

EXECUTIVE SUMMARY

The Rehabilitation Engineering Research Center (RERC) on Wheelchair Mobility at the University of Pittsburgh officially began on August 1, 1993. The five-year award officially ended on November 30, 1998. This final report summarizes research, training and information dissemination activities of the RERC and highlights the outcomes of the five-year effort.

First, it is important to understand the mandate under which all RERCs have been authorized and, then more specifically, the absolute priorities that directed the efforts of the RERC on Wheelchair Mobility since 1993. The RERC program is sponsored by the National Institute on Disability and Rehabilitation Research (NIDRR) of the Department of Education, Washington, DC.

NIDRR Mandate

All RERCs receiving support from NIDRR have common requirements which include:

- ◆ participation of consumers, service providers, equipment manufacturers and others with relevant interest in the prospective research activities,
- ◆ provision of graduate level training to develop capacity for research in rehabilitation engineering and assistive technology,
- ◆ dissemination of information and materials generated by RERC efforts in accessible formats,
- ◆ sharing information and working with other organizations, industry, service providers, other RERCs and particularly the RERC on Evaluation and Technology Transfer, and
- ◆ evaluation of materials and products of the RERC and other researchers in an effort to foster effective transfer of technology.

Obligations for the RERC on Wheelchair Technology that were evident from the statements of "absolute priorities" issued by NIDRR include the development and demonstration of technologies to:

- ◆ improve the mobility of individuals using powered wheelchairs (W/C) by developing more

efficient, reliable, and maintainable W/C systems,

- ◆ improve the mobility of W/C users by developing W/Cs that are stronger, lighter in weight, and easier to manufacture and maintain,
- ◆ enhance the safety and mobility of W/C users by developing safe vehicle securement systems for various types of wheelchairs and various types of vehicles, especially those used in mass transit, and
- ◆ enhance the function of W/C users by developing improved seating systems and interfaces with environmental controls and other devices for daily living activities.

The priorities further require the RERC to identify criteria and support standards for W/C performance and vehicle securement in coordination with the US Department of Transportation (DOT) and the Architectural and Transportation Barriers Compliance Board (ATBCB).

Objectives of the RERC on Wheelchair Mobility

The overall goals of the RERC can be stated in two encompassing objectives:

1. elevate the state-of-the-art technology and knowledge relevant to W/C mobility, seating, and transportation to the highest possible level, and
2. disseminate and transfer this state-of-the-art knowledge and technology to a state of practice that results in optimum utilization of this technology and knowledge by persons with disabilities.

Summary of Tasks

The University of Pittsburgh and its collaborators initiated 27 interrelated tasks over five years grouped across four priority areas: wheeled mobility, wheelchair seating, wheelchair transportation safety, and training and information dissemination (see the following tables for a summary of the tasks).



Table I. RERC Research Tasks

<i>Wheeled Mobility Tasks</i>	<i>Descriptions</i>
PM-1 Improved Electric and Electromechanical Systems	Developments in batteries, power controllers and motors
PM-2 Advanced Materials and Mechanisms	Developments in frames, steering mechanisms and suspensions
PM-3 Improved User Input Devices and Control Concepts	Developments in standard interfaces, input devices and controllers
PM-4- Integration of Improved Mobility Components	System simulation and product specification and design
PM-5 The Use of Integrated Controls by Persons with Physical Disabilities	Investigation of the use of integrated controls
PM-6 New Concepts in Powered Indoor Mobility	Development of novel indoor powered mobility devices
PM-7 Powered Mobility Simulator	Development of a low cost tool to allow consumer experimentation with powered mobility options prior to purchase
MM-1 Structural Improvements to Manual Wheelchairs	Development of improved manual wheelchair frames
WP-1 Consumer-Responsive Mobility Prescription Process	Development of consumer-responsive mobility prescription process
WP-2 Wheelchair Prescription Software Project	Development of a computer-based program to provide training in strategies of wheelchair prescription
STD-1 Research in Support of Wheelchair Standards	Support of the development of W/C standards through laboratory research
<i>Seating Tasks</i>	<i>Descriptions</i>
S-1 Cushion Design for Pressure Ulcer Prevention	To develop systematic techniques necessary to improve the quality and consistency of CAD/CAM cushions producing technology
S-2 Distortion Measurement and Biomechanical Analysis of Invivo Load-Bearing Soft Tissue	To validate or invalidate the use of external pressure as an indicator for harmful internal strain in soft tissue
S-3 Non Invasive Monitoring of Spinal /Pelvic alignment	To research, develop and evaluate a non-invasive clinical tool for monitoring changes in spinal/pelvic alignment over time
S-4 Effects of Seating on Individuals with Quadriplegia	To investigate the effect of W/C seating on the postural status, pulmonary function, and upper extremity function of individuals with SCI at the C5 to C7 level
S-5 Customized Wheelchair Seating for Institutional Populations with Changing Needs	To develop criteria and prototype mobility and seating assemblies to meet the needs of residents in institutions whose needs are constantly changing

<i>Transportation Tasks</i>	<i>Descriptions</i>
T-1 Criteria for Standards and Design of Transport Wheeled Mobility Devices for Use in Transportation Vehicles	To develop design criteria that can be used for both the development of national standards, as well as in the design of transport WMDs that meet the standard
T-2 Development of Standard Interface Concepts	To develop and evaluate universal interface hardware concepts that will assure compatibility between WMDs and securement devices
T-3 Development of Auto-engage Securement Devices	To develop, test and commercialize a series of auto-engage securement devices that are based on universal design standards
T-4 Research in Support of National Standards	To provide direct research support to standards development, and advocate for adoption of universal interface concepts resulting from Tasks 1, 2 & 3 into national and international standards

In addition to the eighteen research and development tasks, the RERC is mandated to conduct activities in training and dissemination. Table II summarizes the seven tasks associated with these activities.

Table II. RERC Training and Dissemination Tasks

<i>Training Tasks</i>	<i>Descriptions</i>
TR-1 Graduate Education	To increase the numbers of qualified professionals in assistive technology through support of formal educational experiences
TR-2 Student Research Training	To provide students with mentored research experiences in the areas of wheeled mobility and related research
TR-3 Continuing Education	To enhance post service skills through supporting continuing education experiences for practicing professionals and others
TR-4 Consumer Training	To provide opportunities for users of technology to become more knowledgeable in AT research and applications
<i>Dissemination Tasks</i>	<i>Descriptions</i>
DU-1 Dissemination of RERC Research Findings	To disseminate the outcomes and findings of the RERC research tasks using multiple venues
DU-2 National Information Center	To disseminate a wide range of information on wheeled mobility via an information concept
DU-3 Technology Transfer	To facilitate the transfer of RERC Center and other research developments through affiliations with others, including industry

The body of the report provides only a brief description of each research task, a summary of each task outcomes and recommendations for future work. Many tasks have generated publications or technical reports that are referenced at the end of each task report. A complete listing of all publications appears in Section V – Dissemination and Utilization.

