### Contact us!

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Editor: Michael Lain

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