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**Title**

Rehabilitation engineering research and education efforts

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None

**Summary**

The Human Engineering Research Laboratories (HERL) is a partnership among the University of Pittsburgh, the US Department of Veterans Affairs, and the UPMC Medical Center. Its mission is to continuously improve mobility and function of people with disabilities (PwD) through advanced engineering and clinical research in medical rehabilitation.

**Introduction**

HERL's grand vision is to create a world where PwD have unencumbered mobility and function, so they can fully participate in and contribute to society. The goals and objectives have evolved over time as the needs of PwD have changed and as new technologies have emerged. Several aspects have remained constant: Participatory action design and research engaging PwD and clinicians who work with them; including a range of professionals who contribute to rehabilitation practice & science and work as integrated teams; providing core resources to support talented and dedicated people; promoting effective pervasive dissemination and knowledge translation; and partnering with "best in class" organizations and people. For the future, HERL relied on Voice of the Consumer (VoC) and Voice of the Process (VoP) studies to gather input from PwD and providers of assistive technology. There were over 1,000 respondents, and their input has informed HERL's research roadmap into 4 main thrusts: Advanced Wheelchair Design including Alternative Power Sources; Robotics and Intelligent Systems; Human Machine Interfaces for Manipulation and Mobility; and Smart Device Applications.

**Methods**

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**Results**

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## Conclusion

The initial focus of HERL was on reducing secondary injuries due to long-term wheelchair use. Studies focused on reducing repetitive strain injuries (RSI), understanding mechanisms for pressure ulcer development, and power assist devices. Significant advances were made in these areas, and led to commercially available pushrim activated power assist devices, and Consortium for SCI Clinical Practice Guidelines for Upper Extremity Preservation. HERL's focus then changed to powered wheelchair controls and user interfaces; which led to improved control algorithms used on numerous powered wheelchairs, novel joystick technologies, and virtual reality assessments for training. In the next 5-year cycle, the focus moved towards understanding the mechanisms of RSI as related to real-world activities (e.g., transfers, starts/stops, turns), and initial work on robotics and virtual coaching systems. This led to widely used tools for ultrasound imaging, development of the Transfer Assessment Instrument, and the creation of Virtual Seating Coach (available from Permobil). In the current cycle, the research & development plan focused on investigating smart and connected wearable devices, pneumatically powered mobility devices, robotic mobility and manipulation, and smart human-machine interfaces. This has led to E-scale, Manual Wheelchair Virtual Coach, Mobility Enhancement Robotic Wheelchair that competed in the inaugural Cybathlon, PneuChair, and better understanding of factors affecting functional mobility & manipulation. HERL has adopted to needs of PwD, to advances in technology, and scientific discoveries. HERL continues to make ground-breaking contributions that have gained wider adoption and impact over time.

## References

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